

25. {Electric razor} 26. {Adding machine, Barometer, Pendulum clock, Thermometer} 27. {Electric razor}
 28. Answers will vary. 29. (a) 22 (b) 12 (c) 28 30. (a) 16 (b) 32 (c) 33 (d) 45 (e) 14 (f) 26

CHAPTER 3 Introduction to Logic

3.1 Exercises (Pages 103–104)

1. statement 3. not a statement 5. statement 7. statement 9. statement 11. not a statement
 13. statement 15. compound 17. not compound 19. not compound 21. compound 23. Her aunt's name is not Hildegard.
 25. At least one dog does not have its day. 27. No book is longer than this book.
 29. At least one computer repairman can play poker. 31. Someone does not love somebody sometime.
 33. $x \leq 12$ 35. $x < 5$ 37. Answers will vary. 39. She does not have green eyes. 41. She has green eyes and he is 56 years old.
 43. She does not have green eyes or he is 56 years old. 45. She does not have green eyes or he is not 56 years old.
 47. It is not the case that she does not have green eyes and he is 56 years old.
 49. $p \wedge \sim q$ 51. $\sim p \vee q$ 53. $\sim(p \vee q)$ or, equivalently, $\sim p \wedge \sim q$ 55. Answers will vary.
 57. C 59. A, B 61. A, C 63. B 65. true 67. true 69. true 71. true 73. false
 75. Answers will vary. 77. Everyone here has done that at one time or another.

3.2 Exercises (Pages 115–117)

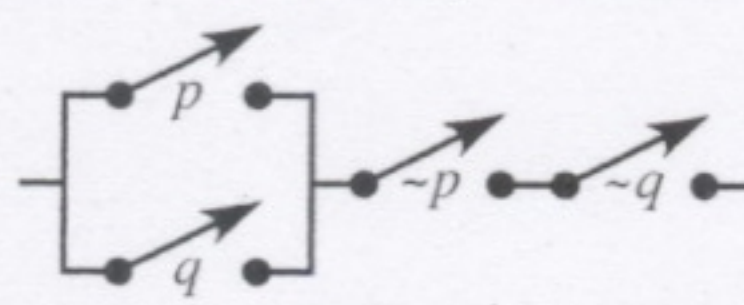
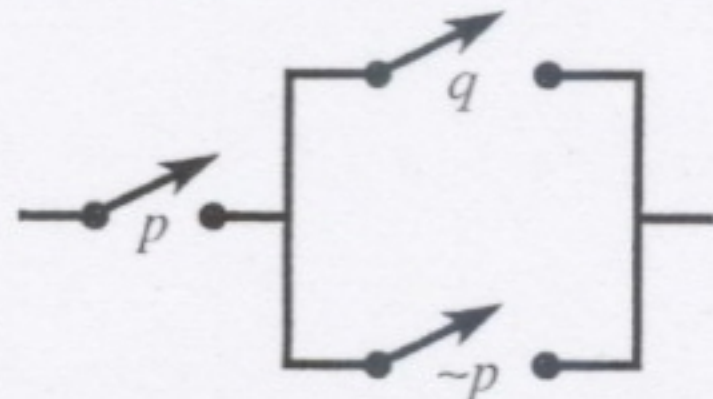
1. false 3. true 5. They must both be false. 7. T 9. T 11. F 13. T 15. T 17. T
 19. It is a disjunction, because it means "5 > 2 or 5 = 2." 21. T 23. F 25. T 27. T 29. F
 31. F 33. T 35. T 37. T 39. 4 41. 16 43. 128 45. seven 47. FFTF 49. FTTT
 51. TTTT 53. FFFT 55. TFFF 57. FFFFTFFF 59. FTFTTTT 61. TTTTTTTTTTTTTTTT
 63. You can't pay me now and you can't pay me later. 65. It is not summer or there is snow. 67. I did not say yes or she did not say no.
 69. $5 - 1 \neq 4$ or $9 + 12 = 7$ 71. Neither Dasher nor Blitzen will lead Santa's sleigh next Christmas. 73. T 75. T 77.

p	q	$p \vee q$
T	T	F
T	F	T
F	T	T
F	F	F

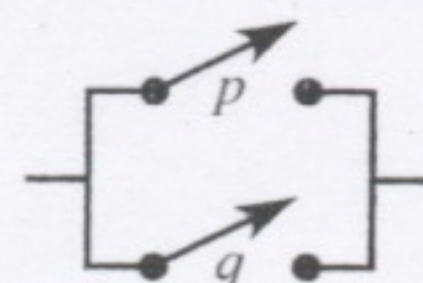
3.3 Exercises (Pages 124–127)

1. If you see it on the Internet, then you can believe it. 3. If the person is Garrett Olinde, then his area code is 225.
 5. If the soldier is a marine, then the soldier loves boot camp. 7. If it is a koala, then it does not live in Iowa.

