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MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

List the elements in the set.

1) {x | x is a whole number between 1 and 5}
A) {2, 3, 4} B) {1, 2, 3, 4} C) {1, 2, 3, 4, 5} D) {2, 3, 4, 5}
Answer: A

2) {x | x is an integer between –8 and –4}
A) {–8, –7, –6, –5, –4} B) {–7, –6, –5} C) {–8, –7, –6, –5} D) {–7, –6, –5, –4}
Answer: B

3) {x | x is a negative multiple of 5}
A) {–5, –10, –15, ...} B) {5, 10, 15, ...} C) {–5, –25, –125, ...} D) {0, –5, –10, ...}
Answer: A

4) {x | x is an integer greater than –6}
A) {–5, –4, –3, ...} B) {–7, –8, –9, ...} C) {–5, –4, –3, –2} D) {–7, –8, –9}
Answer: A

5) The set of all whole numbers greater than 6 and less than 10
A) {6, 7, 8, 9, 10} B) {6, 7, 8, 9} C) {7, 8, 9, 10} D) {7, 8, 9}
Answer: D

6) {x | x is a counting number multiple of 2}
A) {4, 6, 8, ...} B) ∅ C) {0, 2, 4, 6, ...} D) {2, 4, 6, ...}
Answer: D

7) {x | x is a counting number less than –2}
A) {–1, 0, 1, ...} B) {..., –5, –4, –3} C) ∅ D) {–3, –4, –5, ...}
Answer: C

8) The set of all positive integer powers of 3.
A) {3, 9, 27, 81, 243, ...} B) {1, 8, 27, 64, 125, ...}
C) {1, 3, 9, 27, 81, 243, ...} D) {3, 6, 9, 12, 15, ...}
Answer: A

9) { x | x is an even integer smaller than 8}
A) {..., –6, –4, –2, 2, 4, 6} B) {..., –6, –4, –2, 0, 2, 4, 6}
C) {2, 4, 6} D) {0, 2, 4, 6}
Answer: B

10) The set of the days of the week
A) {Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Sunday}
B) {Friday, Monday, Saturday, Sunday, Thursday, Tuesday, Wednesday}
C) {Saturday, Sunday}
D) {Tuesday, Thursday}
Answer: B

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Write the set in set–builder notation.

11) {9}

A) {x is a constant}
B) {x | x is the natural number 9}
C) {x | x is a natural number}
D) {x}

Answer: B

12) {2, 4, 6, 8}

A) {x | x is an even natural number less than 10}
B) {x | x is any even integer less than 10}
C) {x | x is any even natural number}
D) {2, 4, 6, 8}

Answer: A

13) {15, 16, 17, 18}

A) {15, 16, 17, 18}
B) {x | x is an integer between 14 and 19}
C) {x | x is an integer less than 19}
D) {x | x is an integer between 15 and 18}

Answer: B

14) {–6, –5, –4, –3, ...}

A) {x | x is an integer between –7 and –2}
B) {x | x is an integer greater than –7}
C) {x | x is any integer}
D) {–6, –5, –4, –3}

Answer: B

15) {..., –3, –2, –1, 0, 1, 2, 3, ...}

A) {x | x is an integer}
B) {–3, –2, –1, 0, 1, 2, 3}
C) {x | x is any integer greater than –3}
D) {x | x is a natural number}

Answer: A

16) {18, 24, 30, 36, ..., 78}

A) {x | x is a multiple of 6}
B) {x | x is a multiple of 6 between 12 and 84}
C) {x | x is a multiple of 6 greater than 18}
D) {x | x is a multiple of 6 between 18 and 78}

Answer: B

17) {–3, –1, 1, 3, 5, ...}

A) {x | x is an odd integer between –4 and 6}
B) {x | x is an odd integer greater than –4}
C) {x | x is an integer greater than –4}
D) {x | x is an odd integer}

Answer: B

18) {2, 4, 8, 16, 32, ...}

A) {x | x is a positive integer power of 2}
B) {x | x is a positive multiple of 2}
C) {x | x is an integer power of 2}
D) {x | x is a positive multiple of 4}

Answer: A

19) The set of all calculus books

A) {a calculus book}
B) {x is a calculus book}
C) {x | x is a calculus book}
D) {any calculus book}

Answer: C

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20) The set of all cars owned by students

A) {x is a student with a car}
B) {x is a car}
C) {x | x is a student with a car}
D) {x | x is a car owned by a student}

Answer: D

Identify the set as finite or infinite.

