PSYC 301: Statistics (rev. 1'30'2018)

Homework Table of Contents

Homework 1.1: Quant/Qual, Freq. Distribution, Graphs, Levels of Measurement 3
Homework 1.1: Quant/Qual, Freq. Distribution, Graphs, Levels of Measurement- Key 5
Homework 1.2: Experimental Terminology, Treatment Effect, Sampling Error 7
Homework 1.2: Experimental Terminology, Treat. Effect, Sampling Error-Key 9
Homework 2.1: MCT vs. MV, Measures of Central Tendency, Samples vs. Populations 11
Homework 2.1: MCT vs. MV, Measures of Central Tendency, Samples vs. Populations-Key 13
Homework 2.2: Measures of Variability 15
Homework 2.2: Measures of Variability - Key 17
Homework 3.1: Correlation & Regression 19
Homework 3.1: Correlation & Regression – Key 22
Homework 3.2: Correlation & Regression Practice 25
Homework 3.2: Correlation & Regression Practice 28
Homework 3.3: Conceptual Review (closed book) 29
Homework 3.4: Computational Review #1 (open-book) 33
Homework 3.4: Computational Review #1 (open-book) -key 36
Homework 3.5: Computational Review #2 (open book) 39
Homework 3.5: Computational Review – Key , Test #1 (open book) 42
Homework 3.6 - Correlation & Regression Review 46
Homework 3.6: Correlation & Regression Review - Key 47
Homework 4.2: Z-scores, Sampling Distributions, Hypothesis Testing 52
Homework 4.2 – Z-scores, Sampling Distributions, Hypothesis Testing 54
Homework 4.1: Z-scores for scores 56
Homework 4.1: Z-scores 59
Homework 5.1: t-scores 62
Homework 5.1: t-scores - Key 62
Homework 5.2: Hypothesis Testing with T-Scores 64
Homework 5.2: Hypothesis Testing with T-Scores - Key 66
Homework 5.3: One-sample t-test 69
Homework 5.3: One-sample t-test__ Key 71
Homework 6.1: Questions about Independent t-test 77
Homework 6.2 – Independent t-test practice 78
Homework 6.2 – Independent t-test practice- Key 79
Homework 6.3 – Dependent t-tests 80
Homework 6.3 – Dependent t-tests- Key 81
Homework 6.3A – Annotating Output 82
Homework 6.3A – Annotating Output-Key 83
Homework 6.4: Independent & Dependent T-tests 84
Homework 6.4: Independent & Dependent T-tests- Key 88
Homework 6.6 – Conceptual Review 92
Homework 6.6 – Conceptual Review – KEY 94
Homework 6.7 Computational Review (Test 2) 96
Homework 6.7 Computational Review (Test 2) - Key 98
Homework 6.8: Conceptual Review T2 (closed book) 100
Homework 6.9 Practice Test for Test #2 -- (Excluding Essay)-Key 103
Homework 6.9 Practice Test for Test #2 -- (Excluding Essay)-Key 107
Homework 6.9A: Overview of z-tests and t-tests 111
Homework 7.1a: 1-way ANOVA 112
Homework 7.1b: 1-way ANOVA 113
Homework 7.1a: 1-way ANOVA 114
Homework 7.1b: 1-way ANOVA 115
Homework 7.2 – 1-Way ANOVA 116
Homework 7.2 – 1-Way ANOVA *****KEY***** 118
Homework 7.3: Statistics for Breakfast!!! 120
Homework 7.3: Statistics for Breakfast!!!- Key 121
Homework 8.1: 2-Way ANOVA 122
Homework 8.1: 2-Way ANOVA -- Key 124
Homework 8.2: Setting up Data for 2-way ANOVA 126
Homework 8.2B: 2-way ANOVA Annotation Exercise 128
Homework 8.2B: 2-way ANOVA Annotation Exercise - KEY 131
Homework 8.3: 2-Way ANOVA Write-ups 134
Homework 8.3: 2-way ANOVA Write-ups – Key 135
Homework 8.4: Paragraphs & Name that Stat Review 136

Homework 8.4 Paragraphs & Name that Stat Review Key 137
Homework 8.5: Practice Quiz #1 140
Homework 8.6: Practice Quiz #2 141
Homework 9.1 - χ^2 "Chi Squared" 142
Homework 9.1 - χ^2 "Chi Squared" Key 143
Homey Work 9.4: Conceptual Review for Final 144
Homey Work 9.4: Conceptual Review for Final - Key 146
Homework 10.1: Journal Reading 148
Homework 10.1: Journal Reading -Key 151
Homework 10.2: Conceptual Final Review, MC & FIB practice 154
Homework 10.2 Conceptual Final Review, MC & FIB practice - Key 156

Homework 1.1: Quant/Qual, Freq. Distribution, Graphs, Levels of Measurement

1. Indicate if the following variables are Qualitative (QL) or Quantitative (QN):

_____ height	____ religion (type of)	_____ religiosity (level of involvement with)
____ gender	____ region (e.g., South, North)	_____ grade in a class (e.g., A, B, C)
____ self-esteem	____ marital status (single, etc.)	_____ ethnicity (Black, White, Martian)

2. For each of the following data sets, determine if the data are Qualitative or Quantitative then construct an appropriate frequency table and histograms or bar graph (whichever is appropriate).

a. On the seven item quiz people scored as follows: 6,2,5,4,6,7,4,4,3,5,0,4, 3,5,2,3,5,7,4,6,3,3,5,4,2,4

Qualitative or Quantitative? (circle)

_____	_____
7	
6	
5	5
4	
3	
2	
1	
0	

Graph of this distribution:

b. On a measure of social anxiety people scored: 35, 40, 45, 40, 40, 35, 45, 50, 50, 60, 60, 70, 70, 30, 40, 45, 50, 40, 40, 30

Qualitative or Quantitative?

_____	_____

Graph of this distribution:

c. Survey participants indicated their religious beliefs as follows: Christian (X), Atheist (A), Agnostic (G), or Foodie (F): C A G C F C G A C G C A G C C F F A C C C

Qualitative or Quantitative?

_____	_____

Graph of this distribution:

Test2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	45	1	6.7	6.7	6.7
	60	1	6.7	6.7	13.3
	65	1	6.7	6.7	20.0
	70	3	20.0	20.0	40.0
	80	1	6.7	6.7	46.7
	85	2	13.3	13.3	60.0
	90	1	6.7	6.7	66.7
	95	1	6.7	6.7	73.3
	100	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

3. Reading Frequency Tables:

a. How many people got a 60 on Test 2?

b. What percent of people got a 70?

c. What percent of people scored a 70 or below?

d. What percent of people scored between 45 and 100?

e. What's a bit odd or unusual about this distribution of scores?

MINORITY Minority Classification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 No	370	78.1	78.1	78.1
	1 Yes	104	21.9	21.9	100.0
	Total	474	100.0	100.0	

f. What percent of employees are minorities?

g. How many employees are not minorities?

h. Are these data qualitative or quantitative?

EDUC Educational Level (years)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	8	53	11.2	11.2	11.2
	12	190	40.1	40.1	51.3
	14	6	1.3	1.3	52.5
	15	116	24.5	24.5	77.0
	16	59	12.4	12.4	89.5
	17	11	2.3	2.3	91.8
	18	9	1.9	1.9	93.7
	19	27	5.7	5.7	99.4
	20	2	.4	.4	99.8
	21	1	.2	.2	100.0
	Total	474	100.0	100.0	

i. How many employees appear to have a high school education but not more than that?

j. What percent of people might have done graduate level work, assuming they spent 12 years in primary education and 4 years in college?

4. Level/scale of measurement: (a) Identify the defining characteristics of each scale of measurement (b) sort the following four scales appropriately: years of age, Celsius temperature scale, top 10 finishing times in a race, the State you were born in

Nominal	Ordinal	Interval	Ratio
a.			
b.			

5. Identify the levels of measurement used in the following examples: (NOIR)

a. Group your friends in to the categories (a) best friends, (b) good friends, (c) expendable in a crisis.

b. Time (measured in seconds) required to duck after yelling "fore!" in a golfer's ear.

c. Teaching effectiveness, summing responses across a five-item scale. Each item is on a 1-7 scale.

d. Ask students to self-assess their procrastination ability on a 1-5 scale.

e. Dividing people into males, females, and other.

f. Ranking of 10 possible heroes (Abraham Lincoln, Martin Luther King, Jr., your stats instructor, etc.) from best to worst.

g. The number of times a Soap Opera star is depicted sleeping with someone other than his/her spouse.

h. Level of understanding after a statistics course measured in length of groans using a stopwatch.

i. A survey instrument with 15 items assessing the extent to which someone endorses Right Wing Authoritarianism. Each item is on a 1-10 scale.

6. See instructions for problem 2 above:

a. People identified the political affiliation (R=Republican, D=Democrat, I=Independent) as follows: R I R R D D R D R R D R I R

Qualitative or Quantitative? (circle)

Graph of this distribution:

b. Students reported the following scores on the ACT: 16, 32, 34, 25, 18, 20, 24, 23, 26, 25, 27, 26, 23

Qualitative or Quantitative? (circle)

15-19	
20-24	
25-29	
30-34	

Graph of this distribution:

Homework 1.1: Quant/Qual, Freq. Distribution, Graphs, Levels of Measurement- Key

1. Indicate if the following variables are Qualitative (QL) or Quantitative (QN):

_QN__ height
_QL__ gender
_QN__ self-esteem
_QL___ religion (type of)
_QL___ region (e.g., South, North)
_QL___ marital status (single, etc.)
_QN _ religiosity (level of involvement with)
_QN _ grade in a class (e.g., A, B, C)
_QL __ ethnicity (Black, White, Martian)

2. For each of the following data sets, determine if the data are Qualitative or Quantitative then construct an appropriate frequency table and histograms or bar graph (whichever is appropriate).

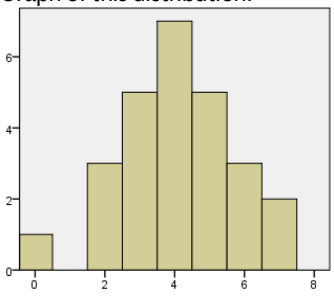
a. On the seven item quiz people scored as follows: 6,2,5,4,6,7,4,4,3,5,0,4, 3,5,2,3,5,7,4,6,3,3,5,4,2,4

Qualitative or Quantitative? (circle)

Score	Freq
0	1
1	0
2	3
3	5
4	7
5	5
6	3
7	2

Note: On this and other problems, scores can go from high to low or vice-versa, same on corresponding graphs.

Graph of this distribution:

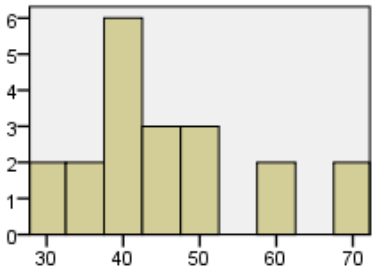


b. On a measure of social anxiety people scored: 35, 40, 45, 40, 40, 35, 45, 50, 50, 60, 60, 70, 70, 30, 40, 45, 50, 40, 40, 30

Qualitative or Quantitative?

Score	Freq
70	2
65	0
60	2
55	0
50	3
45	3
40	6
35	2
30	2

Graph of this distribution:

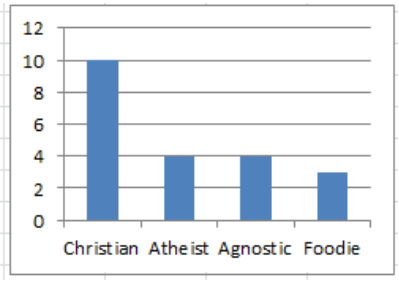


c. Survey participants indicated their religious beliefs as follows: Christian (X), Atheist (A), Agnostic (G), or Foodie (F): C A G C F C G A C G C A G C C F F A C C C

Qualitative or Quantitative?

Score	Freq
Christians	10
Atheists	4
Agnostic	4
Foodie	3

Graph of this distribution:



Test2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	45	1	6.7	6.7	6.7
	60	1	6.7	6.7	13.3
	65	1	6.7	6.7	20.0
	70	3	20.0	20.0	40.0
	80	1	6.7	6.7	46.7
	85	2	13.3	13.3	60.0
	90	1	6.7	6.7	66.7
	95	1	6.7	6.7	73.3
	100	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

3. Reading Frequency Tables:

a. How many people got a 60 on Test 2? 1

b. What percent of people got a 70? 20

c. What percent of people scored a 70 or below? 40

d. What percent of people scored between 45 and 100? 100

e. What's a bit odd or unusual about this distribution of scores? 4 people get 100 (ceiling effect)

MINORITY Minority Classification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 No	370	78.1	78.1	78.1
	1 Yes	104	21.9	21.9	100.0
	Total	474	100.0	100.0	

f. What percent of employees are minorities?
21.9%

g. How many employees are not minorities?
370

h. Are these data qualitative or quantitative?
Qualitative

EDUC Educational Level (years)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	8	53	11.2	11.2	11.2
	12	190	40.1	40.1	51.3
	14	6	1.3	1.3	52.5
	15	116	24.5	24.5	77.0
	16	59	12.4	12.4	89.5
	17	11	2.3	2.3	91.8
	18	9	1.9	1.9	93.7
	19	27	5.7	5.7	99.4
	20	2	.4	.4	99.8
	21	1	.2	.2	100.0
	Total	474	100.0	100.0	

i. How many employees appear to have a high school education but not more than that?
190

j. What percent of people might have done graduate level work, assuming they spent 12 years in primary education and 4 years in college?
10.5%

4. Level/scale of measurement: (a) Identify the defining characteristics of each scale of measurement (b) sort the following four scales appropriately: years of age, Celsius temperature scale, top 10 finishing times in a race, the State you were born in

Nominal	Ordinal	Interval	Ratio
a. Categorized	Categories in order	Equal intervals	True zero
b. State	Top 10	Celsius	Years of age

5. Identify the levels of measurement used in the following examples: (NOIR)

a. Group your friends in to the categories (a) best friends, (b) good friends, (c) expendable in a crisis. O

b. Time (measured in seconds) required to duck after yelling "fore!" in a golfer's ear. R

c. Teaching effectiveness, summing responses across a five-item scale. Each item is on a 1-7 scale. I

d. Ask students to self-assess their procrastination ability on a 1-5 scale. I

e. Dividing people into males, females, and other. N

f. Ranking of 10 possible heroes (Abraham Lincoln, Martin Luther King, Jr., your stats instructor, etc.) from best to worst. O

g. The number of times a Soap Opera star is depicted sleeping with someone other than his/her spouse. R

h. Level of understanding after a statistics course measured in length of groans using a stopwatch. R

i. A survey instrument with 15 items assessing the extent to which someone endorses Right Wing Authoritarianism. Each item is on a 1-10 scale. I

6. See instructions for problem 2 above:

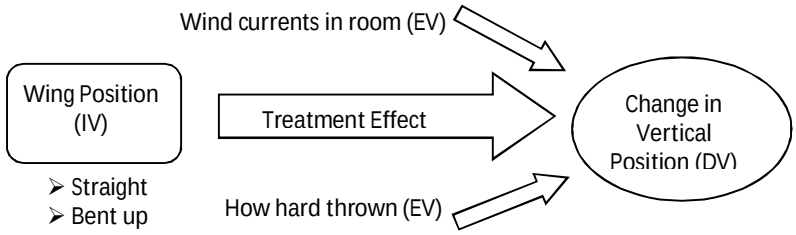
a. People identified the political affiliation (R=Republican, D=Democrat, I=Independent) as follows: R I R R D D R D R R D R I R

Qualitative or Quantitative? (circle)

b. Students reported the following scores on the ACT: 16, 32, 34, 25, 18, 20, 24, 23, 26, 25, 27, 26, 23

Qualitative or Quantitative? (circle)

Homework 1.2: Experimental Terminology, Treatment Effect, Sampling Error

1. Terminology for Experiments: For each of the following research designs, draw a diagram (like those shown in class) that identifies the independent variable, the levels of the independent variable (e.g., wings bent up vs. wings straight), the dependent variable, and two possible extraneous variables (other things that affect the dependent variable). Here's an example from the airplane demonstration in class:	 ➢ Straight ➢ Bent up
a. A developmental psychologist wants to know if type of setting for care (day-care vs. stay at home) affected childrens' aggression levels. (For DV you might think about counting certain types of behaviors during an observation period. For extraneous variables, you might think of genetics, overall quality of care, number of children per adult, etc.)	
b. A social psychologist manipulates appearance of job applicants to see if it affects raters' perceptions of the applicant's qualifications: The experimenter uses identical resumes, but switches pictures that supposedly show the applicant, showing half the participants attractive people, and half the subjects unattractive people.	
c. A class of students decides to see if they can control a professor's lecture habits. Whenever the professor moves to the left side of the room, the students act interested and awake. When the professor moves to the right side of the room, the students act bored and some pretend to be drifting off to sleep.	
d. A researcher hypothesizes that participants subtly primed with the words of "sacrifice and "generous" would donate more to a charity when propositioned. She gave word puzzles to participants that either primed key words or neutral words. She then recorded amount given to charity ($1-10) in a purportedly unrelated task.	

2. For each study above, assume a treatment effect was discovered. Explain what that means in terms of the IV and DV (i.e., which variable affected which other variable).

a.	type of setting: (day vs home-care) affected .....
b.	..... the ratings given to the job applicants.
c.	
d.	

3. For each of the following, identify two sources of sampling error (hint: same as asking for extraneous variables):

a. Our ability to control our behavior tends to degrade as we get more tired. A researcher examined whether time of day (morning vs. late afternoon) affected the extent of cheating on a supposed IQ test.	#1. #2.
b. Terror management theory predicts signs of destruction cause us to feel under threat and more likely to display aggression. Researchers examined whether pictures of buildings (intact or destroyed) affected support for military action against Iran.	#1 #2.
c. A researcher examined whether recent exposure to the US flag affected their belief that the "US healthcare system is the best in the world."	#1 #2

4. For the following histograms, indicate whether the distribution appears normal or describe any deviations from normality.

a.

b.

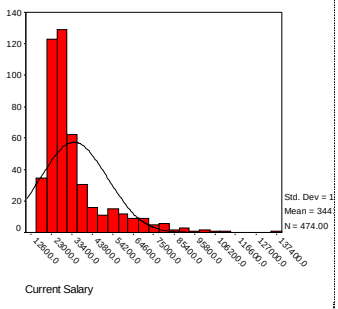
c.

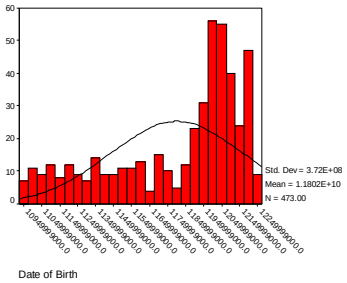
d.

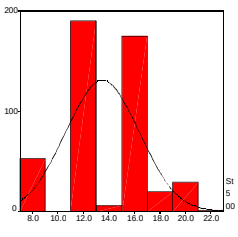
e.

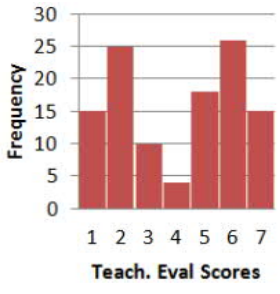
f.

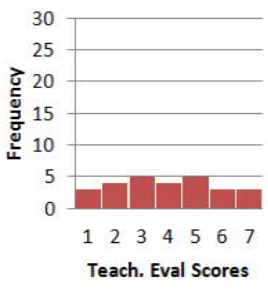
g.

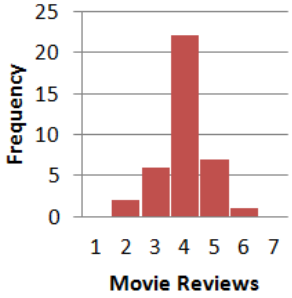


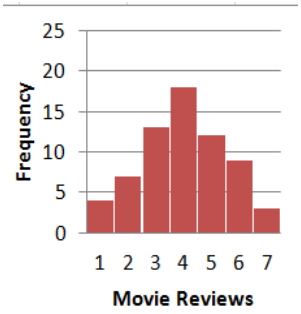








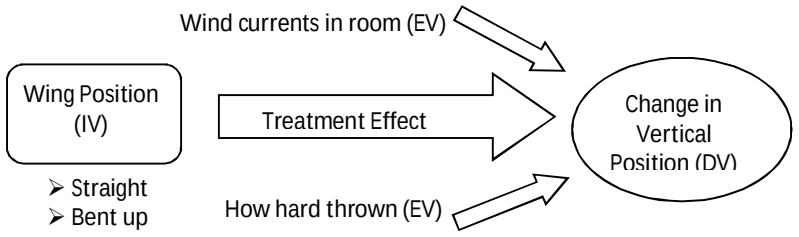




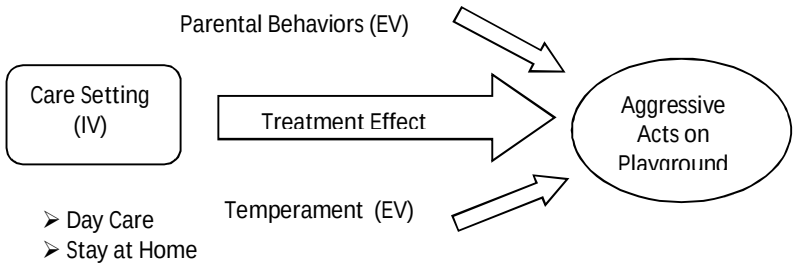
5. In the space to the right, draw a normal distribution of human height. Label where the most common scores fall, the 5% tallest, the 5% shortest. Give one reason why someone might be on the far left and one reason they might be on the far right.

Homework 1.2: Experimental Terminology, Treat. Effect, Sampling Error-Key

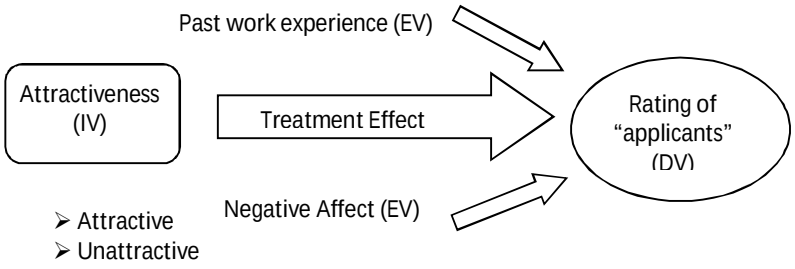
1. Terminology for Experiments: For each of the following research designs, draw a diagram (like those shown in class) that identifies the independent variable, the levels of the independent variable (e.g., wings bent up vs. wings straight), the dependent variable, and two possible extraneous variables (other things that affect the dependent variable). Here's an example from the airplane demonstration in class:



a. A developmental psychologist wants to know if type of setting for care (day-care vs. stay at home) affected childrens' aggression levels. (For DV you might think about counting certain types of behaviors during an observation period. For extraneous variables, you might think of genetics, overall quality of care, number of children per adult, etc.)



b. A social psychologist manipulates appearance of job applicants to see if it affects raters' perceptions of the applicant's qualifications: The experimenter uses identical resumes, but switches pictures that supposedly show the applicant, showing half the participants attractive people, and half the subjects unattractive people.



c. A class of students decides to see if they can control a professor's lecture habits. Whenever the professor moves to the left side of the room, the students act interested and awake. When the professor moves to the right side of the room, the students act bored and some pretend to be drifting off to sleep.

d. A researcher hypothesizes that participants subtly primed with the words of "sacrifice and "generous" would donate more to a charity when propositioned. She gave word puzzles to participants that either primed key words or neutral words. She then recorded amount given to charity ($1-10) in a purportedly unrelated task.

2. For each study above, assume a treatment effect was discovered. Explain what that means in terms of the IV and DV (i.e., which variable affected which other variable).

a.	type of setting: (day vs home-care) affected ..... levels of aggression
b.	Attractiveness of "applicant" affected ..... the ratings given to the job applicants.
c.	Class behavior (i.e., shown interest) affected the professor's left-right position in the room
d.	Primed concept (generosity vs. something neutral) affected amount given to charity

3. For each of the following, identify two sources of sampling error (hint: same as asking for extraneous variables):

a. Our ability to control our behavior tends to degrade as we get more tired. A researcher examined whether time of day (morning vs. late afternoon) affected the extent of cheating on a supposed IQ test.	#1. test taking ability #2. fatigue or lack of sleep
b. Terror management theory predicts signs of destruction cause us to feel under threat and more likely to display aggression. Researchers examined whether pictures of buildings (intact or destroyed) affected support for military action against Iran.	#1 personal military experience #2. xenophobia (fear of foreigners)
c. A researcher examined whether recent exposure to the US flag affected their belief that the "US healthcare system is the best in the world."	#1 personal health care experiences #2 knowledge re: other systems

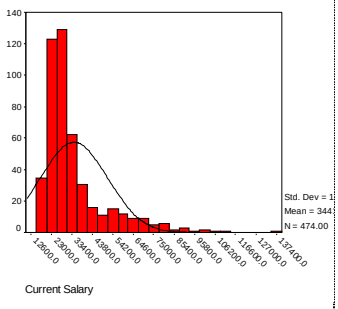
4. For the following histograms, indicate whether the distribution appears normal or describe any deviations from normality.

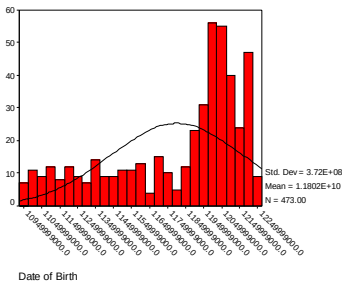
a. positive skew

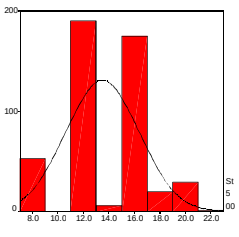
b. negative skew

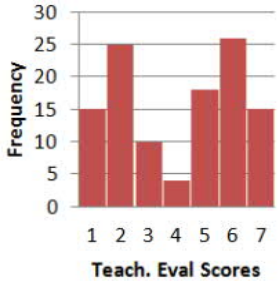
c. bimodal (12 & 16 years)

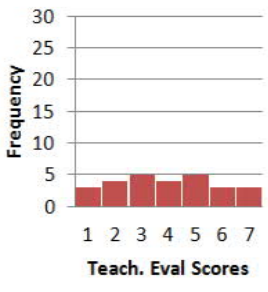
d. bimodal

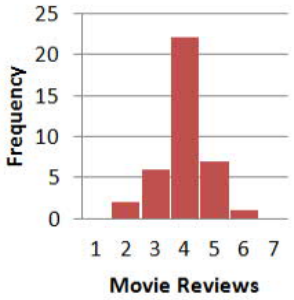


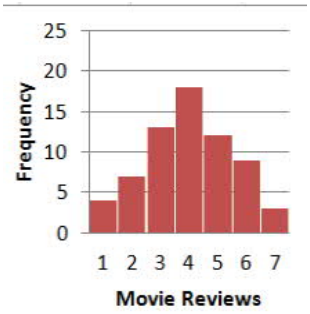




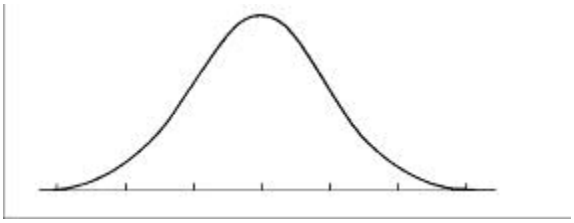








5. In the space to the right, draw a normal distribution of human height. Label where the most common scores fall, the 5% tallest far right , the 5% shortest far left. Give one reason why someone might be on the far left (poor nutrition) and one reason they might be on the far right (genetic predisposition).



Homework 2.1: MCT vs. MV, Measures of Central Tendency, Samples vs. Populations

1. Calculate the Mean (M), Median (Md), and Mode (Mo) for the following distributions (or state not appropriate)	3 4 4 5 6 6 6 7 8	3 3 3 4 4 5 6 14 26	3 3 5 5 5 12 12 14 14 14	20 22 23 24 24 24 25 30 40 80 100	30 40 40 50 50 50 60 70 75 75	Duck Dynasty Duck Dynasty How I met your Mother How I met your Mother How I met your Mother Breaking Bad Walking Dead Walking Slightly Impaired
Mean						
Median						
Mode						

2. Circle best MCT for each

3. Which measure of central tendency (Mean, Median, or Mode is appropriate, and why?

a. A distribution of reading speed scores for a class of third graders.	b. The most popular major at Winthrop.	c. The typical income of people in a bar after Bill Gates walks in.
d. The number of hours students typically study for a stats test, knowing that Susie Studiaholic studies way more than anyone else.	e. Number of greeting cards sent from sample including 1000 Men and 1000 Women. [Men tend to send far fewer cards than women].	f. The typical length of a baby born at St. Snufalufagus. Some of the babies are Irish, and others have statisticians for parents.
g. Length of incarceration. [A few prisoners serve life sentences, the vast majority typically severe between 2 & 10 years].	h. Bench press strength with a sample including 50 college football players and 50 math majors.	i. Number of movies watched per week, including a handful of people who work in movie theaters.

4. In a normal population distribution the _____, _____, and _____ all fall in the exact center of the distribution. Scores that fall far from the middle of the distribution are considered _____ scores ; scores falling near the mean are very _____. The _____ _____ [2 words] will tell you the overall spread of the scores and is the most precise measure of _____. In contrast, the mode, median, and mean are all measure of _____ _____ [2 words]. A normal curve is considered hypothetical because it is based on a(n) _____ large sample. If you don't like someone, you serve them _____ _____ (2 words).

mean
variability
median
fruit cake
mode
central tendency
common
standard deviation
fashionable
extreme
infinitely
insanely

5. Imagine a distribution of extraversion scores based on a set of Likert scales. The scores can be ranked so the data must be _____ and the level of measurement is _____. If the distribution is symmetrical then the distribution is NOT _____. If we have the entire population of scores then both the mean and the standard deviation will be considered _____ rather than _____. Now assume that we have a sample of sales people who are more extraverted than the normal population. If we compare the mean of this sample (__)[symb.] to the mean of the population (___) [symb.] we would expect the sample mean to fall to the _____ of the population mean. The farther the sample mean of sales people falls from the population mean (the farther into the tail it goes) the more likely we would be to assume that sales people come from a(n) _____ distribution with a higher population mean. The South Carolina grocery store with the best name is _____ _____ . [2-words].	statistics right alternative parameters ordinal Piggly Wiggly interval skewed M quantitative qualitative razzle dazzle bimodal μ σ left identical

6. Which would have greater variability? Circle the correct answer.

a. Baseball vs. Football scores	
b. Hours practiced by professional vs. amateur athletes	
c. Hours spent in class vs. watching TV for WU students.	
d. Books read by English vs. non-English majors	
e. The salaries of Hollywood secretaries vs. actors	
f. Amount paid in taxes vs. given to a church.	

7. Assume a researcher administers a drug thought to lower anxiety to an intervention group (n=10) and gives a placebo drug (i.e., a sugar pill that does nothing) to the control group (n=10). After six weeks she measures anxiety levels in both groups and finds the intervention group has a lower anxiety score on average (41) than the control group (49).

a. The 41 and 49 are sample means or population means? So the correct symbol for each should be M or μ ?

b. We can think about the sample mean of 41 as striving to represent the _____ mean of all the people in the world that might take the drug or not take the drug? The 41 will likely not perfectly represent the population mean because of _____.

c. The difference we observe between a statistic and the parameter it is trying to represent is called _____.

d. If the people who took the drug now really do on average have lower anxiety scores then we can say that the IV affected the DV and that means there was a _____.

e. The difference observed between 41 and 49 may be due to either a _____ or _____.

f. If the population means of the two conditions really do differ then that means there was a _____.

g. We can be more confident that there really is a significant difference between the sample means if the variability in the sample scores is _____ (high/low)?

Homework 2.1: MCT vs. MV, Measures of Central Tendency, Samples vs. Populations-Key

1. Calculate the Mean (M), Median (Md), and Mode (Mo) for the following distributions (or state not appropriate)	3 4 4 5 6 6 6 7 8	3 3 3 4 4 5 6 14 26	3 3 5 5 5 12 12 14 14 14	20 22 23 24 24 24 25 30 40 80 100	30 40 40 50 50 50 60 70 75 75	Duck Dynasty Duck Dynasty How I met your Mother How I met your Mother How I met your Mother Breaking Bad Walking Dead Walking Slightly Impaired
Mean	5.4444	7.5556	8.7		54	not appropriate
Median	6	4	8.5		50	not appropriate
Mode	6	3	5,14		50	How I met your Mother

2. Circle best MCT for each

3. Which measure of central tendency (Mean, Median, or Mode is appropriate, and why?

a. A distribution of reading speed scores for a class of third graders. Mean – no skew or multi-modality indicated.	b. The most popular major at Winthrop. Mode– qualitative data.	c. The typical income of people in a bar after Bill Gates walks in. Median positively skewed.
d. The number of hours students typically study for a stats test, knowing that Susie Studiaholic studies way more than anyone else. Median – Susie will create an extreme score, which causes skew.	e. Greeting cards sent by sample including 1000 Men and 1000 Women. [Men tend to send far fewer cards than women]. Mode – we will likely see a bimodal distribution – say maybe a mode of 4 for men and 10 for women.	f. The typical length of a baby born at St. Snufalufagus. Some of the babies are Irish, and others have statisticians for parents. Mean – no skew or multi-modality indicated.
g. Length of incarceration. [A few prisoners serve life sentences, the vast majority typically severe between 2 & 10 years]. Median – the "lifers" will be extreme scores and skew the distribution.	h. Bench press strength with a sample including 50 college football players and 50 math majors. Mode – the weight training of football players will have a large effect on strength, thus causing a split into two distinct groups.	i. Number of movies watched per week, including a handful of people who work in movie theaters. . Median – the few movie workers will see many more; their extreme scores will fall high above where most people fall.

4. In a normal population distribution the _mean_, _media_, and _mode__ all fall in the exact center of the distribution. Scores that fall far from the middle of the distribution are considered _extreme__ scores ; scores falling near the mean are very _common__. The __standard__ __deviation_ [2 words] will tell you the overall spread of the scores and is the most precise measure of _variability_. In contrast, the mode, median, and mean are all measure of __central tendency__ [2 words]. A normal curve is considered hypothetical because it is based on a(n) _infinitely_ large sample. If you don't like someone, you serve them __fruit__ _cake_ (2 words).

mean
variability
median
fruit cake
mode
central tendency
common
standard deviation
fashionable
extreme
infinitely
insanely

5. Imagine a distribution of extraversion scores based on a set of Likert scales. The scores can be ranked so the data must be _Quantitative_ and the level of measurement is _interval_. If the distribution is symmetrical then the distribution is NOT _skewed_. If we have the entire population of scores then both the mean and the standard deviation will be considered _parameters_ rather than _statistics_. Now assume that we have a sample of sales people who are more extraverted than the normal population. If we compare the mean of this sample (M) [symb.] to the mean of the population (μ) [symb.] we would expect the sample mean to fall to the _right_ of the population mean. The farther the sample mean of sales people falls from the population mean (the farther into the tail it goes) the more likely we would be to assume that sales people come from a(n) _alternative_ distribution with a higher population mean. The South Carolina grocery store with the best name is _Piggly Wiggly_ . [2-words].

statistics
right
alternative
parameters
ordinal
Piggly Wiggly
interval
skewed
M
quantitative
qualitative
razzle dazzle
bimodal
μ
σ
left
identical

6. Which would have greater variability? Circle the correct answer.

a. Baseball vs. Football scores	Football scores (because you get 7 points for a touchdown) will produce scores with bigger spreads, say 7 to 28. Baseball scores tend to be scores like 2 to 5, 0 to 2, 2 to 7 – much less spread.
b. Hours practiced by professional vs. amateur athletes	Professional athletes are required to practice – amateur athletes might practice much more or much less than this amount.
c. Hours spent in class vs. watching TV for WU students.	Hours spent in class will be standardized (between 12 and 18 typically), whereas TV hours could vary from 0 to 20+ per week.
d. Books read by English vs. non-English majors	English majors are required to read a particular number of books. Other students may read zero or maybe even as many (or more) books.
e. The salaries of Hollywood secretaries vs. actors	Depending on level of fame, actors can make either very little or a huge amount – secretaries will tend to make about the same amount.
f. Amount paid in taxes vs. given to a church.	Taxes are mandatory for all. Amount given to churches is voluntary, and will therefore be much more variable.

7. Assume a researcher administers a drug thought to lower anxiety to an intervention group (n=10) and gives a placebo drug (i.e., a sugar pill that does nothing) to the control group (n=10). After six weeks she measures anxiety levels in both groups

ge (41) than the control group (49).

a. The symbol for each should be M or μ ?

b. We _population_ mean of all the people in the world t perfectly represent the population mean becaus

c. The ing to represent is called _sampling error_.

d. If th xiety scores then we can say that the IV affecte

e. The atment effect_ or _sampling error_.

f. If the eans there was a _treatment effect__.

g. We ween the sample means if the variability in the sample

Homework 2.2: Measures of Variability

1. The symbol for	The following symbol represents...
a. The standard deviation of a population: ____	d. $\hat{s}$: _____
b. The variance of population ____	e. σ: _____
c. The stand. dev. of a population as an estimate.____	f. SS: _____

2. Contrasting measures of central tendency and variability

a. Assume you have one play left in the football game to score and thereby win. You need to move the ball 13 yards to score. You can give the ball either to Bruno (averages 10 yards, $\hat{s}$ =1) or Rocky (averages 5 yards, $\hat{s}$=10). Who should get the ball?

b. Assume you need $700 per month to cover your expenses and not get evicted. You have no savings and you will spend whatever you earn within the month. Would you rather work for tips at job A (average pay $1000, $\hat{s}$=500) or job B (average pay $800, $\hat{s}$=100)?

Note: For guidance on the following problems, find in your course-pack a page of example standard deviation problems.

3. Calculate standard deviation: 3, 6, 3, 7

x	x^2

$$\hat{s}_x = \sqrt{\frac{\sum x^2 - \frac{\left(\sum x\right)^2}{n}}{n-1}}$$

4. Calculate standard deviation: 7, 7, 6, 6, 5

x	x^2

5. Calculate standard deviation: 4, 5, 4, 5

x	x^2

6. Calculate standard deviation: 1, 6, 2, 3, 7

x	x^2

5. A group of students indicate how many videos they rent in a two week period: 2,0,2,1,3. Find the sum of squares (i.e., the sum of the squared deviation scores) and the standard deviation as a population estimate. (Note: you should get a $\hat{s}$ of 1.1402)

SS	$\hat{s}$

6. Assume a group of 10 depressed people have a SS of 81. Calculate standard deviation.

7. A group of computer geeks report how many times they check their email in a 4 hour period: 4, 19, 3, 0, 14. Calculate SS.

8. A class of six stats students reports having 3, 4, 5, 6, 7, & 1 nightmares the night before a stats test. Calculate variance.

9. Assume SS equals 10,000, n=1,000. Calculate σ.

10. Assume you're trying predict how students will score on a reading ability test. Students in class #1 score 8,10,5,8,2,3,6. Students in class #2 score 13,9,10,10,10,8,10. Calculate M and s_x for both.

11. Consider the results for the previous problem. For which class you more likely to be able to make a more accurate prediction about additional scores. Why? What piece of information is irrelevant for this question?

12. Using these same results, calculate the 68% confidence interval for each class. That is, take the mean for each group, then subtract and add the standard deviation to get the range of scores in which the mean will fall 68% of the time.

Homework 2.2: Measures of Variability - Key

1. The symbol for	The following symbol represents...
a. The standard deviation of a population: σ_x	d. $\hat{s}$: Estimate of the std. dev. of a population
b. The variance of population σ^2_x	e. σ_x: The std. dev. of a population.
c. The stand. dev. of a population as an estimate. $\hat{s}_x$	f. SS: Sum of Squares

2. Contrasting measures of central tendency and variability

a. Assume you have one play left in the football game to score and thereby win. You need to move the ball 13 yards to score. You can give the ball either to Bruno (averages 10 yards, $\hat{s}$ =1) or Rocky (averages 5 yards, $\hat{s}$=10). Who should get the ball? Rocky. You'd go with Bruno on a typical play, since you'd expect a reliable 10 ± 1 yards (9 to 11 yards). But he probably won't get the necessary 13 yards. Rocky will get 5 ± 10 yards (-5 to 15 yards). Though he might even lose yardage, 13 yards is clearly within the expected outcome.

b. Assume you need to earn at least $700 per month to cover your expenses and not get evicted. You have no savings and you will spend whatever you earn within the month. Would you rather work for tips at job A (average pay $1000, $\hat{s}$=500) or job B (average pay $800, $\hat{s}$=100)? You'd expect to earn $\$1000 \pm 500$ ($500 to $1500) with job A, and $\$800 \pm \$100$ ($700-$900) with job B. It's more likely you'd make your minimum of $700 with job B.

3. Calculate standard deviation: 3, 6, 3, 7

x	x^2
3	9
6	36
3	9
7	49
$\Sigma x = 19$	$\Sigma x^2 = 103$
$(\Sigma x)^2 = 361$	

$$\hat{s} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

$$\hat{s} = \sqrt{\frac{103 - \frac{361}{4}}{4-1}}$$

$$\hat{s} = 2.0616$$

3. Calculate standard deviation: 7, 7, 6, 6, 5

x	x^2
7	49
7	49
6	36
6	36
5	25
$\Sigma x = 31$	$\Sigma x^2 = 195$
$(\Sigma x)^2 = 961$	

$$\hat{s} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

$$\hat{s} = \sqrt{\frac{195 - \frac{961}{5}}{5-1}}$$

$$\hat{s} = 0.8367$$

5. Calculate standard deviation: 4, 5, 4, 5

x	x^2
4	16
5	25
4	16
5	25
$\Sigma x = 18$	$\Sigma x^2 = 82$
$(\Sigma x)^2 = 324$	

$$\hat{s} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

$$\hat{s} = \sqrt{\frac{82 - \frac{324}{4}}{4-1}}$$

$$\hat{s} = 0.5774$$

6. Calculate standard deviation: 1, 6, 2, 3, 7

x	x^2
1	1
6	36
2	4
3	9
7	49
$\Sigma x = 19$	$\Sigma x^2 = 99$
$(\Sigma x)^2 = 361$	

$$\hat{s} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

$$\hat{s} = \sqrt{\frac{99 - \frac{361}{5}}{5-1}}$$

$$\hat{s} = 2.5884$$

5. You ask a group of students how many videos they rent in a two week period and get the following data: 2,0,2,1,3. Find the sum of squares (i.e., the sum of the squared deviation scores) and the standard deviation as a population estimate. (Note: you should get a $\hat{s}$ of 1.1402)

SS

x	x^2
2	4
0	0
2	4
1	1
3	9
$\Sigma x = 8$	$\Sigma x^2 = 18$
$(\Sigma x)^2 = 64$	

$$SS = \sum x^2 - \frac{\left(\sum x\right)^2}{n}$$

$$SS = 18 - \frac{64}{5}$$

$$SS = 18 - 12.8 = 5.2$$

$\hat{s}$

$$\hat{s} = \sqrt{\frac{SS}{n-1}}$$

$$\hat{s} = \sqrt{\frac{5.2}{5-1}}$$

$$\hat{s} = \sqrt{1.3}$$

$$\hat{s} = 1.1402$$

6. Assume a group of 10 depressed people have a SS of 81. Calculate standard deviation.

$$\hat{s} = \sqrt{\frac{SS}{n-1}}$$

$$\hat{s} = \sqrt{\frac{81}{9}}$$

$$\hat{s} = 3$$

7. A group of computer geeks report how many times they check their email in a 4 hour period: 4, 19, 3, 0, 14. Calculate SS.

8. A class of six stats students reports having 3, 4, 5, 6, 7, & 1 nightmares the night before a stats test. Calculate variance.

$$\hat{s}$$

9. Assume SS equals 10,000, n=1,000. Calculate σ.

$$\sigma = \sqrt{\frac{SS}{n}}$$

$$\sigma = \sqrt{\frac{10{,}000}{1{,}000}}$$

$$\sigma = 3.1623$$

10. Assume you're trying predict how students will score on a reading ability test. Students in class #1 score 8,10,5,8,2,3,6. Students in class #2 score 13,9,10,10,10,8,10. Calculate M and s_x for both.

$$\hat{s} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} \qquad \hat{s} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

$$\hat{s} = \sqrt{\frac{302 - \frac{1764}{7}}{6}} \qquad \hat{s} = \sqrt{\frac{714 - \frac{4900}{7}}{6}}$$

$$\hat{s} = 2.8868 \qquad \hat{s} = 1.5275$$

$M_1 = 6$ **$M_2 = 10$**

11. Consider the results for the previous problem. For which class you more likely to be able to make a more accurate prediction about additional scores. Why? What piece of information is irrelevant for this question?

Class #2, less variability, mean

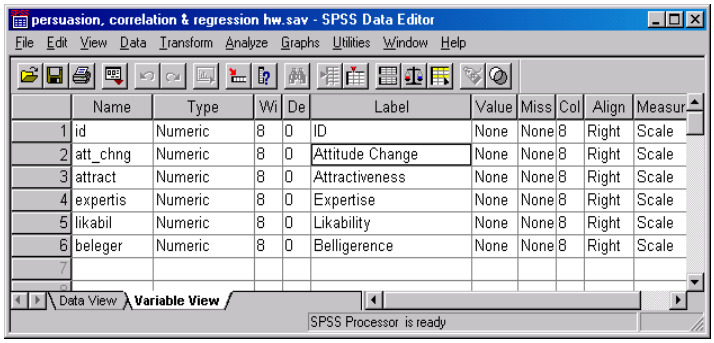
12. Using these same results, calculate the 68% confidence interval for each class. That is, t
subtract and add the standard deviation to get the range of scores in which the mean will fall 68

68%CI = M ± 1SD = 6 ± 2.8868 = 3.1132, 8.8868

68%CI = M ± 1SD =

Homework 3.1: Correlation & Regression

This study tries to predict how persuasive someone is based on several factors. Imagine that you watched people with varying levels of EXPERTISE, ATTRACTIVENESS, LIKABILITY, & BELIGENERENCE (hostility in argumentation) try to persuade someone to change their mind, and that you then measure the resulting amount of ATTITUDE-CHANGE. You have data from 20 such observations.