9. If it is an opium-eater, then it has no self-command. 11. true 13. true 15. true 17. false
 19. Answers will vary. 21. F 23. T 25. T 27. If they do not raise alpacas, then he trains dogs.
 29. If she has a ferret for a pet, then they raise alpacas and he trains dogs. 31. If he does not train dogs, then they do not raise alpacas or she has a ferret for a pet. 33. $b \rightarrow p$ 35. $p \rightarrow \sim r$ 37. $p \wedge (r \rightarrow \sim b)$ 39. $p \rightarrow r$
 41. T 43. F 45. T 47. F 49. T 51. T 53. Answers will vary. 55. TTTF 57. TTFT
 59. TTTT; tautology 61. TFTF 63. TTTTFT 65. TTTFTTTTTTTTTTTT 67. one
 69. That is an authentic Persian rug and I am not surprised. 71. The English measures are not converted to metric measures and the spacecraft does not crash on the surface of Saturn. 73. You want to be happy for the rest of your life and you make a pretty woman your wife. 75. You do not give your plants tender, loving care or they flourish.
 77. She does or he will. 79. The person is not a resident of Oregon City or is a resident of Oregon. 81. equivalent
 83. equivalent 85. equivalent 87. not equivalent 89. equivalent 91. $(p \wedge q) \vee (p \wedge \sim q)$; The statement simplifies to p . 93. $p \vee (\sim q \wedge r)$ 95. $\sim p \vee (p \vee q)$; The statement simplifies to T.
 97. The statement simplifies to $p \wedge q$. 99. The statement simplifies to F.



101. The statement simplifies to $(r \wedge \sim p) \wedge q$. 103. The statement simplifies to $p \vee q$.



3.4 Exercises (Pages 132–134)

1. (a) If you were an hour, then beauty would be a minute. (b) If beauty were not a minute, then you would not be an hour. (c) If you were not an hour, then beauty would not be a minute. 3. (a) If you don't fix it, then it ain't broke. (b) If it's broke, then fix it. (c) If you fix it, then it's broke. 5. (a) If it is dangerous to your health, then you walk in front of a moving car. (b) If you do not walk in front of a moving car, then it is not dangerous to your health. (c) If it is not dangerous to your health, then you do not walk in front of a moving car. 7. (a) If they flock together, then they are birds of a feather. (b) If they are not birds of a feather, then they do not flock together. (c) If they do not flock together, then they are not birds of a feather. 9. (a) If he comes, then you built it. (b) If you don't build it, then he won't come. (c) If he doesn't come, then you didn't build it. 11. (a) $\sim q \rightarrow p$ (b) $\sim p \rightarrow q$ (c) $q \rightarrow \sim p$
 13. (a) $\sim q \rightarrow \sim p$ (b) $p \rightarrow q$ (c) $q \rightarrow p$ 15. (a) $(q \vee r) \rightarrow p$ (b) $\sim p \rightarrow (\sim q \wedge \sim r)$ (c) $(\sim q \wedge \sim r) \rightarrow \sim p$
 17. Answers will vary. 19. If it is muddy, then I'll wear my galoshes. 21. If 18 is positive, then $18 + 1$ is positive. 23. If a number is an integer, then it is a rational number. 25. If I do crossword puzzles, then I am driven crazy. 27. If Gerald Guidroz is to shave, then he must have a day's growth of beard. 29. If I go from Park Place to Baltic Avenue, then I pass GO. 31. If a number is a whole number, then it is an integer. 33. If their pitching improves, then the Orioles will win the pennant. 35. If the figure is a rectangle, then it is a parallelogram with a right angle. 37. If a triangle has two sides of the same length, then it is isosceles. 39. If a two-digit number whose units digit is 5 is squared, then it will end in 25. 41. D 43. Answers will vary. 45. true 47. false
 49. false 51. contrary 53. consistent 55. contrary 57. Answers will vary. One example is: That man is Carter Fenton. That man sells books.