21) {7, 8, 9, ..., 28}

A) Infinite
B) Finite

Answer: B

22) $\left\{1, \frac{1}{4}, \frac{1}{16}, \frac{1}{64}, \ldots\right\}$

A) Finite
B) Infinite

Answer: B

23) {x | x is a counting number larger than 815}

A) Infinite
B) Finite

Answer: A

24) {x | x is an odd counting number}

A) Finite
B) Infinite

Answer: B

25) {x | x is a 12–headed lizard}

A) Infinite
B) Finite

Answer: B

26) {x | x is a fraction between 60 and 61}

A) Finite
B) Infinite

Answer: B

27) {x | x is a prime number}

A) Infinite
B) Finite

Answer: A

28) $\left\{1, \frac{2}{7}, \frac{4}{49}, \frac{8}{343}, \ldots, \frac{32}{16807}\right\}$

A) Infinite
B) Finite

Answer: B

Find n(A) for the set.

29) A = {0, 2, 4, 6, 8}

A) n(A) = 8
B) n(A) = 5
C) n(A) = 4
D) n(A) = 2

Answer: B

30) A = {200, 201, 202, ..., 2000}

A) n(A) = 4
B) n(A) = 2000
C) n(A) = 1801
D) n(A) = 1800

Answer: C

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31) A = {x | x is a month in the year}
A) n(A) = 24 B) n(A) = 52 C) n(A) = 12 D) n(A) = 1
Answer: C

32) A = {x | x is a number on a clock face}
A) n(A) = 24 B) n(A) = 6 C) n(A) = 12 D) n(A) = 3
Answer: C

33) A = {x | x is a second in a minute}
A) n(A) = 60 B) n(A) = Infinite C) n(A) = 12 D) n(A) = 120
Answer: A

34) A = {2, 2, 3, 3, ..., 6, 6}
A) n(A) = 10 B) n(A) = 5 C) n(A) = 6 D) n(A) = 3
Answer: B

35) A = {–7, –6, –5, ..., 0}
A) n(A) = 7 B) n(A) = 1 C) n(A) = 4 D) n(A) = 8
Answer: D

36) $A = \left\{\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \ldots, \frac{1}{29}, \frac{1}{30}\right\}$
A) n(A) = Infinite B) n(A) = 31 C) n(A) = 29 D) n(A) = 30
Answer: C

37) $A = \left\{\frac{1}{2}, -\frac{1}{2}, \frac{2}{3}, -\frac{2}{3}, \frac{3}{4}, -\frac{3}{4}, \ldots, \frac{19}{20}, -\frac{19}{20}\right\}$
A) n(A) = 38 B) n(A) = Infinite C) n(A) = 19 D) n(A) = 40
Answer: A

Determine whether or not the set is well defined.

38) {x | x is a tennis player who has won at Wimbledon}
A) Well defined B) Not well defined
Answer: A

39) {x | x is a low–fat ice cream}
A) Well defined B) Not well defined
Answer: B

40) {x | x is a football team that has won the Super Bowl}
A) Not well defined B) Well defined
Answer: B

41) {x | x is a adventure book in the library}
A) Not well defined B) Well defined
Answer: A

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42) {x | x is a stock on the AmEx today}
A) Not well defined B) Well defined
Answer: B

43) {x | x is an expensive boat on the Great Lakes}
A) Not well defined B) Well defined
Answer: A

44) {x | x is a four–year college in Utah}
A) Well defined B) Not well defined
Answer: A

Complete the blank with either ∈ or ∉ to make the statement true.