1. Correlations:

a. We call the thing to the right a

_____

b. The strongest correlation is between

_____ & _____, with an r

value of _____.

c. The weakest correlation is between

_____ & _____, with an r value

of _____.

Correlations

		ATT_CHNG	ATTRACT	EXPERTIS	LIKABIL	BELEGER
ATT_CHNG	Pearson Correlation	1.000	.208	.511*	.710**	-.506*
	Sig. (2-tailed)	.	.378	.021	.000	.023
	N	20	20	20	20	20
ATTRACT	Pearson Correlation	.208	1.000	.344	.084	-.055
	Sig. (2-tailed)	.378	.	.138	.724	.819
	N	20	20	20	20	20
EXPERTIS	Pearson Correlation	.511*	.344	1.000	.545*	-.295
	Sig. (2-tailed)	.021	.138	.	.013	.206
	N	20	20	20	20	20
LIKABIL	Pearson Correlation	.710**	.084	.545*	1.000	-.080
	Sig. (2-tailed)	.000	.724	.013	.	.738
	N	20	20	20	20	20
BELEGER	Pearson Correlation	-.506*	-.055	-.295	-.080	1.000
	Sig. (2-tailed)	.023	.819	.206	.738	.
	N	20	20	20	20	20

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

d. The biggest inverse relationship is between _____ & _____.

e. What is the p-value for the weakest correlation? _____. What is the standard cut-off level we use? ____

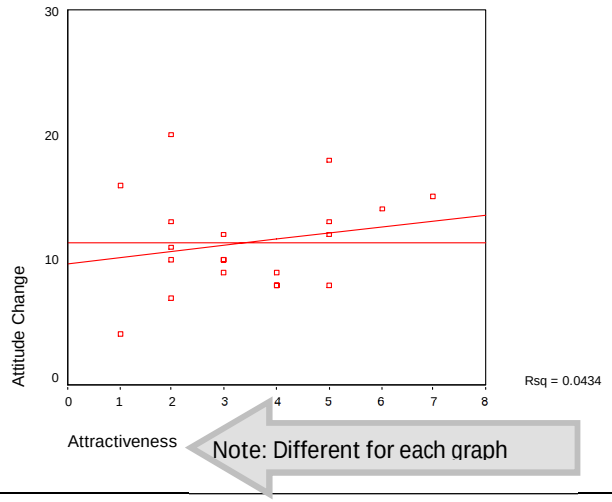
f. Check all the correlations that are significant.

g. Explain the difference between negative and positive correlations.

h. Explain what the p-value means.

i. Explain the difference between r and ρ.

j. Why can't we say likeability causes attitude change?



Descriptive Statistics

	N	Mean	SD
ATT_CHNG Attitude Change	20	11.35	3.91
Valid N (listwise)	20		

Note: Each scatterplot shows a flat, horizontal line intersecting the y axis at 11.35 – this represents the mean of y – not the regression line.

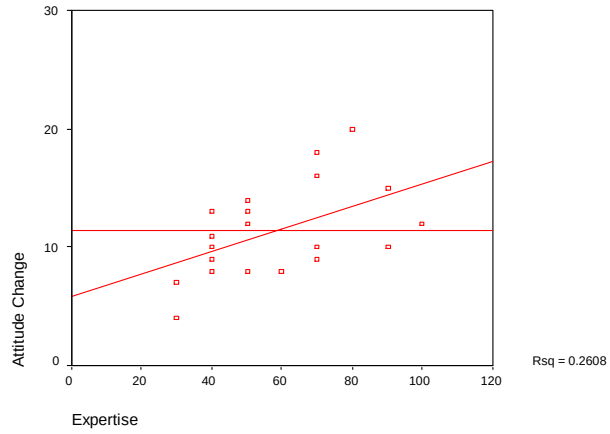
2. Scatterplots with Regression Lines:

Note: You may need to refer to the correlation matrix to answer some of the questions on this page.

a. Label the predictor, criterion, slope, y-intercept, x & y-axes.

b. What's the r value for here? Is it significant? (See correlation matrix on previous page.)

c. What's the r^2 value?



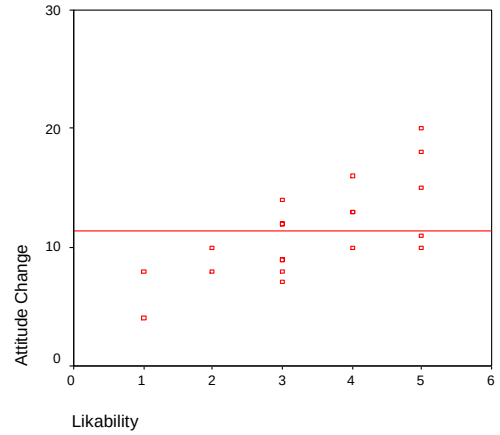
d. What's the r-value here? Is it significant?

e. What's r^2?

f. Is this a <u>better</u> or <u>worse</u> predictor than above ? <u>More</u> or <u>less</u> prediction error?

g. Label prediction error for the score of <u>80 Expertise</u>.

h. What two things differ about this regression line and the one above?

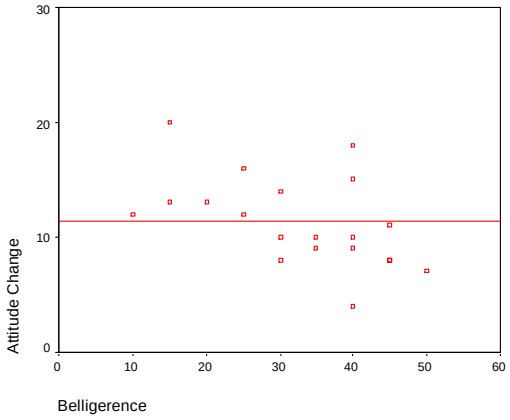


i. What's the r-value here? Is it significant?

i. Is this a <u>weaker</u> or <u>stronger</u> relationship?

k. The actual y-values now fall _____ to the reg. line.

l. This means there will be _____ __prediction error with the regression line.



m. How does the strength of the regression line impact the mean amount of attitude change? [Sneaky question!]

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.710[a]	.505	.477	2.83

a. Predictors: (Constant), LIKABIL Likability

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.932	1.844		2.132	.047
	LIKABIL Likability	2.182	.510	.710	4.282	.000

a. Dependent Variable: ATT_CHNG Attitude Change

3. Using the regression formula:

a. label r2, a, b, the criterion, & the predictor.

b. Define:

y':

a: b:

x:

c. Write the regression equation:

d. Draw the regression line on the appropriate graph

e. Is the regression coefficient significant? What's the p-value?

f. What amount of attitude change would you predict with a likeability score of 4? (Use your regression equation and plug in 4.)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.506[a]	.256	.215	3.46

a. Predictors: (Constant), BELEGER Belligerence

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	17.033	2.409		7.070	.000
	BELEGER Belligerence	-.174	.070	-.506	-2.491	.023

a. Dependent Variable: ATT_CHNG Attitude Change

g. Write the regression equation for this regression analysis.

h. Draw the regression line on the appropriate graph

i. Is the regression coefficient significant? What's the p-value?

4. Integrative Wrap-up. Important!

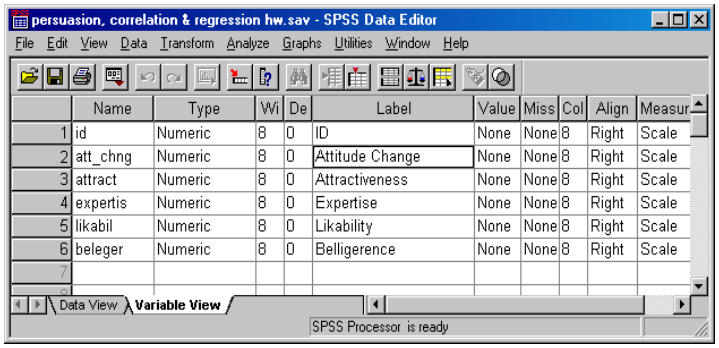
Which predictors of attitude change can you safely use? Why?

Which is the best predictor? Why?

With this predictor, how much more accurate are you relative to just guessing the mean of y?

Homework 3.1: Correlation & Regression – Key

This study tries to predict how persuasive someone is based on several factors. Imagine that you watched people with varying levels of EXPERTISE, ATTRACTIVENESS, LIKABILITY, & BELIGENERENCE (hostility in argumentation) try to persuade someone to change their mind, and that you then measure the resulting amount of ATTITUDE-CHANGE. You have data from 20 such observations.



1. Correlations:

a. We call the thing to the left a ___Correlation Matrix_____

b. The strongest correlation is between ___Likeability_ & _Attitude Change_____, with an r value of __r=.710_____.

c. The weakest correlation is between _Belligerence _& _Attractive._, with an r value of __r=-.055__.

Correlations

		ATT_CHNG	ATTRACT	EXPERTIS	LIKABIL	BELEGER
ATT_CHNG	Pearson Correlation	1.000	.208	.511*	.710**	-.506*
	Sig. (2-tailed)	.	.378	.021	.000	.023
	N	20	20	20	20	20
ATTRACT	Pearson Correlation	.208	1.000	.344	.084	-.055
	Sig. (2-tailed)	.378	.	.138	.724	.819
	N	20	20	20	20	20
EXPERTIS	Pearson Correlation	.511*	.344	1.000	.545*	-.295
	Sig. (2-tailed)	.021	.138	.	.013	.206
	N	20	20	20	20	20
LIKABIL	Pearson Correlation	.710**	.084	.545*	1.000	-.080
	Sig. (2-tailed)	.000	.724	.013	.	.738
	N	20	20	20	20	20
BELEGER	Pearson Correlation	-.506*	-.055	-.295	-.080	1.000
	Sig. (2-tailed)	.023	.819	.206	.738	.
	N	20	20	20	20	20

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

d. The one biggest inverse relationship is between _Belligerence___ & _Attitude Change___.

e. What is the p-value for the weakest correlation? _p_{obt} =.819_. What is the standard cut-off level we use? _$\alpha \leq .05$___

f. Check all the correlations that are significant.

g. Explain the difference between negative and positive correlations.

Positively correlated variables move in the same direction (e.g., SAT scores & GPA). Negatively correlated variables move in opposite directions (e.g., as SAT scores increase, time spent watching TV decreases).

h. Explain what the p-value means.

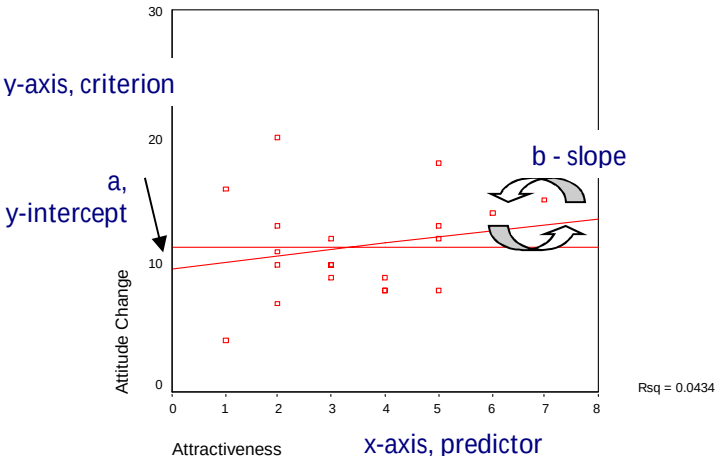
The p-value indicates the percentage chance that the observed correlation (r) would occur just by chance (i.e., when in the population $\rho = 0$ & the H_0 hypothesis is true).

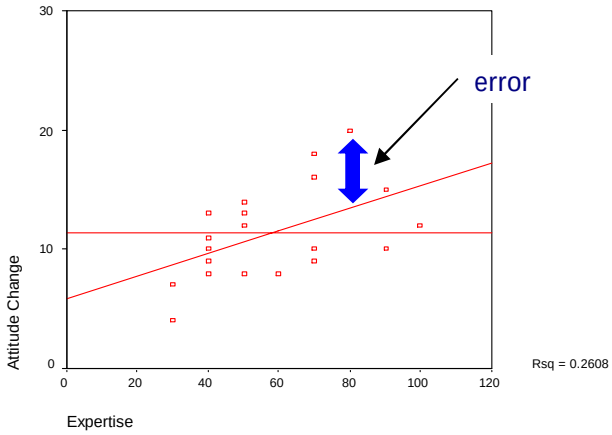
i. Explain the difference between r and ρ.

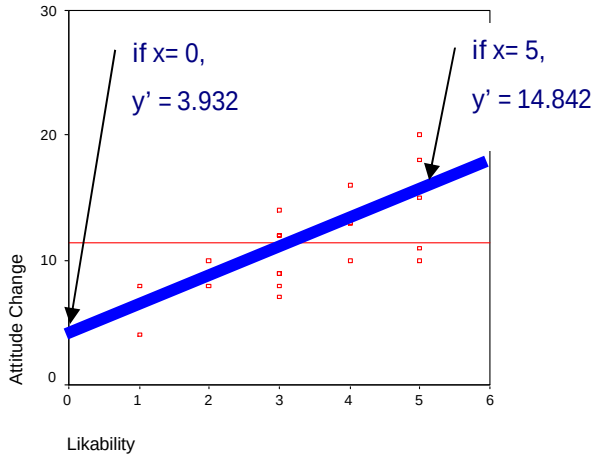
The sample statistic r gives the observed correlation in a give sample – the values shown in the correlation matrix. The population parameter ρ is the value we try to estimate with r. We are always want to reject the null hypothesis H_o: $\rho = 0$, by getting an r large enough that we can "trust" it.

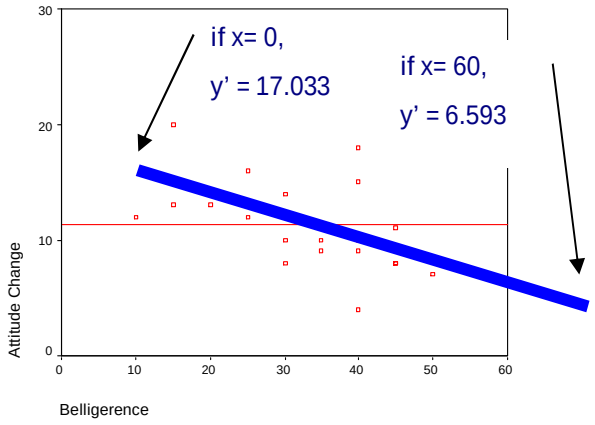
j. Why can't we say likeability causes attitude change?

Correlation only tests for relationship, not causality. Some other factor may be influencing both likeability and attitude change, making it appear one causes the other.









Descriptive Statistics

	N	Mean	SD
ATT_CHNG Attitude Change	20	11.35	3.91
Valid N (listwise)	20		

Note: Each scatterplot shows a flat, horizontal line intersecting the y axis at 11.35 – this represents the mean of y – not the regression line.

2. Scatterplots with Regression Lines:

a. Label the predictor, criterion, slope, and y-intercept, x-axis, and y-axis.

b. What's the r value for the relationship graphed here? Is it significant? r(18)=.208, n.s.

c. What's the r^2 value? $r^2 = .0433$

d. What's the r value for the relationship graphed here? Is it significant? r(18)=.511, p≤.05

e. What's the r^2 value? $r^2 = .2611$

f. Is this a better or worse predictor? More or less prediction error? better, less error

g. Label prediction error for the score of 80 Expertise.

h. What two things differ about this regression line and the one above? Greater slope, actual scores fall closer to regression line.

i. What's the r value for the relationship graphed here? Is it significant? r (18)=.710, p≤.05.

i. Is this a weaker or stronger relationship?

stronger

k. The actual y values now fall _____ to the reg. line.

closer

l. This means there will be _____ prediction error with the regression line.

less

m. How does the strength of the regression line impact the mean amount of attitude change? [Sneaky question!]

It doesn't. The mean of y (attitude change) stays the same regardless of what you use to try to predict it. (Note the read horizontal line is always at 11.35, because $M_y = 11.35$).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.710[a]	.505	.477	2.83

a. Predictors: (Constant), LIKABIL Likability

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.932	1.844		2.132	.047
	LIKABIL Likability	2.182	.510	.710	4.282	.000

a. Dependent Variable: ATT_CHNG Attitude Change

y' = 2.182(x) + 3.932
y' = 2.182(5) + 3.932
y' = 14.82

3. Using the regression formula:

a. label r2, a, b, the criterion, & the predictor.

b. Define:

y': predicted value of y

a: y-intercept b: slope of r. line

x: value of predictor you plug in

c. Write the regression equation:

y' = 2.182(x) + 3.932

d. Draw the regression line on the appropriate graph

e. Is the regression coefficient significant? What's the p-value?

yes, p≤ .05 p=.000

f. What amount of attitude change would you predict with a likeability score of 4? (Use your regression equation and plug in 4.)

y' = 2.182(x) + 3.932
y' = 2.182(4) + 3.932
y' = 12.66

Pick a large number for belligerence (x), like 60

y' = -.174(x) + 17.033

y' = -.174(60) + 17.033

y' = 6.593

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.506[a]	.256	.215	3.46

a. Predictors: (Constant), BELEGER Belligerence

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	17.033	2.409		7.070	.000
	BELEGER Belligerence	-.174	.070	-.506	-2.491	.023

a. Dependent Variable: ATT_CHNG Attitude Change

g. Write the regression equation for this regression analysis.

y' = -.174(x) + 17.033

h. Draw the regression line on the appropriate graph

i. Is the regression coefficient significant? What's the p-value?

yes, p≤ .05 p=.023

4. Integrative Wrap-up. Important!

Which predictors of attitude change can you safely use? Why?

Expertise, Likeability, and Belligerence all produced significant regression coefficients for predicting Attitude Change.

Which is the best predictor? Why?

Likeability is the best predictor of Attitude Change because it had the highest r (r=.710).

With this predictor, how much more accurate are you relative to just guessing the mean of y?

You can explain about 50% of the variability in Attitude Change (r^2 = .505).

Homework 3.2: Correlation & Regression Practice

From the website, get Smoking & Four Lung Cancers -- These are 1960s data relating Cigarettes smoked and deaths per 100k in 44 states.

1. Correlate Cigarettes Smoked & the four kinds of cancer. Report the number of unique sig. correlations in the matrix.	2. For the relationship between Cig. and B-Cancer, summarize the stat. 3. Summarize the statistics for the three other relationships (between Cig and other cancers)..... ➔	
4. How likely is it that the correlation between Lung-Cancer and K-Cancer is due to chance? What hypothesis testing conclusion do you reach?	5. How likely is it that the correlation between K-Cancer and B-Cancer is simply a fluke? What hypothesis testing conclusion do you reach?	6. What percent of variance in Lung-Cancer is explained by Cigarettes?
7. What percent of variance in B-Cancer is explained by K-Cancer?	8. If appropriate, state the regression formula for predicting B-Cancer based on Cigarettes.	9. How much more accurate are you using the regression formula in the previous problem?
10. If appropriate, state the reg. formula for predicting Lung-Cancer based on Cigarettes.	11. What percent of variance in Lung-Cancer is explained by Cigarettes? What's the std err of the residual?	12. Predict Lung-Cancer deaths based on 40 Cigarettes per capita.
13. If appropriate, state the reg. formula predicting Leuk-Cancer based on Cigarettes.	14. Create a scatterplot with regression line predicting Lung-Cancer with Cigarettes. Sketch here .....➔	
Open the employee selection data file. Correlate (in this order) job perf, ass. center avg, cog abil, structured interview, & handwriting analysis.	15. How many unique sig. correlations? 16. Summarize the four correlations with job performance here..... ➔	
17. How likely is it that the correlation between ass. center avg and job performance is due to chance? What hypothesis testing conclusion? ..... ➔		
18. How likely is it that the correlation between structured interview and job perf is due to chance? What hypothesis testing conclusion? .....➔		

19. What percent of variance in job perform explained by cog abil?	20. Percent of variance in structured int score explained by cog abil?	21. Explain to manager the problem with using Ass Cntr avg to predict job perf.
22. If appropriate, state formula for predicting job perf based on cog ability.	23. Predict job perf with cog ability of 700.	24. For prior problem, how much overall error in predictions? How much var accounted for in job perf?
25. If appropriate, state formula for predicting cog ability based on job perf.	26. Predict cognitive ability with job perf scr of 7.	27. If appropriate, state formula for predicting job perf based on assessment center average.

Output for HW #3.2

Correlations

		cig_smk	bladcncr	lungcncr	kidcncr	leukcncr
cig_smk	Pearson Correlation	1	.704**	.697**	.487**	-.068
	Sig. (2-tailed)		.000	.000	.001	.659
	N	44	44	44	44	44
bladcncr	Pearson Correlation	.704**	1	.659**	.359*	.162
	Sig. (2-tailed)	.000		.000	.017	.293
	N	44	44	44	44	44
lungcncr	Pearson Correlation	.697**	.659**	1	.283	-.152
	Sig. (2-tailed)	.000	.000		.063	.326
	N	44	44	44	44	44
kidcncr	Pearson Correlation	.487**	.359*	.283	1	.189
	Sig. (2-tailed)	.001	.017	.063		.220
	N	44	44	44	44	44
leukcncr	Pearson Correlation	-.068	.162	-.152	.189	1
	Sig. (2-tailed)	.659	.293	.326	.220	
	N	44	44	44	44	44

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Descriptive Statistics

	N	Mean	Std. Deviation
cig_smk	44	24.9141	5.57329
bladcncr	44	4.1211	.96492
lungcncr	44	19.6532	4.22812
kidcncr	44	2.7945	.51908
leukcncr	44	6.8298	.63826
Valid N (listwise)	44		

1. CIG = Number of cigarettes smoked (hds per capita)
2. BLAD = Deaths per 100K population from bladder cancer
3. LUNG = Deathes per 100K population from lung cancer
4. KID = Deaths per 100K population from bladder cancer
5. LEUK = Deaths per 100 K population from leukemia

The data are per capita numbers of cigarettes smoked (sold) by 43 states and D.C. in 1960 together with death rates per thousand population from various forms of cancer.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.704[a]	.495	.483	.69377

a. Predictors: (Constant), cig_smk

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.086	.484		2.242	.030
	cig_smk	.122	.019	.704	6.417	.000

a. Dependent Variable: bladcncr

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.697[a]	.486	.474	3.06607

a. Predictors: (Constant), cig_smk

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.472	2.141		3.023	.004
	cig_smk	.529	.084	.697	6.306	.000

a. Dependent Variable: lungcncr

Model Summary

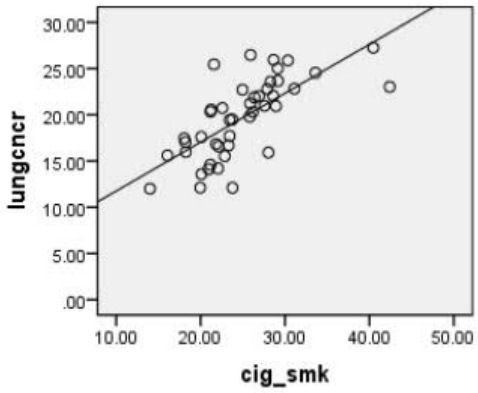
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.068[a]	.005	-.019	.64430

a. Predictors: (Constant), cig_smk

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.025	.450		15.617	.000
	cig_smk	-.008	.018	-.068	-.445	.659

a. Dependent Variable: leukcncr



Correlations

		Job Performance	Assessment Center, average	Cognitive Ability	Structured Interview	Handwriting Analysis
Job Performance	Pearson Correlation	1	.470	.520*	.367	-.183
	Sig. (2-tailed)		.057	.032	.147	.482
	N	17	17	17	17	17
Assessment Center, average	Pearson Correlation	.470	1	.231	.259	-.049
	Sig. (2-tailed)	.057		.373	.316	.851
	N	17	17	17	17	17
Cognitive Ability	Pearson Correlation	.520*	.231	1	.588*	-.042
	Sig. (2-tailed)	.032	.373		.013	.874
	N	17	17	17	17	17
Structured Interview	Pearson Correlation	.367	.259	.588*	1	.022
	Sig. (2-tailed)	.147	.316	.013		.932
	N	17	17	17	17	17
Handwriting Analysis	Pearson Correlation	-.183	-.049	-.042	.022	1
	Sig. (2-tailed)	.482	.851	.874	.932	
	N	17	17	17	17	17

*. Correlation is significant at the 0.05 level (2-tailed).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.520[a]	.271	.222	1.303

a. Predictors: (Constant), Cognitive Ability

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.160	2.185		-.531	.603
	Cognitive Ability	.009	.004	.520	2.359	.032

a. Dependent Variable: Job Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.520[a]	.271	.222	74.749

a. Predictors: (Constant), Job Performance

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	444.781	53.033		8.387	.000
	Job Performance	29.832	12.645	.520	2.359	.032

a. Dependent Variable: Cognitive Ability

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.470[a]	.221	.169	1.347

a. Predictors: (Constant), Assessment Center, average

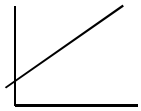
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.541	1.678		.322	.752
	Assessment Center, average	.058	.028	.470	2.065	.057

a. Dependent Variable: Job Performance

Homework 3.2: Correlation & Regression Practice

From the website, get Smoking & Four Lung Cancers -- These are 1960s data relating Cigarettes smoked and deaths per 100k in 44 states.

1. Correlate Cigarettes Smoked & the four kinds of cancer. Report the number of unique sig. correlations in the matrix. 5	2. For the relationship between Cig. and B-Cancer, summarize the stat. 3. Summarize the statistics for the three other relationships (between Cig and other cancers)..... ➔	r (42) = .704, p ≤ .05 r (42) = .697, p ≤ .05 r (42) = .487, p ≤ .05 r (42) = -.068, n.s.
4. How likely is it that the correlation between Lung-Cancer and K-Cancer is due to chance? What hypothesis testing conclusion do you reach? 6.3% chance, Retain Ho	5. How likely is it that the correlation between K-Cancer and B-Cancer is simply a fluke? What hypothesis testing conclusion do you reach? 1.7%, Reject Ho.	6. What percent of variance in Lung-Cancer is explained by Cigarettes? r^2 = .4858, so 48.58%
7. What percent of variance in B-Cancer is explained by K-Cancer? r^2 = .1289, so 12.89%	8. If appropriate, state the regression formula for predicting B-Cancer based on Cigarettes. y' = bx + a = .122x + 1.086	9. How much more accurate are you using the regression formula in the previous problem? r^2 = .495, so 49.5%
10. If appropriate, state the reg. formula for predicting Lung-Cancer based on Cigarettes. y' = bx + a = .529x + 6.472	11. What percent of variance in Lung-Cancer is explained by Cigarettes? What's the std err of the residual? r^2 = .4858, so 48.58%, Sy' = 3.0661	12. Predict Lung-Cancer deaths based on 40 Cigarettes per capita. y' = .529(40) + 6.472 = 27.632
13. If appropriate, state the reg. formula predicting Leuk-Cancer based on Cigarettes. Not appropriate	14. Create a scatterplot with regression line predicting Lung-Cancer with Cigarettes. Sketch here .....➔	
Open the employee selection data file. Correlate (in this order) job perf, ass. center avg, cog abil, structured interview, & handwriting analysis.	15. How many unique sig. correlations? 2 16. Summarize the four correlations with job performance here..... ➔	r (15) = .470, n.s. r (15) = .520, p ≤ .05 r (15) = .367, n.s. r (15) = -.183, n.s.
17. How likely is it that the correlation between ass. center avg and job performance is due to chance? What hypothesis testing conclusion? ..... ➔		5.7%, Retain Ho
18. How likely is it that the correlation between structured interview and job perf is due to chance? What hypothesis testing conclusion? ..... ➔		14.7%

19. What percent of variance in job perform explained by cog abil? r^2 = .271	20. Percent of variance in structured int score explained by cog abil? r^2 = .3457	21. Explain to manager the problem with using Ass Cntr avg to predict job perf. Greater than 5% chance that correlation is a fluke (i.e., not reliable)
22. If appropriate, state formula for predicting job perf based on cog ability. y' = bx + a = .009x -1.160	23. Predict job perf with cog ability of 700. y' = bx + a = .009(700) -1.160 = 5.14	24. For prior problem, how much overall error in predictions? How much var accounted for in job perf? Sy' = 1.303, r^2 = .271
25. If appropriate, state formula for predicting cog ability based on job perf. y' = 29.832x + 444.781	26. Predict cognitive ability with job perf scr of 7. y' = 29.832(7) + 444.781= 653.605	27. If appropriate, state formula for predicting job perf based on assessment center average. Not appropriate

Homework 3.3: Conceptual Review (closed book)

Fold paper on middle line. Correct answers on right. Correct letter choice is second to last letter..

1) Having people rate their religiosity (how religious they are) on a 1-7 scale will produce data at what level of measurement? a) Interval b) Nominal c) Ratio d) Ordinal	dcae. Any Likert type scale (e.g., 1-7) produces interval data (i.e., equal intervals between rankings but no true zero).
2) It will be easiest to detect a correlation if _____ and _____ a) $\rho = 0$; n = 10 b) $\rho \neq 1$; n = 10 c) $\rho = .87$; n = 30 d) $\rho = 1.5$; n = 30 e) your teacher tells you the answer	abce. A large ρ means a strong correlation, so it's easier to detect. A large n gives you more power to detect whatever is there.
3) As the correlation strength increases which 2 things occur? a) the coefficient of determination increases; Sy' decreases b) the coefficient of determination increases; n decreases c) p_{obt} increases; Sy' decreases d) p_{obt} decreases; Sy' increases e) p_{obt} increases; r^2 increases f) the price of orange juice concentrate tops $70 per barrel	afaf. coeff of determination (r^2) always increases as r increases, and the amount of prediction error (Sy') always goes down because your prediction ability is getting stronger.
4) The coefficient of determination tells you a) Whether the correlation is statistically significant b) Whether regression is allowed c) The increases in prediction accuracy d) The amount of variance explained by y' e) The amount of variance explained by b	aace. r^2 (the coefficient of determination) tells you the increase in prediction accuracy, or the amount of variance in y accounted for by x.
5) You collect data on the number of hours of TV children watch each night. For some reason, almost all of the children report watching between 80 and 90 minutes of television, with very, very few watching more or less than that. The distribution would likely be described as: a) symmetrical b) normally distributed c) leptokurtic d) skewed e) mesokurtic f) bimodal	cece. Low variability will produce a graph of the distribution that is "pointy" – Leptokurtic
6) We can define sum of squares as the a) $\Sigma x^2 + (\Sigma x)^2$ b) $\Sigma x^2/n + (\Sigma x)^2$ c) average squared deviation score d) sum of the squared deviation scores e) sum of the deviation scores squared	abdb. Sum of squares is short for "sum of the squared deviation scores"

7) You want to predict test performance for a given student on a given U.S. History test. You would likely be most accurate under which of the following conditions: a) σ=15 μ=60 Md=58 b) σ=15 μ=50 Md=52 c) σ=10 μ=70 Md=72 d) σ=17 μ=65 Md=67	acce. All that matters here is picking the smallest standard deviation – as variability decreases prediction accuracy increases.
8) If a student scored much higher than average then her deviation score would be a) negative and large b) positive and large c) large (but you don't know whether negative or positive) d) negative (but you don't know whether large or small) e) positive (but you don't know whether large or small)	dbb. Deviation score is equal to $x - x_{bar}$, so higher than average would make it positive, and "much higher than average" would make it a large deviation.
9) Tonika always scored about the same on the depression index and it was usually a higher number. Ahmad's scores were less consistent, but there were always smaller values. Ahmad's scores indicate _____ and _____. a) higher variability; higher central tendency b) higher variability; lower central tendency c) lower variability; higher central tendency d) lower variability; lower central tendency e) depends upon the sample size f) depends upon whether the distributions are skewed.	ddbd. Less consistent means "higher variability" and "always smaller" means a "lower central tendency".
10) Which of the following would provide parameters? a) SS, variance, Standard Deviation b) variance and Standard Deviation c) Sy', b, a d) r, Sy', Sy e) μ, *ρ*, σ f) M, Md, Mo	caee. These are all greek symbols and represent population parameters for mean, correlation, and standard deviation (respectively).
11) Students are assigned to complete a fashion survey in one of four class rooms. Classroom number would provide _____ data and favorite color of shirt would provide _____ data. a) quantitative; qualitative b) quantitative; quantitative c) qualitative; quantitative d) qualitative; qualitative	adde. Classroom number is not rankable in a meaningful way and so is qualitative; favorite color would also produce qualitative data.
12) Which of the following would best enable you to show the number of times Stove-top stuffing was listed as favorite food among a group of 200 people? a) Mean b) Median c) Mode d) Frequency Distribution e) Range f) Standard Deviation	eaca. Favorite type of food is qualitative data – mode is the only measure of central tendency that works with qualitative data.
13) You ask students to rank 10 cafeteria meals from best to worst. This would provide which level of measurement: a) Nominal b) Ordinal c) Interval d) Ratio	ddbe. Rankings produce ordinal level data.

14) Assume evil civil engineers change traffic light colors to orange, purple, & fuchsia. Counting the number of accidents occurring in the first hour after the change would provide which level of measurement: a) Nominal b) Ordinal c) Interval d) Ratio	bdda. You would start counting at zero, so the data would be ratio.
15) Which of the following SPSS graphs most easily enable you to check for deviations from normality for a distribution of data? a) Bar graph b) Error bar c) Graphing of sample means d) Pie chart e) Line graph f) Histogram	alfg. The Histogram on SPSS allows you to overlay the curve of a normal distribution.
16) A distribution with two distinct clusters of high frequency scores could be described as a) normally distributed b) mesokurtic c) leptokurtic d) bimodal e) skewed f) bumpy	bldk. Bimodal data has two clumps of data producing a camel-like shape.
17) Which measure gives the score at the 50^{th} percentile? a) Skew b) Mean c) Median d) Mode e) Mendacity f) Standard Deviation	eocq. By definition, the Median gives the score at the 50^{th} percentile.
18) A deviation score tells you if the a) Distribution is skewed b) Distribution is bimodal c) Distribution has kurtosis d) The score is smaller or bigger than the mean e) The score is smaller or bigger than the median	gtdb. By definition, the deviation score tells you the number of units a raw score is bigger than or smaller than the mean.
19) SS/n provides a) Standard Deviation b) Variance c) Sum of Squares d) $\Sigma x^2 + (\Sigma x)^2/n$ e) a Deviation Score f) Sum of the Deviation Scores	tbbd. By definition, dividing SS by n gives you Variance.
20) As the strength of the correlation increases, which of the following increase a) r^2, slope of the regression line, prediction accuracy b) r^2, a, prediction accuracy c) Sy', n, prediction accuracy d) Sy', Sy, r^2 e) prediction accuracy, slope of the regression line, Sy'	beag If r increases, all of these three things must also increase.

21) As a correlation gets stronger, the scatterplot pattern become more a) elliptical (egg shaped) b) line-like c) flatter d) variable e) slanted to the right f) slanted to the left	agbd. A stronger correlation has less error so the points fall closer to the regression line. In a perfect correlation all the points fall exactly on the regression line.
22) If the Ho for a correlation is false it means a) There really isn't a correlation b) $\rho = 0$ c) There really is a correlation d) $\rho \neq 0$ e) r must be a large value f) a & b g) c & d h) c, d, & e	qggh. The Ho says there is no correlation – if this is false then there must be an actual correlation. ($\rho \neq 0$ means there is some sort of correlation, either positive or negative).
23) When conducting a correlation, you are more likely to get a small p value if a) ρ is small b) ρ is large c) the sample is small d) the sample is large e) a & c f) b & d	ogfp. You're more likely to get a small p value (an indication of a real correlation) if the true correlation (ρ) is large and you have a larger (more reliable) sample to reflect this.
24) Assume you correlate self-esteem and depression and then realize that for some reason your sample has very few people with average or below average self-esteem. You are likely to experience… a) a large ρ b) a small ρ c) a curvilinear relationship d) truncation of range e) a smaller standard deviation for depression	egdg. The truncation of the range off x (i.e., you have only people with average self-esteem) causes an underestimation of ρ.
25) The As r increases…. a) Prediction accuracy decreases b) The difference between Sy and Sy' gets smaller c) Sy' gets larger d) The coefficient of determination increases e) The slope of the regression line gets flatter	oudo. If r increases r^2 – the correlation of determination – must increase as well.
26) When conducting a correlation, we calculate ___ to estimate____. a) x_{bar} ; μ b) μ; x_{bar} c) r; ρ d) ρ ; ρ e) r; p f) b; y'	ppce. Using our sample we calculate r (a statistic) to estimate ρ (a population parameter).
27) When Sy' increases a) Sy increases and r increases b) Sy decreases and r decreases c) Prediction error increases and r^2 increases d) Prediction error decreases and r^2 decreases e) r decreases and prediction error increases	goeo. Strength of correlation never affects Sy, ruling out a & b. An increasing Sy' means more prediction error which means r is getting smaller.

Homework 3.4: Computational Review #1 (open-book)

You can find the dataset at the website http://faculty.winthrop.edu/sinnj/ . It's creatively called Computational Review #1. The researcher is attempting to identify factors that can predict anxiety levels.

1. Do an appropriate graph of the marital status distribution.	2. Do an appropriate graph of the anxiety distribution, with a normal curve as a backdrop. a. Any deviations from normality? b. What would probably make the data fit the normal curve better?
[Paste Graph of Marital Status Distribution Here.]	[Paste Graph of Anxiety Distribution Here.]
3. Do a graph that shows you the mean, plus or minus 1 standard deviation on anxiety.	
[Paste Graph of Marital Status Distribution Here.]	

4. Do an analysis to provide the minimum values, maximum values, means, and standard deviations.
   a. Which variable has the lowest standard deviation? (Be careful, you can only get standard deviation on quantitative data measured at the interval level or above).

[Paste Table of Descriptive Statistics Here.]

Do a correlation matrix correlating Anxiety, Hours worked per week, Social Support Quality, and Hours of Exercise.

* What's the smallest correlation (significant or not)?
* What's the direction of the relationship between Anxiety &… Hours Exer? &…. Hours Worked?
* In which cases would you assume that "rho" is not equal to zero?

[Paste Correlation Matrix Here.]

7. Do 3 sets of scatterplots and regression analyses, pasting your work on the next page. You'll do three sets of analyses trying to predict anxiety. Use these three predictors: Hours worked, social support, and hours of exercise.

Which predictor accounts for the most variance?

Which predictor accounts for the least variance?
Which predictor best predicts anxiety?
What level of anxiety would you predict for an individual who exercised only 4 hours per week?

Show output where you're trying to predict Anxiety based on Hours worked per week.	
[Paste "Model Summary" table here and "Coefficients" table in space below.]	[Paste Scatterplot with regression line Here.]

Show output of regression analysis where you're trying to predict Anxiety based on Social support Quality.	
[Paste "Model Summary" table here and "Coefficients" table in space below.]	[Paste Scatterplot with regression line Here.]

Show output of regression analysis where you're trying to predict Anxiety based on Hours of exercise per week.	
[Paste "Model Summary" table here and "Coefficients" table in space below.]	[Paste Scatterplot with regression line Here.]

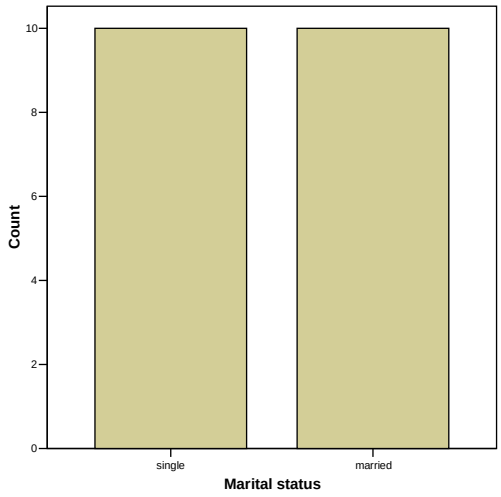
Homework 3.4: Computational Review #1 (open-book) -key

You can find the dataset at the website http://faculty.winthrop.edu/sinnj/ . It's creatively called Computational Review #1. The researcher is attempting to identify factors that can predict anxiety levels.

1. Do an appropriate graph of the marital status distribution.

How to do it: It's qualitative data, so bar or pie graph is appropriate. Go to graphs, bar, groups of cases, move marital status into category axis box.

[Paste Graph of Marital Status Distribution Here.]

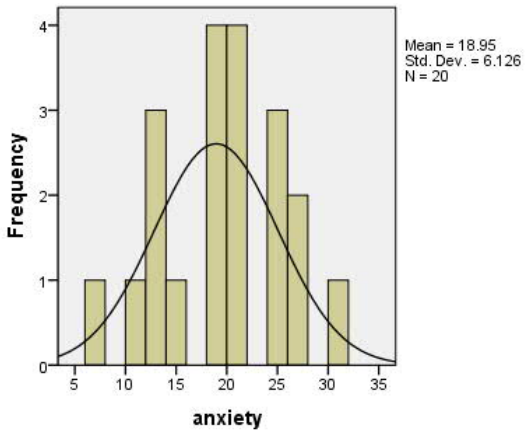


2. Do an appropriate graph of the anxiety distribution, with a normal curve as a backdrop.

c. Any deviations from normality? no
d. What would probably make the data fit the normal curve better? A larger sample.

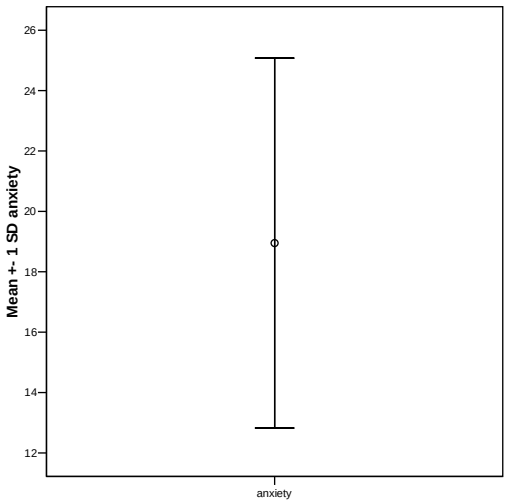
How to do it: Go to Graphs, Histogram, select display normal curve.

[Paste Graph of Anxiety Distribution Here.]



3. Do a graph that shows you the mean, plus or minus 1 standard deviation on anxiety.

[Paste Graph of Marital Status Distribution Here.]



4. Do an analysis to provide the minimum values, maximum values, means, and standard deviations.

b. Which variable has the lowest standard deviation? (Be careful, you can only get standard deviation on quantitative data measured at the interval level or above).

– Social Support Quality has lowest standard deviation.

• How to do it: Go to Descriptives, Descriptives (again), move over every QUANTITATIVE variable (i.e., not Marital Status)

[Paste Table of Descriptive Statistics Here.]

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
anxiety	20	7	30	18.95	6.126
Hours worked per week	20	20	60	41.50	14.244
Social Support quality	20	2	7	4.75	1.552
hrsexer	20	2	12	6.90	3.144
Valid N (listwise)	20				

Do a correlation matrix correlating Anxiety, Hours worked per week, Social Support Quality, and Hours of Exercise.

* What's the smallest correlation (significant or not)? Hrs Exercised & Hrs Worked. (r = -.173)

* What's the direction of the relationship between Anxiety &... Hours Exer? Negative &.... Hours Worked? Positive

* In which cases would you assume that "rho" is not equal to zero? Social Support and Anxiety, Hrs Exercise & Anxiety

[Paste Correlation Matrix Here.]

Correlations

		anxiety	Hours worked per week	Social Support quality	hrsexer
anxiety	Pearson Correlation	1	.194	.530*	-.774**
	Sig. (2-tailed)		.413	.016	.000
	N	20	20	20	20
Hours worked per week	Pearson Correlation	.194	1	.375	-.173
	Sig. (2-tailed)	.413		.103	.466
	N	20	20	20	20
Social Support quality	Pearson Correlation	.530*	.375	1	-.318
	Sig. (2-tailed)	.016	.103		.171
	N	20	20	20	20
hrsexer	Pearson Correlation	-.774**	-.173	-.318	1
	Sig. (2-tailed)	.000	.466	.171	
	N	20	20	20	20

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

7. Do 3 sets of scatterplots and regression analyses, pasting your work on the next page. You'll do three sets of analyses trying to predict anxiety. Use these three predictors: Hours worked, social support, and hours of exercise.

Which predictor accounts for the most variance? Hours Exercised

Which predictor accounts for the least variance? Hours Worked

Which predictor best predicts anxiety? Hours Exercised

What level of anxiety would you predict for an individual who exercised only 4 hours per week? 23.3231

$y' = bx + a$

$y' = -1.507(x) + 29.351$

$y' = -1.507(4) + 29.351$

$y' = -6.028 + 29.351$

$y' = 23.3231$

Show output where you're trying to predict Anxiety based on Hours worked per week.

[Paste "Model Summary" table here and "Coefficients" table in space below.]

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.194[a]	.038	-.016	6.174

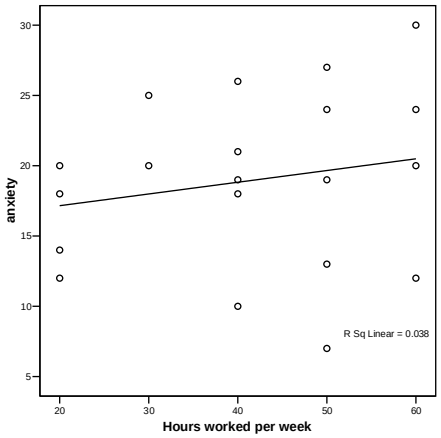
a. Predictors: (Constant), Hours worked per week

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.489	4.352		3.559	.002
	Hours worked per week	.083	.099	.194	.839	.413

a. Dependent Variable: anxiety

[Paste Scatterplot with regression line Here.]



Show output of regression analysis where you're trying to predict Anxiety based on Social support Quality.

[Paste "Model Summary" table here and "Coefficients" table in space below.]