3.5 Exercises (Pages 137–138)

1. valid 3. invalid 5. valid 7. invalid 9. invalid 11. invalid 13. yes
 15. All people with blue eyes have blond hair. 17. invalid 19. valid 21. invalid 23. valid 25. invalid
Dinya Norris does not have blond hair.
 Dinya Norris does not have blue eyes.
 27. invalid 29. valid 31. Answers will vary.

Extension Exercises (Pages 141–144)

1. First, Piotr Knightovich, Yorki; Second, Ivan Rookov, Porki; Third, Boris Bishopnik, Gorki; Fourth, Yuri Pawnchev, Corki. 3. Ben Ashby, Jane Kenny, Dirk and Daisy, American; Hans Gruber, Sue Rogers, Merlyns, English; Peter Owen, Carol Dodds, Starr Twins, own composition; Steven Thorp, Nancy O'Hara, Rose and Thorn, Irish.

5.

7	2	6	4	9	1	5	3	8
9	4	5	8	6	3	2	1	7
8	1	3	7	5	2	4	9	6
6	8	1	3	2	4	7	5	9
2	9	7	6	1	5	3	8	4
3	5	4	9	8	7	1	6	2
4	7	9	1	3	8	6	2	5
5	3	8	2	4	6	9	7	1
1	6	2	5	7	9	8	4	3

7.

2	7	5	3	8	4	6	1	9
8	3	6	5	9	1	4	2	7
4	1	9	7	6	2	8	3	5
3	4	7	2	5	8	1	9	6
6	2	8	1	4	9	7	5	3
5	9	1	6	7	3	2	4	8
9	5	4	8	1	6	3	7	2
7	8	2	4	3	5	9	6	1
1	6	3	9	2	7	5	8	4

9.

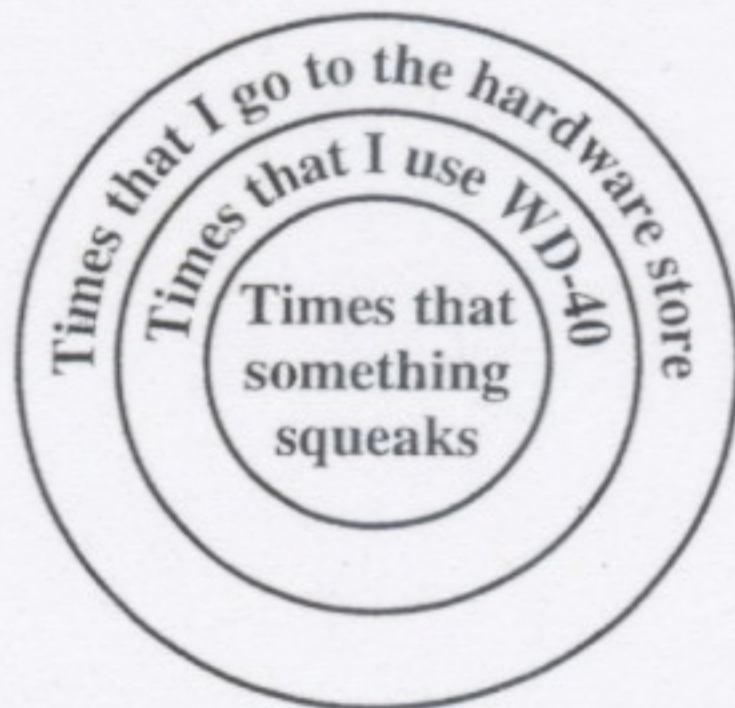
1	8	2	5	7	9	3	4	6
5	3	4	8	1	6	2	9	7
7	6	9	2	3	4	8	1	5
4	1	8	7	9	2	6	5	3
3	7	6	1	8	5	4	2	9
2	9	5	4	6	3	7	8	1
9	2	1	3	4	7	5	6	8
8	5	7	6	2	1	9	3	4
6	4	3	9	5	8	1	7	2

11.