45) –5 __ {5, 7, 9, ..., 17}
A) ∉ B) ∈
Answer: A

46) 0 __ {–1, 1, 3, 12, 22}
A) ∈ B) ∉
Answer: B

47) {7} __ {{4}, {5}, {6}, {7}, {8}}
A) ∈ B) ∉
Answer: A

48) 5 __ {10, 9, 8, 7}
A) ∉ B) ∈
Answer: A

49) 7 __ {6, 11, 5, 7, 15}
A) ∈ B) ∉
Answer: A

50) 12 __ {10, 11, 12, 13}
A) ∈ B) ∉
Answer: A

51) a __ {A, B, C, ..., Z}
A) ∈ B) ∉
Answer: B

52) 7 __ {2, 3, 4, ..., 7}
A) ∉ B) ∈
Answer: B

53) {6} __ {7 – 3, 8 – 3, 9 – 3, 10 – 3}
A) ∉ B) ∈
Answer: A

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54) 7 __ {8 + 5, 6 + 5, 4 + 5, 2 + 5}

A) ∈ B) ∉

Answer: A

Tell whether the statement is true or false.

55) 10 ∈ {20, 30, 40, 50, 60}

A) True B) False

Answer: B

56) {4, 6, 13} = {0, 4, 6, 13}

A) True B) False

Answer: B

57) 17 ∉ {16, 14, 13, ..., 1}

A) True B) False

Answer: A

58) {8} = {x | x is an even counting number between 10 and 16}

A) True B) False

Answer: B

59) {59, 60, 59, 60} = {59, 60}

A) True B) False

Answer: A

60) {2, 12, 28, 10, 31} = {31, 12, 10, 82, 2}

A) True B) False

Answer: B

61) {x | x is a counting number greater than 35} = {35, 36, 37, ...}

A) True B) False

Answer: B

62) 13 ∉ {x | x is an even counting number}

A) True B) False

Answer: A

63) k ∉ {p, a, k, h, v}

A) True B) False

Answer: B

64) {s, q, y, o, d} = {o, d, q, s, y}

A) True B) False

Answer: A

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Write true or false for the following statement.
Let A = {3, 5, 7, 9, 11, 13}
B = {3, 5, 9, 11}
C = {5, 9, 13}

65) $13 \notin C$
A) True B) False
Answer: B

66) $9 \in B$
A) True B) False
Answer: A

67) Every element of B is also an element of C.
A) True B) False
Answer: B

68) A = {x | x is an odd counting number greater than 1 and less than 15}
A) True B) False
Answer: A

69) $0 \in A$
A) True B) False
Answer: B

70) Every element of C is also an element of A.
A) True B) False
Answer: A

71) {x | x is an odd counting number less than 15} = A
A) True B) False
Answer: B

72) $\{13\} \in B$
A) True B) False
Answer: B

Use ⊆ or ⊈ in the blank to make a true statement.

73) {4, 6, 8} __ {3, 4, 5, 6, 8}
A) ⊆ B) ⊈
Answer: A

74) {16, 23, 28} __ {14, 23, 28, 38}
A) ⊈ B) ⊆
Answer: A

75) {e, d, j, h} __ {e, d, j, h, p}
A) ⊈ B) ⊆
Answer: B

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76) ∅ __ ∅

A) ⊆ B) ⊈

Answer: A

77) {1, 3, 5} __ {x | x is an odd counting number}

A) ⊈ B) ⊆

Answer: B

78) {k, m, i} __ {k, k, m, m, i, i}

A) ⊆ B) ⊈

Answer: A

79) {x | x is a counting number larger than 5} __ {7, 8, 9, ...}

A) ⊆ B) ⊈

Answer: B

Decide whether ⊆, ⊂, both, or neither can be placed in the blank to make a true statement.