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.530[a]	.281	.241	5.336

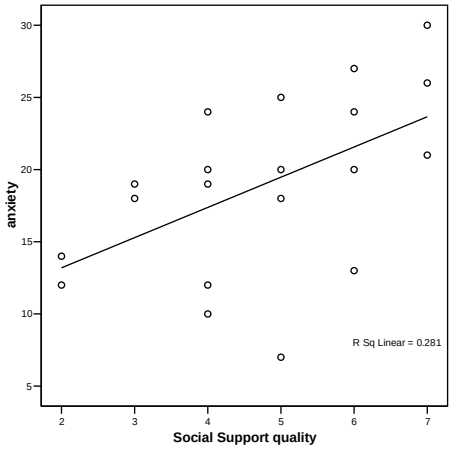
a. Predictors: (Constant), Social Support quality

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.009	3.933		2.291	.034
	Social Support quality	2.093	.789	.530	2.653	.016

a. Dependent Variable: anxiety

[Paste Scatterplot with regression line Here.]



Show output of regression analysis where you're trying to predict Anxiety based on Hours of exercise per week.

[Paste "Model Summary" table here and "Coefficients" table in space below.]

Model Summary

Mode	R	R Square	Adjusted R Square	Std. Error of he Estimate
1	.774[a]	.599	.576	3.987

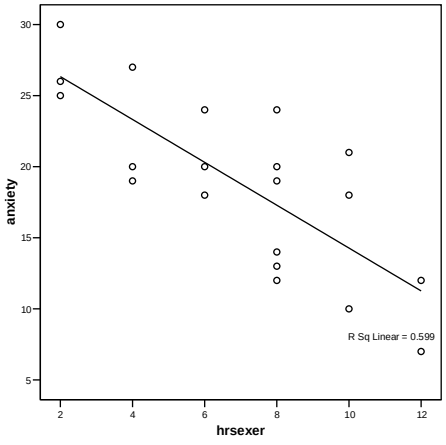
a. Predictors: (Constant), hrsexer

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	29.351	2.197		13.361	.000
	hrsexer	-1.507	.291	-.774	-5.181	.000

a. Dependent Variable: anxiety

[Paste Scatterplot with regression line Here.]



Note: Find HW 3.4 Computational Review in Schoology Folder.

Homework 3.5: Computational Review #2 (open book)

1. A researcher records the following scores in a pilot study: 10, 12, 14, 10, 12, 16. Calculate variance.

Always report correct symbol.

	=					

2. Assume SS = 2468 and n equals 20. Calculate standard deviation.

	=						

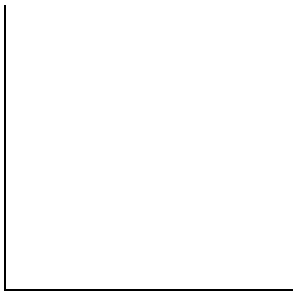
3. A traffic safety engineer measured the number of times motorists ran a read light at various 20 minute intervals throughout the day. Calculate standard deviation for these numbers: 2, 0, 4, 1, 0, 5, 9

	=					

4. Calculate σ if $\sigma^2 = 16$ and n=35.

	=					

5. Open the website dataset Computational Review #1. Using SPSS, construct an appropriate graph to show the average hours of work plus/minus one standard deviation. Roughly sketch the graph below and label the axes appropriately.



6. Using SPSS, create a graph showing the frequency for hours of exercise. Do NOT produce a line chart. Label appropriately.

Note: Questions 7 & 8 missing

9. Produce a table comparing the Hours Exercised by single and married persons.

Avg. Hours Single=				
Avg. Hours Married=				

10. Report the median Hours Worked and Hours Exercised.

Hours Worked Md =				
Hours Exercised Md =				

11. Report the largest standard deviation among the four quantitative variables in the dataset.

	=					

12. Report the Pearson Correlation Coefficient of the variable that best predicts Hours Exercised.

	=					

13. If appropriate, indicate how much variance anxiety accounts for in hours worked. If not appropriate, explain why.

	=					

14. Create a table showing the number of married and unmarried people in the dataset. Report only the two correct numbers.

number of single: ____

number of married: ____

15. Create a table to answer this question: What percent of people exercise 6 hours or less? Report only the correcxt percent

%

16. Correlate <u>anxiety, hours worked, social support, and hours exercised</u>. What's the strongest observed correlation? [Report symbol and correct value.]

Variables: _____ & _____

	=					

17. Correlate <u>anxiety, hours worked, social support, and hours exercised</u>. List all the significant correlations. [Report symbol and correct value.]

=				
=				
=				
=				
=				

18. If appropriate, write the regression equation for predicting anxiety based on hours of exercise. If not appropriate, explain why.

19. If appropriate, predict anxiety given 8 hours of exercise. If not appropriate, explain why.

20. If appropriate, write the regression equation for predicting anxiety based on hours of work. If not appropriate, explain why.

21. If appropriate, predict anxiety given 6 hours of work. If not appropriate, explain why.

22. Sketch the regression line for predicting anxiety based on hours of exercise. Label appropriately, especially where the y-intercept occurs.

Homework 3.5: Computational Review – Key , Test #1 (open book)

1. A researcher records the following scores in a pilot study: 10, 12, 14, 10, 12, 16. Calculate variance.

$$\hat{s}_x = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1} = \frac{940 - \frac{(74)^2}{6}}{6-1}$$

Always report correct symbol.

$\hat{s}_x^2$	=	5.	4	6	6	7

2. Assume SS = 2468 and n equals 20. Calculate standard deviation.

$$\hat{s}_x = \sqrt{\frac{SS}{n-1}} = \sqrt{\frac{2468}{20-1}}$$

$\hat{s}_x$	=	1	1.	3	9	7	1

3. A traffic safety engineer measured the number of times motorists ran a read light at various 20 minute intervals throughout the day. Calculate standard deviation for these numbers: 2, 0, 4, 1, 0, 5, 9

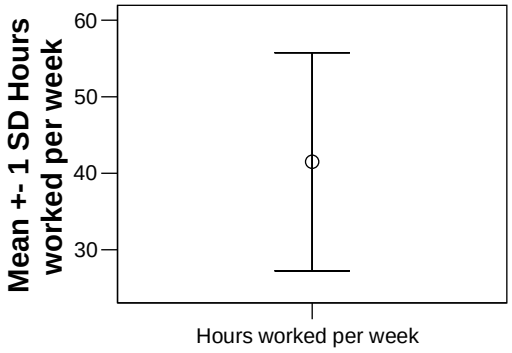
$$\hat{s}_x = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} = \sqrt{\frac{127 - \frac{(21)^2}{7}}{7-1}}$$

$$\hat{s}_x = 3.2650$$

4. Calculate σ if $\sigma^2 = 16$ and n=35.

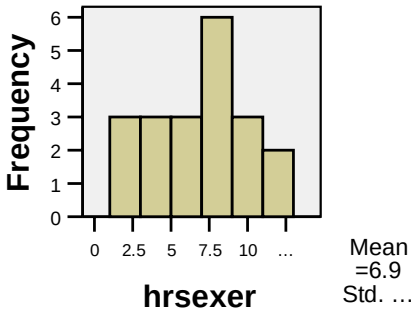
$$\sigma_x = \sqrt{\sigma^2} = \sqrt{16} = 4$$

5. Open the website dataset Test 1 Review. Using SPSS, construct an appropriate graph to show the average hours of work plus/minus one standard deviation. Roughly sketch the graph below and label the axes appropriately.



Go to Error bar, select separate variables, select Standard Deviation and set multiplier to 1.

6. Using SPSS, create a graph showing the frequency for hours of exercise. Do NOT produce a bar chart. Label appropriately.



Go to Graph, histogram, move hrsexer into "variable" box.

9. Produce a table comparing the Hours Exercised by single and married persons.

Avg. Hours Single=	6.00			
Avg. Hours Married=	7.80			

Use Analyze, compare means, means

10. Report the median Hours Worked and Hours Exercised.

Hours Worked Md =	40.00			
Hours Exercised Md =	8.00			

Go to descriptives, frequencies, select statistics, select median

11. Report the largest standard deviation among the four quantitative variables in the dataset.

$\hat{s}_x$	=	1	4.	2	4	4

Use Analyze, descriptives, descriptives.

12. Report the Pearson Correlation Coefficient of the variable that best predicts Hours Exercised.

r	=	-.7	7	4		

		anxiety	Hours worked per week	Social Support quality	hrsexer
anxiety	Pearson Correlation	1	.194	.530*	-.774**
	Sig. (2-tailed)		.413	.016	.000
	N	20	20	20	20
Hours worked per week	Pearson Correlation	.194	1	.375	-.173
	Sig. (2-tailed)	.413		.103	.466
	N	20	20	20	20
Social Support quality	Pearson Correlation	.530*	.375	1	-.318
	Sig. (2-tailed)	.016	.103		.171
	N	20	20	20	20
hrsexer	Pearson Correlation	-.774**	-.173	-.318	1
	Sig. (2-tailed)	.000	.466	.171	
	N	20	20	20	20

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

13. If appropriate, indicate how much variance anxiety accounts for in hours worked. If not appropriate, explain why.

	=					

You could calculate r^2, but the correlation is not significant (p is not below .05), so it is in appropriate to calculate the coefficient of determination (r^2).

14. Create a table showing the number of married and unmarried people in the dataset. Report only the two correct numbers.

number of single: _10___

number of married: __10__

Go to analyze, descriptives, frequencies.

15. Create a table to answer this question: What percent of people exercise 6 hours or less? Report only the correcxt percent

45.0 %

Go to analyze, descriptives, frequencies, and use the cumulative percent column.

hrsexer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	3	15.0	15.0	15.0
	4	3	15.0	15.0	30.0
	6	3	15.0	15.0	45.0
	8	6	30.0	30.0	75.0
	10	3	15.0	15.0	90.0
	12	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

16. Correlate anxiety, hours worked, social support, and hours exercised. What's the strongest observed correlation? [Report symbol and correct value.]

Variables: __hrs exerc_ & _anxiety____

r = -.774

17. Correlate anxiety, hours worked, social support, and hours exercised. List all the significant correlations. [Report symbol and correct value.]

Anx & Hrs Exr: r(18) = -.774, p≤.05

Anx & Soc Sprt: r(18) = .530, p≤.05

18. If appropriate, write the regression equation for predicting anxiety based on hours of exercise. If not appropriate, explain why.

$$y' = bx + a$$

$$y' = -1.507(x) + 29.351$$

19. If appropriate, predict anxiety given 8 hours of exercise. *If not appropriate, explain why.*

$$y' = -1.507(x) + 29.351$$

$$y' = -1.507(8) + 29.351$$

$$y' = 17.295$$

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	29.351	2.197		13.361	.000
	hrsexer	-1.507	.291	-.774	-5.181	.000

a. Dependent Variable: anxiety

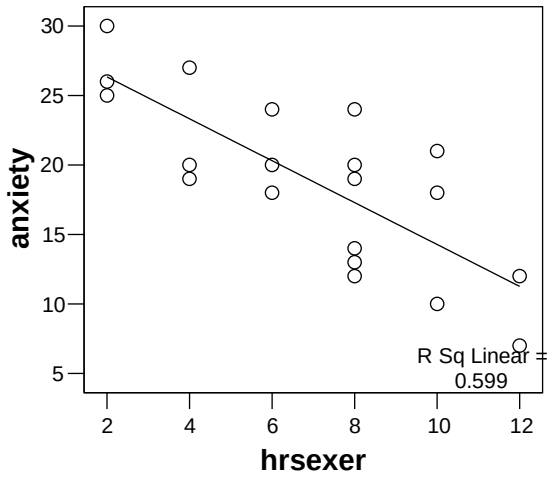
20. If appropriate, write the regression equation for predicting anxiety based on hours of work. If not appropriate, explain why.

Not appropriate, correlation not significant

21. If appropriate, predict anxiety given 6 hours of work. If not appropriate, explain why.

Not appropriate, correlation not significant

22. Sketch the regression line for predicting anxiety based on hours of exercise. Label appropriately, especially where the y-intercept occurs.



Homework 3.6 - Correlation & Regression Review

1. Open Dataset "Sleep," correlate all the variables, and summarize all the correlations in the standard format [r(20) = 4.55, n.s.].	2. Identify the variable pairs with the weakest and strongest correlations in #1. 3. Identify the amount of variance Weekend Sleep accounts for in amount Slept Last Night.	4. If appropriate, provide the formula for predicting Hours Slept Last Night based on Hours Slept Last Weekend.
5. If appropriate, predict Hours Slept Last Night based on Hours Slept on School Night.	6. Using SPSS, create a scatterplot for #4 with a regression line. Roughly sketch axes and line below.	7. Using SPSS, create a scatterplot for #5 with a regression line. Roughly sketch axes and line below.
8. Predict Hours Slept Last Night if Weekend Hours Slept is 5.	9. State the correct symbols and values for #8: a. Coefficient of Determin: b. Std Err of the Residual: c. Chance that $\rho = 0$. d. Pearson's Corr. Coeff:	10. Open Dataset Bogus Winthrop. Summarize all correlations among the interval and ratio data.
11. Identify the two strongest and two weakest correlations in previous problem – state the two variable pairs.	12. If appropriate, state the formula for predicting GPA based on Satisfaction.	13. Do a scatterplot with a regression line for previous problem. Roughly sketch the axes and line here.
14. State the correct symbols and values for #12. a. Coefficient of Determin: b. Std Err of the Residual: c. Chance that $\rho = 0$. d. Pearson's Corr. Coeff:	15. Predict GPA if Satisfaction is 6.	

Homework 3.6: Correlation & Regression Review - Key

1. Open Dataset "Sleep," correlate all the variables, and summarize all the correlations in the standard format [r(20) = 4.55, n.s.].

Correlations

		SLPT_LN	SLPT_SN	SLPT_WKND	BOOKS
SLPT_LN	Pearson Correlation	1	.320	.719**	-.176
	Sig. (2-tailed)		.090	.000	.361
	N	29	29	29	29
SLPT_SN	Pearson Correlation	.320	1	.316	-.340
	Sig. (2-tailed)	.090		.095	.071
	N	29	29	29	29
SLPT_WKND	Pearson Correlation	.719**	.316	1	.111
	Sig. (2-tailed)	.000	.095		.567
	N	29	29	29	29
BOOKS	Pearson Correlation	-.176	-.340	.111	1
	Sig. (2-tailed)	.361	.071	.567	
	N	29	29	29	29

**. Correlation is significant at the 0.01 level (2-tailed).

- r(27)=.320, n.s.
- r(27)=.719, p<=.05
- r(27)=.176, n.s.
- r(27)=.316, n.s.
- r(27)=-.340, n.s.
- r(27)=.111, n.s.

2. Identify the variable pairs with the weakest and strongest correlations in #1.

Correlations

		SLPT_LN	SLPT_SN	SLPT_WKND	BOOKS
SLPT_LN	Pearson Correlation	1	.320	.719**	-.176
	Sig. (2-tailed)		.090	.000	.361
	N	29	29	29	29
SLPT_SN	Pearson Correlation	.320	1	.316	-.340
	Sig. (2-tailed)	.090		.095	.071
	N	29	29	29	29
SLPT_WKND	Pearson Correlation	.719**	.316	1	.111
	Sig. (2-tailed)	.000	.095		.567
	N	29	29	29	29
BOOKS	Pearson Correlation	-.176	-.340	.111	1
	Sig. (2-tailed)	.361	.071	.567	
	N	29	29	29	29

**. Correlation is significant at the 0.01 level (2-tailed).

- Strongest:
  - Slpt_wknd & Slpt_ln
- Weakest:
  - Books and Slpt_wknd

3. Identify the amount of variance Weekend Sleep accounts for in amount Slept Last Night.

Correlations

		SLPT_LN	SLPT_SN	SLPT_WKND	BOOKS
SLPT_LN	Pearson Correlation	1	.320	.719**	-.176
	Sig. (2-tailed)		.090	.000	.361
	N	29	29	29	29
SLPT_SN	Pearson Correlation	.320	1	.316	-.340
	Sig. (2-tailed)	.090		.095	.071
	N	29	29	29	29
SLPT_WKND	Pearson Correlation	.719**	.316	1	.111
	Sig. (2-tailed)	.000	.095		.567
	N	29	29	29	29
BOOKS	Pearson Correlation	-.176	-.340	.111	1
	Sig. (2-tailed)	.361	.071	.567	
	N	29	29	29	29

**. Correlation is significant at the 0.01 level (2-tailed).

- r =.719
- r^2 = .5170

4. If appropriate, provide the formula for predicting Hours Slept Last Night based on Hours Slept Last Weekend.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.719[a]	.516	.498	1.064

a. Predictors: (Constant), SLPT_WKND

- $y' = bx + a$
- $y' = 1.061(x) - 2.406$

Coefficients[a]

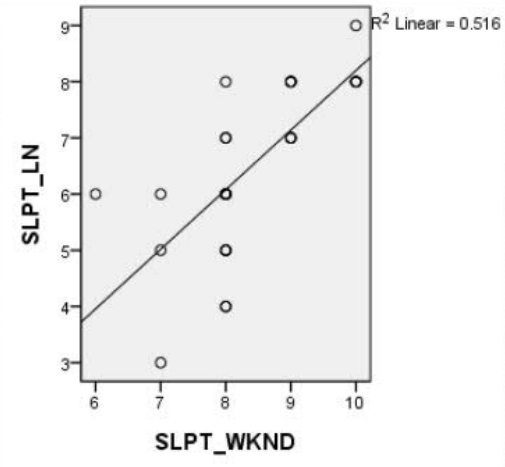
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.406	1.674		-1.438	.162
	SLPT_WKND	1.061	.198	.719	5.370	.000

a. Dependent Variable: SLPT_LN

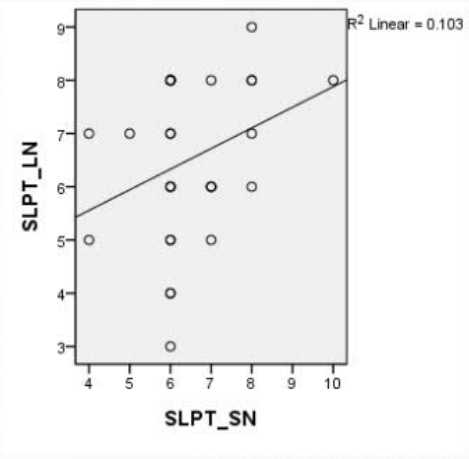
5. If appropriate, predict Hours Slept Last Night based on Hours Slept on School Night.

- Not appropriate. Correlation not significant.

6. Using SPSS, create a scatterplot for #4 with a regression line. Roughly sketch axes and line below.



7. Using SPSS, create a scatterplot for #5 with a regression line.



8. Predict Hours Slept Last Night if Weekend Hours Slept is 5.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.719[a]	.516	.498	1.064

a. Predictors: (Constant), SLPT_WKND

- $y' = bx + a$
- $y' = 1.061(x) - 2.406$
- $y' = 1.061(5) - 2.406$
- $y' = 2.899$

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.406	1.674		-1.438	.162
	SLPT_WKND	1.061	.198	.719	5.370	.000

a. Dependent Variable: SLPT_LN

9. State the correct symbols and values for #8:

- a. Coefficient of Determin: $r^2 = .516$
  b. Std Err of the Residual: $Sy' = 1.064$
  c. Chance that $\rho = 0$: $p = .000$ (actually $p<.001$)
  d. Pearson's Corr. Coeff: $r = .719$

10. Open Dataset **Bogus Winthrop**. Summarize all correlations among the interval and ratio data.

Correlations

		college gpa	number of WU friends	social skills	satisfaction w/ WU
college gpa	Pearson Correlation	1	.555*	-.037	.744**
	Sig. (2-tailed)		.011	.877	.000
	N	20	20	20	20
number of WU friends	Pearson Correlation	.555*	1	.023	.520*
	Sig. (2-tailed)	.011		.924	.019
	N	20	20	20	20
social skills	Pearson Correlation	-.037	.023	1	-.011
	Sig. (2-tailed)	.877	.924		.962
	N	20	20	20	20
satisfaction w/ WU	Pearson Correlation	.744**	.520*	-.011	1
	Sig. (2-tailed)	.000	.019	.962	
	N	20	20	20	20

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

- $r(18)=.555$, $p<=.05$
- $r(18)=-.037$, n.s.
- $r(18)=.744$, $p<=.05$
- $r(18)=.023$, n.s.
- $r(18)=.520$, $p<=.05$
- $r(18)=-.011$, n.s.

11. Identify the two strongest and two weakest correlations in previous problem – state the two variable pairs.

- Strongest: Satisfaction & GPA
- Weakest: Satisfaction & Social Skills

Correlations

		college gpa	number of WU friends	social skills	satisfaction w/ WU
college gpa	Pearson Correlation	1	.555*	-.037	.744**
	Sig. (2-tailed)		.011	.877	.000
	N	20	20	20	20
number of WU friends	Pearson Correlation	.555*	1	.023	.520*
	Sig. (2-tailed)	.011		.924	.019
	N	20	20	20	20
social skills	Pearson Correlation	-.037	.023	1	-.011
	Sig. (2-tailed)	.877	.924		.962
	N	20	20	20	20
satisfaction w/ WU	Pearson Correlation	.744**	.520*	-.011	1
	Sig. (2-tailed)	.000	.019	.962	
	N	20	20	20	20

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

12. If appropriate, state the formula for predicting GPA based on Satisfaction.

- $y' = bx + a$
- $y' = .391(x) + .819$

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.744[a]	.554	.529	.55944

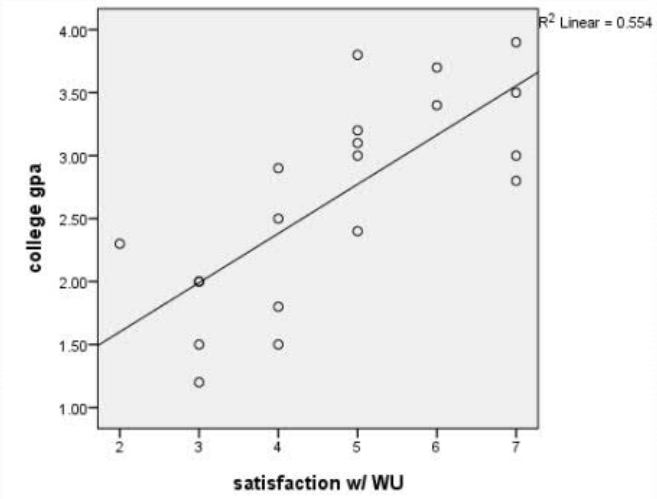
a. Predictors: (Constant), satisfaction w/ WU

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.819	.412		1.987	.062
	satisfaction w/ WU	.391	.083	.744	4.724	.000

a. Dependent Variable: college gpa

13. Do a scatterplot with a regression line for previous problem. Roughly sketch the axes and line here.



14. State the correct symbols and values for #12.

- a. Coefficient of Determin: $r^2 = .554$
  b. Std Err of the Residual: $Sy' = .5594$
  c. Chance that $\rho = 0$: $p = .000$ (actually $p<.001$)
  d. Pearson's Corr. Coeff: $r = .744$

15. Predict GPA if Satisfaction is 6.

- $y' = bx + a$
- $y' = .391(x) + .819$
- $y' = .391(6) + .819$
- $y' = 3.165$

Homework 4.2: Z-scores, Sampling Distributions, Hypothesis Testing

Answer the following questions after listening to the on-line lecture on Z-scores (Hyp Testing & Sampling Distributions)

⇨ Watch first slides before answering these questions:

Assume we test whether psychology majors are more or less anxious than normal. We find just one psychology major (Jayla) and calculate her z-score on an Anxiety test (μ = 50).

The Null Hypothesis is that psychology majors are, compared to normal people, _____ anxious. (more/less/just as)

The Alternative Hypothesis is that psychology majors are _____ normal people. (more/less/just as)

Using the provided μ, state the Ho: _____

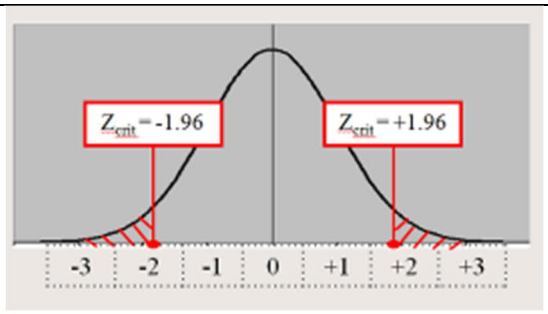
Using the provided μ, state the Ha: _____

As Jayla's z-score gets farther from the center of the distribution, we become _____ (more/less) likely to reject Ho.

We compare the z-obtained score (the one that represents Jayla) to the z-_____ score.

We typically set z-critical equal to ± _____. (This represents 5% of the distribution.)

If Jayla's z-score is ….	… we will (retain/reject) the Ho….	…and conclude that the anxiety of psychology majors is the same, less, or more than normal.
2.49		
1.90		
-2.05		
3.01		
-1.45		



Answer the following after watching slides 4-7

Use this info for the figure and the first five problems:
Reliable Ralphie asks 5 people the travel time to Charleston. Sloppy Suzie asks just 1 person the same question.

All possible travel times to Charleston

n = 5

_____'s Distribution

A _____ distribution

Measure of variability (and symbol) is:

_____

It has _____ variability than the other one.

n = 1

_____'s Distribution

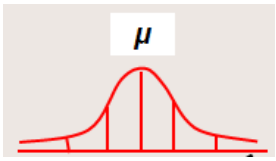
A _____ distribution

Measure of variability (and symbol) is:

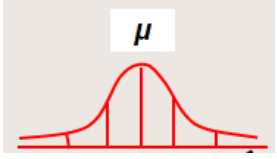
_____

It has _____ variability than the other one.

Fill in the blanks in this figure.



+1___



+1___

1. Ralphie is working with a _____ distribution. Suzie is working with a _____ distribution.
2. In both cases, the true average travel time to Charleston is represented by _____ (ρ or μ).
3. Ralphie's distribution will be _____ (more or less) accurate than Suzie's.
4. Raphie's distribution will have _____ (more or less) sampling error than Suzie's.
5. Raphie's distribution will have _____ (more or less) variability than Suzie's.
6. Sampling distributions are _____ (more or less) accurate than frequency distributions.
7. A z-score for a frequency distribution uses standard _____ to measure variability.
8. A z-score for a sampling distribution uses standard _____ to measure variability.
9. Assume that standard deviation for a frequency distribution is 12. If samples are taken from this same population with 16 people in each sample, the standard error will be _____ (hint: use formula for standard error of the mean).
10. A sampling distribution is comprised of _____(sample means or scores).
11. A frequency distribution is comprised of _____(sample means or scores).
12. Assume you estimate the average GPA of all freshmen by sampling 4 freshmen. If your sample size increases to 8, you accuracy will _____ (increase/decrease).
13. If your accuracy increases, this is the same as saying your standard error of the mean has _____ (increased/decreased)
14. With a frequency distribution you will calculate a z-score for a _____ (score/sample mean).
15. With a sampling distribution you will calculate a z-score for a _____(score/sample mean).
16. The standard error of the mean tells you how far a typical _____ (score/sample mean) falls from the population mean.

Answer the following after slides 8 & 9

You suspect older drivers take longer to drive to Charleston. You ask 9 older drivers how long they take and find they take 4.1 hours on average (M=4.1). Normal drivers take 3.5 hours (μ= 3.5, σ = 0.9)

1. First, set up the problem by recording the key facts: μ = σ = M (or x_{bar})= n =	2. Because you're given n (the sample size) you know it's a _____ distribution and so you'll need to calculate standard _____, represented by the symbol _____.	3. Work the formula for standard error of the mean: $\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{}{\sqrt{}} =$
4. Now work the formula for z-obtained: $z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} =$	5. Does the z-obtained score exceed z-critical (± 1.96)?	6. Do you retain or reject the Ho? 7. Do older drivers take longer to drive to Charleston?

Homework 4.2 – Z-scores, Sampling Distributions, Hypothesis Testing

Answer the following questions after listening to the on-line lecture on Z-scores (Hyp Testing & Sampling Distributions)

⇨ Watch first three slides before answering these questions:

Assume we test whether psychology majors are more or less anxious than normal. We find just one psychology major (Jayla) and calculate her z-score on an Anxiety test (μ = 50).

The Null Hypothesis is that psychology majors are, compared to normal people, _just as___ anxious. (more/less/just as)

The Alternative Hypothesis is that psyc majors are _more or less anxious____ normal people. (more/less/just as)

Using the provided μ, state the Ho: __ **μ = 50** _____

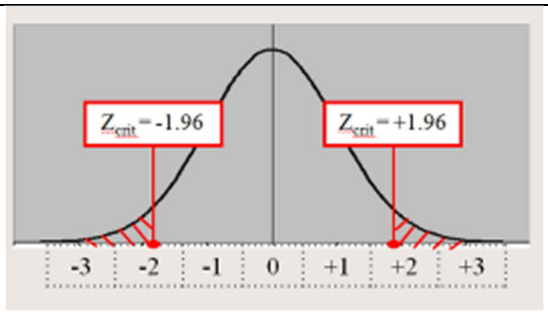
Using the provided μ, state the Ha: ___ **μ ≠ 50**_____

As Jayla's z-score gets farther from the center of the distribution, we become _more____ (more/less) likely to reject Ho.

We compare the z-obtained score (the one that represents Jayla) to the z-critical____ score.

We typically set z-critical equal to ± _1.96____. (This represents 5% of the distribution.)

If Jayla's z-score is	... we will (retain/reject) the Ho....	...and conclude that the anxiety of psychology majors is the same, less, or more than normal.
2.49	Reject	More
1.90	Retain	Same
-2.05	Reject	Less
3.01	Reject	More
-1.45	Retain	Same



Answer the following after watching slides 4-7

Use this info for the figure and the first five problems:
Reliable Ralphie asks 5 people the travel time to Charleston. Sloppy Suzie asks just 1 person the same question.

All possible travel times to Charleston

n = 5

_Ralphie's Distribution

A _sampling_ distribution

Measure of variability (and symbol) is:

___standard error_____

It has __less__ variability than the other one.

n = 1

_Suzies' Distribution

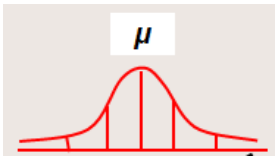
A _frequency_ distribution

Measure of variability (and symbol) is:

___standard deviation___

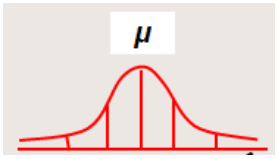
It has __more_ variability than the other one.

Fill in the blanks in this figure.



+1___

$\sigma_{\bar{x}}$



+1___

σ_{x}

17. Ralphie is working with a __sampling__ distribution. Suzie is working with a _frequency_____ distribution.
18. In both cases, the true average travel time to Charleston is represented by ____ ***μ*** _____ (ρ or μ).
19. Ralphie's distribution will be ___more_____ (more or less) accurate than Suzie's.
20. Raphie's distribution will have __less_____ (more or less) sampling error than Suzie's.
21. Raphie's distribution will have ___less_____ (more or less) variability than Suzie's.
22. Sampling distributions are ____more_____ (more or less) accurate than frequency distributions.
23. A z-score for a frequency distribution uses standard __deviation_____ to measure variability.
24. A z-score for a sampling distribution uses standard __error of the mean__ to measure variability.
25. Assume that standard deviation for a frequency distribution is 12. If samples are taken from this same population with 16 people in each sample, the standard error will be __3_____ (hint: use formula for standard error of the mean).
26. A sampling distribution is comprised of _____(sample means or scores).
27. A frequency distribution is comprised of _____(sample means or scores).
28. Assume you estimate the average GPA of all freshmen by sampling 4 freshmen. If your sample size increases to 8, you accuracy will __increase_____ (increase/decrease).
29. If your accuracy increases, this is the same as saying your standard error of the mean has _decreased_____ (increased/decreased)
30. With a frequency distribution you will calculate a z-score for a _____ (score/sample mean).
31. With a sampling distribution you will calculate a z-score for a _____(score/sample mean).
32. The standard error of the mean tells you how far a typical _____ (score/sample mean) falls from the population mean.

Answer the following after slides 8 & 9

You suspect older drivers take longer to drive to Charleston. You ask 9 older drivers how long they take and find they take 4.1 hours on average (M=4.1). Normal drivers take 3.5 hours (μ= 3.5, σ = 0.9)

1. First, set up the problem by recording the key facts: μ = 3.5 σ = 0.9 M (or x_{bar})= 4.1 n = 9	2. Because you're given n (the sample size) you know it's a _sampling_____ distribution and so you'll need to calculate standard _error of the mean__, represented by the symbol _____.	3. Work the formula for standard error of the mean: $\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{0.9}{\sqrt{9}} = 0.3$
4. Now work the formula for z-obtained: $z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{4.1 - 3.5}{0.3} = 2$	5. Does the z-obtained score exceed z-critical (± 1.96)? Yes!	6. Do you retain or reject the Ho? Reject Ho 7. Do older drivers take longer to drive to Charleston? Yes!

Homework 4.1: Z-scores for scores

note: M equals x_{bar} (i.e, the mean of a sample)

1. Define standard deviation:	2. Define z-score for your mother and relate it to standard deviation:	
3. On the Whiznoodle Depression Inventory the average score is 50 (i.e., **μ**=50) with a standard deviation of 5 (**σ**=5).		
a. What's Bob's standard score (z-score) if Bob scored a 62?	b. What percent of people are less depressed than Bob?	c. What percent of people are more depressed than Bob?
d. What's Rolanda's standard score if she had a raw score of 37?	e. What percent of people are less depressed than Rolanda?	f. What percent of people are more depressed than Rolanda?
4. Most IQ tests are normed to have an average score of 100 with a standard deviation of 15.		
a. What's Shanta's z-score if she scores 120 on the IQ test?	b. What percent of people score lower?	c. What percent of people score higher?

5. A teacher administered the Ceespautrun reading ability test where students typically average 40 points with a standard deviation of 4.

a. Shanta scored a 50. What's her z-score?	b. What percent of people have a lower reading ability than Shanta?	c. What percent of people have a higher reading ability than Shanta?
d. Kelly scored a 35. What's her z-score?	e. What percent of students will score higher than Kelly?	f. What percent of students will score lower than Kelly?

6. A researcher tests whether teachers with masters' degrees have classes that do better on the end of grade tests. His sample of 16 teachers averaged 79 on these tests. Teachers in the district averaged 78 (σ = 10) n= M= μ= σ= $\sigma_{\bar{x}} =$ $z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} =$	Do these teachers seem more or less successful than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0
7. Do students in the Sigma Digma Wigma fraternity have GPAs (M=2.4, n=16) different from those of normal students (μ=2.7, σ = 0.3)	Do the fraternity have lower/higher GPAs than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0
8. A school psychologist tests whether 9 teachers trained in classroom management report fewer disciplinary problems (an average of 5) compared to district-wide norms (μ=11, σ = 6).	Do these teachers have fewer/more disciplinary problems than normal? ($z_{crit} = \pm 1.96$). Show sketch. Reject or Retain H_0

9. A researcher tested whether rats on diet pills differed in weight from normal rats (μ=410, σ =25). The four "dieting" rats averaged 375 ounces.	Do these rats seem lighter or heavier than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0
10. A researcher examined whether 9 people with social phobias were more likely to be depressed (M=51) than normal people (who average 50 with a standard deviation of 6).	Do these people seem less or more depressed than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0
11. Do people who've completed a memory enhancement course do better on a test of working memory? The twenty-five memory course students scored 8 on average. People in general average 7 with a standard deviation of 2.	Do these people seem to do worse or better than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0
12. You administer a measure of depression to a group of 25 students deprived of studying for an entire weekend. This sample of students scores 44 on average. Higher scores indicate more depression, and normal people score 50 with a standard deviation of 15.	Do these students seem less or more depressed than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0

13. For the following, indicate whether it's a <u>frequency distribution (FD)</u> or a <u>sampling distribution (SD)</u>

FD SD a. A teacher administered the Ceespautrun reading ability test where students typically average 40 points with a standard deviation of 4. Her 16 students score 45 on average.

FD SD b. Adian scored 650 on the SAT. If people in general score at 500 with a standard deviation of 100, what percent of people score higher than this?

FD SD c. The 13 ROTC students averaged a score of 23 on the ACT when normal students score 20 with a standard deviation of 5. Do ROTC students appear to be above average?

FD SD d. The girl who received the tutoring scored 89 on the test. What percent of people did better than this, assume the average score overall was 75 with a standard deviation of 7?

Homework 4.1: Z-scores

note: M equals x_{bar} (i.e, the mean of a sample)

1. Define standard deviation:

The distance a typical score falls from the mean in a given distribution.

2. Define z-score for your mother and relate it to standard deviation:

The distance a specific score (x) falls from the mean (μ), expressed as standard-deviation (σ) units.

$$z = \frac{x - \mu}{\sigma_x}$$

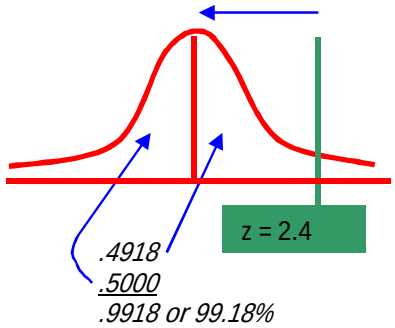
3. On the Whiznoodle Depression Inventory the average score is 50 (i.e., μ=50) with a standard deviation of 5 (σ=5).

a. What's Bob's standard score (z-score) if Bob scored a 62?

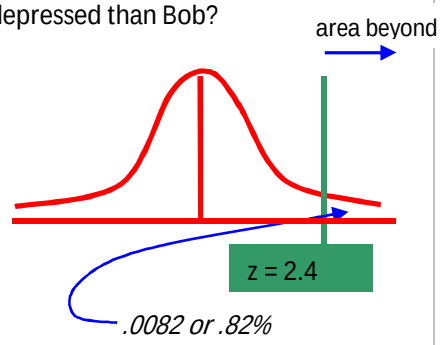
μ = 50
σ = 5
x = 62
z = ?

$$z = \frac{x - \mu}{\sigma_x}$$
$$z = \frac{62 - 50}{5}$$
$$z = 2.4$$

b. What percent of people are less depressed than Bob?



c. What percent of people are more depressed than Bob?

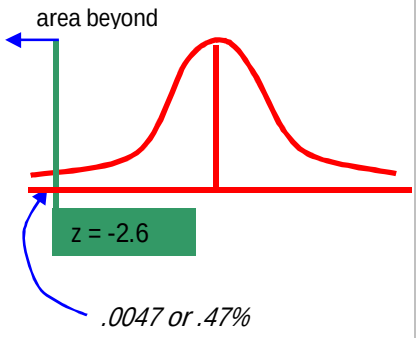


d. What's Rolanda's standard score if she had a raw score of 37?

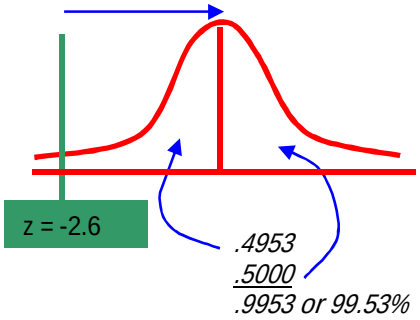
μ = 50
σ = 5
x = 37
z = ?

$$z = \frac{x - \mu}{\sigma_x}$$
$$z = \frac{37 - 50}{5}$$
$$z = -2.6$$

e. What percent of people are less depressed than Rolanda?



f. What percent of people are more depressed than Rolanda?



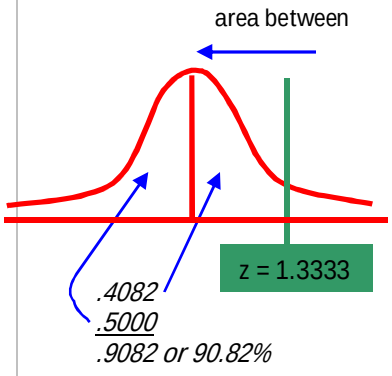
4. Most IQ tests are normed to have an average score of 100 with a standard deviation of 15.

a. What's Shanta's z-score if she scores 120 on the IQ test?

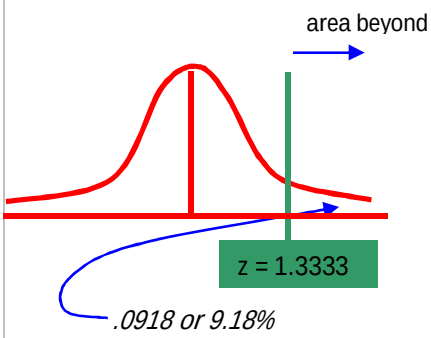
μ = 100
σ = 15
x = 120
z = ?

$$z = \frac{x - \mu}{\sigma_x}$$
$$z = \frac{120 - 100}{15}$$
$$z = 1.3333$$

b. What percent of people score lower?



c. What percent of people score higher?



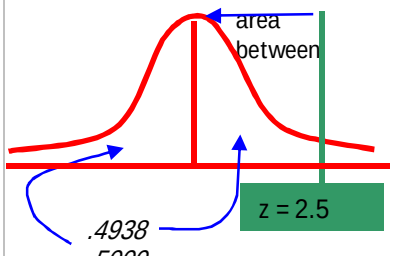
5. A teacher administered the Ceespautrun reading ability test where students typically average 40 points with a standard deviation of 4.

a. Shanta scored a 50. What's her z-score?

μ = 40
σ = 4
x =50
z = ?

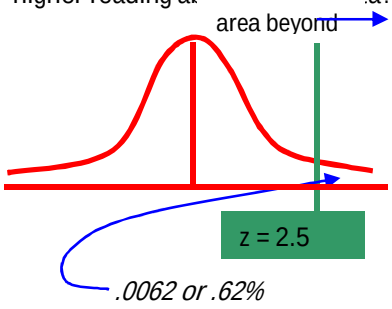
$$z = \frac{x - \mu}{\sigma_x}$$
$$z = \frac{50 - 40}{4}$$
$$z = 2.5$$

b. What percent of people have a lower reading ability than Shanta?



.4938
.5000
.9938 or 99.38%

c. What percent of people have a higher reading ability than Shanta?

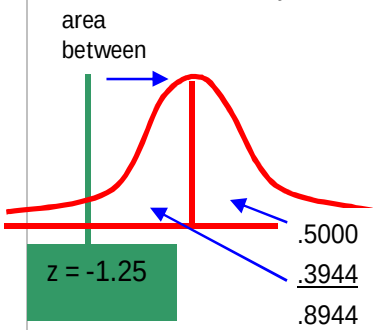


.0062 or .62%

d. Kelly scored a 35. What's her z-score?

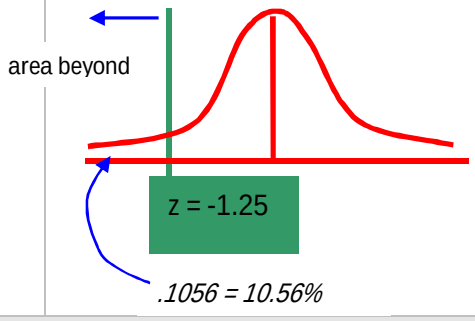
$$z = \frac{x - \mu}{\sigma_x}$$
$$z = \frac{35 - 40}{4}$$
$$z = -1.25$$

e. What percent of students will score higher than Kelly?



.5000
.3944
.8944

f. What percent of students will score lower than Kelly?



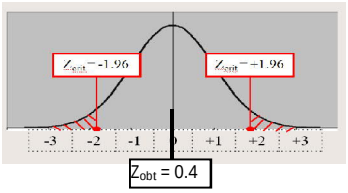
.1056 = 10.56%

6. A researcher tests whether teachers with masters' degrees have classes that do better on the end of grade tests. His sample of 16 teachers averaged 79 on these tests. Teachers in the district averaged 78 (σ = 10)

$n = 16$
$\bar{x} = 79$
$\mu = 78$
$\sigma_x = 10$

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{10}{\sqrt{16}} = 2.5$$
$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{79 - 78}{2.5} = 0.4$$

Do these teachers seem more or less successful than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0

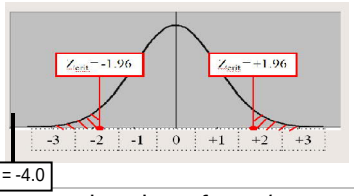


7. Do students in the Sigma Digma Wigma fraternity have GPAs (M=2.4, n=16) different from those of normal students (μ=2.7, σ = 0.3)

$n = 16$
$\bar{x} = 2.4$
$\mu = 2.7$
$\sigma_x = 0.3$

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{0.3}{\sqrt{16}} = .075$$
$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{2.4 - 2.7}{.075} = -4$$

Do the fraternity have lower/higher GPAs than normal? ($z_{crit} = \pm 1.96$). Show sketch.
Circle: Reject or Retain H_0

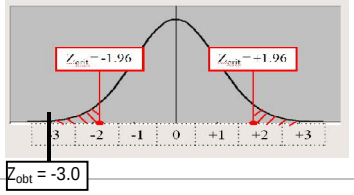


8. A school psychologist tests whether 9 teachers trained in classroom management report fewer disciplinary problems (an average of 5) compared to district-wide norms (μ=11, σ = 6).

$n = 9$
$\bar{x} = 5$
$\mu = 11$
$\sigma_x = 6$

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{6}{\sqrt{9}} =$$
$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{5 - 11}{2} = -3$$

Do these teachers have fewer/more disciplinary problems than normal? ($z_{crit} = \pm 1.96$). Show sketch. Reject or Retain H_0



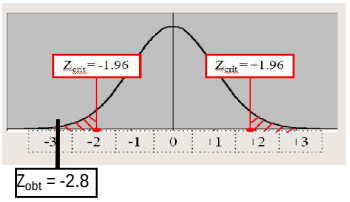
9. A researcher tested whether rats on diet pills differed in weight from normal rats (μ=410, σ =25). The four "dieting" rats averaged 375 ounces.

$\mu = 410$
$\sigma_x = 25$
$n = 4$
$\bar{x} = 375$

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{25}{\sqrt{4}} = 12.5$$

$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{375 - 410}{12.5} = -2.8$$

Do these rats seem lighter or heavier than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0



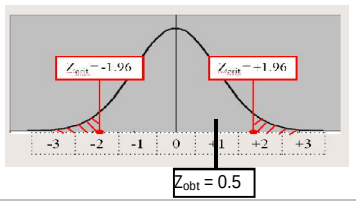
10. A researcher examined whether 9 people with social phobias were more likely to be depressed (M=51) than normal people (who average 50 with a standard deviation of 6).