9	8	3	2	4	5	7	1	6
2	6	1	3	9	7	8	4	5
7	5	4	8	6	1	9	3	2
1	7	6	4	5	3	2	9	8
4	9	5	7	2	8	3	6	1
3	2	8	6	1	9	4	5	7
5	4	7	9	8	6	1	2	3
8	1	2	5	3	4	6	7	9
6	3	9	1	7	2	5	8	4

3.6 Exercises (Pages 151–154)

1. valid by reasoning by transitivity 3. valid by modus ponens 5. fallacy by fallacy of the converse
 7. valid by modus tollens 9. fallacy by fallacy of the inverse 11. valid by disjunctive syllogism 13. invalid
 15. valid 17. invalid 19. valid 21. invalid 23. invalid
 25. Every time something squeaks, I use WD-40. 27. valid
 Every time I use WD-40, I go to the hardware store.
 Every time something squeaks, I go to the hardware store.



29. invalid 31. invalid 33. valid 35. valid 37. If tell you the time, then my life will be miserable.
 39. If it is my poultry, then it is a duck. 41. If it is a guinea pig, then it is hopelessly ignorant of music. 43. If it is a teachable kitten, then it does not have green eyes. 45. If I can read it, then I have not filed it. 47. (a) $p \rightarrow \sim s$
 (b) $r \rightarrow s$ (c) $q \rightarrow p$ (d) None of my poultry are officers. 49. (a) $r \rightarrow \sim s$ (b) $u \rightarrow t$ (c) $\sim r \rightarrow p$
 (d) $\sim u \rightarrow \sim q$ (e) $t \rightarrow s$ (f) All pawnbrokers are honest. 51. (a) $r \rightarrow w$ (b) $\sim u \rightarrow \sim t$ (c) $v \rightarrow \sim s$ (d) $x \rightarrow r$
 (e) $\sim q \rightarrow t$ (f) $y \rightarrow p$ (g) $w \rightarrow s$ (h) $\sim x \rightarrow \sim q$ (i) $p \rightarrow \sim u$ (j) I can't read any of Brown's letters.

Collaborative Investigation (Page 155)

1. 1, *Death in Beijing*, John Gunn, red; 2, *A Killer Abroad*, Mary Hemlock, brown; 3, *Murder in the Sun*, Geoffrey Stringer, green; 4, *The Final Case*, Sandra Bludgeon, blue; 5, *Mayhem in Madagascar*, Dahlia Dagger, yellow; 6, *Lurking in the Shadows*, Philip G Rott, black.