80) {11, 12, 13} __ {10, 11, 12, 13}

A) ⊂ B) Neither C) Both ⊂ and ⊆ D) ⊆

Answer: C

81) ∅ __ {3, 19, 26, 32}

A) Neither B) Both ⊂ and ⊆ C) ⊂ D) ⊆

Answer: B

82) {7, 8, 9} __ {7, 8, 9}

A) ⊂ B) Neither C) ⊆ D) Both ⊂ and ⊆

Answer: C

83) {0} __ ∅

A) Both ⊂ and ⊆ B) ⊂ C) Neither D) ⊆

Answer: C

84) {a, b} __ {z, a, y, b, x, c}

A) Both ⊂ and ⊆ B) ⊆ C) Neither D) ⊂

Answer: A

85) {s, r, t} __ {s, r, t}

A) ⊂ B) Both ⊆ and ⊂ C) Neither D) ⊆

Answer: D

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Determine whether the statement is true or false.

Let A = {1, 3, 5, 7}
B = {5, 6, 7, 8}
C = {5, 8}
D = {2, 5, 8}
U = {1, 2, 3, 4, 5, 6, 7, 8}

86) $C \subset D$
A) True B) False
Answer: A

87) $\varnothing \subseteq A$
A) True B) False
Answer: A

88) $\{6, 5, 8, 7\} \subseteq B$
A) True B) False
Answer: A

89) $D \subseteq B$
A) True B) False
Answer: B

90) $A \neq \{7, 5, 3, 1\}$
A) True B) False
Answer: B

91) $\{5\} \subseteq D$
A) True B) False
Answer: A

92) $\{0\} \subseteq U$
A) True B) False
Answer: B

93) $\{8, 5, 2\} \subset D$
A) True B) False
Answer: B

94) $C \not\subseteq B$
A) True B) False
Answer: B

95) $C \not\subseteq A$
A) True B) False
Answer: A

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Find the number of subsets of the set.

96) {9, 10, 11}

A) 8 B) 3 C) 7 D) 6

Answer: A

97) {x | x is an even number between 19 and 31}

A) 5 B) 29 C) 64 D) 32

Answer: C

98) {0}

A) 2 B) 0 C) 4 D) 1

Answer: A

99) {mom, dad, son, daughter}

A) 12 B) 16 C) 8 D) 14

Answer: B

100) {math, English, history, science, art}

A) 16 B) 28 C) 24 D) 32

Answer: D

101) {x | x is a day of the week}

A) 124 B) 127 C) 256 D) 128

Answer: D

102) {1, 2, 3, ..., 9}

A) 512 B) 1024 C) 508 D) 16

Answer: A

Find the number of proper subsets of the set.

103) {12, 13, 14}

A) 6 B) 7 C) 5 D) 2

Answer: B

104) {x | x is an even number between 11 and 25}

A) 64 B) 128 C) 24 D) 127

Answer: D

105) {0}

A) 0 B) 1 C) 2 D) 4

Answer: B

106) {car, boat, truck, train}

A) 8 B) 15 C) 16 D) 14

Answer: B

107) {poetry, drama, speech, art, film}

A) 24 B) 16 C) 31 D) 32

Answer: C

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108) {x | x is a day of the week}

A) 128 B) 256 C) 127 D) 64

Answer: C

109) {1, 2, 3, ..., 6}

A) 58 B) 63 C) 64 D) 127

Answer: B

Let U = {1, 2, 4, 5, a, b, c, d, e}. Find the complement of the set.