$\mu = 50$
$\sigma_x = 6$
$n = 9$
$\bar{x} = 51$

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{6}{\sqrt{9}} = 2$$

$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{51 - 50}{2} = 0.5$$

Do these people seem less or more depressed than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0



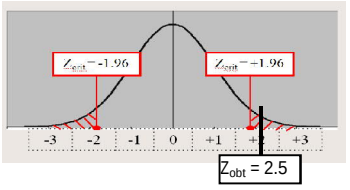
11. Do people who've completed a memory enhancement course do better on a test of working memory? The twenty-five memory course students scored 8 on average. People in general average 7 with a standard deviation of 2.

$\mu = 7$
$\sigma_x = 2$
$n = 25$
$\bar{x} = 8$

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{2}{\sqrt{25}} = 0.4$$

$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{8 - 7}{0.4} = 2.5$$

Do these people seem to do worse or better than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0



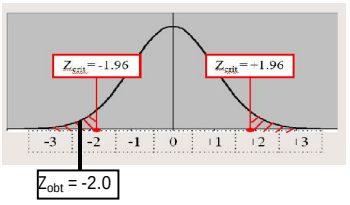
12. You administer a measure of depression to a group of 25 students deprived of studying for an entire weekend. This sample of students scores 44 on average. Higher scores indicate more depression, and normal people score 50 with a standard deviation of 15.

$\mu = 50$
$\sigma_x = 15$
$n = 25$
$\bar{x} = 44$

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{15}{\sqrt{25}} = 3$$

$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{44 - 50}{3} = -2$$

Do these students seem less or more depressed than normal? ($z_{crit} = \pm 1.96$). Show sketch. Circle: Reject or Retain H_0



13. For the following, indicate whether it's a frequency distribution (FD) or a sampling distribution (SD)

FD **SD** a. A teacher administered the Ceespautrun reading ability test where students typically average 40 points with a standard deviation of 4. Her 16 students score 45 on average.

FD SD b. Adian scored 650 on the SAT. If people in general score at 500 with a standard deviation of 100, what percent of people score higher than this?

FD **SD** c. The 13 ROTC students averaged a score of 23 on the ACT when normal students score 20 with a standard deviation of 5. Do ROTC students appear to be above average?

FD SD d. The girl who received the tutoring scored 89 on the test. What percent of people did better than this, assume the average score overall was 75 with a standard deviation of 7?

Homework 5.1: t-scores

These questions accompany Lecture Video 5.1, One Sample T-tests.

slides 1-6

1. Whereas the z-formula utilizes the symbol _____ in the denominator, the t-test utilizes the symbol ____.
2. With a t-test, instead of knowing standard error as a population parameter, we must _____ it.
3. In both the z and t formulas the top portion is unchanged: _____ (write out the symbols)
4. To calculate standard error of the mean as an estimate, we divide _____ [symbol] by _____[symbol].

slides 7 & 8

5. Compared to a z-distribution, a t-distribution is _____ in the middle and _____ at the tails.
6. The _____ (z or t) distribution shows more error.
7. As the size of the sample increases, t-critical gets _____ and approaches the shape of the _____distribution.
8. Using the table in the back of the book, assume $\alpha = .05$, and then determine the value of t-critical for the following sample sizes ….. 4: _____, 7: _____, 20: _____, and 120: _____ .

slides 9 & 10

Car Speed Problem by hand: Are cars traveling slower/faster than 55 mph?

9. What was the observed difference between the sample mean and the population mean? _____
10. What was the expected difference based just on sampling error? _____
11. Would the obtained t-value been large enough for rejection if you were doing a z-test? _____
12. When doing a z- or t-test, hypothesis testing step #1 states you are comparing _____ and _____.

Slides 13-18

Example #3: Critical Thinking Test Problem: Do college graduates score lower/higher than 45 on the test?

13. What was the observed difference between the sample mean and the population mean? _____
14. What was the expected difference based just on standard error? _____
15. Would the obtained t-value have been large enough for rejection if you were doing a z-test? _____
16. What key value do we determine in third step of hypothesis testing? _____

Slides 22-23

Car Speed Problem on SPSS: Are cars traveling slower/faster than 55 mph?

17. What would t-obtained equal if the cars in the sample had been going 54 mph and standard error had been equal to 3? _____ Could you have rejected the null then? _____
18. What would t-obtained equal if the cars in the sample had been going 49 mph and standard deviation had been equal to 3? _____ Could you have rejected the null then? _____
19. Write out the t formula with the orginial values from the SPSS output and then calculate it, making sure you get the same answer.
20. What's the chance you'd get a t-value of this size just by chance? _____
21. What was the sample mean with the first set of data? _____ With the second? _____
22. An increase in the sample mean reflects an increase in (circle one) treatment effect or sampling error.

New Applied Problem

23. The tables to the right test whether people working at the factory 2 or more years average $10/hour. Label each of the SPSS table values with the correct symbol ➔
24. What the null hypothesis? _____
25. What's the difference observed? _____
26. What's the difference expected? _____
27. Do your reject or retain the Ho? _____
28. What percent of time would you see a difference between the means this large just by chance? _____

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
pay	9	8.67	1.581	.527

One-Sample Test

	Test Value = 10			
	t	df	Sig. (2-tailed)	Mean Difference
pay	-2.53	8	.035	-1.333

Homework 5.1: t-scores - Key

slides 1-6.

1. Whereas the z-formula utilizes the symbol ___ σ_{xbar} ___ in the denominator, the t-test utilizes the symbol _ s_{xbar} __.
2. With a t-test, instead of knowing standard error as a population parameter, we must __estimate __ it.
3. In both the z and t formulas the top portion is unchanged: _ $x_{bar} - \mu$ _____ (write out the symbols)
4. To calculate standard error of the mean as an estimate, we divide _s_____ [symbol] by _sqrt n__[symbol].

slides 7 & 8

5. Compared to a z-distribution, a t-distribution is _shorter__ in the middle and __fatter__ at the tails.
6. The __t_____ (z or t) distribution shows more error.
7. As the size of the sample increases, t-critical gets _smaller_ and approaches the shape of the _z____distribution.
8. Using the table in the back of the book, assume $\alpha = .05$, and then determine the value of t-critical for the following sample sizes ..... 4: __3.1824___, 7: __2.4469__, 20: _2.0930_ and 120: _1.9801__.

slides 9 & 10

Car Speed Problem by hand: Are cars traveling slower/faster than 55 mph?

9. What was the observed difference between the sample mean and the population mean? __3.889_____
10. What was the expected difference based just on standard error ? __2.606_____
11. Would the obtained t-value been large enough for rejection if you were doing a z-test? _no_____
12. When doing a z- or t-test, hypothesis testing step #1 states you are comparing __xbar____ and _ μ _____.

Slides 13-18

Example #3: Critical Thinking Test Problem: Do college graduates score lower/higher than 45 on the test?

13. What was the observed difference between the sample mean and the population mean? __1.6667_____
14. What was the expected difference based just on standard error? __3.5355_____
15. Would the obtained t-value have been large enough for rejection if you were doing a z-test? _no_____
16. What key value do we determine in third step of hypothesis testing? __tcritical_____

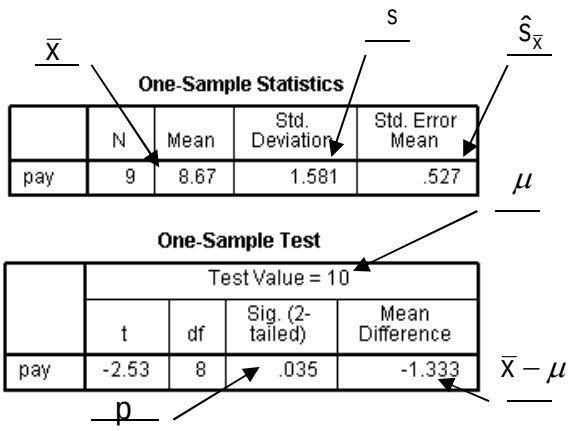
Slides 22-23

Car Speed Problem on SPSS: Are cars traveling slower/faster than 55 mph?

17. What would t-obtained equal if the cars in the sample had been going 54 mph and standard error had been equal to 3? __-.3333_____ Could you have rejected the null then? __no__ ($t_{crit} = 2.306$)
18. What would t-obtained equal if the cars in the sample had been going 49 mph and standard deviation had been equal to 3? __-6_____ Could you have rejected the null then? _yes_ ($t_{crit} = 2.306$)
19. Write out the t formula with the original values from the SPSS output and then calculate it, making sure you get the same answer. $t = \frac{\bar{x} - \mu}{\hat{s}_{\bar{x}}} = \frac{58.89 - 55}{2.606} = 1.492$
20. What's the chance you'd get a t-value of this size just by chance? ___17.4%_____
21. What was the sample mean with the first set of data? _58.89_____ With the second? _61.11_____
22. An increase in the sample mean reflects an increase in (circle one) treatment effect or sampling error.

New Applied Problem

23. The tables to the right test whether people working at the factory 2 or more years average $10/hour. Label each of the SPSS table values with the correct symbol. ➔
24. What the null hypothesis? __Ho: $\mu = 10$ _____
25. What's the difference observed? __-1.333_____
26. What's the difference expected? __0.527_____
27. Do your reject or retain the Ho? __Reject_____
28. What percent of time would you see a difference between the means this large just by chance? __3.5%__



Homework 5.2: Hypothesis Testing with T-Scores

1. Hypothesis Testing #1: A group of students take a new pilot version of a critical thinking course and then complete the Wizweekler test of critical thinking. If normal people score 40 on the test, does it appear that the course affected their critical thinking? (Don't forget effect size if appropriate.)

Data		
45 50 40 35 55 42 48 40 50	$\hat{s}_{\bar{x}} = 6.3048$	1. 2. 3. 4. 5.

2. Impacting Treatment Effect and Sampling Error: For each of the following, indicate (1) whether the change described would affect the treatment effect (T) or sampling error (SE), and (2) whether the change would cause an increase or decrease.

___a) You base the class mean on 25 people, not just 9.

___b) You standardize how people study the course material, so that there are fewer differences in how much they learn about critical thinking.

___c) You provide more feedback on their critical thinking abilities during the course, so that they become more effective at critical thinking.

___d) You have different people teach each of the 9 students about critical thinking, and every person teaches the course differently.

___e) You cut back the course from a semester long course to just a weekend workshop, so the course becomes less effective.

___f) You discover that the class average was 48, not 45.

3. Hypothesis Testing #2: The wise and beloved statistics professor claimed that students who scored an A on the last test studied more than the 4 hours per week studied by average students. Does this small sample of students earning an A support this claim? (Don't forget effect size if appropriate)

Data	Calculations	Hypothesis Testing Steps
4 6 7 9	(calculate $\hat{s}_x$ to start)	1. 2. 3. 4. 5.

4. Hypothesis Testing #2: The wise and beloved statistics professor claimed that students who scored an A on the last test studied more than the 4 hours per week studied by average students. Does this now larger sample of students earning an A support this claim? (Don't forget effect size if appropriate)

Data

4
6
7
9
4
6
7
9
4
6
7
9

Calculations

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
STDYTIME	12	6.50	1.883	.544

One-Sample Test

	Test Value = 4					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
STDYTIME	4.599	11	.001	2.50	1.30	3.70

d=

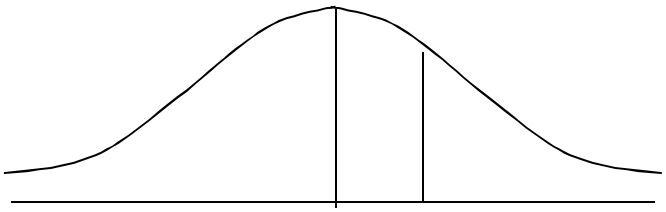
Hypothesis Testing Steps

1. 2.

3. 4.

5.

Sketch the Ho Distribution and label with both raw sample means and standard error scores. Also label t_{obt}, $t_{critical,}$ and the regions of rejections.



Standard Values…… $+1\hat{s}_{\bar{x}}$

Raw Values……

5. Questions pertaining to SPSS print-out above.

First, label information on the SPSS print-out with the appropriate symbols (e.g., $\sigma_{\bar{x}}$).

_____a) What's the sample mean?

_____b) What's the population mean?

_____c) What's the differ. between the two?

_____d) What's the typical deviation of average study times for samples around the population mean of 4 hours that you'd expect based on just sampling error?

_____e) What's the probability you'd see this sort of $t_{obtained}$ value just by chance?

_____f) If you had done this by hand, what would $t_{critical}$ equal?

_____g) What type of decision error might you be making? (I or II)

Indicate which of the following would make it more or less likely you'd reject the Ho and conclude that A students study more?

_____a. t_{obt} is larger

_____b. standard error is smaller

_____c. variability in raw scores is larger

_____d. average time spent studying by A students is larger

Homework 5.2: Hypothesis Testing with T-Scores - Key

1. Hypothesis Testing #1: A group of students take a new pilot version of a critical thinking course and then complete the Wizweekler test of critical thinking. If normal people score 40 on the test, does it appear that the course affected their critical thinking? (Don't forget effect size if appropriate.)

M= 45
μ= 40
df=8
$\hat{s}_x$= 6.3048
$\hat{s}_{xbar}$ =

Data
45
50
40
35
55
42
48
40
50

Calculations

$\hat{s}x$ = 6.3048

$$\hat{s}_{\bar{x}} = \frac{\bar{s}_x}{\sqrt{n}} = \frac{6.3048}{\sqrt{9}} = 2.1016$$

$$t = \frac{\bar{x} - \mu}{\hat{s}_{\bar{x}}} = \frac{45 - 40}{2.1016} = 2.3791$$

$$d = \frac{|\bar{x} - \mu|}{\hat{s}_x} = \frac{|45 - 40|}{6.3048} = .7930$$

Hypothesis Testing Steps

1. cf. M & μ
2. Ho: μ=40; Ha: μ≠40
3. α =.05, df = 8, $t_{crit} = \pm 2.306$
4. $t_{obt} = 2.379$
5. Reject Ho. The hypothesis was supported. Students completing the class scored higher (M=45) than normal (μ=40), t(8)=2.379, p≤.05. The effect size is moderate, d=.7930.

2. Impacting Treatment Effect and Sampling Error: For each of the following, indicate (1) whether the change described would affect the treatment effect (T) or sampling error (SE), and (2) whether the change would cause an increase or decrease.

___a) ↓ SE You base the class mean on 25 people, not just 9.

___b) ↓ SE You standardize how people study the course material, so that there are fewer differences in how much they learn about critical thinking.

___c) ↑ T You provide more feedback on their critical thinking abilities during the course, so that they become more effective at critical thinking.

___d) ↑ SE You have different people teach each of the 9 students about critical thinking, and every person teaches the course differently.

___e) ↓ T You cut back the course from a semester long course to just a weekend workshop, so the course becomes less effective.

___f) ↑ T You discover that the class average was 48, not 45.

3. Hypothesis Testing #2: The wise and beloved statistics professor claimed that students who scored an A on the last test studied more than the 4 hours per week studied by average students. Does this small sample of students earning an A support this claim? (Don't forget effect size if appropriate)

Data
4
6
7
9

$$\hat{s}_x = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} = \sqrt{\frac{182 - \frac{676}{4}}{4-1}} = 2.0817$$

1. cf. M & μ
2. Ho: μ=4; Ha: μ≠4
3. α =.05, t_{crit} = 3.182

M=6.5
μ=4
df=3

$$\hat{s}_{\bar{x}} = \frac{\hat{s}_x}{\sqrt{n}} = \frac{2.0817}{\sqrt{4}} = 1.0409$$

$$t = \frac{\bar{x} - \mu}{\hat{s}_{\bar{x}}} = \frac{6.5 - 4}{1.0409} = 2.402$$

Not appropriate to calculate effect size (d) because t_{obt} is not significant (you didn't reject the Ho).

4. t_{obt} = 2.402

5. Retain Ho. The hypothesis was not supported. The difference in time studying between "A" students (M=6.5 h) and normal students (μ = 4) did not reach statistical significance, t(3)=2.402, n.s.

4. Hypothesis Testing #2: The wise and beloved statistics professor claimed that students who scored an A on the last test studied more than the 4 hours per week studied by average students. Does this now larger sample of students earning an A support this claim? (Don't forget effect size if appropriate)

Data
4
6
7
9
4
6
7
9
4
6
7
9

M= 6.5
μ= 4
df=11
$\hat{s}_x$=1.883
$\hat{s}_{xbar}$ =.544
p_{obt}=.001

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
STDYTIME	12	6.50	1.883	.544

One-Sample Test

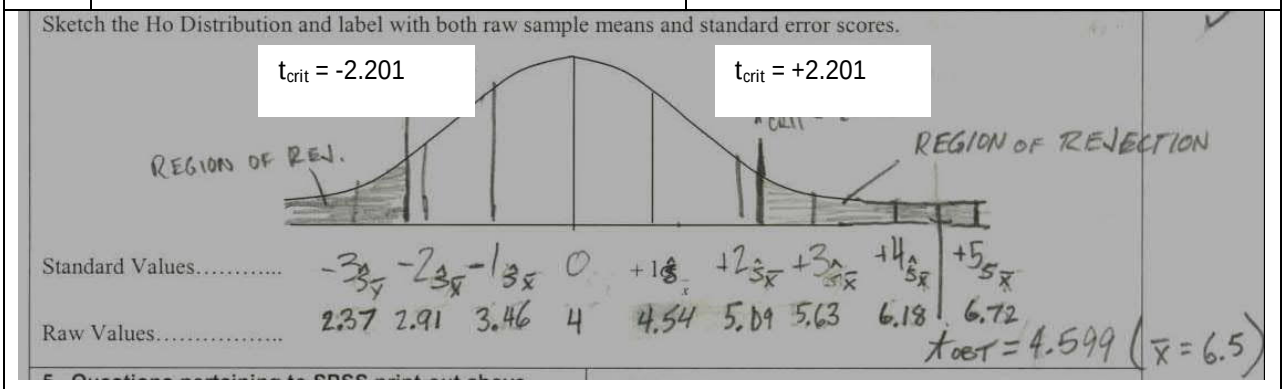
	Test Value = 4					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
STDYTIME	4.599	11	.001	2.50	1.30	3.70

$$d = \frac{|\bar{x} - \mu|}{\hat{s}_x} = \frac{|6.5 - 4|}{1.883} = 1.3277$$

Hypothesis Testing Steps

1. cf. M & μ
2. Ho: μ=4; Ha: μ≠4
3. α =.05, t_{crit}= ± 2.201
4. t_{obt} = 4.599
5. Reject Ho. The hypothesis was supported. The amount "A" students studied (M=6.5 h) exceeded that of normal students (μ = 4), t(11)=4.599, p≤.05. The effect of grade on study time was large, d=1.3277.

Sketch the Ho Distribution and label with both raw sample means and standard error scores.



5. Questions pertaining to SPSS print-out above.

First, label information on the SPSS print-out with the appropriate symbols (e.g., $\sigma_{\bar{x}}$).

_____a) 6.5 What's the sample mean?

_____b) 4 What's the population mean?

_____c) 2.5 What's the difference between the two?

_____d) .544 What's the typical deviation of average study times for samples around the population mean of 4 hours that you'd expect based on just sampling error?

_____e) 0.1% What's the probability you'd see this sort of $t_{obtained}$ value just by chance?

_____f) 2.201 If you had done this by hand, what would $t_{critical}$ equal?

_____g) Type I What type of decision error might you be making? (I or II)

Indicate which of the following would make it more or less likely you'd reject the Ho and conclude that A students study more?

_____e. ↑ t_{obt} is larger

_____f. ↑ standard error is smaller

_____g. ↓ variability in raw scores is larger

_____h. ↑ average time spent studying by A students is larger

Homework 5.3: One-sample t-test

For each of the following, complete hypotheses testing steps 1-5, giving special attention to the paragraph write-ups.

Q1. Punishment: The researcher predicted participants in the "severe vengeance" condition would recommend more than 2 minutes of loud noise to punish the cheating opponent (x=2,3,4,2,3,4,4,2,5,3,4).

Hypothesis testing steps:

1.

2.

3.

4.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
duration	11	3.27	1.009	.304

	Test Value = 2					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
duration	4.183	10	.002	1.273	.59	1.95

5.

If needed, calculate d here:

a. What type of hypothesis testing error is possible? _____ b. Sample mean _____ c. μ = _____

c. What's the chance you would see this difference between the sample & pop. means just by chance? _____

d. State the symbol and value for std error. _____ d. "difference observed" _____

f. Summarize the statistic: _____ g. $\hat{s}_x$ = _____ g. p = _____

Q2. Giving: The researcher predicted participants in the "crushing guilt" condition would offer more than the typical $10 charity gift. (x=$8, 10, 5, 7, 20, 7, 12, 9, 20, 12, 4, 3).

Hypothesis testing steps:

1.

2.

3.

4.

5.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
dollars	12	9.75	5.562	1.606

	Test Value = 10					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
dollars	-.156	11	.879	-.250	-3.78	3.28

If needed calculate d here:

a. What type of hypothesis testing error is possible? _____ b. Sample mean _____ c. μ = _____

c. What's the chance you would see this difference between the sample & pop. means just by chance? _____

d. State the symbol and value for std error. _____ d. "difference observed" _____

f. Summarize the statistic: _____ g. $\hat{s}_x$ = _____ g. p = _____

Q3. The researcher predicted the attractiveness ratings of dates in the "rollercoaster" condition would exceed the normal rating of 5.

Hypothesis testing steps:

1.

2.

3.

4.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
hotness	35	5.40	1.063	.180

	Test Value = 5					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
hotness	2.227	34	.033	.400	.03	.77

5.

If needed, calculate d here:

a. What type of hypothesis testing error is possible? _____ b. Sample mean _____ c. μ = _____

c. What's the chance you would see this difference between the sample & pop. means just by chance? _____

d. State the symbol and value for std error. _____ d. "difference observed" _____

f. Summarize the statistic: _____ g. $\hat{s}_x$ = _____ g. p = _____

Q4. Indicate the types of hypothesis testing error that might be made if you…. Type…

a. _____ Decide the debate team is smarter than normal

b. _____ Decide the sky is falling

c. _____ Decide global warming is not occurring

d. _____ Decide your wait time at the store is greater than the 3 minutes promised.

e. _____ Decide the extraversion scores of the sales people are higher than normal.

Homework 5.3: One-sample t-test__ Key

For each of the following, complete hypotheses testing steps 1-5, giving special attention to the paragraph write-ups.

Q1. Punishment: The researcher predicted participants in the "severe vengeance" condition would recommend more than 2 minutes of loud noise to punish the cheating opponent (x=2,3,4,2,3,4,4,2,5,3,4).

Hypothesis testing steps:

1. cf. M and μ
2. H_O: μ = 2, H_A: μ ≠ 2
3. 2-tailed, α=.05, df= 10, t_{crit} = ± 2.228
4. t_{obt} = 4.183

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
duration	11	3.27	1.009	.304

	Test Value = 2					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
duration	4.183	10	.002	1.273	.59	1.95

5. The hypothesis was supported. Participants in the severe vengeance condition recommended sig. more punishment (M=3.27) than normal (μ =2), t(10) = 4.183, p≤.05. The effect of condition on punishment was large, d = 1.2616.

If needed, calculate d here:

d = 1.273/1.009=1.2616

a. What type of hypothesis testing error is possible? _Type 1___ b. Sample mean _M = 3.27_____ c. μ = __2_____

c. What's the chance you would see this difference between the sample & pop. means just by chance? ___.2%_____

d. State the symbol and value for std error. _$\hat{s}_{xbar}$ = .304_____ d. "difference observed" ____M – μ = 1.273__

f. Summarize the statistic: ___t(10) =4.183, p≤.05__ g. $\hat{s}_x$ = ____1.009_____ g. p = ____.002_____

Q2. Giving: The researcher predicted participants in the "crushing guilt" condition would offer more than the typical $10 charity gift. (x=$8, 10, 5, 7, 20, 7, 12, 9, 20, 12, 4, 3).

Hypothesis testing steps:

1. cf. M and μ
2. H_O: μ = 10, H_A: μ ≠ 10
3. 2-tailed, α=.05, df =11, t_{crit} = ± 2.201
4. t_{obt} = -0.156.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
dollars	12	9.75	5.562	1.606

	Test Value = 10					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
dollars	-.156	11	.879	-.250	-3.78	3.28

5. The hypothesis was not supported. Participants in the guilt condition did not give sig. more or less (M = 9.75) than normal (μ = 10), t(11) = -0.156, n.s.

If needed calculate d here:

n/a (t was not sign)

a. What type of hypothesis testing error is possible? Type II b. Sample mean 9.75 c. $\mu = 10$

c. What's the chance you would see this difference between the sample & pop. means just by chance? 87.9%

d. State the symbol and value for std error. $\hat{s}_{xbar} = .1.606$ d. "difference observed" -.250

f. Summarize the statistic: t(11) = -.156, n.s. g. $\hat{s}_x = 5.562$ g. $p = .879$

Q3. The researcher predicted the attractiveness ratings of dates in the "rollercoaster" condition would exceed the normal rating of 5.

Hypothesis testing steps:

1. cf. M and μ

2. H_O: $\mu = 5$ H_A: $\mu \neq 5$

3. 2-tailed, α=.05, df = 34, $t_{crit} = \pm 2.0322$

4. $t_{obt} = 2.227$

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
hotness	35	5.40	1.063	.180

	Test Value = 5					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
hotness	2.227	34	.033	.400	.03	.77

5. The hypothesis was supported. Participants in the rollercoaster condition gave higher attractiveness ratings (M = 5.40) than normal (μ=5), t(34) = 2.227, p≤.05. The effect of condition on attractiveness was small, d = .3763.

If needed, calculate d here:
d = .4/1.063 = .3763

a. What type of hypothesis testing error is possible? Type I b. Sample mean 5.40 c. $\mu =$ 5

c. What's the chance you would see this difference between the sample & pop. means just by chance? 3.3%

d. State the symbol and value for std error. $\hat{s}_{xbar} = .180$ d. "difference observed" .400

f. Summarize the statistic: t(34) = 2.227, p ≤ .05 g. $\hat{s}_x = 1.063$ g. $p = .033$

Q4. Indicate the types of hypothesis testing error that might be made if you.... Type...

a. __I___ Decide the debate team is smarter than normal
b. __I___ Decide the sky is falling
c. __II___ Decide global warming is not occurring
d. __I___ Decide your wait time at the store is greater than the 3 minutes promised.
e. __I___ Decide the extraversion scores of the sales people are higher than normal.

Homework 5.4: Power

1. What's happening to US temperatures over time in this figure?

2. What's changing, the variability or the central tendency?

3. If we were to depict these yearly temperature ranges as distributions as time passes those distributions would be shifting to the _____.

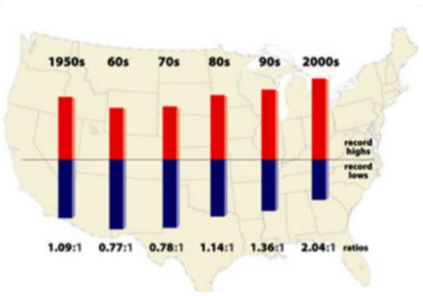


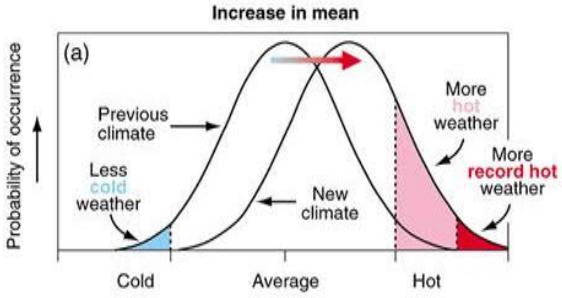
Figure 3. The ratio of record daily temperature highs to record daily lows observed at about 1,800 weather stations in the 48 contiguous United States from Jan. 1950 – Sept. 2009: Source: Meehl et al., 2009

Now let's look at this in terms of a distribution…

Figure 4 represents the change in climate over a period of time due to Global Warming.

4. For these two distributions, the left represents the _____ climate and the right represents the _____ climate.

5. In this figure, what is changing, the mean or variability? What does this mean regarding the type of climate we have?



6. Overall, in the distribution the climate is becoming _____ (hotter/colder). This is displayed by the increasing _____ between the curves.

7. Let's say that you have enough power to conclude that there is a treatment effect between these two distributions. To find the practical significance of this effect, you would calculate _____, or the gap between the old and new. What is the symbol for this? _____.

Now we'll examine a different type of change in the climate ….

8. In Figure 5, what changes between the two distributions depicted? (Hint: It's not central tendency!)
_____

9. More specifically, in the new climate, there will be _____ days falling in the tails (very cold or very hot) and _____ days near the average.

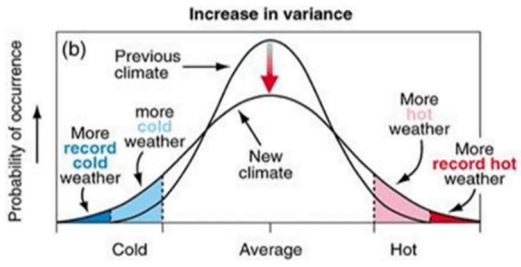


Figure 5

10. The mean of these two curves (in Figure 5) are the same. This means that the average temperature is _____ (getting hotter/getting colder/ staying the same), but that the _____ in temperatures is increasing.

11. In general, we increase power by increasing _____ and decreasing _____.

11. In general, we increase power by increasing _____ and decreasing _____.

Now let's examine both types of changes occuring at once…

Now we have two distributions that combine the differences shown separately in Figures 4 and 5.

12. Overall then, there are going to be more hot days, which means the _____ _____ of the distribution will increase as well as the _____ in temperatures (hint: greater spread).

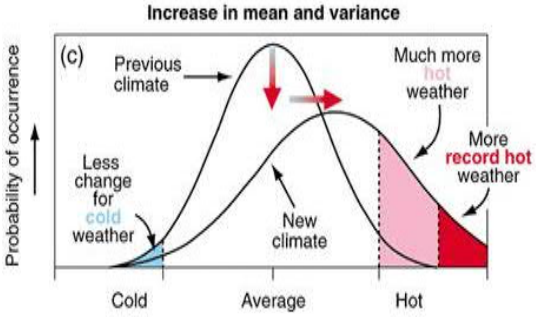


Figure 6

Lastly, we have a graph showing actual temperature distributions for specific years…

13. What happened to the mean temperatures over time in Figure 7?

14. What happened to the variability in temperatures over time?

15. So overall the climate is becoming (what two things)?

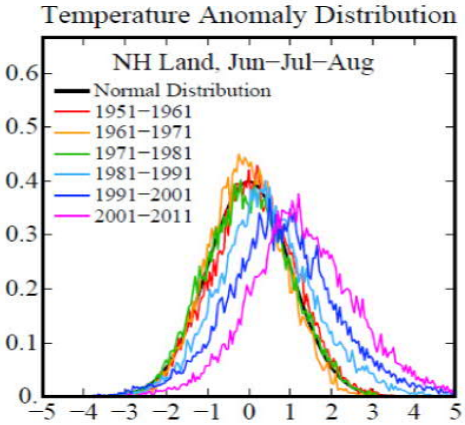


Figure 7

Short Answer & Wrap Up

16. For the distributions examined here, explain what d tells you and what type of change d represents (i.e., change in variability vs. change in central tendency)

17. Think about what gives you more power to detect a difference. In the case of global warming, explain what about the types of changes in the distributions from one year to the next that make it easier to think nothing is changing? What other aspect of the type of changes make it harder to see the shift to the right.

Homework/Quiz 5.4: Power Key

1. What's happening to US temperatures over time in this figure?

They are increasing as time passes.

2. What's changing, the variability or the central tendency?

The central tendency.

3. If we were to depict these yearly temperature ranges as distributions as time passes those distributions would be shifting to the right.

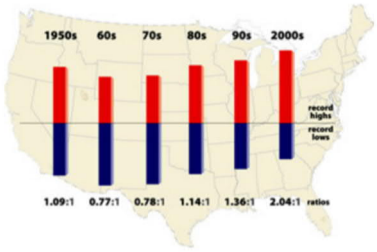


Figure 3: The ratio of record daily temperature highs to record daily lows observed at about 1,800 weather stations in the 48 contiguous United States from January 1950 through September 2009. Source: Meehl et al. 2009

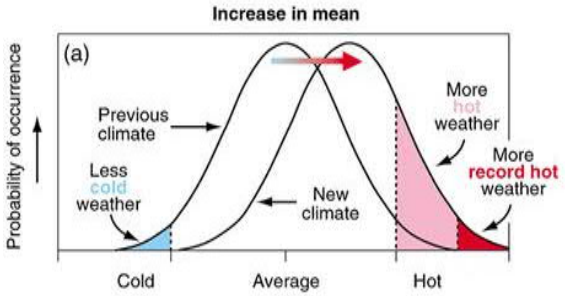
Now let's look at this in terms of a distribution…

Figure 4 represents the change in climate over a period of time due to Global Warming.

4. For these two distributions, the left represents the old climate and the right represents the new climate.

5. In this figure, what is changing, the mean or variability? What does this mean regarding the type of climate we have?

The mean is changing. This means that the climate is getting warmer over time.



6. Overall, in the distribution the climate is becoming hotter (hotter/colder). This is displayed by the increasing mean between the curves.

7. Let's say that you have enough power to conclude that there is a treatment effect between these two distributions. To find the practical significance of this effect, you would calculate effect size, or the gap between the old and new. What is the symbol for this? ___d___

Now we'll examine a different type of change in the climate ….

8. In Figure 5, what changes between the two distributions depicted? (Hint: It's not central tendency!) Variance

9. More specifically, in the new climate, there will be more days falling in the tails (very cold or very hot) and less days near the average.

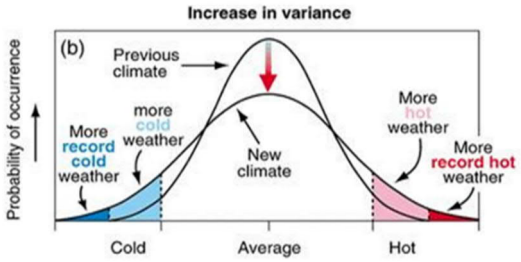


Figure 5

10. The mean of these two curves (in Figure 5) are the same. This means that the average temperature is staying the same (getting hotter/getting colder/ staying the same), but that the variability in temperatures is increasing.

11. In general, we increase power by increasing treatment effect and decreasing sampling error

Now let's examine both types of changes occuring at once…

Now we have two distributions that combine the differences shown separately in Figures 4 and 5.

Overall then, there are going to be more hot days, which means the central tendency of the distribution will increase as well as the variance in temperatures (hint: greater spread).

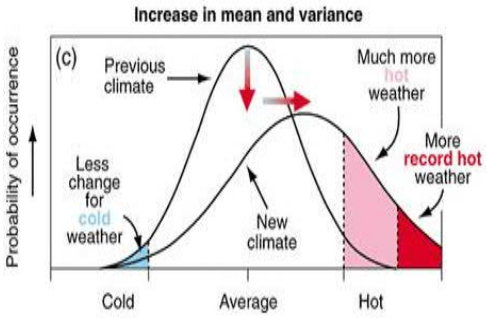


Figure 6

Lastly, we have a graph showing actual temperature distributions for specific years…

14. What happened to the mean temperatures over time in Figure 7?

The mean gradually shifted to the right, showing the slow increase of temperature/climate over the years.

15. What happened to the variability in temperatures over time?

The variability increased, which shows that a wider range of temperatures are being recorded as time passes (i.e., the purple distribution is wider than the earlier distributions).

16. So overall the climate is becoming (what two things)?

The climate is becoming hotter (the mean has shifted to the right) with a

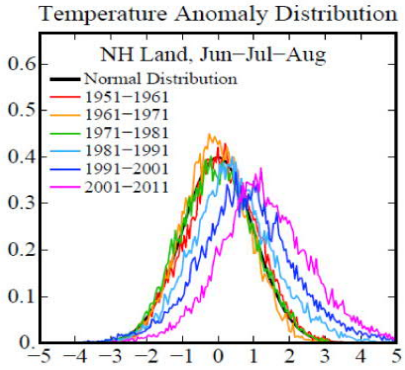


Figure 7

Short Answer & Wrap Up

17. For the distributions examined here, explain what "d" tells you and what type of change "d" represents (i.e., change in variability vs. change in central tendency)

Effect size (d) tells you the practical significance of the change in climates. It represents the overall amount that the mean (i.e., the center) of the distribution has shifted.

17. Think about what gives you more power to detect a difference. In the case of global warming, explain what about the types of changes in the distributions from one year to the next that make it easier to think nothing is changing? What other aspect of the type of changes make it harder to see the shift to the right.

First, from year to year, the distribution shifts just a small amount to the right – that is, the treatment effect is fairly small on a year-to-year basis. Second, within a given year, there is a lot of variability in temperature, so there is also a lot of sampling error which can mask the small treatment effect that is occurring.

Homework 6.1: Questions about Independent t-test

Answer these questions after watching the video on Independent t-tests.

1. The null hypothesis for the independent t-test is…
   a. $\mu_1 - \mu_2 = 0$
   b. $\mu_1 = \mu_2$
   c. $\mu_{Difference} = 0$

2. If the Levine's test for equality of variance (the one next to the F on the output) is significant, you should use which line from the SPSS independent t-test table?
   a. The first line
   b. The second line

3. The measure of variability in an independent t-test formula is the
   a. Standard error of the mean difference
   b. Standard error of the difference

4. What's the formula for an independent t-test? _____

5. You only calculate the d statistic if …
   a. The null hypothesis is rejected
   b. The alternative hypothesis is retained.
   c. t_{crit} exceeds $t_{obtained}$

6. When calculating the d statistic from the SPSS independent t-test output, you must first calculate…
   a. Standard deviation
   b. Standard error

7. When entering data into SPSS for an independent samples t-test, the data is formatted so that you have….
   a. Two columns, with two data points per person
   b. Two columns, one indicating the person's group and the other the person's score.

8. If I conclude your mother loves you significantly more than your brother, I could be making a Type __ error
   a. I
   b. II

9. Imagine a study comparing pain medication A to pain medication B. Which of the following would indicate a treatment effect?
   a. Very low variability in reported pain levels within the two groups.
   b. A large difference in the average amount of pain between the two groups.

10. In the same study, controlling for extraneous variables (e.g., amount of physical activity) would likely do which of the following?
   a. Decrease sampling error
   b. Increase the treatment effect.

Homework 6.2 – Independent t-test practice

#1: The false consensus effect predicts people overestimate the prevalence of their own attitude. You ask smokers and non-smokers to guess what percent of people aged 18 to 22 smoke.

Smokers: 40,35,25,30,30,35,20,10,30,25
Non-Smokers: 30,35,15,25,20,15,30,20,10,10

a. Type of test?

b. Hypotheses?

Group Statistics

	Smoking	N	Mean	Std. Deviation	Std. Error Mean
Estimate	smokers	10	28.00	8.563	2.708
	non-smokers	10	21.00	8.756	2.769

Independent Samples Test

		Levene's Test for Eq of Var		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Er Diff
Estimate	Equal variances assumed	.13	.716	1.807	18	.087	7.000	3.873
	Equal variances not assumed			1.807	17.99	.087	7.000	3.873

c. Show how data would be enetered into SPSS. Name variables and enter values.

e. Measure of standard error:

f. Chance you'd see this difference between means by sheer chance?

d. Effect size (do for practice even if not sig.)

i. Paragraph Write-up (can use separate paper).

#2: You wonder if the smell of smoke affects attractiveness ratings. Each male participant rates the attractiveness of a set of smoking or non-smoking women.

Smokers: 19,25,20,25,29,25,20,15,21
Non-Smokers: 29,25,28,24,28,25,27,25,27

a. Type of test?

b. Hypotheses?

Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
ATTRACT	1 odor	9	22.11	4.23	1.41
	2 no odor	9	26.44	1.74	.58

Independent Samples Test

		Levene's Test for Eq of Var		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Err Diff
Attract	Equal variances assumed	6.998	.018	-2.84	16	.012	-4.33	1.52
	Equal variances not assumed			-2.84	10.6	.016	-4.33	1.52

c. Show how data would be enetered into SPSS. Name variables and enter values.

g. Diff observed?

e. Diff expected (name, symbol, and value)

d. Effect size (do for practice even if not sig.)

i. Paragraph Write-up (can use separate paper).

Homework 6.2 – Independent t-test practice- Key

#1: The false consensus effect predicts people overestimate the prevalence of their own attitude. You ask smokers and non-smokers to guess what percent of people aged 18 to 22 smoke.

a. Type of test?
Indep. t-test

b. Hypotheses?
Ho: $\mu_1 - \mu_2 = 0$
H_A: $\mu_1 - \mu_2 \neq 0$

Group Statistics

	Smoking	N	Mean	Std. Deviation	Std. Error Mean
Estimate	smokers	10	28.00	8.563	2.708
	non-smokers	10	21.00	8.756	2.769

Independent Samples Test

		Levene's Test for Eq of Var		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Err Diff
Estimate	Equal variances assumed	.13	.716	1.807	18	.087	7.000	3.873
	Equal variances not assumed			1.807	17.99	.087	7.000	3.873

c. Show how data would be enetered into SPSS. Name variables and enter values.

Grp	Score
1	40
1	35
1	25
1	30
1	30
1	35
1	20
1	10
1	30
1	25
2	30
2	35
2	15
2	25
2	20
2	15
2	30
2	20
2	10
2	10

e. Measure of standard error:
Std. Err of the Diff: $\hat{s}_{\bar{x}_1 - \bar{x}_2} = 3.873$

f. Chance you'd see this difference between means by sheer chance? 8.7%

d. Effect size (do for practice even if not sig.)

$$\hat{s} = \hat{s}_{\bar{x}_1 - \bar{x}_2} * \sqrt{n} = 3.873 * \sqrt{10} = 12.2475$$

$$d = \frac{|\bar{x}_1 - \bar{x}_2|}{\hat{s}} = \frac{|28 - 21|}{12.2475} = .5715$$

i. Paragraph Write-

The hypothesis was not supported. The smoker's estimate (M=28%) does not differ significantly from that of non-smokers (M=21%), t (18) = 1.807, n.s.

#2: You wonder if the smell of smoke affects attractiveness ratings. Each male participant rates the attractiveness of a set of smoking or non-smoking women.

a. Type of test?
Indep. t-test

b. Hypotheses?
Ho: $\mu_1 - \mu_2 = 0$
H_A: $\mu_1 - \mu_2 \neq 0$

Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
ATTRACT	1 odor	9	22.11	4.23	1.41
	2 no odor	9	26.44	1.74	.58

F-test significant, so use second line.

Independent Samples Test

		Levene's Test for Eq of Var		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Err Diff
Attract	Equal variances assumed	6.998	.018	-2.84	16	.012	-4.33	1.52
	Equal variances not assumed			-2.84	10.6	.016	-4.33	1.52

c. Show how data would be enetered into SPSS. Name variables and enter values.

Grp	Score
1	19
1	25
1	20
1	25
1	29
1	25
1	20
1	15
1	21
2	29
2	25
2	28
2	24
2	28
2	25
2	27
2	25
2	27

g.Diff observed?
(-) 4.33

e. Diff expected (name, symbol, and value)
Std. Err of the Diff: $\hat{s}_{\bar{x}_1 - \bar{x}_2} = 1.52$

d. Effect size (do for practice even if not sig.)

$$\hat{s} = \hat{s}_{\bar{x}_1 - \bar{x}_2} * \sqrt{n} = .1.52 * \sqrt{9} = 4.56$$

$$d = \frac{|\bar{x}_1 - \bar{x}_2|}{\hat{s}} = \frac{|22.11 - 26.44|}{4.56} = .9496$$

i. Paragraph Write-up

The hypothesis was supported. Participants rated smokers as sig. less attractive (M=22.11) compared to non-smokers (M=26.44), t (16) = -2.84, p<=.05. The effect of smoking on attractiveness was large, d=.9496.

Homework 6.3 – Dependent t-tests

#1: You believe National Public Radio (NPR) provides much better news coverage than Fox "News." You have all participants tune-in to a month of one and a month of the other, and administer a current events quiz after each month. You counterbalance the design so the order of viewing is balanced: Half get NPR first and then Fox; half get Fox first and then NPR.

a. Type of test?

b. Hypotheses?

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FOX	13.54	13	1.98	.55
	NPR	16.69	13	2.43	.67

Paired Samples Test

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pair 1 FOX - NPR	-3.15	2.03	.56	-5.588	12	.000

d. Effect size (do for practice even if not sig.)

Fox	NPR
16	18
14	20
13	16
10	15
14	14
13	18
14	14
16	20
16	20
14	18
14	14
12	16
10	14

c. Show data format here:

e. Measure of standard error (precise name, symbol, & value)?

f. Chance you'd see this difference between means by sheer chance?

g. Difference observed?

h. Formula for df?

i. Paragraph Write-up (can use separate paper)

#2: An international studies advisor suspects he can show that study abroad drastically improves the self-esteem of students who undertake such a growth inducing experience. She compares the self-reported self-esteem levels of ten students before and after they study abroad for a semester. a. Type of test? b. Hypotheses?

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	BEFORE Self-esteem before	3.90	10	1.20	.38
	AFTER Self-esteem after	4.40	10	1.17	.37

Paired Samples Test

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	BEFORE Self-esteem before - AFTER Self-esteem after	-.50	1.08	.34	-1.464	9	.177

d. Effect size (do for practice even if not sig.)

Before	After
4	5
6	5
3	5
2	3
3	3
5	4
4	4
3	4
4	4
5	7

c. Show data format here:

e. Appropriate measure of standard error (precise name, symbol, & value)?

f. Chance you'd see a difference between the means of this size by sheer chance?

g. Difference observed?

h. Standard deviation of self-esteem before?

i. Paragraph Write-up (can use separate paper)

Homework 6.3 – Dependent t-tests- Key

#1: You believe National Public Radio (NPR) provides much better news coverage than Fox "News." You have all participants tune-in to a month of one and a month of the other, and administer a current events quiz after each month. You counterbalance the design so the order of viewing is balanced: Half get NPR first and then Fox; half get Fox first and then NPR.

a. Type of test? Dependent t-test b. Hypotheses? $H_0: \mu_D = 0$ $H_A: \mu_D \neq 0$

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FOX	13.54	13	1.98	.55
	NPR	16.69	13	2.43	.67

Paired Samples Test

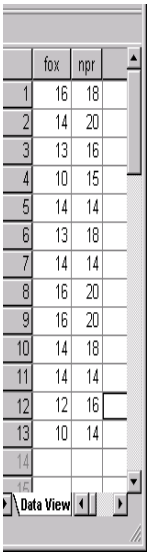
	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pair 1 FOX - NPR	-3.15	2.03	.56	-5.588	12	.000

c. Effect size (do for practice even if not sig.)

$$d = \frac{|\bar{D}|}{\hat{s}_D} = \frac{|-3.15|}{2.03} = 1.5517$$

Fox	NPR
16	18
14	20
13	16
10	15
14	14
13	18
14	14
16	20
16	20
14	18
14	14
12	16
10	14

c. Show data format here:



e. Measure of standard error?: Std. Error of the Mean Difference $\hat{s}_{\bar{D}} = 0.56$

f. Chance you'd see this difference between means by sheer chance? <.1%

g. Difference observed? $\bar{D} = 3.15$

h. Formula for df? df = 12

i. Paragraph Write-up (can use separate paper) The hypothesis was supported. Participants scored higher on current events quiz after listening to NPR (M=16.69) than after watching FOX (M=13.54), t(12) = -5.588, p≤.05. The effect of program type on quiz score was large, d=1.5517.