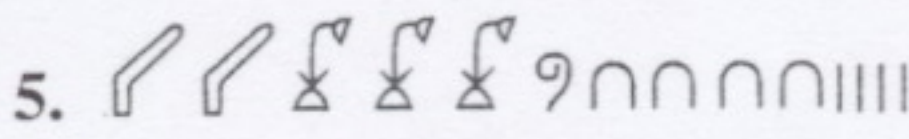
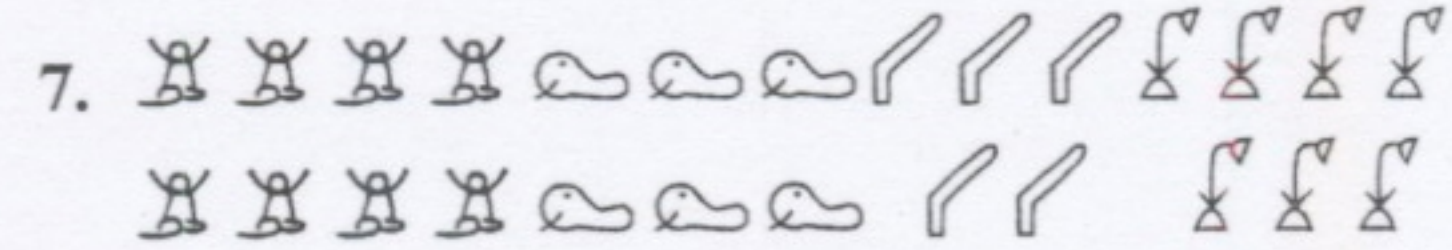
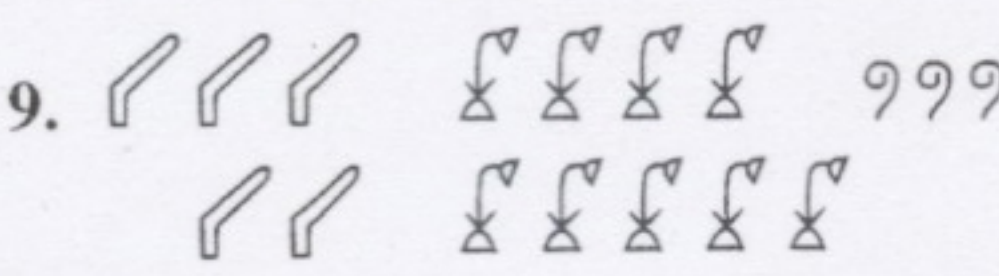
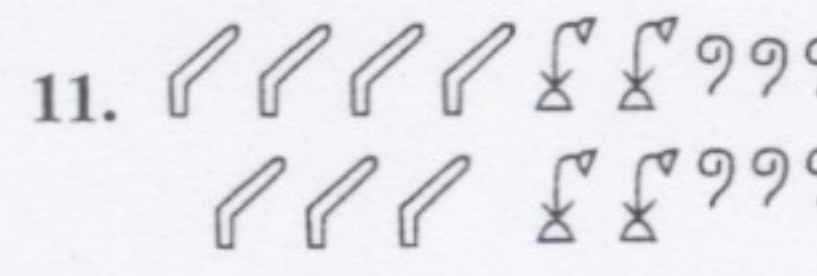
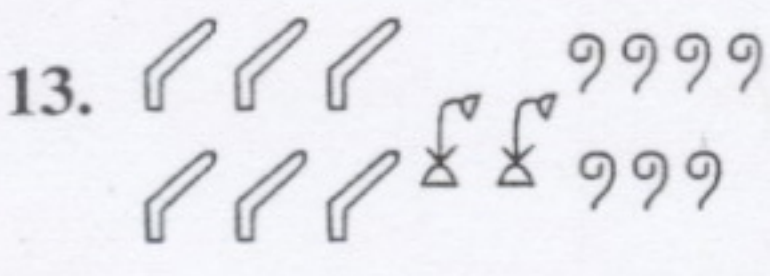
Chapter 3 Test (Pages 156–157)

1. $6 - 3 \neq 3$ 2. Some men are not created equal. 3. No members of the class went on the field trip.
 4. That's the way you feel and I won't accept it. 5. She did not apply or did not get a FEMA trailer. 6. $\sim p \rightarrow q$
 7. $p \rightarrow q$ 8. $\sim q \leftrightarrow \sim p$ 9. You won't love me and I will love you. 10. It is not the case that you will love me or I will not love you. (Equivalently: You won't love me and I will love you.) 11. T 12. T
 13. T 14. F 15. Answers will vary. 16. (a) The antecedent must be true and the consequent must be false. (b) Both component statements must be true. (c) Both component statements must be false. 17. TFFF
 18. TTTT (tautology) 19. false 20. true

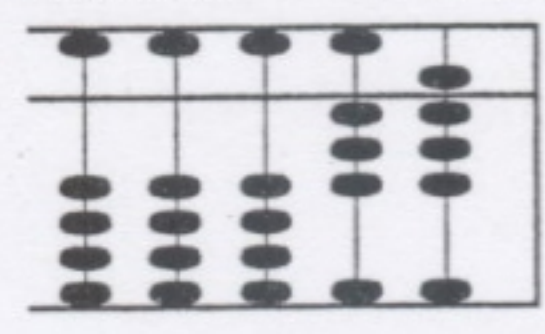
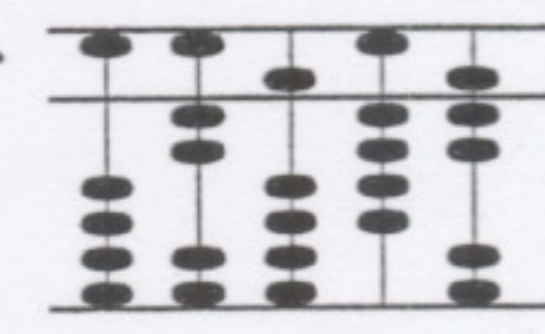
- Wording may vary in the answers for Exercises 21–25.
21. If the number is an integer, then it is a rational number.
 22. If a polygon is a rhombus, then it is a quadrilateral.
 23. If a number is divisible by 9, then it is divisible by 3.
 24. If she digs dinosaur bones, then she is a paleontologist.
 25. (a) If the graph helps me understand it, then a picture paints a thousand words. (b) If a picture doesn't paint a thousand words, then the graph won't help me understand it.
 (c) If the graph doesn't help me understand it, then a picture doesn't paint a thousand words.
 26. (a) $(q \wedge r) \rightarrow \sim p$
 (b) $p \rightarrow (\sim q \vee \sim r)$ (c) $(\sim q \vee \sim r) \rightarrow p$ 27. valid 28. (a) A (b) F (c) C (d) D 29. valid
 30. invalid

