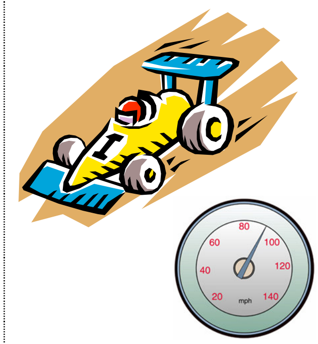
SPSS Guide: One-Sample T-test (*Outcome: H_0 Rejected*)

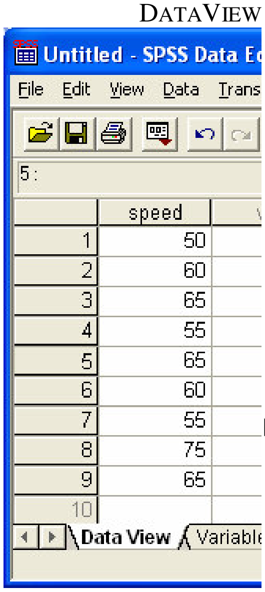
The Government claims cars traveling past your house average **55 mph**, but you think they are actually traveling much faster. You steal a police radar gun and record the speed of the next nine cars that pass your house:

~~45,60,65,55,65,60,50,70,60~~ **50,60,65,55,65,60,55,75,65**. (***Different Data!!)*

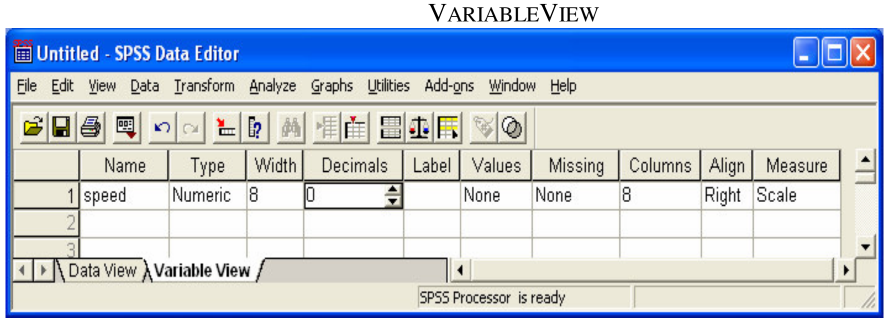
Why a one-sample t-test? You have only one sample, a claimed population average (55 mph), and no information about the standard deviation in the population (σ_x).



DATA VIEW

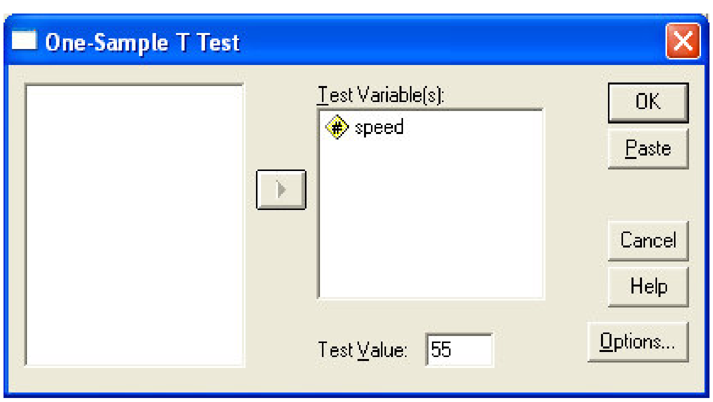


VARIABLE VIEW



You have data on only 1 variable, all from the same group, so you'll use just one column. Switch to **VARIABLE VIEW** to name your variable "speed" and to set the number of decimals to "0". *Hint: Use the tabs at the bottom of the screen to switch back and forth between the DATA VIEW and VARIABLE VIEW when working with your data.*

Same example, but with a different (ie, faster) set of scores.



1. Go to the **Analyze Menu**, select **Compare Means**, then choose **One sample t-test**.
2. Select the variable "speed."
3. Set Test Value equal to μ (in this case 55). *You're testing to see if the data you have could really come from a population with a mean of 55.*

<u>Statistical Hypotheses</u>

H_0: $\mu = 55$ — *This guess says any difference is just due to sample error*

H_A: $\mu \neq 55$ — *This guess says any difference is due to a treatment effect (e.g., if you kept measuring, you'd eventually see a clear partner in which the cars are going faster than 55 on average)*

Formula

Difference observed

$$t_{obtained} = \frac{\bar{x} - \mu}{\hat{s}_{\bar{x}}} = \frac{61.11 - 55}{2.469} = 2.475$$

Difference expected.

$t_{critical} = \pm 2.306$ (from t-test table; df=n-1, two-tailed, α=.05)

SPSS Output

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
speed	9	61.11	7.407	2.469

Comparing to this hypothesized μ

One-Sample Test

	Test Value = 55					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
speed	2.475	8	.038	6.111	.42	11.80

Chance that we'd see a difference between the means just by luck. Because it's less than 5% , we reject Ho and trust the difference as reliable.

Definitions

$\bar{x}$ = sample mean

μ = population mean

$\hat{s}_{\bar{x}}$ = standard error of the mean (as an est.)

N = number of subjects in sample

Mean = $\bar{x}$ (or M) (sample mean)

Std. Deviation = $\hat{s}_x$ (standard deviation as an estimate.)

Std. Error Mean = $\hat{s}_{\bar{x}}$ (standard error of the mean as an est.)

Test Value = μ (the value you selected)

t = $t_{obtained}$

df = degrees of freedom = n - 1

sig = p_{obt} = chance diff due to sampling error

Mean Diff = $\bar{x} - \mu$

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d = effect size, a measure of practical signif.

Practical Significance

$$d = \frac{|\bar{x} - \mu|}{\hat{s}_x} = \frac{|61.11 - 55|}{7.407} = .8249$$

Do only if $t_{obtained}$ exceeds $t_{critical}$. This time we did reject the Ho (we said there was a treatment effect), so we should calculate practical significance (a measure of how big any treatment effect is).The d value of .8249 indicates a large effect.

Summary of Statistic:

Reject Ho $t(8) = 2.475$, $p \leq .05$

This says that the t-test with 8 degrees of freedom was significant – we conclude the sample mean comes from a different population. The $p \leq .05$ means we'll be wrong no more than 5% of the time.

Explanation of Study Outcome: The (research) hypothesis was supported. The average speed of the cars (M = 61.11) was significantly faster than the stated speed (μ = 55), t(8) = 2.475, p ≤ .05. The effect size was large, d=.8249.

Guide to write-ups:

1. *State whether the research hypothesis was supported.*
2. *Summarize the statistical test*
3. *Summarize the practical significance (if appropriate).*