#2: An international studies advisor suspects he can show that study abroad drastically improves the self-esteem of students who undertake such a growth inducing experience. She compares the self-reported self-esteem levels of ten students before and after they study abroad for a semester

a. Type of test? Dependent t-test b. Hypotheses? $H_0: \mu_D = 0$ $H_A: \mu_D \neq 0$

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	BEFORE Self-esteem before	3.90	10	1.20	.38
	AFTER Self-esteem after	4.40	10	1.17	.37

Paired Samples Test

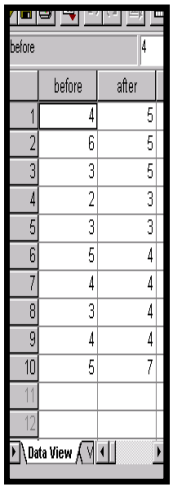
	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pair 1 BEFORE Self-esteem before - AFTER Self-esteem after	-.50	1.08	.34	-1.464	9	.177

d. Effect size (do for practice even if not sig.)

$$d = \frac{|\bar{D}|}{s_D} = \frac{|-.50|}{1.08} = .4630$$

Before	After
4	5
6	5
3	5
2	3
3	3
5	4
4	4
3	4
4	4
5	7

c. Show data format here:



e. Measure of standard error?: Std. Error of the Mean Difference $\hat{s}_{\bar{D}} = 0.34$

f. Chance you'd see a difference between the means of this size by sheer chance? 17.7%

g. Difference observed? $\bar{D} = (-).50$

h. Standard deviation of self-esteem before? s=1.20

i. Paragraph Write-up (can use separate paper) The hypothesis was not supported. Students who studied abroad showed no significant increase in self-esteem after the trip (M=4.40) compared to before (M=3.90), t(9)=-1.464, n.s.

Homework 6.3A – Annotating Output

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
children_desired	20	2.05	.887	.198

One-Sample Test

	Test Value = 2.3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
children_desired	-1.26	19	.223	-.250	-.67	.17

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
rating	cold drnk	9	3.33	1.000	.333
	warm drnk	9	4.22	.833	.278

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
rating	Equal variances assumed	.335	.571	-2.049	16	.057	-.889	.434
	Equal variances not assumed			-2.049	15.996	.058	-.889	.434

	Mean	N	Std. Deviation	Std. Error Mean
BEFORE	45.71	7	13.973	5.281
AFTER	35.71	7	9.759	3.689

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pair 1 BEFORE - AFTER	10.00	8.165	3.086	3.240	6	.018

Homework 6.3A – Annotating Output-Key

$\bar{x}$ $\hat{S}_x$ $\hat{S}_{\bar{x}}$

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
children_desired	20	2.05	.887	.198

μ

One-Sample Test

	Test Value = 2.3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
children_desired	-1.26	19	.223	-.250	-.67	.17

t_{obt} | Degrees of freedom, n -1 | p (probability of false alarm) | $\bar{x} - \mu$

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
rating	cold drnk	9	3.33	1.000	.333
	warm drnk	9	4.22	.833	.278

$\bar{x}_1$

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
rating	Equal variances assumed	.335	.571	-2.049	16	.057	-.889	.434
	Equal variances not assumed			-2.049	15.996	.058	-.889	.434

$\bar{x}_1 - \bar{x}_2$

std error of the diff $\hat{S}_{\bar{x}_1 - \bar{x}_2}$

p, for homog. of variance test | Deg of Freedom, $df = n_1 + n_2 - 2$ | p, for t-test

Mean, $\bar{x}_2$

	Mean	N	Std. Deviation	Std. Error Mean
BEFORE	45.71	7	13.973	5.281
AFTER	35.71	7	9.759	3.689

Mean Difference, $\bar{D}$, difference observed

Standard error of the mean difference, $\hat{S}_{\bar{D}}$, difference expected

Degrees of freedom, $n_{pairs} - 1$

	Paired Differences					
	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pair 1 BEFORE - AFTER	10.00	8.165	3.086	3.240	6	.018

Homework 6.4: Independent & Dependent T-tests

1. Reviewing z and t-scores: Matilda Matador scores a 30 on the extraversion scale whereas normal people score 40 ($\sigma_x = 5$). What percent of people are more extraverted than Matilda?

a. Are you dealing with a score or a sample mean? Frequency or sample distribution?	b. Find the z or t-score.	c. Roughly sketch the distribution and value.	d. Find the correct percent (for z-scores only).

2. Reviewing z and t-scores: A group of 25 teenagers forced to watch 20 hours of Barney average 41 on the depression inventory (μ=40, σ_x=10). What percent of all teenagers are less depressed than this group?

a. Are you dealing with a score or a sample mean? Frequency or sample distribution?	b. Find the z or t-score.	c. Roughly sketch the distribution and value.	d. Find the correct percent (for z-scores only).

3. Reviewing z and t-scores: The "Safe and Speedy" moving company told Opal that the average shipping time was 7 days. Former customers indicated delivery times of 4, 9, 10, 5, 12, and 10 days. Does the 7 days avg. seem plausible based on these data?

a. Are you dealing with a score or a sample mean? Frequency or sample distribution?	b. Find the z or t-score.	c. Roughly sketch the distribution and value.

4. Interpreting Independent t-tests: An educational psychologist speculated that students who spent more time reading would have lower hostility scores because they would be better able to reason through to problem solving and express their feelings to others. She designed a reading intensive summer experience that students took each year of junior high school. She randomly 20 students both a control and experimental condition, and evaluated their hostility scores after 3 years.

Data:

Control	Exp
20	15
30	10
40	15
30	20
20	10
25	25
20	30
30	20
35	20
40	20

Group Statistics

	GR	N	Mean	Std. Deviation	Std. Error Mean
HOSTIL	1	10	29.00	7.746	2.449
	2	10	18.50	6.258	1.979

1= control

2=experimental

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
HOSTIL	Equal variances assumed	.635	.436	3.33	18	.004	10.50	3.149	3.884	17.116
	Equal variances not assumed			3.33	17.2	.004	10.50	3.149	3.863	17.137

* Label as much of the output as possible with the correct symbols. Be sure to distinguish between standard error of the mean and standard error of the difference.

* Show how you'd set up the data to enter it into SPSS

_____a) What's the average level of hostility in the experimental group?

_____b) What's the avg. level of hostility in the control group?

_____c) What's the observed variability?

_____d) What's the expected variability?

_____e) What's t_{obt}?

_____f) What's the probability you'd see this difference between sample means by chance?

Hypothesis Testing Steps:

1. 2.

3. 4.

5.

5. Interpreting Dependent T-tests: An I/O psychologist conducts a study to examine the impact of a diversity training workshop for managers. He asks subordinates to rate managers both before and after the weekend workshop to see if managers have become more sensitive (e.g., less likely to use racial stereotypes, more sensitive to the needs of working mothers, respectful of non-Christian holiday requests, etc.). The subordinates rate their supervisors using a measure of tolerance developed by the psychologist. Scores range from 10 (very insensitive) to 50 (extremely sensitive).

Data

Before	After
25	35
20	20
25	30
30	25
25	30
20	40
25	25
40	50

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	BEFORE	26.25	8	6.409	2.266
	AFTER	31.88	8	9.613	3.399

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	BEFORE - AFTER	-5.63	7.763	2.745	-12.12	.87	-2.049	7	.080

* Label as much of the output as possible with the correct symbols. Be sure to distinguish between standard error of the mean and standard error of the difference.

* Show how you'd set up the data to enter it into SPSS

_____a) What's the average level of tolerance before?

_____b) What's the avg. level of tolerance after the training?

_____c) What's the observed difference?

_____d) What's the expected difference?

_____e) What's t_{obt}?

_____f) What's the probability you'd see this difference between sample means by chance?

Hypothesis Testing Steps:

1. 2.

3. 4.

5.

6. Changing Power: Referring to the study above, indicate for each of the following how the change would affect either sampling error or the treatment effect. Also indicate what would happen to the size of t_{obt}.

_____a) Increasing the length of the training so it would have more impact on participants.

_____b) Decreasing the number of participants.

_____c) Selecting only participants that started with moderate levels of tolerance.

_____d) Picking managers from several different departments and from very different working conditions.

_____e) Making bonuses for managers contingent on improving the tolerance ratings by subordinates.

7. Picking the correct statistic: Indicate which is the appropriate statistic for the following situations:

a) _____Determine whether the average number of community service hours of a particular fraternity chapter differs from the 5 hour, nation-wide average.

b) _____Estimate the variability in service hours for individuals across the entire fraternity based on the variability of service hours for the local chapter.

c) _____Compare fraternity and sororities on community service hours. You have 10 members of each.

d) _____Calculate the typical number of Twinkies eaten by the 10 fraternity brothers.

e) _____Determine the percent of Americans who eat more than the average number of Twinkies eaten by these fraternity brothers (σ =2).

f) _____Determine the percent of Americans who eat more than the 92 Twinkies eaten per day by Big John.

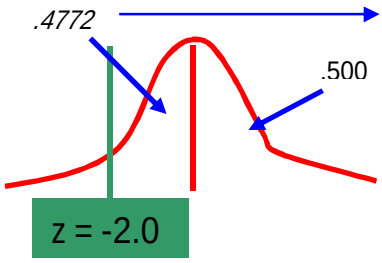
g) _____Determine whether fraternity brothers watch more television than the 3 hour per day, nation-wide average. Use your sample of 10 fraternity brothers.

h) _____Compare the weight of 10 football players before and after an all Fried Chicken diet.

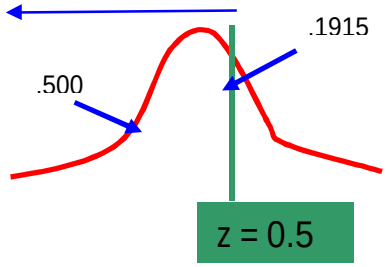
i) _____Compare 10 football players on the diet for 10 weeks to 10 football players who ate normally (as normally as football players can eat).

Homework 6.4: Independent & Dependent T-tests- Key

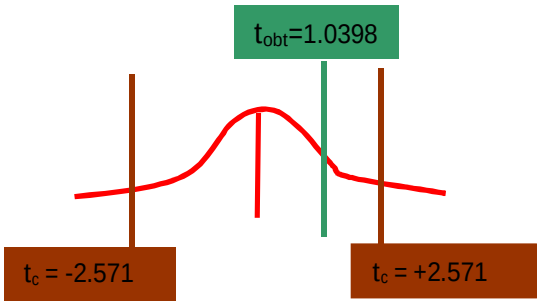
1. Reviewing z and t-scores: Matilda Matador scores a 30 on the extraversion scale whereas normal people score 40 (σ=5). What percent of people are more extraverted Matilda?

a. Are you dealing with a score or a sample mean? Frequency or sampling distribution?	b. Find the z or t-score.	c. Roughly sketch the distribution and value.	d. Find the correct percent (for z-scores only)
score frequency dist.	x = 30 μ = 40 σ = 5 $z = \frac{x-\mu}{\sigma}$ $z = \frac{30-40}{5} = -2.0$		.4772 .5000 .9772 97.72%

2. Reviewing z and t-scores: A group of 25 teenagers forced to watch 20 hours of Barney average 41 on the depression inventory (μ=40, σ=10). What percent of all teenagers are less depressed than this group?

a. Are you dealing with a score or a sample mean? Frequency or sampling distribution?	b. Find the z or t-score.	c. Roughly sketch the distribution and value.	d. Find the correct percent (for z-scores only)
sample mean sampl. distribut.	M = 41 μ = 40 σ = 10 n = 25 z = ? $\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{10}{\sqrt{25}} = 2$ $z = \frac{\bar{x}-\mu}{\sigma_{\bar{x}}}$ $z = \frac{41-40}{2} = 0.5$		.1915 .5000 .6915 69.15%

3. Reviewing z and t-scores: The "Safe and Speedy" moving company told Opal that the average shipping time was 7 days. Former customers indicated delivery times of 4, 9, 10, 5, 12, and 10 days. Does the 7 days avg. seem plausible based on these data?

a. Are you dealing with a score or a sample mean? Frequency or sampling distribution ?	b. Find the z or t-score.	c. Roughly sketch the distribution and value.
	μ=7 M=8.3333 $\hat{s}_x$ = 3.1411 $\hat{s}_x = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} = \sqrt{\frac{466 - \frac{2500}{6}}{6-1}} = 3.14$ $\hat{s}_{\bar{x}} = \frac{\hat{s}_x}{\sqrt{n}} = \frac{3.1411}{\sqrt{6}} = 1.2823$ $t = \frac{\bar{x}-\mu}{\hat{s}_{\bar{x}}} = \frac{8.3333-7}{1.2823} = 1.0398$	 Retain Ho. 7 day average is plausible.

4. Interpreting Independent t-tests: An educational psychologist speculated that students who spent more time reading would have lower hostility scores because they would be better able to reason through to problem solving and express their feelings to others. She designed a reading intensive summer experience that students took each year of junior high school. She randomly 20 students both a control and experimental condition, and evaluated their hostility scores after 3 years.

Data:

Cntrl	Exp
20	15
30	10
40	15
30	20
20	10
25	25
20	30
30	20
35	20
40	20

Group Statistics

	GR	N	Mean	Std. Deviation	Std. Error Mean
HOSTIL	1	10	29.00	7.746	2.449
	2	10	18.50	6.258	1.979

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
HOSTIL	Equal variances assumed	.635	.436	3.33	18	.004	10.50	3.149	3.884	17.116
	Equal variances not assumed			3.33	17.2	.004	10.50	3.149	3.863	17.137

* Label as much of the output as possible with the correct symbols. Be sure to distinguish between standard error of the mean and standard error of the difference.

* Show how you'd set up the data to enter it into SPSS

Group	Hostility
1	20
1	30
...	...
2	15
2	10

_____a) 18.50 What's the average level of hostility in the experimental group?

_____b) 29.00 What's the avg. level of hostility in the control group?

_____c) 10.50 What's the observed variability?

_____d) 3.149 What's the expected variability?

_____e) 3.33 What's t_{obt}?

_____f) .4% What's the probability you'd see this difference between sample means by chance?

Hypothesis Testing Steps:

1. Compare M_1 & M_2
2. Ho: $\mu_1 - \mu_2 = 0$ Ha: $\mu_1 - \mu_2 = 0$
3. $\alpha = .05$, df = 18 $t_{crit} = 2.101$
4. $t_{obt} = 3.33$

$$\hat{s} = \hat{s}_{\bar{x}} * \sqrt{n} = 3.149 * \sqrt{10} = 9.9580$$

$$d = \frac{|\bar{x}_1 - \bar{x}_2|}{\hat{s}} = \frac{29 - 18.5}{9.9580} = 1.0544$$

5. Reject Ho.

The hypothesis was supported. The average hostility score for the experimental group (M=18.50), was significant lower than that of the control group (M=29.00), t(18) = 3.33, p≤.05. Reading has a large effect on hostility scores, d=1.0544.

5. Interpreting Dependent T-tests: An I/O psychologist conducts a study to examine the impact of a diversity training workshop for managers. He asks subordinates to rate managers both before and after the weekend workshop to see if managers have become more sensitive (e.g., less likely to use racial stereotypes, more sensitive to the needs of working mothers, respectful of non-Christian holiday requests, etc.). The subordinates rate their supervisors using a measure of tolerance developed by the psychologist. Scores range from 10 (very insensitive) to 50 (extremely sensitive).

Data

Before	After
25	35
20	20
25	30
30	25
25	30
20	40
25	25
40	50

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	BEFORE	26.25	8	6.409	2.266
	AFTER	31.88	8	9.613	3.399

$\bar{x}_{before} = 26.25$

$\bar{x}_{after} = 31.88$

$\hat{s}_x = 6.409, 9.613$

$\hat{s}_{\bar{x}} = 2.266, 3.399$

$\overline{D} = -5.63$

$\hat{s}_D = 7.763$

$\hat{s}_{\overline{D}} = 2.745$

$t_{obt} = -2.049$

$p_{obt} = .080$

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	BEFORE - AFTER	-5.63	7.763	2.745	-12.12	.87	-2.049	7	.080

* Label as much of the output as possible with the correct symbols. Be sure to distinguish between standard error of the mean and standard error of the difference.

* Show how you'd set up the data to enter it into SPSS

Before After

25 35

20 20

25 30

... .

_a) 26.25 What's the average level of tolerance before?

_b) 31.88 What's the avg. level of tolerance after the training?

_c) –5.63 What's the observed difference?

_d) 2.745 What's the expected difference?

_e) –2.049 What's t_{obt}?

_f) 8% What's the probability you'd see this difference between sample means by chance?

Hypothesis Testing Steps:

1. Compare Dbar & μ_D
2. Ho: $\mu_D = 0$; Ha: $\mu_D \neq 0$
3. $\alpha = .05$, df = n-1= 7; $t_{crit} = 2.365$
4. $t_{obt} = -2.049$
5. Retain Ho.

The hypothesis was not supported. The average tolerance level of managers after training (M=31.88) is not statistically different from the level before training (M=26.25), t(7) = -2.049, n.s..

6. Changing Power: Referring to the study above, indicate for each of the following how the change would affect either sampling er
or the treatment effect. Also indicate what would happen to the size of t_{obt}.

Note: Increasing treatment effect always increases t_{obt}; Increasing sampling error always decreases t_{obt}.

a) ↑ treatment effect, ↑ tobt Increasing the length of the training so it would have more impact on participants.

b) ↑ sampling error, ↓ tobt Decreasing the number of participants.

c) ↓ sampling error , ↑ tobt Selecting only participants that started with moderate levels of tolerance.

d) ↑ sampling error, ↓ tobt Picking managers from several different departments and from very different working conditions.

e) ↑ treatment effect, ↑ tobt Making bonuses for managers contingent on improving the tolerance ratings by subordinates.

7. Picking the correct statistic: Indicate which is the appropriate statistic for the following situations:

a) 1-sample t-test Determine whether the average number of community service hours of a particular fraternity chapter differs from the 5 hour, nation-wide average.

b) Standard deviation as an estimate, $\hat{s}_x$ Estimate the variability in service hours across the entire fraternity based on the variability service hours for the local chapter.

c) Ind. t-test Compare fraternity and sororities on community service hours. You have 10 members of each.

d) Mean x_{bar} Calculate the typical number of twinkies eaten by the 10 fraternity brothers.

e) z-score (sampling distribution) Determine the percent of Americans who eat more than the average number of Twinkies eate by these fraternity brothers ($\sigma = 2$).

f) z-score (frequency distribution) Determine the percent of Americans who eat more than the 92 Twinkies eaten per day by Big Jo

g) 1-sample t-test Determine whether fraternities brothers watch more television than the 3 hour per day, nation-wide average. U your sample of 10 fraternity brothers.

h) Dependent t-test Compare 10 football players before and after an all Fried Chicken diet.

i) Independent t-test Compare 10 football players on the diet for 10 weeks to 10 football players who ate normally (as normally as football players can eat).

Homework 6.6 – Conceptual Review

1) A researcher tests whether caffeine increases academic performance and concludes it does not. Which of the following must be true
   a) $t_{crit} < t_{obt}$
   b) $p < .05$
   c) she could be making a Type II error
   d) there was no sampling error
   e) increasing n would help detect a treatment effect

2) A researcher tested whether those primed to have an avoidance orientation took longer to order dinner at a restaurant. To prime the avoidance orientation she had participants in the experimental group try to list five movies no one should see. Which of the following might she do to reduce sampling error?
   a) Decrease n
   b) Decrease power
   c) Standardize the number of items on a menu
   d) Increase the number of don't-see-movies she requires the person to list in the experimental group.
   e) Increase the variability in hunger level

3) A researcher concludes the new anti-psychotic drug Avernon produces significantly fewer side effects than the market leader and determines the effect size is large. Which of the following must be true?
   a) There is no chance of a Type I error.
   b) There were no extraneous variables affecting the DV
   c) There is no evidence of sampling error
   d) The observed difference was double (or more) the expected difference

4) A researcher suspects that participants will rate spooky stories as scarier if read in low light conditions. She has participants read stories in both low and high light conditions and then rate the stories on scariness. The number of scary elements written into a given story would be ….
   a) the IV
   b) the levels of the IV
   c) the DV
   d) an extraneous variable.

5) A researcher wants to test the effectiveness of debating versus lecturing for teaching the use of evidence in writing. He teaches debate in one class, lectures in another, and then tests for differences in essay quality. Which of the following would <u>decrease sampling error</u> in this design:
   a) run the program for two rather than only one semester
   b) increasing the intensity of the debate training
   c) decrease the quality of the lecturing
   d) a & b

6) A researcher wants to test the effectiveness of debating versus lecturing for teaching the use of evidence in writing. He teaches debate in one class, lectures in another, and then tests for differences in essay quality. Making the debate training more focused on the use of evidence would likely make
   a) Type I error less likely
   b) Type II error less likely
   c) it less likely you can exceed t-critical
   d) it more likely sampling error will increase

7) When doing a two sample t-test, an increase in the difference between means would suggest a(n)
   a) increased treatment effect
   b) decreased treatment effect
   c) increased sampling error
   d) decreases sampling error

8) In a t formula, increasing power will yield
   a) Less Type I error
   b) More Type II error
   c) a smaller α area
   d) a smaller β area

9) As n increases
   a) Treatment effect increases
   b) Sampling error increases
   c) α increases
   d) β increases
   e) Power increases

<u>Fill-in</u>

1. If participants are matched by the experimenter then one should conduct a _____ samples t-test.
2. If the standard deviation in the population is not known we must _____ it based on the sample.
3. As $t_{critical}$ increases $t_{obtained}$ _____. (increases, decreases, or stays the same)

4. As n increases standard _____ will stay the same but standard _____ will decrease (hint: both are measures of variability).
5. In any hypothesis testing formula (z, t, etc.) some measure of variability is on the bottom and it specifies the difference _____ based solely on sampling error.
6. The typical measure of practical significance with the t-test is the _____ statistic (hint: a specific statistic).
7. In an independent t-test, if the treatment effect increases then this may increase the difference between the two _____ in the formula.
8. Unlike the t-distribution, the z-distribution conforms to the _____ _____ _____ (hint: three word).
9. If you wanted to calculate the variability of the points scored per player you'd typically calculate _____ _____.
10. The area under the alternative distribution not designated "power" would be represented by the symbol _____ .
11. Determining the size of a treatment effect (after concluding one exists) requires a calculation of _____ significance.
12. For any given t-test, an increase in treatment effect or a decrease in sampling error gives the experimenter more _____.

Name that Stat

Use the following choices for the items below

a. standard deviation
b. mean
c. correlation
d. regression
e. one-sample z-test
f. one-sample t-test
g. two-sample t-test, independent
h. two-sample t-test, dependent
i. effect size (d)
j. the three-sample Zamboni half-twist with triple flip

1) _____ A researcher examines the effect of music training on math ability. He compares a group of kids with three years of music lessons to a group with no lessons on a math ability test.
2) _____A researcher tests whether victim sensitivity relates to narcissism. Some of the participants are named Ned.
3) _____A researcher tests whether auto mechanics score higher than normal (40 pts) on a test of spatial ability.
4) _____A researcher examines whether former professional football players score differently on a test of verbal recall (μ=100, σ=10).
5) _____ A research attempts to predict someone's narcissism score based on how long they gaze into a mirror mounted in the hallway.
6) _____ A research measures how long the typical person spends showering after finishing a statistics course.
7) _____ A researcher tests whether researchers smell worse than normal people. He matches people on smelling ability and then assigns half to smell researchers and have to smell normal people.
8) _____ A researcher determines that doing research does make people smell funny and now wants to determine how much worse they smell than normal people.
9) _____ A stats teacher wants to test whether people have lower social skills than normal after taking a statistics class. He measures the social skills of his most recent class of ~~victims~~ students and compares it to people in general (μ = 100, σ = 20).

Homework 6.6 – Conceptual Review – KEY

1) A researcher tests whether caffeine increases academic performance and concludes it does not. Which of the following must be true
   a) $t_{crit} < t_{obt}$
   b) $p < .05$
   c) she could be making a Type II error
   d) there was no sampling error
   e) increasing n would help detect a treatment effect

2) A researcher tested whether those primed to have an avoidance orientation took longer to order dinner at a restaurant. To prime the avoidance orientation she had participants in the experimental group try to list five movies no one should see. Which of the following might she do to reduce sampling error?
   a) Decrease n
   b) Decrease power
   c) Standardize the number of items on a menu
   d) Increase the number of don't-see-movies she requires the person to list in the experimental group.
   e) Increase the variability in hunger level

3) A researcher concludes the new anti-psychotic drug Avernon produces significantly fewer side effects than the market leader and determines the effect size is large. Which of the following must be true?
   a) There is no chance of a Type I error.
   b) There were no extraneous variables affecting the DV
   c) There is no evidence of sampling error
   d) The observed difference was double (or more) the expected difference

4) A researcher suspects that participants will rate spooky stories as scarier if read in low light conditions. She has participants read stories in both low and high light conditions and then rate the stories on scariness. The number of scary elements written into a given story would be ….
   a) the IV
   b) the levels of the IV
   c) the DV
   d) an extraneous variable.

5) A researcher wants to test the effectiveness of debating versus lecturing for teaching the use of evidence in writing. He teaches debate in one class, lectures in another, and then tests for differences in essay quality. Which of the following would <u>decrease sampling error</u> in this design:
   a) run the program for two rather than only one semester
   b) increasing the intensity of the debate training
   c) using only participants who can read at grade level
   d) a & b

6) A researcher wants to test the effectiveness of debating versus lecturing for teaching the use of evidence in writing. He teaches debate in one class, lectures in another, and then tests for differences in essay quality. Making the debate training more focused on the use of evidence would likely make
   a) Type I error less likely
   b) Type II error less likely
   c) it less likely you can exceed t-critical
   d) it more likely sampling error will increase

7) When doing a two sample t-test, an increase in the difference between means would suggest a(n)
   a) increased treatment effect
   b) decreased treatment effect
   c) increased sampling error
   d) decreases sampling error

8) In a t or F formula, increasing power will yield
   a) Less Type I error
   b) More Type II error
   c) a smaller α area
   d) a smaller β area

9) As n increases
   a) Treatment effect increases
   b) Sampling error increases
   c) α increases
   d) β increases
   e) Power increases

<u>Fill-in</u>

1. If participants are matched by the experimenter then one should conduct a _DEPENDENT_ samples t-test.
2. If the standard deviation in the population is not known we must _ESTIMATE_ it based on the sample.
3. As $t_{critical}$ increases $t_{obtained}$ _____. (increases, decreases, or stays the same)
4. As n increases standard __DEVIATION__ will stay the same but standard __ERROR___ will decrease (hint: both are measures of variability).

5. In any hypothesis testing formula (z, t, etc.) some measure of variability is on the bottom and it specifies the difference __EXPECTED__ based solely on sampling error.
6. The typical measure of practical significance with the t-test is the ____d_____ statistic (hint: a specific statistic).
7. In an independent t-test, if the treatment effect increases then this may increase the difference between the two __MEANS__ in the formula.
8. Unlike the t-distribution, the z-distribution conforms to the _STANDARD NORMAL CURVE_ (hint: three word).
9. If you wanted to calculate the variability of the points scored per player you'd typically calculate __STANDARD DEVIATION__.
10. The area under the alternative distribution not designated "power" would be represented by the symbol _β__ .
11. Determining the size of a treatment effect (after concluding one exists) requires a calculation of __PRACTICAL_____ significance.
12. For any given t-test, an increase in treatment effect or a decrease in sampling error gives the experimenter more __POWER__.

Name that Stat

Use the following choices for the items below

a. standard deviation
b. mean
c. correlation
d. regression
e. one-sample z-test
f. one-sample t-test
g. two-sample t-test, independent
h. two-sample t-test, dependent
i. effect size (d)
j. the three-sample Zamboni half-twist with triple flip

1) ___G____ A researcher examines the effect of music training on math ability. He compares a group of kids with three years of music lessons to a group with no lessons on a math ability test.
2) ___C____A researcher tests whether victim sensitivity relates to narcissism. Some of the participants are named Ned.
3) ___F____A researcher tests whether auto mechanics score higher than normal (40 pts) on a test of spatial ability.
4) ___E____A researcher examines whether former professional football players score differently on a test of verbal recall (μ=100, σ=10).
5) ___D____ A research attempts to predict someone's narcissism score based on how long they gaze into a mirror mounted in the hallway.
6) ___B____ A research measures how long the typical person spends showering after finishing a statistics course.
7) ___H____ A researcher tests whether researchers smell worse than normal people. He matches people on smelling ability and then assigns half to smell researchers and have to smell normal people.
8) ___I____ A researcher determines that doing research does make people smell funny and now wants to determine how much worse they smell than normal people.
9) ___E____ A stats teacher wants to test whether people have lower social skills than normal after taking a statistics class. He measures the social skills of his most recent class of ~~victims~~ students and compares it to people in general (μ = 100, σ = 20).

Homework 6.7 Computational Review (Test 2)

All questions worth 6 pt unless otherwise marked.

For the following set of questions, assume normal people score 50 on the Ceespotrun verbal ability test (σ= 8).

1. Bob scores 66. Calculate his standard score by hand.

2. If z = 1.5, what percent score higher?

3. If Biff scores 39, what percent score higher?

4. A class of 16 students average 53. Calculate their standard score by hand.

For questions 5-7, assume normal people score 7 on the Wigginout Stress Test. Individuals meditating score 7, 3, 4, & 6. Answer the following questions relating to testing for a significance difference.

5. State the correct $t_{critical}$.

6. Calculate standard error by hand. [Hint: $\Sigma x^2 = 110$, $(\Sigma x)^2 = 400$]

7. Calculate $t_{obtained}$ by hand assuming a standard error of 1.0 (don't use what you found in #6).

8. Calculate the effect size or state why not needed.

For problems 9-11, assume you ask people to rate the severity of their daily problems both before (7,8,5,4,8) and after working in a homeless shelter (6,7,6,3,7).

9. Use SPSS to calculate the $t_{obtained}$.

10. Provide the symbol and value of the standard error used by SPSS to produce $t_{obtained}$.

11. Explain the results in a paragraph. Assume tobtained = 1.7 (do not use the $t_{obtained}$ you calculated). [12 points]

For the following set of problems (12-15), compare the number of walls rats bump into if they are taking the drug Dizzorex (4,3,7,7) vs. a placebo (2,4,2,0).

12. Calculate $t_{obtained}$ using SPSS.

$t_{obtained}$ = _____

13. State the H_0 and H_A hypotheses.

14. Using the two tables below (not your results above), calculate the effect size or state why not needed.

	Group	N	Mean	Std. Deviation	Std. Error Mean
Bumps	Dizzorex	4	5.50	1.732	.866
	Placebo	4	2.50	1.000	.500

		t-test for Equality of Means				
		t	df	Sig. (2-tailed)	Mean Diff	Std. Error Difference
Bumps	Equal variances assumed	3.000	6	.024	3.000	1.000

15. Explain the results in paragraph form [12 points]. (Use the two tables above, not your results.)

Homework 6.7 Computational Review (Test 2) - Key

All questions worth 6 pt unless otherwise marked.

For the following set of questions, assume normal people score 50 on the Ceespotrun verbal ability test (σ= 8).

1. Bob scores 66. Calculate his standard score by hand.

$$z = \frac{x-\mu}{\sigma} = \frac{66-50}{8} = \frac{16}{8} = 2.0$$

2. If z = 1.5, what percent score higher?

6.68% (Use "area beyond")

3. If Biff scores 39, what percent score higher?

$$z = \frac{x-\mu}{\sigma} = \frac{39-50}{8}$$
$$= \frac{-11}{8} = -1.375$$

0.4162
+ 0.5000
0.9162

4. A class of 16 students average 53. Calculate their standard score by hand.

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{8}{\sqrt{16}} = 2$$
$$z = \frac{\bar{x}-\mu}{\sigma_{\bar{x}}} = \frac{53-50}{2} = 1.5$$

For the following set of questions, assume normal people score 7 on the Wigginout Stress Test. Individuals meditating score 7, 3, 4, & 6. Answer the following questions relating to testing for a significance difference.

5. State the correct $t_{critical}$.

$t_{critical} = 3.182$

6. Calculate standard error by hand. [Hint: $\Sigma x^2 = 110$, $(\Sigma x)^2 = 400$]

$$\hat{s}_x = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} = \sqrt{\frac{110 - \frac{400}{4}}{4-1}} = 1.8257$$
$$\hat{s}_{\bar{x}} = \frac{\hat{s}_x}{\sqrt{n}} = \frac{1.8257}{\sqrt{4}} = \frac{1.8257}{2} = .9129$$

7. Calculate $t_{obtained}$ by hand assuming a standard error of 1.0 (don't use what you found in #6).

$$t = \frac{\bar{x}-\mu}{\hat{s}_{\bar{x}}} = \frac{5-7}{1} = -2$$

8. Calculate the effect size or state why not needed.

Difference not statistically significant, so no need to test for practical significance.

You ask people to rate the severity of their daily problems both before (7,8,5,4,8) and after working in a homeless shelter (6,7,6,3,7). Calculate the correct t-test on the computer.

9. Provide the $t_{obtained}$ provided by SPSS.

t = 1.500

10. Provide the symbol and value of the standard error used by SPSS to produce $t_{obtained}$.

$\hat{s}_{\bar{D}} = 0.4$

11. Explain the results in a paragraph. Assume tobtained = 1.7 (do not use the $t_{obtained}$ you calculated). [12 points]

The hypothesis was not supported. Problem ratings after working (M=5.8) were not significantly lower than before (M=6.4), t(4) = 1.7, n.s.

12. Do rats taking the drug Dizzorex bump into walls more times than rates given a placebo? Calculate $t_{obtained}$ using SPSS.

Dizzorex: 4,3,7,7

Placebo: 2,4,2,0 $t_{obtained}$ = 2.472

13. State the H_0 and H_A hypotheses.

H_0: __μ1-μ 2 = 0 _____

H_A: __ μ1-μ 2 ≠ 0 _____.

	Group	N	Mean	Std. Deviation	Std. Error Mean
Bumps	Dizzorex	4	5.50	1.732	.866
	Placebo	4	2.50	1.000	.500

		t-test for Equality of Means				
		t	df	Sig. (2-tailed)	Mean Diff	Std. Error Difference
Bumps	Equal variances assumed	3.000	6	.024	3.000	1.000

14. Calculate the effect size or state why not needed. (Use the two tables above, not your results.)

$$\hat{s} = \hat{s}_{\bar{x}_1 - \bar{x}_2} * \sqrt{n} = 1 * \sqrt{4} = 2$$

$$d = \frac{|\bar{x}_1 - \bar{x}_2|}{\hat{s}} = \frac{3.000}{2} = 1.5000$$

15. Explain the results in paragraph form [12 points]. (Use the two tables above, not your results.)

The hypothesis was supported. Dizzorex rats hit significantly more walls (M=5.50) than placebo rats (M=2.50), t(6) = 3.000, p≤.05. The effect of Dizzorex on wall bumping was large, d=1.5000.

Homework 6.8: Conceptual Review T2 (closed book)

Fold paper on middle line. Correct answers on right. Correct letter choice is second to last letter..

1) You study the effect of social loafing (i.e., people slacking off when no one is watching) on team performance. Which of the following might increase the treatment effect? a) Using people from the same department in the corporation b) Using people from different departments within the corporation. c) Using only people named Bob, Brian, or Bartholomew d) Making it harder for team members to track amount of work done by each person e) Making it easier for team members to track amount of work done by each team member	abcededf Making monitoring of work done more difficult will likely increase the amount of social loafing (the potential treatment effect).
2) If p_{obt} increases you become more likely to a) Retain the Ha b) Reject the Ho c) Reject the Ha d) Retain the Ho e) See t_{obt} surpass $t_{critical}$ f) See t_{obt} increase	bedegadb Because p_{obt} indicates the chance the difference is just a fluke, a larger p value makes you more likely to retain Ho – the idea that any difference is just random. (We never retain/reject the Ha.)
3) The existence of a treatment effect becomes more likely when you … a) Increase alpha b) Decrease alpha c) See p_{obt} getting large d) See t_{obt} getting smaller e) Sampling error increases f) Sampling error decreases g) None of the above	gabefsgf The answers a,b,e, & f only determine your ability to detect a treatment effect – not whether one exists or not. A larger t or smaller p would suggest the existences is more likely (but the choices are the reverse).
4) The effect size statistic "d" is most similar to in purpose to a) t_{obt} b) t_{crit} c) z_{obt} d) regression e) r^2 f) p_{obt}	bcdedfcea Like d, r^2 indicates something related to practical significance – the amount of variance accounted for.
5) You study whether people who attend church regularly are more or less likely to support the use of military force compared with a group who does not attend regularly. Which of the following would make it more likely you could reject the null hypothesis? a) t_{obt} increases; $t_{critical}$ increases; alpha increases b) t_{obt} decreases; $t_{critical}$ decreases; alpha decreases c) t_{obt} increases; $t_{critical}$ decreases; alpha increases d) t_{obt} increases; $t_{critical}$ increases; alpha decreases e) you threaten to "shoot 'em all and let God sort it out."	agbhdetcs We always want t_{obt} large and $t_{critical}$ small to optimize chance for rejection. Increasing alpha would increase our willingness to gamble on rejecting (e.g., increasing alpha from .05 to .10 would mean we'd reject 10% of the time rather than just 5% of the time).

6) You study whether people who smoke are more likely to weigh more. You compare the weight of 10 smokers to 10 non-smokers. Detecting a treatment effect becomes more likely if you a) Use people of about the same age b) Use only smokers who smoke heavily c) Decrease alpha d) Use only smokers who smoke infrequently e) a & b f) a, b, & c	adefabec (a) Using only people the same age decreases variability in weight. (b) Smoking is the potential treatment effect, so using heavy smokers would increase the effect if there is one. [Decreasing alpha makes us more conservative about rejecting.]
7) You ask people to compare a lower-fat and full-fat version of Chocolate Munky-Skunky to determine if people think one tastes better than the other. You use two different groups of people. What factors would decrease sampling error? a) Making the ice cream extra cold instead of just regularly cold. b) Making the low-fat version taste better by adding extra sugar. c) Testing only people who had not eaten within the last 3 hours. d) Testing only people who admit to watching day-time television e) Putting only thin people in the full-fat condition. f) Eating three pounds of each just to make sure it is safe for your participants.	abdabcecd This is the only option that standardizes across conditions. Option "a" doesn't standardize any more – it's just shifting from one standardized value to another.
8) Using a standardized test of social anxiety ($\mu = 40$, $\sigma = 5$), a researcher determines whether social anxiety varies systematically with loneliness. Which statistical procedure is most appropriate? a) Standard deviation b) Sample mean c) Z-test d) One-sample t-test e) Independent t-test f) Dependent t-test g) Correlation h) Regression	aefcgh Testing whether two variables vary together is a testing for a relationship. It's not regression because you're not making any predictions.
9) You ask 10 women to rate how attractive they perceive a particular male to be, and determine the amount of variability in their ratings. a) Standard deviation b) Sample mean c) Z-test d) One-sample t-test e) Independent t-test f) Dependent t-test g) Correlation h) Regression	bfaefah Simply assessing variability is a descriptive statistic. Standard deviation is our preferred measure of variability.

10) You compare highly educated (Masters degree or higher) and modestly educated (High School degree) women according to their rankings of attractiveness for men they observe. a) Standard deviation b) Sample mean c) Z-test d) One-sample t-test e) Independent t-test f) Dependent t-test g) Correlation h) Regression	eabbdcec This implies you're looking for a difference between independent groups.
11) Using a standardized test of social anxiety ($\mu = 40$, $\sigma = 5$), a researcher determines whether a sample of construction workers is more anxious than normal. Which statistical procedure is most appropriate? a) Standard deviation b) Sample mean c) Z-test d) One-sample t-test e) Independent t-test f) Dependent t-test g) Correlation h) Regression i) a, e, and g – just to cover all her bases	aghbiecf One group, hypothesis of difference, standard deviation in the population is known.
12) A researcher examines whether eliminating sugary drinks (soft drinks, sweetened tea, Gatorade, etc.) causes weight loss. She measures the weight of 20 college students before and one month after the change. She might commit a type II error if she a) Rejects the Ho b) Retains the Ho c) Concludes the diet causes weight loss d) Concludes the diet does not cause weight loss e) Finds that t-obt exceeds t-crit f) b & d g) a & c	bcadefa You can only commit type II errors when not rejecting the hypothesis (the same as concluding there is no effect of the independent variable).
13) When conducting a correlation, which of the following makes it more likely to reject the Ho? a) a small p; a small r ; a large ρ b) a small p; a large r ; a large ρ c) a small p; a small r ; a small ρ d) a large p; a large r ; a small ρ e) a large p; a small r ; a small ρ f) a large p; a large r ; a large ρ	Bdaabdbc A small p means you're more confident there is a correlation. A large r means you're observing a stronger correlation, and a large ρ means there actually exists a large correlation in the population for you to observe if you were to sample from it.

Homework 6.9 Practice Test for Test #2 -- (Excluding Essay)-Key

Conceptual: Multiple Choice (5 points each)

1) As n increases, the shape of the t-distribution becomes _____ and t-critical _____
   a) less like a z-distribution; increases
   b) less like a z-distribution; decreases
   c) more like a z-distribution; increases
   d) more like a z-distribution; decreases

2) When doing a t-test, a larger difference between the sample and population mean makes which thing more likely?
   a) the presence of sampling error
   b) the presence of a treatment effect
   c) that you can retain the Ho
   d) that you can reject the Ha

3) If the probability level associated with a t-test is .007, we would do which of the following?
   a) reject the Ho
   b) recognize the chance of a treatment effect is 0.7
   c) conclude there is too much error to say there is a treatment effect
   d) a & b

4) When doing a t-test, a decrease in the variability of the raw scores gives the experimenter
   a) more sampling error
   b) more power
   c) a higher standard error
   d) a larger treatment effect

5) Which of the following indicates the degree of impact of the independent variable on the dependent variable?
   a) power
   b) inferential statistics
   c) the d statistic
   d) the t statistic

6) If Beta (β) increases, which of the following must be true?
   a) treatment effect increases
   b) alpha (α) decreases
   c) sampling error decreases
   d) power decreases

7) If an author reports "t(59) = 3.19, p<=.05" she is telling you...
   a) the probability of Type I error is equal or less than 5%
   b) the probability of Type II error is equal or less than 5%
   c) there is too much sampling error to conclude that a treatment effect is present
   d) there is a 3.19% chance the observed difference is due to chance

8) If z-obtained equals 1.99, one could conclude that....
   a) the chance of obtaining this result by chance is less than or equal to 99%
   b) there is no treatment effect
   c) the sample comes from a different population than the Ho distribution
   d) the chance of a type I error is zero

9) A sampling distribution
   a) shows the distribution of scores based on sampling error
   b) shows the size of the treatment effect
   c) shows the amount of power from the treatment effect
   d) is based on the assumption the null hypothesis is true

10) When doing an independent t-test, the ____ hypothesis states the means are _____.
   a) null; equal
   b) null; not equal
   c) research; equal
   d) research; not equal

11) Cohen's d statistic expresses the effect size in terms of _____

a) standard deviation units
b) variance units
c) variance accounted for
d) mean units

12) You want to know if the advertized average class size for a university (20 students) differs significantly from the average class size in your sample of 9 different classes. Which statistic would be the most appropriate?
a) correlation
b) effect size
c) one-sample t-test
d) two-sample t-test, independent

13) You want to know if job satisfaction is related to job performance. You have data from 60 people. Which statistical procedure is most appropriate?
a) Regression
b) Correlation
c) Independent t-test
d) Dependent t-test

14) You want to know if the attractiveness of job applicants affects the assessment of their credentials. You have people rate two applicants each by looking at resumes with pictures. The supposed applicants are matched on their job-relevant qualifications. Which statistical procedure is most appropriate?
a) Independent t-test
b) Correlation
c) Regression
d) Dependent t-test

15) Which of the following statements is TRUE?
a) True differences are more likely to be detected if the sample size is large.
b) A very low significance level (p-value) increases the chances of a Type I error.
c) If the d statistic is a small number, a Type II error is unlikely.

16) Rejecting the null hypothesis means the population means are not equal. What does it mean to say a result is statistically significant?
a) The observed difference exceeded the expected difference due to sampling error
b) The observed difference is too large to be reasonably attributed to sampling error
c) Sampling error was so small as to be insignificant
d) Sampling error was less than the observed difference

17) In regression, we call the variable on the "x" axis the _____.

18) Decreasing sampling error in an experiment gives the experimenter more _____.

19) When doing a t-test, the standard error of the difference tells you the difference _____ between means due to sampling error.

20) A _____ _____ [two-words] pictures the variability of means expected from sampling error alone.

21) The chance that an experimenter will fail to reject the Ho when it should be rejected is represented by _____ [symbol].

22) The abbreviation used by statisticians for the Sum of the Squared Deviation Scores is _____.

23) The measure of variability used in a two-sample dependent t-test is called standard error of the _____ [one or two words].

24) Both r^2 and d are examples of _____-size statistics.

25) Both z and t are examples of tests for _____ significance.

26) If the IV affects the DV we call this impact a _____ _____. [two-words].

Computational Portion, Open Book (100 points total; 5 pts unless noted.)