CHAPTER 4 Numeration and Mathematical Systems

4.1 Exercises (Pages 166–168)

1. 13,036 3. 7,630,729 5.  7. 
9.  11.  13.  15. 935
17. 3007 19. $\begin{matrix} 九 \\ 百 \\ 六 \\ 十 \end{matrix}$ 21. $\begin{matrix} 七 \\ 十 \\ 零 \\ 十 \\ 二 \end{matrix}$ 23. $\begin{matrix} 一 \\ 十 \\ 三 \\ 百 \\ 六 \\ 十 \\ 八 \end{matrix}$ to $\begin{matrix} 一 \\ 十 \\ 六 \\ 百 \\ 四 \\ 十 \\ 四 \end{matrix}$ 25. $\begin{matrix} 六 \\ 百 \\ 十 \\ 八 \end{matrix}$ to $\begin{matrix} 九 \\ 百 \\ 零 \\ 七 \end{matrix}$ 27. 216 29. 53,601 31. 113
33. 7598 35. 1378 37. 5974 39. 622,500 shekels 41. Answers will vary. 43. Answers will vary.
 45. 99,999 47. 3124 49. $10^d - 1$ 51. $7^d - 1$ 53. Answers will vary.

4.2 Exercises (Pages 177–178)

1. $(7 \cdot 10^1) + (3 \cdot 10^0)$ 3. $(3 \cdot 10^3) + (7 \cdot 10^2) + (7 \cdot 10^1) + (4 \cdot 10^0)$ 5. $(4 \cdot 10^3) + (9 \cdot 10^2) + (2 \cdot 10^1) + (4 \cdot 10^0)$ 7. $(1 \cdot 10^7) + (4 \cdot 10^6) + (2 \cdot 10^5) + (0 \cdot 10^4) + (6 \cdot 10^3) + (0 \cdot 10^2) + (4 \cdot 10^1) + (0 \cdot 10^0)$
9. 42 11. 6209 13. 70,401,009 15. 89 17. 32 19. 109 21. 733 23. 6 25. 206
 27. 256 29. 63,259 31.  33.  35. 1885 37. 38,325
39. 3,035,154 41. 496 43. 217,204 45. 242 47. 49,801 49. 460 51. 32,798

4.3 Exercises (Pages 187–189)

1. 1, 2, 3, 4, 5, 6, 10, 11, 12, 13, 14, 15, 16, 20, 21, 22, 23, 24, 25, 26 3. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22 5. 13_{five} ; 20_{five} 7. $B6E_{\text{sixteen}}$; $B70_{\text{sixteen}}$ 9. 3 11. 11 13. least: $1000_{\text{three}} = 27$; greatest: $2222_{\text{three}} = 80$ 15. 14 17. 11 19. 956 21. 881 23. 28,854 25. 139 27. 5601
 29. 321_{five} 31. 10011_{two} 33. 93_{sixteen} 35. 2131101_{five} 37. 1001001010_{two} 39. 102112101_{three}
 41. 111134_{six} 43. 32_{seven} 45. 1031321_{four} 47. 11110111_{two} 49. 467_{eight} 51. 11011100_{two}
 53. $2D_{\text{sixteen}}$ 55. 37_{eight} 57. 1427 59. 1000011_{two} 61. 1101011_{two} 63. HELP
 65. $100111011001011110111_{\text{two}}$ 67. Answers will vary. 69. (a) The binary ones digit is 1. (b) The binary twos digit is 1. (c) The binary fours digit is 1. (d) The binary eights digit is 1. (e) The binary sixteens digit is 1.
 71. 6 73. yes 75. yes 77. yes 79. yes 81. Answers will vary. 83. no 85. yes
 87. Answers will vary. 89. 20120011_{three} 91. 25657_{nine}