(for 1-2) You measure people's life satisfaction both before (6,4,5,6,7) and after (5,4,3,4,4) they watch TV show depicting fabulously wealthy families. *Using SPSS, test whether there is a statistically significant difference.*

1. Report the t_{obt} value.

2. Report the ***difference observed*** and the ***difference expected*** for this output.

(for 3-4) You test weather people that join fraternities or sororities report having a lesser or greater number of close friends (6,4,5,7,7,5) than college students in general (5). Using SPSS, test whether there is a statistically significant difference.

3. Formally **summarize** the statistic.

4. Calculate the **effect size statistic** for this outcome or if not appropriate state "NA."

5. Are fully-caffeinated people smarter or dumber than normal? You find 25 fully-caffeinated people average 106 on an IQ test ($\mu = 100$, $\sigma_x = 15$). State the correct **test value** and indicate whether your **retain or reject** the Ho.

6. What **percent** of students have a GPA **higher** than 3.7 (μ=2.7 & σ=0.4)?

7. A therapy group of 9 individuals average 3.6 on a depression index. What percent of groups are less depressed than this (μ=4 & σ = 0.6)?

8. In a sampling distribution for the previous problem, what raw score would be one standard unit below the distribution center?

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	warthogs	4.71	7	1.380	.522
	wombats	6.86	7	1.676	.634

A researcher tested whether people prefer warthogs or wombats as pets. Each person had both types for one month; participants then rated their satisfaction with each of the two.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	warthogs - wombats	-2.143	2.035	.769	-4.025	-.260	-2.785	6	.032

9. What percent of time would you see this difference between the means solely by chance?

10. Using the output above, calculate the effect size, or if not appropriate, state "NA."

Paragraph #1. (10 pts) Write a paragraph explanation of the this outcome on the answer sheet.

11. By hand, test whether biker-gang members (M=8.67, n=9, s_x = 1.658) eat more or less than the recommended serving of 10 fruits and vegetables per day. Formally **summarize** the statistic (you do not need to show hypothesis testing steps).

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
helping	unattractive	9	8.00	1.581	.527
	attractive	9	10.33	2.291	.764

Independent Samples Test

		Levene's Test for Equal of Var		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
helping	Equal variances assumed	1.426	.250	-2.514	16	.023	-2.33	.928
	Equal variances not assumed			-2.514	14.211	.025	-2.33	.928

(for 12-14) An experimenter manipulated the attractiveness of a person who dropped pencils in an elevator and then measured the number of pencils people helped pick up.

12. Indicate the difference **observed** and **expected**.

Paragraph #2. Write a paragraph explanation of this outcome in the space provided.

13. Calculate the effect size statistic or state "NA" if not appropriate.

14. Recalculate t-obt by hand assuming the mean for the unattractive condition was 7.00.

Correlations

		A	B	C	D	E
A	Pearson Correlation	1	.654*	.766**	.487	-.599
	Sig. (2-tailed)		.040	.010	.154	.067
	N	10	10	10	10	10
B	Pearson Correlation	.654*	1	.827**	.867**	-.819**
	Sig. (2-tailed)	.040		.003	.001	.004
	N	10	10	10	10	10
C	Pearson Correlation	.766**	.827**	1	.856**	-.850**
	Sig. (2-tailed)	.010	.003		.002	.002
	N	10	10	10	10	10
D	Pearson Correlation	.487	.867**	.856**	1	-.861**
	Sig. (2-tailed)	.154	.001	.002		.001
	N	10	10	10	10	10
E	Pearson Correlation	-.599	-.819**	-.850**	-.861**	1
	Sig. (2-tailed)	.067	.004	.002	.001	
	N	10	10	10	10	10

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

15. The correlation between which two variables is most likely due to chance?

16. How many significant correlations are represented in this matrix?

17. A researcher wanted to estimate the variability of scores in a population based on her sample. Calculate the standard deviation where SS=64 and n=5

Homework 6.9 Practice Test for Test #2 -- (Excluding Essay)-Key

Conceptual: Multiple Choice (5 points each)

1) As n increases, the shape of the t-distribution becomes _____ and t-critical _____
   a) less like a z-distribution; increases
   b) less like a z-distribution; decreases
   c) more like a z-distribution; increases
   d) more like a z-distribution; decreases

2) When doing a t-test, a larger difference between the sample and population mean makes which thing more likely?
   a) the presence of sampling error
   b) the presence of a treatment effect
   c) that you can retain the Ho
   d) that you can reject the Ha

3) If the probability level associated with a t-test is .007, we would do which of the following?
   a) reject the Ho
   b) recognize the chance of a treatment effect is 0.7
   c) conclude there is too much error to say there is a treatment effect
   d) a & b

4) When doing a t-test, a decrease in the variability of the raw scores gives the experimenter
   a) more sampling error
   b) more power
   c) a higher standard error
   d) a larger treatment effect

5) Which of the following indicates the degree of impact of the independent variable on the dependent variable?
   a) power
   b) inferential statistics
   c) the d statistic
   d) the t statistic

6) If Beta (β) increases, which of the following must be true?
   a) treatment effect increases
   b) alpha (α) decreases
   c) sampling error decreases
   d) power decreases

7) If an author reports "t(59) = 3.19, p<=.05" she is telling you...
   a) the probability of Type I error is equal or less than 5%
   b) the probability of Type II error is equal or less than 5%
   c) there is too much sampling error to conclude that a treatment effect is present
   d) there is a 3.19% chance the observed difference is due to chance

8) If z-obtained equals 1.99, one could conclude that....
   a) the chance of obtaining this result by chance is less than or equal to 99%
   b) there is no treatment effect
   c) the sample comes from a different population than the Ho distribution
   d) the chance of a type I error is zero

9) A sampling distribution
   a) shows the distribution of scores based on sampling error
   b) shows the size of the treatment effect
   c) shows the amount of power from the treatment effect
   d) is based on the assumption the null hypothesis is true

10) When doing an independent t-test, the ____ hypothesis states the means are _____.
   a) null; equal
   b) null; not equal
   c) research; equal
   d) research; not equal

11) Cohen's d statistic expresses the effect size in terms of _____

a) standard deviation units
b) variance units
c) variance accounted for
d) mean units

12) You want to know if the advertized average class size for a university (20 students) differs significantly from the average class size in your sample of 9 different classes. Which statistic would be the most appropriate?
a) correlation
b) effect size
c) one-sample t-test
d) two-sample t-test, independent

13) You want to know if job satisfaction is related to job performance. You have data from 60 people. Which statistical procedure is most appropriate?
a) Regression
b) Correlation
c) Independent t-test
d) Dependent t-test

14) You want to know if the attractiveness of job applicants affects the assessment of their credentials. You have people rate two applicants each by looking at resumes with pictures. The supposed applicants are matched on their job-relevant qualifications. Which statistical procedure is most appropriate?
a) Independent t-test
b) Correlation
c) Regression
d) Dependent t-test

15) Which of the following statements is TRUE?
a) True differences are more likely to be detected if the sample size is large.
b) A very low significance level (p-value) increases the chances of a Type I error.
c) If the d statistic is a small number, a Type II error is unlikely.

16) Rejecting the null hypothesis means the population means are equal. What does it mean to say a result is statistically significant?
a) The observed difference exceeded the expected difference due to sampling error
b) The observed difference is too large to be reasonably attributed to sampling error
c) Sampling error was so small as to be insignificant
d) Sampling error was less than the observed difference

17) In regression, we call the variable on the "x" axis the _____. Predictor

18) Decreasing sampling error in an experiment gives the experimenter more _____. Power

19) When doing a t-test, the standard error of the difference tells you the difference _____ between means due to sampling error. expected

20) A _____ _____ [two-words] pictures the variability of means expected from sampling error alone. Sampling distribution.

21) The chance that an experimenter will fail to reject the Ho when it should be rejected is represented by _____ [symbol]. β (Beta)

22) The abbreviation used by statisticians for the Sum of the Squared Deviation Scores is _____. SS

23) The measure of variability used in a two-sample dependent t-test is called standard error of the _____ [one or two words]. Mean difference.

24) Both r^2 and d are examples of _____-size statistics. Effect

25) Both z and t are examples of tests for _____ significance. statistical

26) If the IV affects the DV we call this impact a _____ _____. [two-words] treatment effect

Computational Portion, Open Book (100 points total; 5 pts unless noted.)

(for 1-2) You measure people's life satisfaction both before (6,4,5,6,7) and after (5,4,3,4,4) they watch TV show depicting fabulously wealthy families. *Using SPSS, test whether there is a statistically significant difference.*

18. Report the t_{obt} value. 3.138

19. Report the ***difference observed*** and the ***difference expected*** for this output. 1.6, .510

(for 3-4) You test weather people that join fraternities or sororities report having a lesser or greater number of close friends (6,4,5,7,7,5) than college students in general (5). Using SPSS, test whether there is a statistically significant difference.

20. Formally **summarize** the statistic.

t(5) = 1.348, n.s.

21. Calculate the **effect size statistic** for this outcome or if not appropriate state "NA."

Not sig. so not appropriate to do d.

22. Are fully-caffeinated people smarter or dumber than normal? You find 25 fully-caffeinated people average 106 on an IQ test ($\mu = 100$, $\sigma_x = 15$). State the correct **test value** and indicate whether your **retain or reject** the Ho.

n =25
M = 106
μ = 100
σ_x= 15

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{15}{\sqrt{25}} = 3$$

$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{106 - 100}{3} = 2$$

Reject

23. What **percent** of students have a GPA **higher** than 3.7 (μ=2.7 & σ=0.4)?

x =3.7
μ = 2.7
σ_x= 0.4

$$z = \frac{x - \mu}{\sigma_x}$$

$$z = \frac{3.7 - 2.7}{0.4}$$

$$z = 2.5$$

Use z-score table in back of book...

Higher = Area beyond z=2.5 ➔ 0.62%

24. A therapy group of 9 individuals average 3.6 on a depression index. What percent of groups are less depressed than this (μ=4 & σ = 0.6)?

n =9
M = 3.6
μ = 4
σ_x= 0.6

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{0.6}{3} = .2$$

$$z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{3.6 - 4}{.2} = -2$$

.0228 beyond z=-2 ➔ 2.28%

25. In a sampling distribution for the previous problem, what raw score would be one standard unit below the distribution center?

The raw score in the center of the distribution is 4 (because μ =4). One standard error unit is 0.2, so one standard error unit below 4 is 3.8.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	warthogs	4.71	7	1.380	.522
	wombats	6.86	7	1.676	.634

A researcher tested whether people prefer warthogs or wombats as pets. Each person had both types for one month; participants then rated their satisfaction with each of the two.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	warthogs - wombats	-2.143	2.035	.769	-4.025	-.260	-2.785	6	.032

26. What percent of time would you see this difference between the means solely by chance?

3.2%

27. Using the output above, calculate the effect size, or if not appropriate, state "NA."

$$d = \frac{|\bar{x} - \bar{x}|}{\hat{s}_D} = \frac{|4.71 - 6.86|}{2.035} = 1.0531$$

Paragraph #1. (10 pts) Write a paragraph explanation of the this outcome on the answer sheet.

The hypothesis was supported. Participants rated wombats significantly higher (M=6.86) than warthogs (M=4.71), t(6)=-2.785, p≤.05. The effect of animal type on satisfaction was large, d=2.7867.

28. By hand, test whether biker-gang members (M=8.67, n=9, s_x = 1.658) eat more or less than the recommended serving of 10 fruits and vegetables per day. Formally **summarize** the statistic (you do not need to show hypothesis testing steps).

M = 8.67
n =9
s_x= 1.658

$$\hat{s}_{\bar{x}} = \frac{\hat{s}_x}{\sqrt{n}} = \frac{1.658}{\sqrt{9}} = .5527$$

$$t = \frac{\bar{x} - \mu}{\hat{s}_{\bar{x}}} = \frac{8.67 - 10}{.5527} = .-2.4064$$

Find t-critical in table. With df=8 so t-critical =± 2.3060.

t(8) - -2.4064, p≤.05

(for 12-14) An experimenter manipulated the attractiveness of a person who dropped pencils in an elevator and then measured the number of pencils people helped pick up.

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
helping	unattractive	9	8.00	1.581	.527
	attractive	9	10.33	2.291	.764

Independent Samples Test

		Levene's Test for Equal of Var		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
helping	Equal variances assumed	1.426	.250	-2.514	16	.023	-2.33	.928
	Equal variances not assumed			-2.514	14.211	.025	-2.33	.928

29. Indicate the difference **observed** and **expected**.

2.33, .928

Paragraph #2. Write a paragraph explanation of this outcome in the space provided.

See below.

30. Calculate the effect size statistic or state "NA" if not appropriate.

$$\hat{s} = \sqrt{n} * \hat{s}_{\bar{x}_1 - \bar{x}_2}$$

$$\hat{s} = \sqrt{9} * .928 = 2.784$$

$$d = \frac{|\bar{x}_1 - \bar{x}_2|}{\hat{s}} = \frac{|2.33|}{2.784} = .8370$$

31. Recalculate t-obt by hand assuming the mean for the unattractive condition was 7.00.

$$t_{obt} = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\hat{s}_{\bar{x}_1 - \bar{x}_2}}$$

$$t_{obt} = \frac{(7 - 10.33) - (0)}{.928} = -3.5884$$

The hypothesis was supported. Participants picked up significantly more pencils when the person was attractive (M=10.33) than when unattractive (M=8.00), t(16) = -2.514, p ≤ .05. The effect of attractiveness on helping was large, d = .8370

Correlations

		A	B	C	D	E
A	Pearson Correlation	1	.654*	.766**	.487	-.599
	Sig. (2-tailed)		.040	.010	.154	.067
	N	10	10	10	10	10
B	Pearson Correlation	.654*	1	.827**	.867**	-.819**
	Sig. (2-tailed)	.040		.003	.001	.004
	N	10	10	10	10	10
C	Pearson Correlation	.766**	.827**	1	.856**	-.850**
	Sig. (2-tailed)	.010	.003		.002	.002
	N	10	10	10	10	10
D	Pearson Correlation	.487	.867**	.856**	1	-.861**
	Sig. (2-tailed)	.154	.001	.002		.001
	N	10	10	10	10	10
E	Pearson Correlation	-.599	-.819**	-.850**	-.861**	1
	Sig. (2-tailed)	.067	.004	.002	.001	
	N	10	10	10	10	10

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

32. The correlation between which two variables is most likely due to chance? Largest p = .154, A&D

33. How many significant correlations are represented in this matrix? There are 8 starred relationships

34. A researcher wanted to estimate the variability of scores in a population based on her sample. Calculate the standard deviation where SS=64 and n=5

$$\hat{s}_x = \sqrt{\frac{SS}{n-1}} = \sqrt{\frac{64}{4}} = 4$$

Homework 6.9A: Overview of z-tests and t-tests

The following questions presents different questions one could answer with different types of statistics. Each assumes a measure of job satisfaction where an individual or group of individuals rates how satisfied they are with their job on a 1 to 7 scale.

Remember, each stat always asks how _____ is _____.

Problem	Info	Type of Distribution & What's Known	Measure of Variability	Formula	Distribution
Is John more/less satisfied with his job compared to normal people?	$\mu = 6$ $x = 8$ $\sigma = 2$				
Is the salesgroup more/less satisfied compared to normal people?	$\mu = 6$ $M = 4$ $\sigma = 2$ $n = 16$				
Is the salesgroup more/less satisfied than normal people?	$\mu = 6$ $x = 2, 4, 3, \& 2$ $n = 4$				
Are day-shift workers more/less satisfied than night-shift workers?	N:2,1,2,3,2,1,4 D:5,3,4,6,2,4,4				X
Are night-shift workers more/less satisfied after moving to the day shift?	N:2,1,2,3,2,1,4 D:5,3,4,6,2,4,4				X

Homework 7.1a: 1-way ANOVA

1. Fear & Persuasion: A researcher examines the effect of fear on persuasion. She randomly assigns participants to read an ad for anti-virus software, designed to create (1) Low, (2) Medium, or (3) High fear about computer viruses. Participants then report the amount of money they would be willing to spend on anti-virus software. For each different outcome below (1) Indicate if you reject or retain the outcome, and (2) Write a paragraph explanation of each outcome. Calculate η^2 as necessary.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1361.667	2	680.833	15	.000
Within Groups	1205.000	27	44.630		
Total	2566.667	29			

Student-Newman-Keuls [a]

		Subset for alpha = .05		
Group	N	1	2	3
1	10	13.50		
2	10		21.50	
3	10			30.00
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10.000.

Outcome #1: Ho: Reject or Retain?

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	581.667	2	290.833	5.158	.013
Within Groups	1522.500	27	56.389		
Total	2104.167	29			

Student-Newman-Keuls [a]

		Subset for alpha = .05	
Group	N	1	2
1	10	12.00	
2	10	13.50	
3	10		22.00
Sig.		.659	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10.000.

Outcome #2: Ho: Reject or Retain?

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	61.667	2	30.833	.601	.555
Within Groups	1385.000	27	51.296		
Total	1446.667	29			

Student-Newman-Keuls [a]

		Subset for alpha = .05
Group	N	1
1	10	12.00
2	10	13.50
3	10	15.50
Sig.		.527

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10.000.

Outcome #3: Ho: Reject or Retain?

Homework 7.1b: 1-way ANOVA

2. Caffeine, Power: In the caffeine study described in class, the difference between 0 mg and 10 mg was not significant. It's possible that there really is a difference between these levels, but that there just wasn't enough power in the experiment's design to pick it up. For the following, explain whether power increases and why.

a. Changing from 0, 10, & 20 mg to 0, 5, and 10 mg?	
b. Using only rats that have a moderate metabolism?	
c. Using only rats that are hungry?	
d. Using only rats that are named Oscar?	

3. Packing Freshmen, Power: An unethical sociologist manipulates levels of crowding for 6 freshmen, randomly assigning them to different conditions of crowding for the semester (2, 3, or 4 roommates in a 10'x10' dorm-room) and observing acts of hostility (number of unflattering comments about a roommate's mother). For each of the following, indicate (a) what could be done with that item (if anything) to increase power, and (b) why the change would increase power.

a. Size of the dorm-room	
b. Number of subjects in the study	
c. The level of agreeableness among participants	
d. The type of tennis shoes worn by participants	
e. The number of roommates (2, 4, or 8)	
f. The duration of the study	

Homework 7.1a: 1-way ANOVA

1. Fear & Persuasion: A researcher examines the effect of fear on persuasion. She randomly assigns participants to read an ad for anti-virus software, designed to create (1) Low, (2) Medium, or (3) High fear about computer viruses. Participants then report the amount of money they would be willing to spend on anti-virus software. For each different outcome below (1) Indicate if you reject or retain the outcome, and (2) Write a paragraph explanation of each outcome. Calculate η^2 as necessary.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1361.667	2	680.833	15	.000
Within Groups	1205.000	27	44.630		
Total	2566.667	29			

Student-Newman-Keuls [a]

Group	N	Subset for alpha = .05		
		1	2	3
1	10	13.50		
2	10		21.50	
3	10			30.00
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10.000.

Outcome #1: Ho: ✓Reject or Retain?

$\eta^2 = SS_{BG}/SS_T = 1361.667 \div 2566.667 = .5305$

The hypothesis was supported. Participants in the High fear condition were willing to spend significantly more on the anti-virus software (M = $30) than those in the Medium condition (M = $21.5), who in turn would spend more than those in the Low condition (M = $13.5), F(2,27) = 15, p ≤ .05. Fear accounts for approximately 53% of the variance in amount to spend, $\eta^2 = .5305$.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	581.667	2	290.833	5.158	.013
Within Groups	1522.500	27	56.389		
Total	2104.167	29			

Student-Newman-Keuls [a]

Group	N	Subset for alpha = .05	
		1	2
1	10	12.00	
2	10	13.50	
3	10		22.00
Sig.		.659	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10.000.

Outcome #2: Ho: ✓Reject or Retain?

$\eta^2 = SS_{BG}/SS_T = 581.667 \div 2104.167 = .2764$

The hypothesis was supported. Participants in the High fear condition were willing to spend significantly more on the anti-virus software (M = $22) than those in the Medium (M = $13.5) or Low condition (M = $12), F(2,27) = 5.158, p ≤ .05. Fear accounts for approximately 27.64% of the variance in amount to spend, $\eta^2 = .2764$.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	61.667	2	30.833	.601	.555
Within Groups	1385.000	27	51.296		
Total	1446.667	29			

Student-Newman-Keuls [a]

Group	N	Subset for alpha = .05
		1
1	10	12.00
2	10	13.50
3	10	15.50
Sig.		.527

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10.000.

Outcome #3: Ho: Reject or ✓Retain?

η^2 = not required because Ho Retained

The hypothesis was not supported. Participants in the High (M = $15.50), Medium (M = $13.5), and Low (M = $12) fear conditions did not differ in willingness to spend on anti-virus software, F(2,27) = .601, n.s.

Homework 7.1b: 1-way ANOVA

2. Caffeine, Power: In the caffeine study described in class, the difference between 0 mg and 10 mg was not significant. It's possible that there really is a difference between these levels, but that there just wasn't enough power in the experiment's design to pick it up. For the following, explain whether power increases and why.

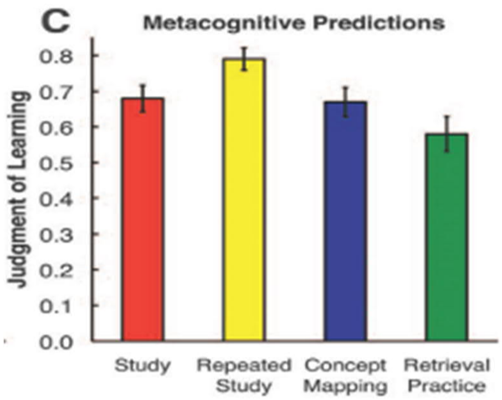
e. Changing from 0, 10, & 20 mg to 0, 5, and 10 mg?	Power decreases: Less treatment effect to cause a difference between groups.
f. Using only rats that have a moderate metabolism?	Power increases: Standardizing metabolism should decrease within group variability in amount of food found (less sampling error).
g. Using only rats that are hungry?	Power increases: Standardizing hunger should decrease within group variability in amount of food found (less sampling error).
h. Using only rats that are named Oscar?	No change: No conceivable way rat name could affect DV of food found.

3. Packing Freshmen, Power: An unethical sociologist manipulates levels of crowding for 6 freshmen, randomly assigning them to different conditions of crowding for the semester (2, 3, or 4 roommates in a 10'x10' dorm-room) and observing acts of hostility (number of unflattering comments about a roommate's mother). For each of the following, indicate (a) what could be done with that item (if anything) to increase power, and (b) why the change would increase power.

g. Size of the dorm-room	Reducing would increase treatment effect (crowding)
h. Number of subjects in the study	Increasing would decrease sampling error (larger n).
i. The level of agreeableness among participants	Standardizing would decrease sampling error
j. The type of tennis shoes worn by participants	Not relevant
k. The number of roommates (2, 4, or 8)	Increasing would increase treatment effect (crowding)
l. The duration of the study	Lengthening would increase treatment effect (cumulative impact of crowding) and decrease sampling error (better measurement, similar to increase the number of subjects in the study).

Homework 7.2 – 1-Way ANOVA

Study Background: Karpicke, J. D., & Blunt, J. R. (2011). Retrieval practice produces more learning than elaborative studying with concept mapping. Science, 331(6018), 772. Summary: Educators tend to favor elaborative learning activities (such as concept mapping) over the retrieval and reconstruction of knowledge (such as taking practice tests). This research examined which learning techniques people thought would be most effective (their metacognitive predictions) AND actual effectiveness. Participants divided into four conditions: Study, Repeated Study, Concept Mapping, & Retrieval Practice. After experiencing the study technique, participants predicted the percent of information they would recall in one week ("metacognitive predictions"). Note: Data are bogus, but designed to mimic the actual results.



Study	Rpt Study	Cncpt Map	Retrv Practc
0.52	0.80	0.60	0.50
0.87	0.72	0.70	0.62
0.79	0.90	0.56	0.72
0.59	0.63	0.82	0.45
0.53	0.78	0.70	0.79
0.77	0.90	0.50	0.54
0.52	0.79	0.78	0.57
0.81	0.86	0.81	0.47

To the left is a graph taken from the actual study. Let's pretend we collected the following data. First, show how you'd enter it into SPSS for doing a 1-way ANOVA. In the first row enter appropriate variable names.

1.

2. What's the IV:

3. What are the levels of the IV:

4. Which condition had the highest mean? What was it?

5. Which condition had the lowest mean? What was it?

6. What's the formula for df-BG? Show that SPSS is correct.

7. What's the formula for df - WG? Show SPPS is correct.

8. What's the formula for F? Write it out, then plug-in, and show that you get the same value.

test_scr

	N	Mean	Std. Deviation	Std. Error
study	8	.6750	.14871	.0525
repeated study	8	.7975	.09208	.0325
concept mapping	8	.6838	.11975	.0423
retrieval practice	8	.5825	.12092	.0427
Total	32	.6847	.13947	.0246

ANOVA

test_scr

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.186	3	.062	4.167	.015
Within Groups	.417	28	.015		
Total	.603	31			

9. Is there a significant difference? _____

10. Summarize the F statistic.

test_scr

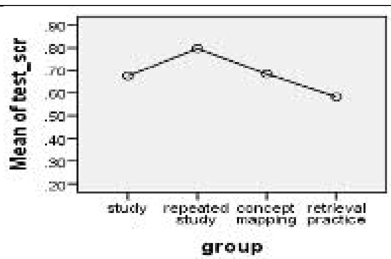
Student-Newman-Keuls[a]

group	N	Subset for alpha = 0.05: 1	2
retrieval practice	8	.5825	
study	8	.6750	.6750
concept mapping	8	.6838	.6838
repeated study	8		.7975
Sig.		.238	.129

11. On the post-hoc table, circle the means that differ significantly from one another and draw a line between them. Show the same on the "Means Plot" graph below.

12. What percent of the time would the difference between study and repeated study be observed just by chance? (HINT: think "sig")

13. Calculate η^2 here:



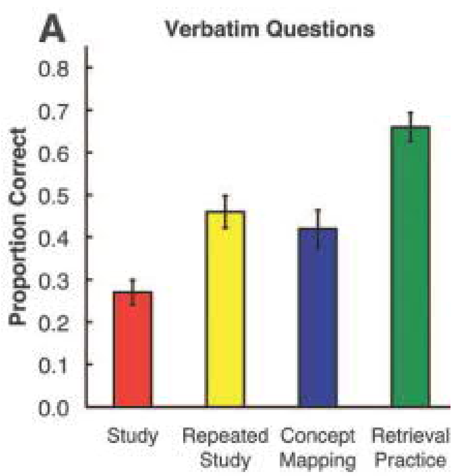
14. Summarize the outcome here (I've given you some hints):

The hypothesis was……

Participants in the retrieval practice predicted ….

______________ accounted for a ________amount of variance in ______________, ______.

The same participants also came back to the lab after one week and took a recall test. The data below show how they actual did on the test. (Note – their actual performance was very different than they predicted it would be in the "metacognitive predictions" portion described on the previous page!)



Study	Rpt Study	Cncpt Map	Retrv Practc
0.28	0.46	0.43	0.68
0.35	0.58	0.38	0.79
0.38	0.30	0.50	0.39
0.15	0.54	0.50	0.59
0.43	0.36	0.30	0.81
0.39	0.50	0.61	0.74
0.13	0.30	0.39	0.59
0.16	0.60	0.34	0.84

To the right is a graph taken from the actual study. Let's pretend we collected the following data. First, show how you'd enter it into SPSS for doing a 1-way ANOVA. In the first row enter appropriate variable names.

1.

2. What's the IV:

3. What are the levels of the IV:

4. Which condition had the highest mean? What was it?

5. Which condition had the lowest mean? What was it?

6. What's the formula for df-BG? Show that SPSS is correct.

7. What's the formula for df - WG? Show SPPS is correct.

8. What's the formula for F? Write it out, then plug-in, and show that you get the same value.

test_scr

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.638	3	.213	13.65	.000
Within Groups	.436	28	.016		
Total	1.074	31			

9. Is there a significant difference?

10. Summarize the F statistic.

test_scr

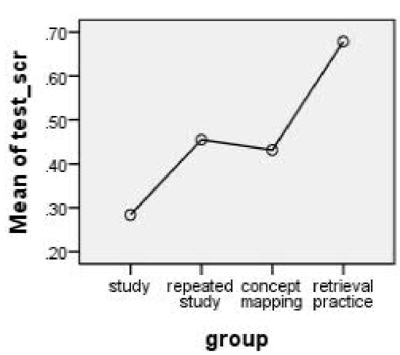
Student-Newman-Keuls[a]

group	N	Subset for alpha = 0.05		
		1	2	3
study	8	.2838		
concept mapping	8		.4313	
repeated study	8		.4550	
retrieval practice	8			.6788
Sig.		1.000	.706	1.000

11. On the post-hoc table, circle the means that differ significantly from one another and draw a line between them. Show the same on the "Means Plot" graph below.

12. What percent of the time would the difference between study and repeated study be observed just by chance? (HINT: think "sig")

13. Calculate η^2 here:



14. Summarize the outcome here (I've given you some hints):

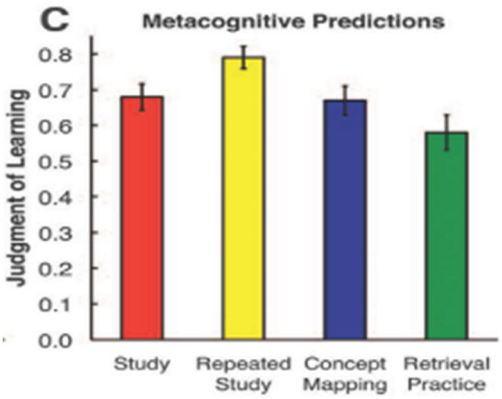
The hypothesis was……

Participants in the retrieval practice recalled more correct answers ….

___________ accounted for a _________amount of variance in __________, _______.

Homework 7.2 – 1-Way ANOVA *****KEY*****

Study Background: Karpicke, J. D., & Blunt, J. R. (2011). Retrieval practice produces more learning than elaborative studying with concept mapping. Science, 331(6018), 772. Summary: Educators tend to favor elaborative learning activities (such as concept mapping) over the retrieval and reconstruction of knowledge (such as taking practice tests). This research examined which learning techniques people thought would be most effective (their metacognitive predictions) AND actual effectiveness. Participants divided into four conditions: Study, Repeated Study, Concept Mapping, & Retrieval Practice. After experiencing the study technique, participants predicted the percent of information they would recall in one week ("metacognitive predictions"). Note: Data are bogus, but designed to mimic the actual results.



Study	Rpt Study	Cncpt Map	Retrv Practc
0.52	0.80	0.60	0.50
0.87	0.72	0.70	0.62
0.79	0.90	0.56	0.72
0.59	0.63	0.82	0.45
0.53	0.78	0.70	0.79
0.77	0.90	0.50	0.54
0.52	0.79	0.78	0.57
0.81	0.86	0.81	0.47

To the left is a graph taken from the actual study. Let's pretend we collected the following data. First, show how you'd enter it into SPSS for doing a 1-way ANOVA. In the first row enter appropriate variable names.

1.

Grp	Scr
1	0.52
1	0.87
1	0.79
1	0.59
1	0.53
1	0.77
1	0.52
1	0.81
2	0.80
2	0.72
2	0.90
2	0.63
2	0.78
2	0.90
2	0.79
2	0.86
3	0.60
3	0.70
3	0.56
3	0.82
3	0.70
3	0.50
3	0.78
3	0.81
4	0.50
4	0.62
4	0.72
4	0.45
4	0.79
4	0.54
4	0.57
4	0.47

test_scr

	N	Mean	Std. Deviation	Std. Error
study	8	.6750	.14871	.0525
repeated study	8	.7975	.09208	.0325
concept mapping	8	.6838	.11975	.0423
retrieval practice	8	.5825	.12092	.0427
Total	32	.6847	.13947	.0246

ANOVA

test_scr

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.186	3	.062	4.167	.015
Within Groups	.417	28	.015		
Total	.603	31			

2. What's the IV: Study Technique

3. What are the levels of the IV:

Study, Repeated Study, Concept Mapping, Retrieval Pract.

4. Which condition had the highest mean? What was it?

Repeated Study, M=.7975

5. Which condition had the lowest mean? What was it?

Retrieval Practice, M=..5825

6. What's the formula for df-BG? Show that SPSS is correct.

df-BG= K – 1 = 4 – 1 = 3

7. What's the formula for df - WG? Show SPPS is correct.

df-WB = NT = K = 32 -4 = 28

8. What's the formula for F? Write it out, then plug-in, and show that you get the same value.

F = MSbg/MSwg = .062/.015 = 4.133

9. Is there a significant difference? __yes___

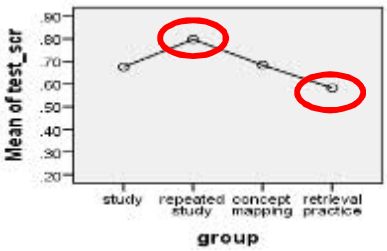
10. Summarize the F statistic.

F (3, 28) = 4.167, p≤.05.

test_scr

Student-Newman-Keuls[a]

group	N	Subset for alpha = 0.05	
		1	2
retrieval practice	8	.5825	
study	8	.6750	.6750
concept mapping	8	.6838	.6838
repeated study	8		.7975
Sig.		.238	.129



11. On the post-hoc table, circle the means that differ significantly from one another and draw a line between them. Show the same on the "Means Plot" graph below.

12. What percent of the time would the difference between study and repeated study be observed just by chance? (HINT: think "sig") p = .129, 12.9%

13. Calculate η^2 here:

η^2= SSbg/SST = .186/.603 = .3085

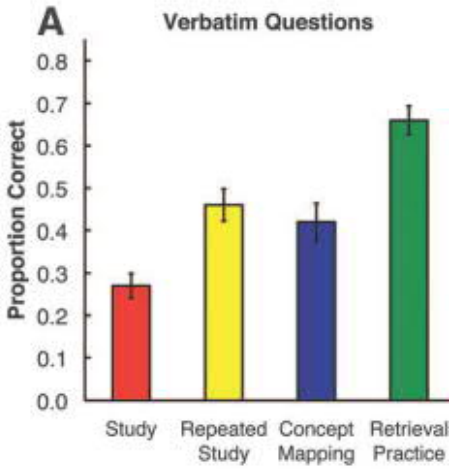
14. Summarize the outcome here (I've given you some hints):

The hypothesis was.....supported

Participants in the retrieval practice predicted ....sig. lower scores (M=.5825) than those in the repeated study condition (M=.7975). Predicted scores in the study (M=.6750) and concept mapping conditions (M=.6838) showed no sig diference, F (3, 28) = 4.167, p≤.05.

Study technique accounted for a _large_ amount of variance in _recall perf._, _ η^2=.3085__.

The same participants also came back to the lab after one week and took a recall test. The data below show how they actual did on the test. (Note – their actual performance was very different than they predicted it would be in the "metacognitive predictions" portion described on the previous page!)



Study	Rpt Study	Cncpt Map	Retrv Practc
0.28	0.46	0.43	0.68
0.35	0.58	0.38	0.79
0.38	0.30	0.50	0.39
0.15	0.54	0.50	0.59
0.43	0.36	0.30	0.81
0.39	0.50	0.61	0.74
0.13	0.30	0.39	0.59
0.16	0.60	0.34	0.84

To the right is a graph taken from the actual study. Let's pretend we collected the following data. First, show how you'd enter it into SPSS for doing a 1-way ANOVA. In the first row enter appropriate variable names.

1.

Grp	Scr
1	0.28
1	0.35
1	0.38
1	0.15
1	0.43
1	0.39
1	0.13
1	0.16
2	0.46
2	0.58
2	0.30
2	0.54
2	0.36
2	0.50
2	0.30
2	0.60
3	0.43
3	0.38
3	0.50
3	0.50
3	0.30
3	0.61
3	0.39
3	0.34
4	0.68
4	0.79
4	0.39
4	0.59
4	0.81
4	0.74
4	0.59
4	0.84

2. What's the IV: Study Technique

3. What are the levels of the IV:

Study, Repeated Study, Concept Mapping, Retrieval Pract.

4. Which condition had the highest mean? What was it?

Retrieval Practice, M=.6788

5. Which condition had the lowest mean? What was it?

Study, M=.2838

6. What's the formula for df-BG? Show that SPSS is correct.

df-BG= K – 1 = 4 – 1 = 3

7. What's the formula for df - WG? Show SPPS is correct.

df-WB = NT = K = 32 -4 = 28

8. What's the formula for F? Write it out, then plug-in, and show that you get the same value.

F = MSbg/MSwg = .213/.016 = 13.3125

test_scr

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.638	3	.213	13.65	.000
Within Groups	.436	28	.016		
Total	1.074	31			

9. Is there a significant difference? yes

10. Summarize the F statistic.

F (3, 28) = 13.65, p≤.05.

test_scr

Student-Newman-Keuls[a]

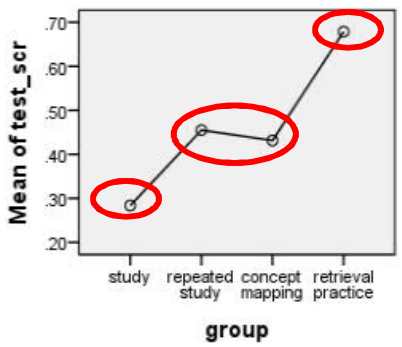
group	N	Subset for alpha = 0.05		
		1	2	3
study	8	.2838		
concept mapping	8		.4313	
repeated study	8		.4550	
retrieval practice	8			.6788
Sig.		1.000	.706	1.000

11. On the post-hoc table, circle the means that differ significantly from one another and draw a line between them. Show the same on the "Means Plot" graph below.

12. What percent of the time would the difference between study and repeated study be observed just by chance? (HINT: think "sig") alpha = .05, so p≤.05

13. Calculate η^2 here:

η2= SSbg/SST = .638/1.074 = .5940



14. Summarize the outcome here (I've given you some hints):

The hypothesis was..... supported

Participants in the retrieval practice recalled more correct answers ....(M=.6788) than those in the CM (M=43.13) or RS(M=.4550) conditions, who in turn recalled more correct answers than those in the S (M=.2838) condition, F (3, 28) = 13.65, p≤.05.

Study technique accounted for a _large__amount of variance in _recall performance_, _ η^2= .5940_.

Homework 7.3: Statistics for Breakfast!!!

Name that Stat!!	Key Features	Statistic
1. Which type of saturated fat do people prefer? You ask (the same) 10 people to rate their satisfaction with both bacon and sausage as a breakfast choice.		
2. What goes best with bacon, orange or pineapple juice? You have 10 people rate their satisfaction with orange-juice, and another 10 people rate pineapple juice.		
3. You think that smarter people tend to eat more bacon. You measure how pieces 10 customers eat, and how long it takes each to tip (ie, as a measure of intelligence).		
4. Does age moderate artery clogging? You form groups of people aged 10, 20, 30, and 40 years, and measure artery clogging after 5 years of an all bacon diet.		
5. Do people really tip 15%? You surreptitiously measure the percent given by 15 diners, and compare this to 15%.		

6. <u>Output Interpretation</u>: Assume you're comparing 4 different marketing slogans for the restaurant. You run each program for 5 days, and recording how many customers order the advertised special.

	N	Mean	Std. Deviation	Std. Error
1 All you can eat for $5.99	5	8.20	2.59	1.16
2 All you can eat for $5.99, drink included	5	7.40	1.34	.60
3 All you can eat for $5.99, clean restroom	5	11.40	2.41	1.08
4 All you can eat for $5.99, stats instruction included!	5	13.20	2.86	1.28
Total	20	10.05	3.25	.73

What are your hypotheses?

Summarize F.

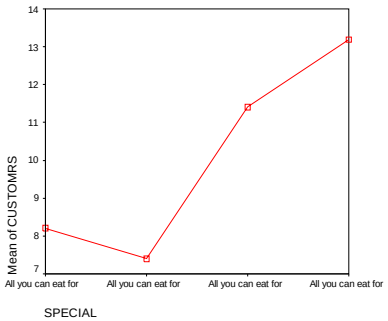
On a separate sheet of paper, explain the outcome.

CUSTOMRS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	110.950	3	36.983	6.575	.004
Within Groups	90.000	16	5.625		
Total	200.950	19			

Student-Newman-Keuls

SPECIAL	N	Subset for alpha = .05 1	2
2 All you can eat for $5.99, drink included	5	7.40	
1 All you can eat for $5	5	8.20	
3 All you can eat for $5.99, clean restroom	5		11.40
4 All you can eat for $5.99, stats instruction included!	5		13.20
Sig.		.601	.248



Homework 7.3: Statistics for Breakfast!!!- Key

Name that Stat!!	Key Features	Statistic
1. Which type of saturated fat do people prefer? You ask (the same) 10 people to rate their satisfaction with both bacon and sausage as a breakfast choice.	▪ 2 groups of data ▪ Subjects matched (same people)	Dept. t-test
2. What goes best with bacon, orange or pineapple juice? You have 10 people rate their satisfaction with orange-juice, and another 10 people rate pineapple juice.	▪ 2 groups of data ▪ Subjects not-matched	Indep. t-test
3. You think that smarter people tend to eat more bacon. You measure how pieces 10 customers eat, and how long it takes each to tip (ie, as a measure of intelligence).	▪ 1 group (2 variables) ▪ Hypothesis of relationship	Correlation
4. Does age moderate artery clogging? You form groups of people aged 10, 20, 30, and 40 years, and measure artery clogging after 5 years of an all bacon diet.	▪ 4 groups of data ▪ Only 1 IV (age)	1-way ANOVA
5. Do people really tip 15%? You surreptitiously measure the percent given by 15 diners, and compare this to 15%.	▪ 1 group ▪ Hypothesis of difference	One sample t-test

6. Output Interpretation: Assume you're comparing 4 different marketing slogans for the restaurant. You run each program for 5 days, and recording how many customers order the advertised special.

1 All you can eat for $5.99
2 All you can eat for $5.99, drink included
3 All you can eat for $5.99, clean restroom
4 All you can eat for $5.99, stats instruction included!
Total

CUSTOMRS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	110.950	3	36.983	6.575	.004
Within Groups	90.000	16	5.625		
Total	200.950	19			

What are your hypotheses?

H_o: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

H_A: Not all μ's equal

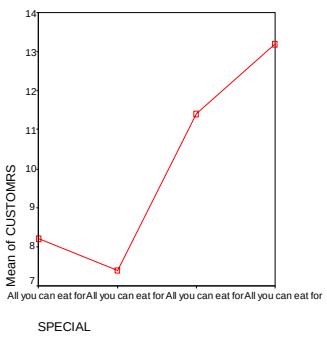
Summarize F.

$F(3,16) = 6.575, p \leq .05$

The hypothesis was supported. The number of orders generated by offering (in addition to base offer) a clean restroom (M=11.40) or stats instruction (M=13.20) significantly exceeded that generated by offering nothing additional (M=8.20) or a free drink (M=7.40), $F(3,16) = 6.575$, $p \leq .05$. Offer type accounted for about 55% of the variance in orders, $\eta^2 = .5521$.

Student-Newman-Keuls

SPECIAL	N	Subset for alpha = .05	
		1	2
2 All you can eat for $5.99, drink included	5	7.40	
1 All you can eat for $5.99	5	8.20	
3 All you can eat for $5.99, clean restroom	5		11.40
4 All you can eat for $5.99, stats instruction included!	5		13.20
Sig.		.601	.248



Homework 8.1: 2-Way ANOVA

Study Background: Read Carefully!!

Social psychologists have studied extensively the variables that influence the ability of a speaker to persuade an audience to take the speaker's position on an issue. One important factor that influences the amount of attitude change a speaker can generate is the discrepancy between the position advocated by the speaker and the position of the audience. Up to a point, the more discrepant the speaker's position, the greater the attitude change that will result. However, if the speaker's position becomes too discrepant, the speaker looses credibility and the message is less persuasive.

It has been hypothesized that the nature of the relationship between message discrepancy and attitude change differs, depending on the expertise of the speaker, formally referred to as the source. According to this perspective, speakers with high expertise can take much more discrepant positions that speakers with low expertise and still obtain large amounts of attitude change. As an example of how this proposition could be tested, consider the following hypothetical experiment.

College students evaluated the quality of a passage of poetry on a 21-point scale and then listened to a taped message concerning this passage that was presented as representing the opinion of either an expert (a famous poetry critic) or a non-expert (an undergraduate student enrolled in a creative writing class). The messages were identical except for which source they were attributed to. In addition, the messages were constructed to be either slightly discrepant, moderately discrepant, or highly discrepant from students' initial ratings of quality. For example, in the large-discrepancy condition, if a student rated the passage as being relatively high in quality, the message argued that the passage was low in quality. For example, in the large-discrepancy condition, if a student rated that the relatively high in quality, the message, argued that the passage was low in quality. After listening to the message, students re-rated the poetry. The resulting design was a 3 x 2 factorial with three levels of message discrepancy (small, medium, or large) and two levels of source expertise (high versus low). The dependent variable was the amount of change in the quality ratings after listening to the message. Scores could range from -20 to +20, with higher values indicating grater attitude change in the direction advocated by the source. The data for the experiment are presented below along with intermediate statistics necessary to calculate the sums of squares.

Data Collected

Calculate Row Means

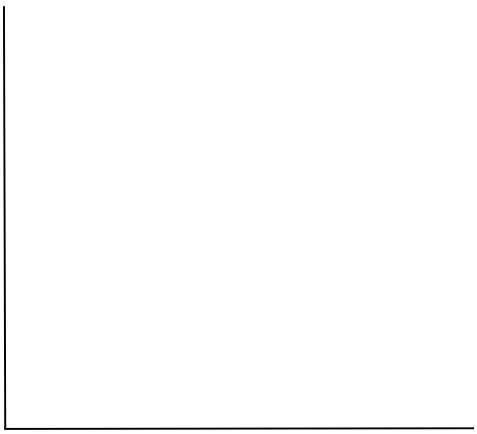
	Source Expertise	
Msg Discrep.	HIGH	LOW
SMALL	3	1
	4	0
	2	2
	3	1
	3	1
MEDIUM	8	1
	7	3
	7	1
	7	2
	6	2
LARGE	9	0
	8	1
	10	1
	9	2
	9	1

Calculate Cell Means

Calculate Column Means

Note: Let's call Msg Discrepancy Factor A
Let's call Source Expertise Factor B
The DV is Attitude Change

1. Graph the results of the study using the cell means. Put Message Discrepancy on the x-axis.



2. State the 3 null hypotheses you can test with a 2-way ANOVA.

3. Describe the study design:

a = b =

Design:

4. Determine the typical Attitude Change occurring when participants experienced a large discrepancy from a source low in expertise? Report the appropriate mean (row, column, or cell).

5. What condition produced the most attitude change? Report the appropriate mean (row, column, or cell).

6. Which type of authority produces the most attitude change? Report the appropriate mean (row, column, or cell).

7. Which type of message discrepancy produced the largest attitude change? Report the appropriate mean (row, column, or cell).

8. Explain why we can't just base our interpretation of the results on the graph. Why must we do an ANOVA? Mention the difference between sample means and population means in your answer.

9. Complete this source of variation table.

Source of V.	SS	df	MS	F-obt	F-crit	η^2
Msg Discrep.	50.40					
Source Expertise	192.53	1		361.00		
A*B	45.067					.15
Error	12.8		.533			
Total		29				

Post-hoc test

		Subset	
descrepancy	N	1	2
small	10	2.00	
medium	10		4.40
large	10		5.00
Sig.		1.000	.079

10. Summarize the three F tests and the relation between the μ's.

11. On a separate piece of paper, explain the outcome of the analysis in paragraph form.

Homework 8.1: 2-Way ANOVA -- Key

Study Background: Read Carefully!!

Social psychologists have studied extensively the variables that influence the ability of a speaker to persuade an audience to take the speaker's position on an issue. One important factor that influences the amount of attitude change a speaker can generate is the discrepancy between the position advocated by the speaker and the position of the audience. Up to a point, the more discrepant the speaker's position, the greater the attitude change that will result. However, if the speaker's position becomes too discrepant, the speaker looses credibility and the message is less persuasive.

It has been hypothesized that the nature of the relationship between message discrepancy and attitude change differs, depending on the expertise of the speaker, formally referred to as the source. According to this perspective, speakers with high expertise can take much more discrepant positions that speakers with low expertise and still obtain large amounts of attitude change. As an example of how this proposition could be tested, consider the following hypothetical experiment.

College students evaluated the quality of a passage of poetry on a 21-point scale and then listened to a taped message concerning this passage that was presented as representing the opinion of either an expert (a famous poetry critic) or a non-expert (an undergraduate student enrolled in a creative writing class). The messages were identical except for which source they were attributed to. In addition, the messages were constructed to be either slightly discrepant, moderately discrepant, or highly discrepant from students' initial ratings of quality. For example, in the large-discrepancy condition, if a student rated the passage as being relatively high in quality, the message argued that the passage was low in quality. For example, in the large-discrepancy condition, if a student rated that the relatively high in quality, the message, argued that the passage was low in quality. After listening to the message, students re-rated the poetry. The resulting design was a 3 x 2 factorial with three levels of message discrepancy (small, medium, or large) and two levels of source expertise (high versus low). The dependent variable was the amount of change in the quality ratings after listening to the message. Scores could range from -20 to +20, with higher values indicating grater attitude change in the direction advocated by the source. The data for the experiment are presented below along with intermediate statistics necessary to calculate the sums of squares.

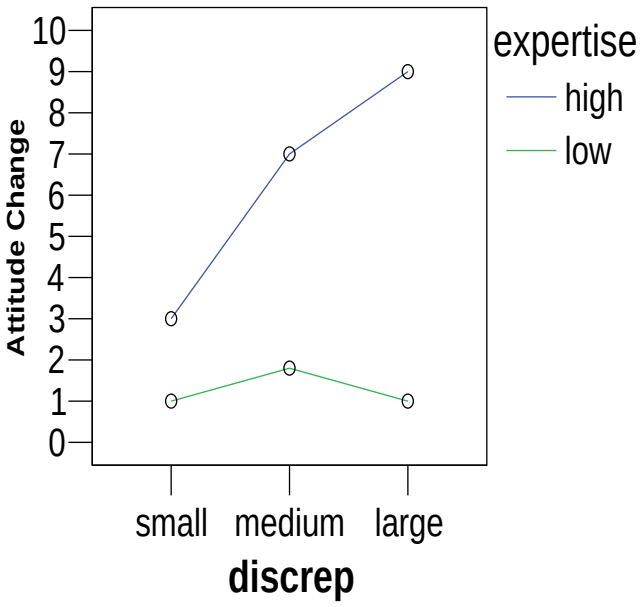
Data Collected

Calculate Row Means

Msg Discrep.	Source Expertise: HIGH	Source Expertise: LOW	
SMALL	3, 4, 2, 3, 3 — M = 3	1, 0, 2, 1, 1 — M = 1	M=2.0
MEDIUM	8, 7, 7, 7, 6 — M = 7	1, 3, 1, 2, 2 — M = 1.8	M= 4.4
LARGE	9, 8, 10, 9, 9 — M = 9	0, 1, 1, 2, 1 — M = 1	M= 5.0
Calculate Column Means	M=6.33	M=1.27	Calculate Cell Means

Note: Let's call Msg Discrepancy Factor A
Let's call Source Expertise Factor B
The DV is Attitude Change

1. Graph the results of the study using the cell means. Put Message Discrepancy on the x-axis.



2. State the 3 null hypotheses you can test with a 2-way ANOVA.

Ho: Message Discrepancy: $\mu_{small} = \mu_{med} = \mu_{large}$

Ho: Source Expertise: $\mu_{high} = \mu_{low}$

Ho: No Interaction

3. Describe the study design:

2x3 a=2 b=3

[OR 3x2 a=3 b=2]

4. Determine the typical Attitude Change occurring when participants experienced a large discrepancy from a source low in expertise? Report the appropriate mean (row, column, or cell).

Large Disc (M = 1)

5. What condition produced the most attitude change? Report the appropriate mean (row, column, or cell).

High Expertise &
Large Discrepancy (M = 9)

6. Which type of authority produces the most attitude change? Report the appropriate mean (row, column, or cell).

High Expertise (M=6.33)

7. Which type of message discrepancy produced the largest attitude change? Report the appropriate mean (row, column, or cell).

Large Discrp (M=5)

8. Explain why we can't just base our interpretation of the results on the graph. Why must we do an ANOVA? Mention the difference between sample means and population means in your answer.

The graph only shows differences between sample means trying to represent population means. To determine if apparent differences are reliable (i.e., reflect true differences among population means), we conduct an ANOVA.

9. Complete this source of variation table.

Source of V.	SS	df	MS	F-obt	F-crit	η^2
Msg Discrep.	50.40	2	25.2	47.279	3.40	.1676
Source Expertise	192.53	1	192.53	361.00	4.26	.64
A*B	45.067	2	22.533	42.277	3.40	.15
Error	12.8	24	.533			
Total	300.8	29				

Post-hoc test

descrepancy	N	Subset 1	Subset 2
small	10	2.00	
medium	10		4.40
large	10		5.00
Sig.		1.000	.079

10. Summarize the three F tests and the relation between the μ's.

$F(2,24) = 47.279, p \leq .05$ μ_{medium} and $\mu_{large} > \mu_{small}$

$F(1,24) = 361.00, p \leq .05$ $\mu_{high\ exp} > \mu_{low\ exp}$

$F(2,24) = 42.277, p \leq .05$

11. On a separate piece of paper, explain the outcome of the analysis in paragraph form.

–

–

–

–

–

Descriptive Statistics

Dependent Variable: att_change

expertise	discrep	Mean	Std. Deviation	N
high	small	3.00	.707	5
	medium	7.00	.707	5
	large	9.00	.707	5
	Total	6.33	2.664	15
low	small	1.00	.707	5
	medium	1.80	.837	5
	large	1.00	.707	5
	Total	1.27	.799	15
Total	small	2.00	1.247	10
	medium	4.40	2.836	10
	large	5.00	4.269	10
	Total	3.80	3.221	30

att_change

Student-Newman-Keuls[a,b]

discrep	N	Subset 1	Subset 2
small	10	2.00	
medium	10		4.40
large	10		5.00
Sig.		1.000	.079

Means for groups in homogeneous subsets are displ

Dependent Variable: att_change

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	288.000[a]	5	57.600	108.000	.000
Intercept	433.200	1	433.200	812.250	.000
expertise	192.533	1	192.533	361.000	.000
discrep	50.400	2	25.200	47.250	.000
expertise * discrep	45.067	2	22.533	42.250	.000
Error	12.800	24	.533		
Total	734.000	30			
Corrected Total	300.800	29			

Homework 8.2: Setting up Data for 2-way ANOVA

1. As you watch the website lecture video SPSS data entry for 2-way ANOVA, show proper data setup for problems #1 & #2

2. Study Design: Participants rate the morality (DV) of described behaviors (bad or good) under different lighting levels (low, med, high).

		Toy Color	
		Blue ( )	Pink ( )
Sex	Boy ( )	7 6 5	2 3 4
	Girl( )	4 5 6	12 10 11

(check against lecture slides)

3. Examine the effect of attachment style (avoidant, secure) and extraversion (low, high) on number of close friends. Show below how the data should be entered into SPSS.

		Attachment Style	
		Avoidant	Secure
Extraversion	Low	0 2 1	5 7 6
	High	2 4 3	7 5 4

should add to five

4. Does user age (young, middle-aged, or old) interact with web design (alpha, beta) in determining number of user errors (per 50 website orders)?

DV: errors per 50 orders

		User Age		
		Young	Middle	Old
Web Design	Alpha	4 5	7 6	10 8
	Beta	2 3	4 1	3 1

should add to five

5. Does age (5, 10, 15), type of Day-Time Care (Home, High Quality Day-Care, Low Quality Day-Care), or the interaction between the two affect number of aggressive acts per month?

		Age		
		5	10	15
Day-time care	Home	2 2	7 6	2 1
	High Qlty Day Care	6 5	4 1	2 3
	Low Qlty Day Care	7 8	6 5	3 2

should add to five

Homework 8.2B: 2-way ANOVA Annotation Exercise

Dependent Variable: SCORE

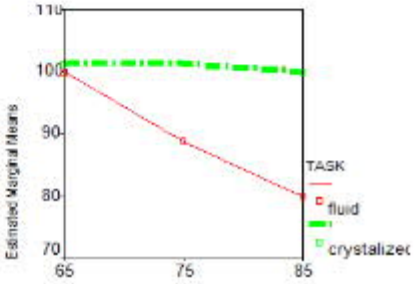
TASK	AGE	Mean	Std. Deviation	N
fluid	65	100.00	4.082	4
	75	88.75	4.787	4
	85	80.00	4.082	4
	Total	89.58	9.405	12
crystalized	65	101.25	6.292	4
	75	101.25	4.787	4
	85	100.00	4.082	4
	Total	100.83	4.687	12
Total	65	100.63	4.955	8
	75	95.00	8.018	8
	85	90.00	11.339	8
	Total	95.21	9.264	24

A developmental psychologist examines how type of **Task** (ones requiring *Fluid* vs. *Crystallized* intelligence) and **Age** (*65*, *75*, or *85* years old) affect cognitive performance **Scores**.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1567.708[a]	5	313.542	13.892	.000
Intercept	217551.042	1	217551.042	9639.185	.000
TASK	759.375	1	759.375	33.646	.000
AGE	452.083	2	226.042	10.015	.001
TASK * AGE	356.250	2	178.125	7.892	.003
Error	406.250	18	22.569		
Total	219525.000	24			
Corrected Total	1973.958	23			

Student-Newman-Keuls [a,b]

AGE	N	Subset 1	Subset 2	Subset 3
85	8	90.00		
75	8		95.00	
65	8			100.63
Sig.		1.000	1.000	1.000



1. Please show in an equation which numbers from the output you would use to calculate each of the folloing:

$F_A = \frac{MS_A}{MS_{err}}$ = ------ =33.646

F_B=_____=10.015

F_{A*B}=_____=7.892

MS_B=_____=226.042

η^2_A=_____

df_B=_____=2

2. Highlight the following useing one color for Factor A (e.g., yellow) and another for Factor B (e.g., blue). In other words, make everything pertaining to Factor A one color, and everything for Factor B another color:

- In the Source of Variation table, the rows for Factors A & B
- In the Descriptive Stats table, the means for Factor A (collapsing across B)
- In the Descriptive Stats table, the means for Factor B (collapsing across A)
- In the Means Plot, the levels of Factor A and the levels of Factor B
- In the Post Hoc table, the levels of the Factor shown

3. Formally summarize the F-test results for the three Factors (A, B, & A*B)

A: _____ , B: _____, A*B: _____

4. What was the average score for 65 year olds? _____

5. Which statement best describes the interaction?

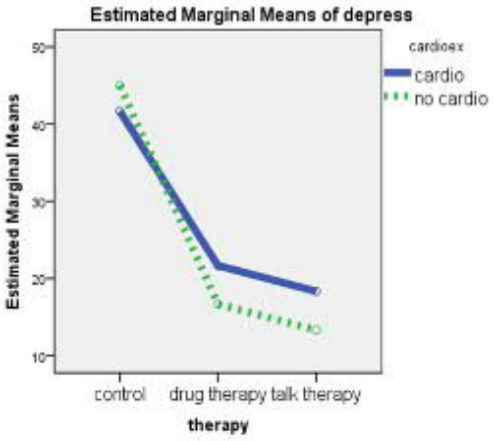
a. The interaction was not significant
b. As age increases, fluid intelligence decreases while crystalized intelligence increases
c. As age increases, both fluid and crystalized intelligence decrease
d. As age increases, fluid intelligence decreases while crystalized intelligence remains about the same

6. Which pattern of significant difference is shown in the post hoc table?

a. 90<95<100.63
b. [90=95]<100.63
c. 90<[95=100.63]
d. There is no post hoc

Dependent Variable:depress

therapy	cardioex	Mean	SD	N
control	cardio	41.67	2.887	3
	no cardio	45.00	5.000	3
	Total	43.33	4.082	6
drug therapy	cardio	21.67	2.887	3
	no cardio	16.67	2.887	3
	Total	19.17	3.764	6
talk therapy	cardio	18.33	7.638	3
	no cardio	13.33	2.887	3
	Total	15.83	5.845	6
Total	cardio	27.22	11.756	9
	no cardio	25.00	15.411	9
	Total	26.11	13.346	18



Dependent Variable: depress

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2794.444[a]	5	558.889	28.743	.000
Intercept	12272.222	1	12272.222	631.143	.000
therapy	2702.778	2	1351.389	69.500	.000
cardioex	22.222	1	22.222	1.143	.306
therapy * cardioex	69.444	2	34.722	1.786	.209
Error	233.333	12	19.444		
Total	15300.000	18			
Corrected Total	3027.778	17			

Student-Newman-Keuls[a,b]

therapy	N	Subset 1	Subset 2
talk therapy	6	15.83	
drug therapy	6	19.17	
control	6		43.33
Sig.		.215	1.000

Means for groups in homogeneous subsets

A clinical psychologist examined the impact of **Therapy** (*drug, talk,* or *neither*) and **Cardio Exercise** (*cardio* or *no cardio*) on **Depression**.

1. Please show in an equation which numbers from the output you would use to calculate each of the following:

$F_A = \frac{MS_A}{MS_{err}}$ = ---- =69.500

F_B=_____=1.143

F_{A*B}=_____=1.786

MS_A=_____=1351.389

η^2_A=_____

df_A=____=2

2. Highlight the following useing one color for Factor A (e.g., yellow) and another for Factor B (e.g., blue). In other words, make everything pertaining to Factor A one color, and everything for Factor B another color:

- In the Source of Variation table, the rows for Factors A & B
- In the Descriptive Stats table, the means for Factor A (collapsing across B)
- In the Descriptive Stats table, the means for Factor B (collapsing across A)
- In the Means Plot, the levels of Factor A and the levels of Factor B
- In the Post Hoc table, the levels of the Factor shown

3. Formally summarize the F-test results for the three Factors (A, B, & A*B)

A: _____ , B: _____, A*B: _____

4. What was the average score for drug therapy? _____

5. Which statement best describes the interaction?

a. The interaction was not significant
b. As therapy levels changed, people doing cardio had decreased levels of depression
c. As therapy levels changed, people not doing cardio had more decrease in their levels of depression than people doing cardio
d. As therapy levels changed, people doing cardio had no change in depression, while people not doing cardio had decreased levels of depression.

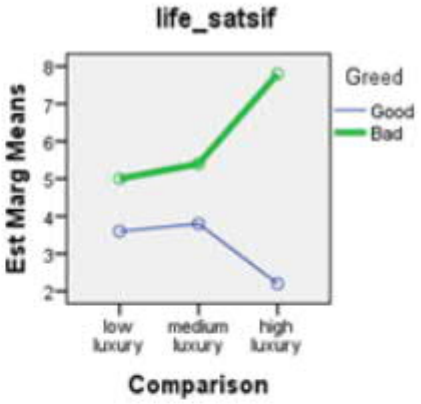
6. Which pattern of significant difference is shown in the post hoc table?

a. 15.83<19.17<43.33
b. [15.83=19.17]<43.33
c. 15.83<[19.17=43.33]
d. 15.83=19.17=43.33

Descriptive Statistics

Dependent Variable:life_satsif

Greed	Comparison	Mean	Std. Dev	N
Good	low luxury	3.60	1.673	5
	medium luxury	3.80	.837	5
	high luxury	2.20	.837	5
	Total	3.20	1.320	15
Bad	low luxury	5.00	.707	5
	medium luxury	5.40	1.140	5
	high luxury	7.80	.837	5
	Total	6.07	1.534	15
Total	low luxury	4.30	1.418	10
	medium luxury	4.60	1.265	10
	high luxury	5.00	3.055	10
	Total	4.63	2.025	30



Materialism can "bum you out." People listed either *good* or *bad* things about **Greed** and then saw images prompting a **Comparison** of their life with different levels of lifestyle luxury (*low, medium,* or *high*). Participants then rated their own **Life Satisfaction**.

Tests of Between-Subjects Effects

Dependent Variable:life_satsif

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	92.167[a]	5	18.433	16.50	.000
Intercept	644.033	1	644.03	576.7	.000
Greed	61.633	1	61.633	55.19	.000
Comparison	2.467	2	1.233	1.104	.348
Greed * Comparison	28.067	2	14.033	12.56	.000
Error	26.800	24	1.117		
Total	763.000	30			
Corrected Total	118.967	29			

a. R Squared = .775 (Adjusted R Squared = .728)

1. Please show in an equation which numbers from the output you would use to calculate each of the following:

$F_A = \frac{MS_A}{MS_{err}}$ =_____=55.19

F_B=_____=1.104

F_{A*B}=_____=12.56

MS_{A*B}=_____=14.033

η^2_{A*B}=_____

df_B=_____=2

2. Highlight the following useing one color for Factor A (e.g., yellow) and another for Factor B (e.g., blue). In other words, make everything pertaining to Factor A one color, and everything for Factor B another color:

- In the Source of Variation table, the rows for Factors A & B
- In the Descriptive Stats table, the means for Factor A (collapsing across B)
- In the Descriptive Stats table, the means for Factor B (collapsing across A)
- In the Means Plot, the levels of Factor A and the levels of Factor B

3. Formally summarize the F-test results for the three Factors (A, B, & A*B)

A: _____ , B: _____, A*B: _____

4. What was the average life satisfaction for the high luxury condition? _____

5. Which statement best describes the interaction?

a. The interaction was not significant
b. When people listed good things about greed, their life satisfaction decreased as luxury levels increased
c. When people listed bad things about greed, their life satisfaction increased as luxury levels increased
d. When luxury levels were low and medium, people that listed bad or good things about greed did not have vast differences, but when luxury levels were high, people that listed bad things had a sharp increase in life satisfaction, while people that listed good things had a sharp decrease in satisfaction

6. Which pattern of significant difference is shown in the post hoc table?

a. There is no post hoc table
b. 4.30<4.60<5.00
c. 4.30=4.60=5.00
d. [4.30=4.60]<5.00

Homework 8.2B: 2-way ANOVA Annotation Exercise - KEY

Dependent Variable: SCORE

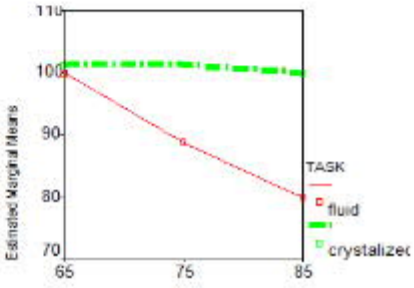
TASK	AGE	Mean	Std. Deviation	N
fluid	65	100.00	4.082	4
	75	88.75	4.787	4
	85	80.00	4.082	4
	Total	89.58	9.405	12
crystalized	65	101.25	6.292	4
	75	101.25	4.787	4
	85	100.00	4.082	4
	Total	100.83	4.687	12
Total	65	100.63	4.955	8
	75	95.00	8.018	8
	85	90.00	11.339	8
	Total	95.21	9.264	24

A developmental psychologist examines how type of **Task** (ones requiring *Fluid* vs. *Crystallized* intelligence) and **Age** (*65*, *75*, or *85* years old) affect cognitive performance **Scores**.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1567.708[a]	5	313.542	13.892	.000
Intercept	217551.042	1	217551.042	9639.185	.000
TASK	759.375	1	759.375	33.646	.000
AGE	452.083	2	226.042	10.015	.001
TASK * AGE	356.250	2	178.125	7.892	.003
Error	406.250	18	22.569		
Total	219525.000	24			
Corrected Total	1973.958	23			

Student-Newman-Keuls[a,b]

AGE	N	Subset 1	Subset 2	Subset 3
85	8	90.00		
75	8		95.00	
65	8			100.63
Sig.		1.000	1.000	1.000



1. Please show in an equation which numbers from the output you would use to calculate each of the folloing:

$F_A = \frac{MS_A}{MS_{err}} = \frac{759.375}{22.569} = 33.646$

$F_B = \frac{226.042}{22.569} = 10.015$

$F_{A*B} = \frac{178.125}{22.569} = 7.892$

$MS_B = \frac{452.083}{2} = 226.042$

$\eta^2_A = \frac{759.375}{1973.958}$

$df_B = 3-1 = 2$

2. Highlight the following useing one color for Factor A (e.g., yellow) and another for Factor B (e.g., blue). In other words, make everything pertaining to Factor A one color, and everything for Factor B another color:

- In the Source of Variation table, the rows for Factors A & B
- In the Descriptive Stats table, the means for Factor A (collapsing across B)
- In the Descriptive Stats table, the means for Factor B (collapsing across A)
- In the Means Plot, the levels of Factor A and the levels of Factor B
- In the Post Hoc table, the levels of the Factor shown

3. Formally summarize the F-test results for the three Factors (A, B, & A*B)

A: _F(1,18)=33.646, p<.05___ , B: _F(2,18)=10.015, p<.05__, A*B: _F(2,18)=7.892, p<.05___

4. What was the average score for 65 year olds? __100.63__

5. Which statement best describes the interaction?

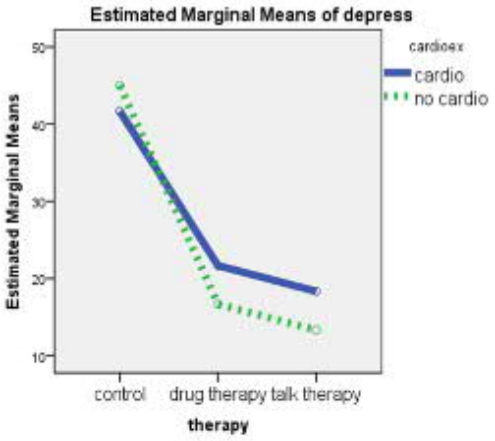
e. The interaction was not significant
f. As age increases, fluid intelligence decreases while crystalized intelligence increases
g. As age increases, both fluid and crystalized intelligence decrease
h. As age increases, fluid intelligence decreases while crystalized intelligence remains about the same

6. Which pattern of significant difference is shown in the post hoc table?

e. 90<95<100.63
f. [90=95]<100.63
g. 90<[95=100.63]
h. There is no post hoc

Dependent Variable:depress

therapy	cardioex	Mean	SD	N
control	cardio	41.67	2.887	3
	no cardio	45.00	5.000	3
	Total	43.33	4.082	6
drug therapy	cardio	21.67	2.887	3
	no cardio	16.67	2.887	3
	Total	19.17	3.764	6
talk therapy	cardio	18.33	7.638	3
	no cardio	13.33	2.887	3
	Total	15.83	5.845	6
Total	cardio	27.22	11.756	9
	no cardio	25.00	15.411	9
	Total	26.11	13.346	18



Dependent Variable: depress

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2794.444[a]	5	558.889	28.743	.000
Intercept	12272.222	1	12272.222	631.143	.000
therapy	2702.778	2	1351.389	69.500	.000
cardioex	22.222	1	22.222	1.143	.306
therapy * cardioex	69.444	2	34.722	1.786	.209
Error	233.333	12	19.444		
Total	15300.000	18			
Corrected Total	3027.778	17			

Student-Newman-Keuls[a,b]

therapy	N	Subset 1	Subset 2
talk therapy	6	15.83	
drug therapy	6	19.17	
control	6		43.33
Sig.		.215	1.000

Means for groups in homogeneous subsets

A clinical psychologist examined the impact of **Therapy** (*drug, talk, or neither*) and **Cardio Exercise** (*cardio or no cardio*) on **Depression**.

1. Please show in an equation which numbers from the output you would use to calculate each of the following:

$F_A = \frac{MS_A}{MS_{err}} = \frac{1351.389}{19.444} = 69.500$

$F_B = \frac{22.222}{19.444} = 1.143$

$F_{A*B} = \frac{34.722}{19.444} = 1.786$

$MS_A = \frac{2702.778}{2} = 1351.389$

$\eta^2_A = \frac{2702.778}{3027.778}$

$df_A = 3-1=2$

2. Highlight the following useing one color for Factor A (e.g., yellow) and another for Factor B (e.g., blue). In other words, make everything pertaining to Factor A one color, and everything for Factor B another color:

- In the Source of Variation table, the rows for Factors A & B
- In the Descriptive Stats table, the means for Factor A (collapsing across B)
- In the Descriptive Stats table, the means for Factor B (collapsing across A)
- In the Means Plot, the levels of Factor A and the levels of Factor B
- In the Post Hoc table, the levels of the Factor shown

3. Formally summarize the F-test results for the three Factors (A, B, & A*B)

A: _F(2,12)=69.500, p<.05__ , B: _F(1,12)=1.143, n.s.__, A*B: _F(2,12)=1.786, n.s.__

4. What was the average score for drug therapy? _19.17__

5. Which statement best describes the interaction?

e. The interaction was not significant
f. As therapy levels changed, people doing cardio had decreased levels of depression
g. As therapy levels changed, people not doing cardio had more decrease in their levels of depression than people doing cardio
h. As therapy levels changed, people doing cardio had no change in depression, while people not doing cardio had decreased levels of depression.

6. Which pattern of significant difference is shown in the post hoc table?

e. 15.83<19.17<43.33
f. [15.83=19.17]<43.33
g. 15.83<[19.17=43.33]
h. 15.83=19.17=43.33

Descriptive Statistics

Dependent Variable: life_satsif

Greed	Comparison	Mean	Std. Dev	N
Good	low luxury	3.60	1.673	5
	medium luxury	3.80	.837	5
	high luxury	2.20	.837	5
	Total	3.20	1.320	15
Bad	low luxury	5.00	.707	5
	medium luxury	5.40	1.140	5
	high luxury	7.80	.837	5
	Total	6.07	1.534	15
Total	low luxury	4.30	1.418	10
	medium luxury	4.60	1.265	10
	high luxury	5.00	3.055	10
	Total	4.63	2.025	30

Materialism can "bum you out." People listed either *good* or *bad* things about **Greed** and then saw images prompting a **Comparison** of their life with different levels of lifestyle luxury (*low, medium,* or *high*). Participants then rated their own **Life Satisfaction**.

Tests of Between-Subjects Effects

Dependent Variable: life_satsif

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	92.167[a]	5	18.433	16.50	.000
Intercept	644.033	1	644.03	576.7	.000
Greed	61.633	1	61.633	55.19	.000
Comparison	2.467	2	1.233	1.104	.348
Greed * Comparison	28.067	2	14.033	12.56	.000
Error	26.800	24	1.117		
Total	763.000	30			
Corrected Total	118.967	29			

a. R Squared = .775 (Adjusted R Squared = .728)

1. Please show in an equation which numbers from the output you would use to calculate each of the following:

$F_A = \frac{MS_A}{MS_{err}} = \frac{61.633}{1.117} = 55.19$

$F_B = \frac{1.233}{1.117} = 1.104$

$F_{A*B} = \frac{14.033}{1.117} = 12.56$

$MS_{A*B} = \frac{28.067}{2} = 14.033$

$\eta^2_{A*B} = \frac{28.067}{118.967}$

$df_B = 3-1 = 2$

2. Highlight the following useing one color for Factor A (e.g., yellow) and another for Factor B (e.g., blue). In other words, make everything pertaining to Factor A one color, and everything for Factor B another color:

- In the Source of Variation table, the rows for Factors A & B
- In the Descriptive Stats table, the means for Factor A (collapsing across B)
- In the Descriptive Stats table, the means for Factor B (collapsing across A)
- In the Means Plot, the levels of Factor A and the levels of Factor B

3. Formally summarize the F-test results for the three Factors (A, B, & A*B)

A: _F(1,24)=55.19, p<.05__ , B: _F(2,24)=1.104, p<.05__, A*B: _F(2,24)=12.56, p<.05__

4. What was the average life satisfaction for the high luxury condition? _5.00__

5. Which statement best describes the interaction?

e. The interaction was not significant
f. When people listed good things about greed, their life satisfaction decreased as luxury levels increased
g. When people listed bad things about greed, their life satisfaction increased as luxury levels increased
h. When luxury levels were low and medium, people that listed bad or good things about greed did not have vast differences, but when luxury levels were high, people that listed bad things had a sharp increase in life satisfaction, while people that listed good things had a sharp decrease in satisfaction

6. Which pattern of significant difference is shown in the post hoc table?

e. There is no post hoc table
f. 4.30<4.60<5.00
g. 4.30=4.60=5.00
h. [4.30=4.60]<5.00

Homework 8.3: 2-Way ANOVA Write-ups

This homework will help you practice the paragraph write-ups required for 2-way ANOVAs.

Industrial/Organizational psychology studies factors that effect job performance, so let's imagine an I/O psychologists studying two different independent variables that might affect the amount of effort someone puts into a task: size of team and evaluation arrangement.

IV#1: Size of team: Social psychologists have studied diffusion of responsibility – the tendency for the effort of individuals to decrease as the number of individuals on a team increases. (You might also call this the slacker effect). As the number of teammates increases, each person tends to feel less responsible for the overall outcome, and so he or she tends to get lazy. We can imagine the psychologist putting people in situations with two, four, or eight teammates.

IV#2: Peer evaluation: I/O psychologist can tell you that if people are held accountable for their performance they have more incentive to put forth effort. Perhaps having people evaluate their teammates can counteract the slacker effect described above. Maybe having more teammates could even increase effort if you knew there would be more people evaluating you. Lets imagine the researcher establishing two conditions: One where participants expect peer evaluation and one where they don't.

Note: The following three pages have three distinct outcomes that might occur. I've generated three different SPSS outcomes so that you can practice writing-up different outcomes.

- For HW 8.3a: Write up outcomes #1 and #2. (Two paragraphs.)
- For HW 8.3b: Write up outcome #3. (One paragraph).

You can find a key for outcomes #1 and #3 on the website

Homework 8.3: 2-way ANOVA Write-ups – Key

All 2-way write-ups can follow the same simple pattern:

1. Statement about how hypotheses overall.
2. Explain outcome for hypothesis #1 – a possible main effect (e.g., for number of teammates)
3. Explain outcome for hypothesis #2 – another possible main effect (e.g., for peer evaluations)
4. Explain outcome for hypothesis #3 – a possible interaction
5. Explain practical significance for any significant effects.

Outcome #1: Some of the hypotheses were supported. There was a main effect for teammates. Participants with two teammates worked harder (M = 12.70) than those with four teammates (M = 6.8), who in turn worked harder than those with 8 teammates (M = 3.8), $F(2,24) = 34.751$, $p \leq .05$. However, there was no main effect for peer evaluations. Those who expected peer evaluations (M = 8.33) did not differ significantly from those who did not expect evaluations (M = 7.20), $F(1,24) = 1.633$, n.s. The two variables did not interact, $F(2,24) = .684$, n.s. Number of teammates accounted for a large amount of variance in effort, $\eta^2 = .7202$.

Outcome #3: Some of the hypotheses were supported. There was no main effect for number of teammates. Participants with two teammates (M = 7.10), four teammates (M = 6.70, or eight teammates (M = 7.60) did not differ significantly in effort, $F(2,24) = .359$, n.s. Participants expecting a peer evaluation put forth greater effort (M = 10.13) than those not expecting an evaluation (M = 4.13), $F(1,24) = 47.647$, $p \leq .05$. Finally, there was a significant interaction, $F(2,24) = 16.535$, $p \leq .05$. With peer evaluations, an increase in teammates increases effort. Without peer evaluations, an increase in teammates decreases effort. Peer evaluation accounts for the most variance in effort, $\eta^2 = .4519$, although the interaction also accounted for a large amount of variance, $\eta^2 = .3137$.

Homework 8.4: Paragraphs & Name that Stat Review

1. Paragraph Write-up: To compare different techniques for reducing aggression in kids, you measure the number of aggressive acts seen during one day after 4 weeks of role-playing therapy (1,2,1,4), time-out restrictions (3,4,2,4), pink-room restrictions (6,5,7,6), and watching Barney (9,8,7,8).

2. Paragraph Write-up: Are extraverts more likely to enjoy scary movies? You reason that extraverts will tend to seek stimulation, and so should be more inclined to like the stimulation of getting scared senseless. You collect the following extraversion scores: 15,15,20,30,35,35,40 and desire to see scary movies 3,2,3,6,4,5,4. Test the hypothesis that the two variables are related.

3. Paragraph Write-up: You've developed a test of persistence that you think will nicely complement the SAT in predicting college grades. After all, obtaining a high GPA requires not only intelligence but (perhaps more importantly) hard work. For a single group of students, you obtain both the following GPAs (2.00,2.50,3.20,3.00,3.20, 3.60,3.75) and persistence scores (10,13,16,17,17,20,25), respectively. (Do both a correlation write-up and regression analysis.)

4. Identify the correct statistic

   a. Test a weight loss clinic's claim that customers lose 15 pounds on average. You've talked to 9 people and recorded their weight lost.

   b. Do women who receive social support during pregnancy have healthier babies at birth? You compare the weights of 7 new-borns from women receiving the extra social-support and compare this to the weights of 7 women receiving no special support.

   c. A mother claims her child is smarter than 1 in 100 kids; she scored 120 on an IQ test (μ=100, σ = 7).

   d. A developmental psychologist argues that social skills tend to correlate strongly with intelligence. You have assessments of social skills and IQ for 10 kids.

   e. A developmental psychologist argues that corporeal punishment causes kids to resent their parents. He measures resentment levels before and after corporeal punishment.

   f. A developmental psychologist suggests he can predict the number of inappropriate, attention grabbing behaviors by the number of attentive parent-child interactions initiated by the parent. He observers the interaction of 20 parent-child dyads, and records the number of each behavior.

   g. A developmental psychologist argues that kids will have less discipline problems if their parents both explain why particular behaviors are inappropriate AND reinforce good behavior. He compares the behavior problems displayed by kids with four types of discipline techniques: (1) punishment, (2) explanation, (3) reinforcement, (4) explanation + reinforcement.

5. Paragraph Write-up: Does hunger make food smell better? From previous research you know that most people rate the smell of a Whopper as a 4 on a 7 point scale. A statistics professor administers a 24 hour exam (to ensure her students won't eat during this time), then ask those still conscious to rate the smell of a Whopper. They rate the Whopper as follows (5,6,3,4,6,2,3,5,5)

6. Paragraph Write-up: You wonder if perfume really makes people appear more attractive. Six male participants rate a female confederate (i.e., your assistant) who is wearing perfume (6,7,5,6,7) and another six participants rate the same assistant when not wearing perfume (7,6,6,6,8).

7. Paragraph Write-up: You are interested in the relationship between stress and laughter. The research literature suggests that laughter can actually change someone's physiological response to stress. In your study you tell participants that they will perform a learning task in which they will receive a mild shock for wrong answers. You measure their galvanic skin response (a measure of stress) before (6, 9, 7, 8) and after you make them laugh (4, 5, 7, 5).

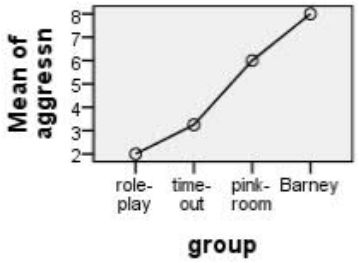
Homework 8.4 Paragraphs & Name that Stat Review Key

aggressn

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
role-play	4	2.00	1.414	.707	-.25	4.25	1	4
time-out	4	3.25	.957	.479	1.73	4.77	2	4
pink-room	4	6.00	.816	.408	4.70	7.30	5	7
Barney	4	8.00	.816	.408	6.70	9.30	7	9
Total	16	4.81	2.588	.647	3.43	6.19	1	9

aggressn

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	87.688	3	29.229	27.510	.000
Within Groups	12.750	12	1.063		
Total	100.438	15			



Student-Newman-Keuls[a]

group	N	Subset for alpha = 0.05		
		1	2	3
role-play	4	2.00		
time-out	4	3.25		
pink-room	4		6.00	
Barney	4			8.00
Sig.		.112	1.000	1.000

1. The hypothesis was supported. Participants watching Barney engaged in significantly more aggressive acts (M=8.00) than those in the pink room (M=6.00), who in turn engaged in more aggressive acts than those in either the time-out (M=3.25) or role-play (M=2.00) conditions, F (3,12) = 27.51, p≤.05. The effect of technique on aggression was large, η^2=.8731.

Correlations

		extraversn	desirescary
extraversn	Pearson Correlation	1	.684
	Sig. (2-tailed)		.090
	N	7	7
desirescary	Pearson Correlation	.684	1
	Sig. (2-tailed)	.090	
	N	7	7

2. The hypothesis was not supported. Extraversion did not correlate significantly with desire to see a scary movie, r(5) = .684, n.s. [If this had been significant, you would have added... Extraversion accounts for a large amount of variance in desire to see a scary moive, r^2=.4679.]

Correlations

		gpa	persist
gpa	Pearson Correlation	1	.943**
	Sig. (2-tailed)		.001
	N	7	7
persist	Pearson Correlation	.943**	1
	Sig. (2-tailed)	.001	
	N	7	7

**. Correlation is significant at the 0.01 level (2-tailed).

3a. [Correlation- table to the left] The hypothesis was supported. Persistence and GPA correlated significantly, r(5) = .943, p ≤ .05. Persistence accounts for a large amount of variance in GPA, r^2 = .8892.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.943[a]	.888	.866	.22385

a. Predictors: (Constant), persist

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.016	.331		3.068	.028
	persist	.120	.019	.943	6.307	.001

a. Dependent Variable: gpa

3b. [Regression – table above and to the left] y'=.120x + 1.016 (note, x= some given level of persistence and y'= the predicted GPA)

4. a. one-sample t-test b. ind. t-test c. z-score d. correlation e. dep t-test f.regression g. one-way ANOVA

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
rating	9	4.33	1.414	.471

One-Sample Test

	Test Value = 4					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
rating	.707	8	.500	.333	-.75	1.42

5. The hypothesis was not supported. The rating hungry participants give the Whopper (M=4.33) is not significantly higher than for normal participants (μ = 4), t(8) = .707, n.s. Note: You'd calculate the d statistic if you had rejected the Ho.

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
rating	perfume	5	6.20	.837	.374
	no perfume	5	6.60	.894	.400

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	Lower	Upper
rating	Equal variances assumed	.094	.767	-.730	8	.486	-.400	.548	-1.663	.863
	Equal variances not assumed			-.730	7.96	.486	-.400	.548	-1.664	.864

6. The hypothesis was not supported. Participants in the perfume condition did not give significantly higher ratings (M=6.20) than participants in the non-perfume condition (M=6.60), t(8) = .730, n.s. Note: You'd calculate the d statistic if you had rejected the Ho.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	before	7.50	4	1.291	.645
	after	5.25	4	1.258	.629

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	before - after	2.250	1.708	.854	-.468	4.968	2.635	3	.078

7. The hypothesis was not supported. Participants in the laughing condition did not show significantly lower stress levels after laughing (M=5.25) than before (M=7.50), t(3)=2.635, n.s. Note: You'd calculate the d statistic if you had rejected the Ho.

HW 8.4 Instructors Key -- Students can ignore this.

1. The hypothesis was supported. Participants watching Barney engaged in significantly more aggressive acts (M=8.00) than those in the pink room (M=6.00), who in turn engaged in more aggressive acts than those in either the time-out (M=3.25) or role-play (M=2.00) conditions, $F(3,12) = 27.51$, $p \leq .05$. The effect of technique on aggression was large, $\eta^2 = .8731$.

2. The hypothesis was not supported. Extraversion did not correlate significantly with desire to see a scary movie, $r(5) = .684$, n.s.

3. The hypothesis was supported. Persistence and GPA correlated significanctly, $r(5) = .943$, $p \leq .05$. Persistence accounts for a large amount of variance in GPA, $r^2 = .8892$. $y' = .120x + 1.016$

4.
a. one-sample t-test
b. ind. t-test
c. z-score
d. correlation
e. dep t-test
f.regression
g. one-way ANOVA

5. The hypothesis was not supported. The rating hungry participants give the Whopper (M=4.33) is not significantly higher than for normal participants ($\mu = 4$), $t(8) = .707$, n.s.

6. The hypothesis was not supported. Participants in the perfume condition did not give significantly higher ratings (M=6.20) than participants in the non-perfume condition (M=6.60), $t(8) = .730$, n.s.

7. The hypothesis was not supported. Participants in the laughing condition did not show significantly higher stress levels after laughing (M=5.25) than before laughing (M=7.50), $t(3) = 2.635$, n.s.

Homework 8.5: Practice Quiz #1

A researcher tests whether 1 month of daily meditation (10, 20, 30, or 40 min/day) and religiosity (religious or not religious) affects happiness. She obtained the following results.

Dependent Variable: Happiness

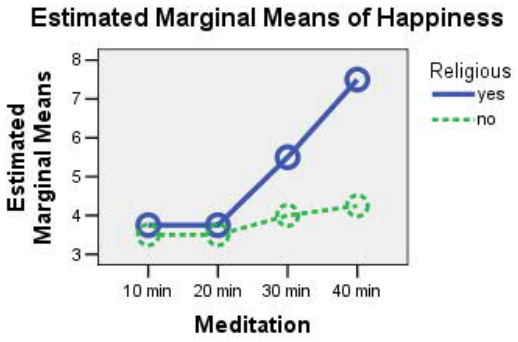
Meditation	Religious	Mean	Std. Deviation	N
10 min	yes	3.75	.957	4
	no	3.50	1.291	4
	Total	3.63	1.061	8
20 min	yes	3.75	1.258	4
	no	3.50	.577	4
	Total	3.63	.916	8
30 min	yes	5.50	.577	4
	no	4.00	.816	4
	Total	4.75	1.035	8
40 min	yes	7.50	.577	4
	no	4.25	1.258	4
	Total	5.88	1.959	8
Total	yes	5.13	1.784	16
	no	3.81	.981	16
	Total	4.47	1.565	32

Dependent Variable: Happiness

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	53.719[a]	7	7.674	8.278	.000
Intercept	639.031	1	639.031	689.292	.000
Meditation	27.844	3	9.281	10.011	.000
Religious	13.781	1	13.781	14.865	.001
Meditation * Religious	12.094	3	4.031	4.348	.014
Error	22.250	24	.927		
Total	715.000	32			
Corrected Total	75.969	31			

Student-Newman-Keuls[a,b]

Meditation	N	Subset 1	Subset 2
10 min	8	3.63	
20 min	8	3.63	
30 min	8	4.75	
40 min	8		5.88
Sig.		.070	1.0



1. Formally summarize the result of the F-test for Factor B. (e.g.: t (7) = ...)

2. Calculate η^2 for Factor A (if appropriate)

3. What two specific values (give numbers) are used to calculate the F value for the interaction?

4. What specific means (give numbers) would you use in describing whether there was a main effect for Factor B?

5. What was the average happiness level for <u>religious people</u> doing <u>10 minutes of meditation</u>?

6. Little "a" is equal to what numeric value?

7. The things that can affect the dependent variable in a two-way ANOVA are called _____ [one-word].

8. Which statement best describes the interaction

   a. The interaction was not significant.
   b. As meditation time increased, happiness increased for both religious & non-religious participants.
   c. As meditation time increased, happiness increased more for religious (vs. non-religious) participants.
   d. Increasing meditation time from 10 to 20 minutes doesn't increase happiness, but increasing it from 20 to 30, and from 30 to 40 does.

9. Which pattern of significant differences is shown in the post-hoc table?

   a. 10min < 20 min < 30 min < 40 min
   b. [10 min = 20 min = 30 min] < 40 min
   c. 10 min < [20 min = 30 min = 40 min]
   d. [10 min = 20 min] < [30 min = 40 min]

10. Name a common household pet. Three letters, the first one is "D" and the last is "G."

Homework 8.6: Practice Quiz #2

A researcher tests the impact of practice time (10,20,30,40,50 min/day) and material (video vs. workbook) on math test performance.

Dependent Variable: TestScr

Time	Material	Mean	Std. Deviation	N
10 min	video	4.00	.707	5
	workbook	3.80	.837	5
	Total	3.90	.738	10
20 min	video	3.80	.837	5
	workbook	4.00	.707	5
	Total	3.90	.738	10
30 min	video	4.00	.707	5
	workbook	5.40	.548	5
	Total	4.70	.949	10
40 min	video	4.00	.707	5
	workbook	6.00	.707	5
	Total	5.00	1.247	10
50 min	video	4.40	.548	5
	workbook	6.20	.837	5
	Total	5.30	1.160	10
Total	video	4.04	.676	25
	workbook	5.08	1.222	25
	Total	4.56	1.110	50

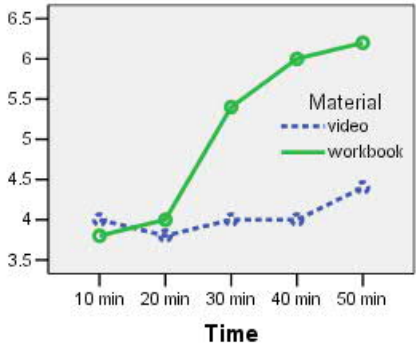
Dependent Variable: TestScr

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	39.520[a]	9	4.391	8.444	.000
Intercept	1039.680	1	1039.680	1999.38	.000
Time	16.320	4	4.080	7.846	.000
Material	13.520	1	13.520	26.000	.000
Time * Material	9.680	4	2.420	4.654	.004
Error	20.800	40	.520		
Total	1100.000	50			
Corrected Total	60.320	49			

TestScr

Student-Newman-Keuls[a,b]

Time	N	Subset 1	Subset 2
20 min	10	3.90	
10 min	10	3.90	
30 min	10		4.70
40 min	10		5.00
50 min	10		5.30
Sig.		1.000	.163



1. Calculate η^2 for Factor B (if appropriate)
2. When discussing Factor B, what means would you use? (specific numbers)
3. Little "b" is equal to what value? (specific number)
4. The values that an Independent Variable takes on are called _____ (a term).
5. What two specific numeric values yield the F value for A*B?
6. Formally summarize the F-test result for Factor A. e.g., t(7) =..... etc.
7. Formally summarize the F-test result for Factor B.
8. Overall there were 2 significant _____ effects and 1 significant ___.
9. What was the average test score for people doing workbooks for 30 minutes per day?

10. Which statement best describes the interaction

    a. The interaction was not significant.
    b. As practice time increases video participants do worse while workbook participants do better.
    c. As practice time increases in general both video and workbook participants do better.
    d. As practice time increases workbook participants eventually improve but video participants do not.

11. Which pattern of significant differences is shown in the post-hoc table?

    a. 10min < 20 min < 30 min < 40 min < 50 min
    b. 10 min = 20 min = 30 min = 40 min = 50 min
    c. 10, 20 min < 30, 40, & 50 min
    d. 20, 10 30 min < 40, 50 min

Homework 9.1 - χ^2 "Chi Squared"

1. Test whether you could say more than half of people favor gay marriage based on this sample. On this and other problems, look-up $\chi^2_{critical}$ and state whether you retain or reject the Ho.

	Approve	Oppose	
OF	45	30	N=_____
EF	____	_____	
	50%	50%	

$$\chi^2 = \sum \frac{(OF - EF)^2}{EF} =$$

2. You compare the beliefs about global warming of WU students to the national breakdown. Test the hypothesis that Winthrop Students are more supportive.

	True	False	Don't Know	
OF	37	10	7	
EF				
	50%	40%	10%	

$\chi^2 =$

3. A researcher wants to know if those who had a heart attack (vs. those that didn't) were more likely to be red-meat eaters. Conduct the Test for Independence with the following data:

		Red-Meat Eater		
Heart Attack		Yes	No	
	Yes	20	8	
	No	10	22	

$\chi^2 =$

4. A researcher wonders if Political Affiliation (Dem, Rep, or Independent) relates to support for gay marriage.

		Political Affiliation			
Gay Marriage		Dem	Rep	Indep	
	Approve	15	2	7	
	Oppose	7	20	7	

$\chi^2 =$

Homework 9.1 - χ^2 "Chi Squared" Key

1. Test whether you could say more than half of people favor gay marriage based on this sample. On this and other problems, look-up $\chi^2_{critical}$ and state whether you retain or reject the Ho.

	Approve	Oppose	
OF	45	30	N = 75
EF	37.5	37.5	
	50%	50%	

$$\chi^2 = \sum \frac{(OF - EF)^2}{EF} = \frac{(45-37.5)^2}{37.5} + \frac{(30-37.5)^2}{37.5}$$

$$\chi^2 = 1.5 + 1.5 = 3.0$$

df = 2-1 = 1, $\chi^2_{critical}$ = 3.841

Retain Ho, 50% -50% split is possible.

2. You compare the beliefs about global warming of WU students to the national breakdown. Test the hypothesis that Winthrop Students are more supportive.

	True	False	Don't Know	
OF				
EF				

$\chi^2 =$

$\chi^2 =$

df = 3-1

Reject H … be support…

3. A researcher wants to know if those who had a heart attack (vs. those that didn't) were more likely to be red-meat eaters. Conduct the Test for Independence with the following data:

		Red-Meat Eater		
		Yes	No	
Heart Attack	Yes	20 14	8 14	28
	No	10 16	22 16	32
		30	30	N=60

$$\chi^2 = \frac{(20-14)^2}{14} + \frac{(8-14)^2}{14} + \frac{(10-16)^2}{16} + \frac{(22-16)^2}{16}$$

$$\chi^2 = 2.571 + 2.571 + 2.250 + 2.250 = 9.642$$

df = (R-1)*(C-1) = 1 * 1 = 1, $\chi^2_{critical}$ = 3.841

Reject Ho, Red-Meat eaters significantly more likely to have a heart attack.

4. A researcher wonders if Political Affiliation (Dem, Rep, or Independent) relates to support for gay marriage.

		Political Affiliation			
		Dem	Rep	Indep	
Gay Marriage	Approve	15 9.103	2 9.103	7 5.793	24
	Oppose	7 12.897	20 12.897	7 8.207	34
					N=58

$\chi^2 =$

$\chi^2 = 3.81$

df = (R-1…

Reject H… …iage.

Homey Work 9.4: Conceptual Review for Final

[Use the following scenario for questions 1-4] Researchers manipulate noise level (5,10,15, 20 decibels) and test for an impact on reading comprehension among college students.

1. Which of the following would increase the treatment effect?

   a. changing the levels to 15, 20, 25, 30
   b. changing the levels to 5, 15, 25, 35
   c. using more subjects
   d. decreasing MS_{BG}
   e. a & b

2. Which of the following would decrease sampling error?

   a. making the sound quality more soothing
   b. using a variety of reading materials to test reading comprehension
   c. removing other possible distractions
   d. getting more power
   e. increasing MS_{BG}

3. Which of the following pairs of reading comprehension scores (for groups 1 & 2) show a large MS_{BG} and a small MS_{WG}?

   a. 10,20,10,15 and 20,10,20,15
   b. 5,10,5,15 and 40,45,40,35
   c. 5,30,10,5 and 40,70,80,40
   d. 10,30,5,40 and 20,40,20,80

4. If the ANOVA is significant, the experimenter will calculate a _____ to examine difference between means and a _____ to assess practical significance.

   a. η^2 ; post hoc
   b. post hoc ; coefficient of determination
   c. F ; η^2
   d. post hoc ; η^2
   e. (nothing needed); post hoc

5. A researcher is testing whether social anxiety correlates with alcohol consumption. Which of the following would make it more likely that she could reject the null hypothesis?

   a. large sample; small r
   b. large ρ ; large sample.
   c. large r ; small ρ
   d. large Sy'; large sample
   e. small Sy' and shallow slope of regression line
   f. small p ; large Sy'

6. A researcher hopes to show that students studying 50 or more hours for the Baadwidnoombrs quantitative ability test do better than the overall average (50 points, with a known σ). Which of the following makes it more likely he and his pet parrot can reject the Ho?

   a. The scores of participants who study have lower variability
   b. The scores of participants who study have higher variability
   c. The scores of the general population have lower variability
   d. The scores of the general population have higher variability
   e. The difference between sx and σx is small
   f. The difference between sx and σx is large

7. Which of the following will increase power?
   a. Increase MS_{BG}; Increase MS_{WG}
   b. Increase treatment; Increase MS_{WG}
   c. Decrease sampling error; Decrease treatment error
   d. Decrease MS_{BG}; Decrease MS_{WG}
   e. Increase MS_{BG}; Decrease error

8. As $t_{critical}$ increases, _____
   a. t_{obt} decreases
   b. treatment effect increases
   c. rejection of Ho becomes less likely
   d. power becomes more likely
   e. size of d likely increases

9. As sampling error increases
   a. t_{obt} decreases
   b. treatment increases
   c. t_{crit} increases
   d. d increases
   e. t_{obt} remains unchanged

10. When doing correlation & regression we become more likely to reject Ho when
    a. Sy' increases
    b. r gets smaller
    c. r^2 gets smaller
    d. prediction error decreases
    e. slope of regression line gets flatter

11. For a given distribution, relative to variance
    a. SS is larger
    b. s_x is larger
    c. $\Sigma(x-x_{bar})$ is larger
    d. $\Sigma(x-\mu)$ is larger
    e. $\sqrt{s_x^2}$ is larger

12. As r increases
    a. prediction accuracy decreases
    b. the likelihood of ρ=0 increases
    c. Sy decreases
    d. Sy' increases
    e. β decreases
    f. the chance of rejecting Ho increases

13. If we reject Ho, we then calculate an _____ _____ statistic. [2 words]
14. Deciding whether an observed correlation indicates an actual correlation in the population requires the process of _____ _____. [2 words]
15. As β decreases _____ increases.
16. _____ represents the chance of a Type I error. [symbol]
17. If the effect of one IV depends upon the level of another IV we call that a(n) _____ effect [2-words].
18. With a z or t-test, standard error tells us the _____ _____ [2 words] based on sampling error alone.
19. The t-test differs from the z because we must estimate _____ _____. [First 2 words of name]
20. When doing regression, the variability around the regression line is expressed by _____. [symbol]

Homey Work 9.4: Conceptual Review for Final - Key

[Use the following scenario for questions 1-4] Researchers manipulate noise level (5,10,15, 20 decibels) and test for an impact on reading comprehension among college students.

1. Which of the following would increase the treatment effect?

   a. changing the levels to 15, 20, 25, 30
   b. changing the levels to 5, 15, 25, 35
   c. using more subjects
   d. decreasing MS_{BG}
   e. a & b

2. Which of the following would decrease sampling error?

   a. making the sound quality more soothing
   b. using a variety of reading materials to test reading comprehension
   c. removing other possible distractions
   d. getting more power
   e. increasing MS_{BG}

3. Which of the following pairs of reading comprehension scores (for groups 1 & 2) show a large MS_{BG} and a small MS_{WG}?

   a. 10,20,10,15 and 20,10,20,15
   b. 5,10,5,15 and 40,45,40,35
   c. 5,30,10,5 and 40,70,80,40
   d. 10,30,5,40 and 20,40,20,80

4. If the ANOVA is significant, the experimenter will calculate a _____ to examine difference between means and a _____ to assess practical significance.

   a. η^2 ; post hoc
   b. post hoc ; coefficient of determination
   c. F ; η^2
   d. post hoc ; η^2
   e. (nothing needed); post hoc

5. A researcher is testing whether social anxiety correlates with alcohol consumption. Which of the following would make it more likely that she could reject the null hypothesis?

   a. large sample; small r
   b. large ρ ; large sample
   c. large r ; small ρ
   d. large Sy'; large sample
   e. small Sy' and shallow slope of regression line
   f. small p ; large Sy'

6. A researcher hopes to show that students studying 50 or more hours for the Baadwidnoombrs quantitative ability test do better than the overall average (50 points, with a known σ). Which of the following makes it more likely he and his pet parrot can reject the Ho?

   a. The scores of participants who study have lower variability
   b. The scores of participants who study have higher variability
   c. The scores of the general population have lower variability
   d. The scores of the general population have higher variability
   e. The difference between sx and σx is small
   f. The difference between sx and σx is large

7. Which of the following will increase power?
   a. Increase MS_{BG}; Increase MS_{WG}
   b. Increase treatment; Increase MS_{WG}
   c. Decrease sampling error; Decrease treatment error
   d. Decrease MS_{BG}; Decrease MS_{WG}
   e. Increase MS_{BG}; Decrease error

8. As $t_{critical}$ increases, _____
   a. t_{obt} decreases
   b. treatment effect increases
   c. rejection of Ho becomes less likely
   d. power becomes more likely
   e. size of d likely increases

9. As sampling error increases
   a. t_{obt} decreases
   b. treatment increases
   c. t_{crit} increases
   d. d increases
   e. t_{obt} remains unchanged

10. When doing correlation & regression we become more likely to reject Ho when
    a. Sy' increases
    b. r gets smaller
    c. r^2 gets smaller
    d. prediction error decreases
    e. slope of regression line gets flatter

11. For a given distribution, relative to variance
    a. SS is larger
    b. s_x is larger
    c. $\Sigma(x-x_{bar})$ is larger
    d. $\Sigma(x-\mu)$ is larger
    e. $\sqrt{s_x^2}$ is larger

12. As r increases
    a. prediction accuracy decreases
    b. the likelihood of ρ=0 increases
    c. Sy decreases
    d. Sy' increases
    e. β decreases
    f. the chance of rejecting Ho increases

13. If we reject Ho, we then calculate an __effect size_____ _____ statistic. [2 words]
14. Deciding whether an observed correlation indicates an actual correlation in the population requires the process of _____hypothesis testing_____ _____. [2 words]
15. As β decreases _____power_____ increases.
16. __ α _____ represents the chance of a Type I error. [symbol]
17. If the effect of one IV depends upon the level of another IV we call that a(n) _____interaction_____ effect.
18. With a z or t-test, standard error tells us the __difference expected____ [2 words] based on sampling error alone.
19. The t-test differs from the z because we must estimate __standard error__. [First 2 words of name]
20. When doing regression, the variability around the regression line is expressed by _Sy'_____. [symbol]

Homework 10.1: Journal Reading

This exercise requires you to read and interpret actual passages regarding statistics from real psychological research journals. In several cases you will need to extrapolate on what you've learned and make your best guess. The purpose is to help prepare you for reading research articles in preparation for conducting your own research project in PSYC 302, Research Methods.

Article #1: Banerjee, P., Chatterjee, P., & Sinha, J. (2012). Is It Light or Dark? Recalling Moral Behavior Changes Perception of Brightness. Psychological Science. ✦ HELPFUL HINTS: These authors hypothesize that people unconsciously associate bad behavior with darkness and good behavior with light. They prime people to think about one or the other and then see if this affects their perceptions and preferences regarding light.

1. IV: _____
2. DV: _____ _____
3. Obtained t value: _____
4. Type of t-test: _____
5. Mean for the ethical condition _____
6. Was there a treatment effect? _____
7. Based on the effect size statistic, how many standard deviation units of difference does the IV cause? _____
8. The effect size is _____.

Study 1: "Forty participants at a large public university participated in this study in return for partial course credit. We asked participants to recall and describe in detail either an ethical or an unethical deed from their past and to describe any feelings or emotions associated with it (Zhong & Liljenquist, 2006). After completing a filler task, participants were asked to judge the brightness of the room, using a 7-point scale (1 = low, 7 = high). A t test revealed a significant difference in perception of the room's brightness between the two conditions (ethical condition: M = 5.3; unethical condition: M = 4.71), t(38) = 2.03, p < .05, Cohen's d = 0.65. As predicted, participants in the unethical condition judged the room to be darker than did participants in the ethical condition. In our next study, we sought to extend these findings by testing whether participants who recalled unethical behavior, relative to those who recalled ethical behavior, exhibited a greater preference for light-producing objects (i.e., lamp, candle, and flashlight) that would brighten the room."

9. DV for brightness perception: _____
10. How big of difference did they find in perception of brightness? (State the statistic and its value): _____
11. What was the preference for the lamp in the ethical condition vs. the unethical condition: _____vs._ _____
12. The largest effect size was for which object? _____
13. For which objects were there no significant differences? _____
14. Why would the above objects not show a significant difference? _____

Study 2: "Seventy-four students participated in this study in return for partial course credit. As in Study 1, we asked participants to recall and describe either an unethical or an ethical deed from their past, as well as the feelings or emotions they associated with it. Next, participants were asked to indicate their preferences for the following products: a jug, a lamp, crackers, a candle, an apple, and a flashlight. Responses were made using 7-point scales (1 = low, 7 = high). We also asked participants to estimate (in watts) the brightness of the light in the lab. As expected, participants in the unethical condition found the lab to be darker than did participants in the ethical condition (ethical condition: M = 87.6 W; unethical condition: M = 74.3 W), t(72) = 2.7, p < .01, d = 0.64. Moreover, as predicted, participants in the unethical condition demonstrated greater preference for the light-related objects (but not the other objects): lamp (ethical condition: M = 2.34; unethical condition: M = 4.16), t(72) = 5.23, p < .0001, d = 1.23; candle (ethical condition: M = 2.37; unethical condition: M = 3.62), t(72) = 3.36, p < .01, d = 0.79; and flashlight (ethical condition: M = 2.35; unethical condition: M = 4.33), t(72) = 5.68, p < .0001, d = 1.33."

Article #2: Eppig, C., Fincher, C. L., & Thornhill, R. (2011). Parasite prevalence and the distribution of intelligence among the states of the USA. Intelligence, 39(2–3), 155–160. HELPFUL HINTS: ✦ The authors hypothesize that in early childhood development the body makes a trade-off between maximizing brain functioning and maximizing immune system functioning. If the body detects a high parasite-stress environment, it will devote more resources to the immune system, thereby sacrificing a some level of intelligence. They therefore predict that people will be less intelligent in regions of the country where there are more risks from parasites (typically those areas that are closer to the equator – that is, lower in latitude). ✦ They conduct a hierarchical regression which tries to control for other potential variables (e.g., educational quality) that could provide another explanation for the relationship between IQ and parasite-stress).

15. Parasite-stress (PS) correlated with what geographical variable? _____
16. As you head south, PS _____.
17. What amount of variance in PS could you account for with latitude: _____.

Excerpt from literature review. Hint: The authors are providing evidence that their measure of parasite-stress (i.e., the level of risk for a parasite infection in a given area) measures what it is supposed to. ✦ "This index of parasite-stress, Parasite-Stress USA, is validated by the fact that it shows a negative correlation with latitude (−0.45, n=50, and p=0.001; or after removing the latitudinal outliers Alaska and Hawaii, −0.71, n=48, and p=0.0001) just as do global measures of parasite-stress (Cashdan, 2001; Guernier, Hochberg, & Guégan, 2004; Low, 1990). Furthermore,

18. What's the correlation between PS and life expectancy? _____
19. At what level was this relationship significant? _____
20. Which variable was standardized? _____

Parasite-Stress USA was correlated strongly and negatively across US states with the average lifespan expectancy at birth for both sexes in the year 2000 according to data we collected from www.census.gov (r=−0.67, n=50, and p=0.0001). Similar strong relationships between infectious disease stress and lifespan expectancy are found in cross-national analyses (Thornhill et al., 2009). This variable was z-scored (mean= −0.0044, median=−0.023, and SD=0.91). See Fincher and Thornhill (in press) for further details and data."

21. What's the cor. between IQ and PS?_____
22. What percent of variance in IQ can you account for with PS? _____
23. The reason n=50 is because that's the number of _____.
24. Based on the regression line, if PS is 2 standard deviations above average, the average IQ should be just a little above _____.
25. What's the next best predictor of IQ? _____
26. Besides the PS, the only other negative correlation with IQ is with _____.

Excerpt from Results:
"Average state IQ and parasite stress correlated at r=−0.67 (n=50, and p=0.0001; Fig. 1). Average IQ also correlated significantly with wealth (r=0.32, n=50, and p=0.025), percent of teachers highly qualified (r=0.42, n=50, and p=0.0023), and student–teacher ratio (r=−0.31, n=50, and p=0.031) (see Table 1 for additional correlations).

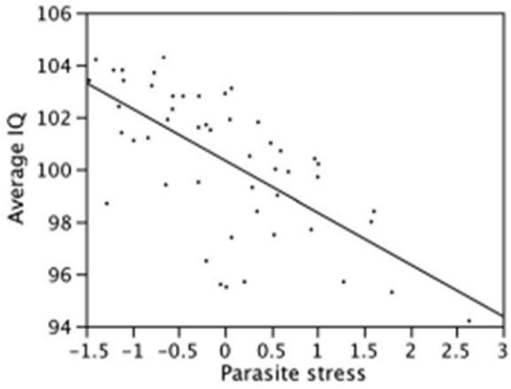


Fig. 1. Bivariate relationship between average U.S. state IQ and infectious disease stress. Average state IQ and parasite stress correlated at r = −0.67 (n = 50, and p<0.0001). The line is the least-squares line through the points.

Table 1
Zero-order correlations among all variables.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Average IQ		−0.67**	−0.31*	0.42*	0.27†	0.34*	0.28*	0.32*
2. Parasite stress			−0.0069	−0.11	−0.15	−0.047	0.013	−0.065
3. Student–teacher ratio				−0.35*	0.12	−0.0007	0.020	0.052
4. Percent of teachers highly qualified					−0.23	−0.07	0.029	−0.049
5. Median household income						0.88**	0.77**	0.95**
6. Income per capita							0.80**	0.95**
7. Gross state product								0.91**
8. Wealth								

All others p>0.10. All n = 50.
** p<0.001.
* p<0.05.
† p<0.1.

27. What's the cor. IQ and Med. Household income? _____ Is it significant? _____
28. What's the best predictor of Household income? _____ What's the r value? _____
29. The relationship between IQ and household income isn't sig., but _____.
30. If a relationship has two asterisks it's significant at the _____ level.

31. What's the amount of variance accounted for in IQ after entering just PS in the first step? _____
32. What does the amount of variance accounted for reach after everything is entered in the third step? _____
33. Is PS still significant after they've controlled for wealth, education, etc.? _____

Excerpt from Results: Hierarchical regression was used to predict average state IQ using parasite stress, wealth, percent of teachers highly qualified, and student/teacher ratio (Table 2). Parasite stress was added in the first iteration of the model, resulting in a change in R^2 of 0.445. Wealth was added in the second iteration of the model, resulting in a change in R^2 of 0.075. Both education variables were added simultaneously in the third iteration of the model because they both measure the same theoretical construct, resulting in a change in R^2 of 0.133. While these variables were added into the model in order of presumed causal priority, adding these variables in a different order did not appreciably change the additive R^2 of each iteration. In the final model, parasite stress (Std Beta= −0.62, variance inflation factor (VIF)=1.02, and p=0.0001), wealth (Std Beta=0.30, VIF=1.00, and p=0.0006), percent of teachers highly qualified (Std Beta=0.29, VIF=1.16, and p=0.0019), and student/teacher ratio (Std Beta=−0.22, VIF=1.15, and p=0.015) (Table 3) were all significant predictors of average state IQ. The whole model R^2 was 0.698 (p=0.0001)." Also see Table 2 below.

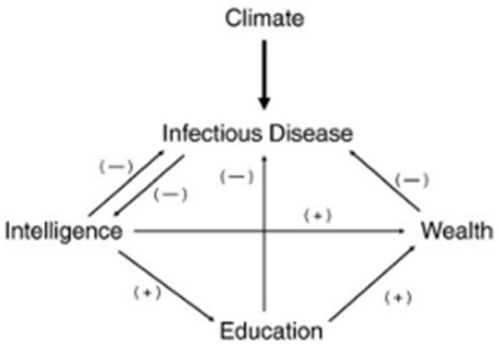


Fig. 2. The directions of influences predicted by our hypothesis among climate, infectious disease, intelligence, education, and wealth.

Table 2
Hierarchical regression model predicting average state IQ.

Model	Term	p	R^2	change in R^2
1		<0.0001	0.445	0.445
	Parasites	<0.0001		
2		<0.0001	0.520	0.075
	Parasites	<0.0001		
	Wealth	0.0094		
3		<0.0001	0.698	0.133
	Parasites	<0.0001		
	Wealth	0.0006		
	HQT	0.0019		
	STR	0.015		

HQT = percent of teachers highly qualified; and STR = student/teacher ratio.

Answer the following based on the above model (not your own intuition).

34. What's the fundamental driver of infectious disease risk? _____
35. What's the direction of relationship between education and infectious disease risk? _____
36. As infectious disease risk increases, wealth _____
37. Can education increase intelligence? _____
38. As intelligence increases, what happens to infectious disease risk? _____. Speculate below on why they might suggest this relationship:

Homework 10.1: Journal Reading -Key

This exercise requires you to read and interpret actual passages regarding statistics from real psychological research journals. In several cases you will need to extrapolate on what you've learned and make your best guess. The purpose is to help prepare you for reading research articles in preparation for conducting your own research project in PSYC 302, Research Methods.

Article #1: Banerjee, P., Chatterjee, P., & Sinha, J. (2012). Is It Light or Dark? Recalling Moral Behavior Changes Perception of Brightness. Psychological Science. ✦ HELPFUL HINTS: These authors hypothesize that people unconsciously associate bad behavior with darkness and good behavior with light. They prime people to think about one or the other and then see if this affects their perceptions and preferences regarding light.

1. IV: __recalling (un)ethical deed_
2. DV: __brightness perception, 1-7 scale____
3. Obtained t value: __2.03____
4. Type of t-test: ____Independent_____
5. Mean for the ethical condition __5.3____
6. Was there a treatment effect? __Yes___
7. Based on the effect size statistic, how many standard deviation units of difference does the IV cause? __0.65____
8. The effect size is ___Medium____.

Study 1: "Forty participants at a large public university participated in this study in return for partial course credit. We asked participants to recall and describe in detail either an ethical or an unethical deed from their past and to describe any feelings or emotions associated with it (Zhong & Liljenquist, 2006). After completing a filler task, participants were asked to judge the brightness of the room, using a 7-point scale (1 = low, 7 = high). A t test revealed a significant difference in perception of the room's brightness between the two conditions (ethical condition: M = 5.3; unethical condition: M = 4.71), t(38) = 2.03, p < .05, Cohen's d = 0.65. As predicted, participants in the unethical condition judged the room to be darker than did participants in the ethical condition. In our next study, we sought to extend these findings by testing whether participants who recalled unethical behavior, relative to those who recalled ethical behavior, exhibited a greater preference for light-producing objects (i.e., lamp, candle, and flashlight) that would brighten the room."

9. DV for brightness perception: __estimated Wattage___
10. How big of difference did they find in perception of brightness? (State the statistic and its value): _d=0.64__
11. What was the preference for the lamp in the ethical condition vs. the unethical condition: _M=2.34__vs._ _M=4.16__
12. The largest effect size was for which object? __Flashlight___
13. For which objects were there no significant differences? __Jug, Crackers, Apple___
14. Why would the above objects not show a significant difference? _They do not give off light.__

Study 2: "Seventy-four students participated in this study in return for partial course credit. As in Study 1, we asked participants to recall and describe either an unethical or an ethical deed from their past, as well as the feelings or emotions they associated with it. Next, participants were asked to indicate their preferences for the following products: a jug, a lamp, crackers, a candle, an apple, and a flashlight. Responses were made using 7-point scales (1 = low, 7 = high). We also asked participants to estimate (in watts) the brightness of the light in the lab. As expected, participants in the unethical condition found the lab to be darker than did participants in the ethical condition (ethical condition: M = 87.6 W; unethical condition: M = 74.3 W), t(72) = 2.7, p < .01, d = 0.64. Moreover, as predicted, participants in the unethical condition demonstrated greater preference for the light-related objects (but not the other objects): lamp (ethical condition: M = 2.34; unethical condition: M = 4.16), t(72) = 5.23, p < .0001, d = 1.23; candle (ethical condition: M = 2.37; unethical condition: M = 3.62), t(72) = 3.36, p < .01, d = 0.79; and flashlight (ethical condition: M = 2.35; unethical condition: M = 4.33), t(72) = 5.68, p < .0001, d = 1.33."

Article #2: Eppig, C., Fincher, C. L., & Thornhill, R. (2011). Parasite prevalence and the distribution of intelligence among the states of the USA. Intelligence, 39(2–3), 155–160. HELPFUL HINTS: ✦ The authors hypothesize that in early childhood development the body makes a trade-off between maximizing brain functioning and maximizing immune system functioning. If the body detects a high parasite-stress environment, it will devote more resources to the immune system, thereby sacrificing a some level of intelligence. They therefore predict that people will be less intelligent in regions of the country where there are more risks from parasites (typically those areas that are closer to the equator – that is, lower in latitude). ✦ They conduct a hierarchical regression which tries to control for other potential variables (e.g., educational quality) that could provide another explanation for the relationship between IQ and parasite-stress).

15. Parasite-stress (PS) correlated with what geographical variable? ___Latitude____
16. As you head south, PS __Increases____.
17. What amount of variance in PS could you account for with latitude: __20.25%____.
18. What's the correlation between PS and life expectancy? ___r=-0.67____
19. At what level was this relationship significant? ____p<.001_____
20. Which variable was standardized? __parasite stress_

Excerpt from literature review. Hint: The authors are providing evidence that their measure of parasite-stress (i.e., the level of risk for a parasite infection in a given area) measures what it is supposed to. ✦ "This index of parasite-stress, Parasite-Stress USA, is validated by the fact that it shows a negative correlation with latitude (−0.45, n=50, and p=0.001; or after removing the latitudinal outliers Alaska and Hawaii, −0.71, n=48, and p=0.0001) just as do global measures of parasite-stress (Cashdan, 2001; Guernier, Hochberg, & Guégan, 2004; Low, 1990). Furthermore, Parasite-Stress USA was correlated strongly and negatively across US states with the average lifespan expectancy at birth for both sexes in the year 2000 according to data we collected from www.census.gov (r=−0.67, n=50, and p=0.0001). Similar strong relationships between infectious disease stress and lifespan expectancy are found in cross-national analyses (Thornhill et al., 2009). This variable was z-scored (mean= −0.0044, median=−0.023, and SD=0.91). See Fincher and Thornhill (in press) for further details and data."

21. What's the cor. between IQ and PS? __-0.67_
22. What percent of variance in IQ can you account for with PS? ___44.89%_____
23. The reason n=50 is because that's the number of ___US states_____.
24. Based on the regression line, if PS is 2 standard deviations above average, the average IQ should be just a little above _96__.
25. What's the next best predictor of IQ? _percent of teachers highly qualified_
26. Besides PS, the only other negative correlation with IQ is with __student-teacher ratio_

Excerpt from Results: "Average state IQ and parasite stress correlated at r=−0.67 (n=50, and p=0.0001; Fig. 1). Average IQ also correlated significantly with wealth (r=0.32, n=50, and p=0.025), percent of teachers highly qualified (r=0.42, n=50, and p=0.0023), and student–teacher ratio (r=−0.31, n=50, and p=0.031) (see Table 1 for additional correlations).

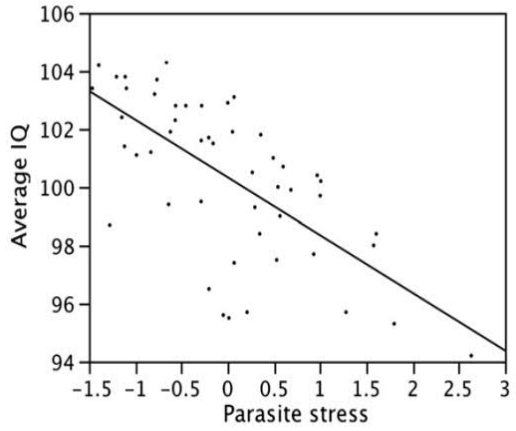


Fig. 1. Bivariate relationship between average U.S. state IQ and infectious disease stress. Average state IQ and parasite stress correlated at r = −0.67 (n = 50, and p < 0.0001). The line is the least-squares line through the points.

Table 1
Zero-order correlations among all variables.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Average IQ		−0.67**	−0.31*	0.42*	0.27†	0.34*	0.28*	0.32*
2. Parasite stress			−0.0069	−0.11	−0.15	−0.047	0.013	−0.065
3. Student–teacher ratio				−0.35*	0.12	−0.0007	0.020	0.052
4. Percent of teachers highly qualified					−0.23	−0.07	0.029	−0.049
5. Median household income						0.88**	0.77**	0.95**
6. Income per capita							0.80**	0.95**
7. Gross state product								0.91**
8. Wealth								

All others p>0.10. All n = 50.
** p<0.001.
* p<0.05.
† p<0.1.

28. What's the cor. IQ and Med. Household income? ___0.27_____ Is it significant? __No_____
29. What's the best predictor of Household income? __Wealth or Income per capita_ What's the r value? __0.95__
30. The relationship between IQ and household income isn't sig., but ____it's close, p<.10 _____.
31. If a relationship has two asterisks it's significant at the __p<.001____ level.

32. What's the amount of variance accounted for in IQ after entering just PS in the first step? _____ R^2= 0.445_____
33. What does the amount of variance accounted for reach after everything is entered in the third step? __ R^2= 0.698_____
34. Is PS still significant after they've controlled for wealth, education, etc.? ___Yes_____

Excerpt from Results: Hierarchical regression was used to predict average state IQ using parasite stress, wealth, percent of teachers highly qualified, and student/teacher ratio (Table 2). Parasite stress was added in the first iteration of the model, resulting in a change in R^2 of 0.445. Wealth was added in the second iteration of the model, resulting in a change in R^2 of 0.075. Both education variables were added simultaneously in the third iteration of the model because they both measure the same theoretical construct, resulting in a change in R^2 of 0.133. While these variables were added into the model in order of presumed causal priority, adding these variables in a different order did not appreciably change the additive R^2 of each iteration. In the final model, parasite stress (Std Beta= −0.62, variance inflation factor (VIF)=1.02, and p=0.0001), wealth (Std Beta=0.30, VIF=1.00, and p=0.0006), percent of teachers highly qualified (Std Beta=0.29, VIF=1.16, and p=0.0019), and student/teacher ratio (Std Beta=−0.22, VIF=1.15, and p=0.015) (Table 3) were all significant predictors of average state IQ. The whole model R^2 was 0.698 (p=0.0001)." Also see Table 2 below.

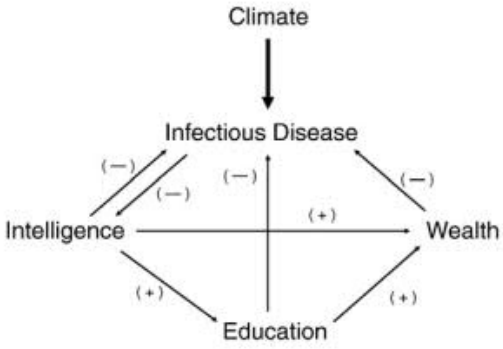


Fig. 2. The directions of influences predicted by our hypothesis among climate, infectious disease, intelligence, education, and wealth.

Table 2
Hierarchical regression model predicting average state IQ.

Model	Term	p	R^2	change in R^2
1		<0.0001	0.445	0.445
	Parasites	<0.0001		
2		<0.0001	0.520	0.075
	Parasites	<0.0001		
	Wealth	0.0094		
3		<0.0001	0.698	0.133
	Parasites	<0.0001		
	Wealth	0.0006		
	HQT	0.0019		
	STR	0.015		

HQT = percent of teachers highly qualified; and STR = student/teacher ratio.

Answer the following based on the above model (not your own intuition).

35. What's the fundamental driver of infectious disease risk? ____Climate?_____
36. What's the direction of relationship between education and infectious disease risk? ____Negative_____
37. As infectious disease risk increases, wealth ____Decreases_____
38. Can education increase intelligence? ___No, the model shows causality running from Intelligence to Education_____
39. As intelligence increases, what happens to infectious disease risk? _Decreases?__. Speculate below on why they might suggest this relationship: As intelligence increases, people invest more resources in public health and prevention (e.g., vaccinations).

Homework 10.2: Conceptual Final Review, MC & FIB practice

1) A researcher tested whether participants would recommend longer prison sentences if the description of the crime was paired with a disgusting smell. Which of the following would increase the treatment effect?
   a) more serious crimes
   b) more disgusting crimes
   c) more disgusting odors
   d) standardize smelling ability (e.g., no people with colds)
   e) standardize participants (e.g., no law enforcement people)

2) An educational psychologist examined the effect of peer teaching on writing skills. She randomly placed students in freshman composition into one of three groups, 0, 5, or 10 hours peer teaching, and then compared grades on final papers at the semester's end. Which of the following would likely decrease MSwg?
   a) including a wider range of students in the study
   b) giving more guidance in effective peer teaching
   c) switching to 0, 10, and 20 hrs of peer teaching
   d) basing the assessment on two final papers (averaged together) rather than just one

3) Which of the following is affected by treatment effect?
   a) MS_{bg}
   b) df_{bg}
   c) MS_{wg}
   d) SS_{wg}
   e) a & b

4) Conceptually, _____ influences both the top and bottom portions of the F ratio
   a) df_{bg}
   b) dg_{wg}
   c) sampling error
   d) sample size
   e) treatment effect

5) The statistic η^2 is a measure of …
   a) practical significance
   b) statistical significance
   c) sampling error
   d) power

6) In a 2-way ANOVA, we do a _____ test if there are 3 or more _____ of an IV.
   a) post-hoc, factors
   b) η^2, levels
   c) η^2, factors
   d) post-hoc, levels

7) Variance is defined as the
   a) square root of the average deviation around the mean
   b) square root of the average squared deviation around the mean
   c) average of the squared deviations around the mean
   d) sum of the squared deviations around the mean

8) When doing a t-test, t_{obt} will get larger if
   a) treatment effect increases
   b) sampling error increases
   c) $t_{critical}$ decreases
   d) α increases
   e) the observed difference gets smaller

9) Retaining the Ho means:
   a) You claim the sample comes from an alternative distribution
   b) Power was too large
   c) There is no chance of a treatment effect being present
   d) There is no chance of a Type I error

10) If God tells you that for a given t-test the true treatment effect for the sample is zero, then the true treatment effect is
   a) $d = 1$
   b) $d = 0$
   c) $d < .05$
   d) $d > 0$

11) A t-test is less powerful than a z-test because it
   a) use more degrees of freedom
   b) estimates standard error
   c) estimates the treatment effect
   d) requires a larger n

12) With a t-test, as n decreases the shape of the distribution becomes
   a) more like a z-distribution
   b) more accurate
   c) shorter in the middle and taller at the tails
   d) more like an F distribution

13) A researcher tests whether a sample (n=16) of students from Hogwartz High do significantly better on an end of grade test (M=107) than normal (μ = 88). Rejecting the Ho in this case means
   a) concluding that the true population is $\mu = 88$
   b) there's no sampling error
   c) β is large
   d) claiming $\rho \neq 0$
   e) claiming $d > 0$

14) If the variance accounted for in openness by promotion motivation increases from .29 to .45, then _____ is decreasing.
   a) r^2
   b) Sy'
   c) the slope of the line
   d) Sy

15) A researcher examines the effect of meditation type (mindfulness, mantra, and movement) on insomnia, measuring hours slept per night. Which of the following would increase power?
   a) Including people with a wide variety of sleep disorders
   b) Decrease α
   c) Increase β
   d) Accept only people with moderate intelligence
   e) Ensure that participants are practicing the meditation regiment as directed

16) A researcher examines the effect of meditation type (mindfulness, mantra, and movement) on insomnia, measuring hours slept per night. Which of the following would determine which groups differed significantly?
   a) F-test
   b) t-test
   c) post hoc
   d) d
   e) η^2

17) A researcher examines the effect of meditation type (mindfulness, mantra, and movement) on insomnia, measuring hours slept per night. If the researcher rejects the Ho when in fact meditation has no impact on sleep, which of the following is/are true?
   a) the true treatment effect is zero
   b) A type I error has occurred
   c) Beta = 1
   d) the researcher is probably a bad person
   e) a & b
   f) a, b, & c

18) When doing a t-test, if the treatment effect gets stronger then
   a) t-critical increases
   b) df decreases
   c) t obtained decreases
   d) the difference expected increases
   e) the difference observed increases
   f) a & b

19) A χ^2 is performed with data at the _____ level of measurement

20) The χ^2 test for _____ is similar to how a two-way Anova can detect an interaction.

21) In a 2-way ANOVA notation MS stands for _____ and SS stands for _____.

22) A(n) _____ graphs the frequency distribution of observed scores using vertical, touching columns.

23) If treatment effect increases dramatically when conducting an F-test, then _____ should increases and _____ should stay the same.

24) If the data are normal distributed, the _____ is the preferred measure of central tendency.

25) A _____ converts a raw score to a standard score (with a mean of zero and a standard deviation of 1).

26) In calculating an ANOVA, you compute MS by dividing _____ by _____.

27) In a 2-way ANOVA, there are 3 F tests, which could produce three different _____[one word] -- one for each of the 3 _____ [one word].

28) In a 2-way ANOVA, there are two possible _____ effects and one possible _____ effect.

29) The "design" of a 2-way ANOVA concerns the respective _____ of the two IVs.

30) To consider the main effect for factor A requires _____across the levels of factor B when looking at the relevant means.

31) If a frequency distribution showed 2 distinct peaks we might consider the _____ as the best measure of central tendency.

32) If you reject the Ho, you might make a _____ decision making error.

33) As the slope of the regression line increases, r^2 will _____.

34) Whereas "r" is a test of _____ significance, r^2 is a test of _____ significance.

Homework 10.2 Conceptual Final Review, MC & FIB practice - Key

1) A researcher tested whether participants would recommend longer prison sentences if the description of the crime was paired with a disgusting smell. Which of the following would increase the treatment effect?
   a) more serious crimes
   b) more disgusting crimes
   c) more disgusting odors
   d) standardize smelling ability (e.g., no people with colds)
   e) standardize participants (e.g., no law enforcement people)

2) An educational psychologist examined the effect of peer teaching on writing skills. She randomly placed students in freshman composition into one of three groups, 0, 5, or 10 hours peer teaching, and then compared grades on final papers at the semester's end. Which of the following would likely decrease MSwg?
   a) including a wider range of students in the study
   b) giving more guidance in effective peer teaching
   c) switching to 0, 10, and 20 hrs of peer teaching
   d) basing the assessment on two final papers (averaged together) rather than just one

3) Which of the following is affected by treatment effect?
   a) MS_{bg}
   b) df_{bg}
   c) MS_{wg}
   d) SS_{wg}
   e) a & b

4) Conceptually, _____ influences both the top and bottom portions of the F ratio
   a) df_{bg}
   b) dg_{wg}
   c) sampling error
   d) sample size
   e) treatment effect

5) The statistic η^2 is a measure of …
   a) practical significance
   b) statistical significance
   c) sampling error
   d) power

6) In a 2-way ANOVA, we do a _____ test if there are 3 or more _____ of an IV.
   a) post-hoc, factors
   b) η^2, levels
   c) η^2, factors
   d) post-hoc, levels

7) Variance is defined as the
   a) square root of the average deviation around the mean
   b) square root of the average squared deviation around the mean
   c) average of the squared deviations around the mean
   d) sum of the squared deviations around the mean

8) When doing a t-test, t_{obt} will get larger if
   a) treatment effect increases
   b) sampling error increases
   c) $t_{critical}$ decreases
   d) α increases
   e) the observed difference gets smaller

9) Retaining the Ho means:
   a) You claim the sample comes from an alternative distribution
   b) Power was too large
   c) There is no chance of a treatment effect being present
   d) There is no chance of a Type I error

10) If God tells you that for a given t-test the true treatment effect for the sample is zero, then the true treatment effect is
   a) $d = 1$
   b) $d = 0$
   c) $d < .05$
   d) $d > 0$

11) A t-test is less powerful than a z-test because it
   a) use more degrees of freedom
   b) estimates standard error
   c) estimates the treatment effect
   d) requires a larger n

12) With a t-test, as n decreases the shape of the distribution becomes
   a) more like a z-distribution
   b) more accurate
   c) shorter in the middle and taller at the tails
   d) more like an F distribution

13) A researcher tests whether a sample (n=16) of students from Hogwartz High do significantly better on an end of grade test (M=107) than normal (μ = 88). Rejecting the Ho in this case means
   a) concluding that the true population is $\mu = 88$
   b) there's no sampling error
   c) β is large
   d) claiming $\rho \neq 0$

e) claiming d > 0

14) If the variance accounted for in openness by promotion motivation increases from .29 to .45, then _____ is decreasing.
   a) r^2
   b) Sy'
   c) the slope of the line
   d) β

15) A researcher examines the effect of meditation type (mindfulness, mantra, and movement) on insomnia, measuring hours slept per night. Which of the following would increase power?
   a) Including people with a wide variety of sleep disorders
   b) Decrease α
   c) Increase β
   d) Accept only people with moderate intelligence
   e) Ensure that participants are practicing the meditation regiment as directed

16) A researcher examines the effect of meditation type (mindfulness, mantra, and movement) on insomnia, measuring hours slept per night. Which of the following would determine which groups differed significantly?
   a) F-test
   b) t-test
   c) post hoc
   d) d
   e) η^2

17) A researcher examines the effect of meditation type (mindfulness, mantra, and movement) on insomnia, measuring hours slept per night. If the researcher rejects the Ho when in fact meditation has no impact on sleep, which of the following is/are true?
   a) the true treatment effect is zero
   b) A type I error has occurred
   c) β = 1
   d) the researcher is probably a bad person
   e) a & b
   f) a, b, & c

18) When doing a t-test, if the treatment effect gets stronger then
   a) t-critical increases
   b) df decreases
   c) t-obtained decreases
   d) the difference expected increases
   e) the difference observed increases
   f) a & b

19) A χ^2 is performed with data at the __nominal_____ level of measurement

20) The χ^2 test for __independence_ is similar to how a two-way Anova can detect an interaction.

21) In a 2-way ANOVA notation MS stands for __means squared__ and SS stands for __sum of squares_.

22) A(n) __histogram__ graphs the frequency distribution of observed scores using vertical, touching columns.

23) If treatment effect increases dramatically when conducting an F-test, then __MSbg___ should increases and _MSwg__ should stay the same.

24) If the data are normal distributed, the _mean_ is the preferred measure of central tendency.

25) A _z-score_ converts a raw score to a standard score (with a mean of zero and a standard deviation of 1).

26) In calculating an ANOVA, you compute MS by dividing __SS__ by __df____.

27) In a 2-way ANOVA, there are 3 F tests, which could produce three different _effects_[one word] -- one for each of the 3 _factors__ [one word].

28) In a 2-way ANOVA, there are two possible _main_ effects and one possible _interaction_ effect.

29) The "design" of a 2-way ANOVA concerns the respective _levels_ of the two IVs.

30) To consider the main effect for factor A requires _collapsing_across the levels of factor B when looking at the relevant means.

31) If a frequency distribution showed 2 distinct peaks we might consider the _mode_ as the best measure of central tendency.

32) If you reject the Ho, you might make a _Type I_ decision making error.

33) As the slope of the regression line increases, r^2 will _increase__.

34) Whereas "r" is a test of _____statistical_____ significance, r^2 is a test of ___practical___ significance.