110) T = {2, 4, b, d}

A) {1, 3, 5, a, c, e} B) {1, 2, 4, 5, a, b, c, d, e}
C) {1, 5, a, e} D) {1, 5, a, c, e}

Answer: D

111) W = {1, 5, e, d, a}

A) {2, 3, 4, a, b, c} B) {2, 4, b, c} C) {2, 3, 4, b, c} D) {1, 2, 4, b, c}

Answer: B

112) V = {1, 2, 4, 5, a, b, c, e}

A) {3, d} B) {u} C) ∅ D) {d}

Answer: D

113) T = {a, b, c, d}

A) {e} B) {1, 2, 3, 4, 5, e} C) {1, 2, 4, 5, e} D) {1, 2, 4, 5}

Answer: C

114) G = {a}

A) {1, 2, 4, 5, b, c, d, e} B) {u, v}
C) {1, 2, 3, 4, 5, b, c, d, e} D) {1, 2, 5, b, c, d, e}

Answer: A

115) P = ∅

A) {0} B) ∅ C) U D) ∅'

Answer: C

116) P = {a, b, d, e, 1, 2, 4, 5}

A) ∅ B) U C) {c, 3} D) {c}

Answer: D

117) R = {1, 2, 5, b, d}

A) {3, 4, a, c, e} B) {4, a, b, c, e} C) {4, a, c, e} D) {3, 4, a, b, c, e}

Answer: C

118) T = U

A) ∅ B) {U – T'} C) U D) T

Answer: A

119) P = {e, a, c, 4, 5}

A) {1, 2, 3, b, d} B) {b, d, 1, 2, 3} C) {1, 2, b, d} D) {1, 2, b, c, d}

Answer: C

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The lists below show five agricultural crops in Alabama, Arkansas, and Louisiana.

Alabama	Arkansas	Louisiana
soybeans (s)	soybeans (s)	soybeans (s)
peanuts (p)	rice (r)	sugarcane (n)
corn (c)	cotton (t)	rice (r)
hay (h)	hay (h)	corn (c)
wheat (w)	wheat (w)	cotton (t)

Let U be the smallest possible universal set that includes all of the crops listed, and let A, K and L be the sets of five crops in Alabama, Arkansas, and Louisiana, respectively. Find each of the following sets.

120) The set of crops in U.
A) {c, h, n, p, r, s, t, w}
B) {s, p, c, w, r, t, n}
C) {s, p, c, h, w, s, r, t, h, w, s, n, r, c, t}
D) {s, p, c, h, w, r, t, n, c}
Answer: A

121) The set of crops in A'.
A) {h, n, r, t}
B) {n, r, t}
C) {r, t}
D) {c, h, n, r, s, t, w}
Answer: B

122) The set of crops in both A and K
A) {c, h, p, r, s, t, w}
B) {c, p, r, t}
C) {c, h, s, t, w}
D) {h, s, w}
Answer: D

123) The set of crops in both L and K
A) {r, s, t}
B) {c, n, r, s, t}
C) {c, h, n, w}
D) {c, h, n, r, s, t, w}
Answer: A

124) The set of crops in both L and K'
A) {h, w}
B) {c, n, p}
C) {r, s, t}
D) {c, n}
Answer: D

125) The set of crops in both A and L'
A) {n, r, t}
B) {c, s}
C) {h, n, t, w}
D) {h, p, w}
Answer: D

126) The set of crops in both A' and K'
A) {c, p, r, t}
B) {n}
C) {c, n, p, r, t}
D) ∅
Answer: B

127) The set of crops common to A, K, and L
A) {c, h, n, p, r, s, t, w}
B) {n, p, s}
C) {n, p}
D) {s}
Answer: D

128) The set of crops in either A or L or both
A) {h, n, p, r, t, w}
B) {c, n, p}
C) {c, h, n, p, r, s, t, w}
D) {c,s}
Answer: C

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129) The set of crops in either A' or L or both

A) {h, n, p, r, t, w} B) {c, n, r, s, t} C) {n, r, t} D) {h, p, w}

Answer: B

Solve the problem.

130) List all possible subsets of the set {m, n}.

A) {m}, {n}
B) {m}, {n}, ∅
C) {m}, {n}, {m, n}
D) {m}, {n}, {m, n}, ∅

Answer: D

131) List all possible proper subsets of the set {2, 6, 7}.

A) ∅, {2}, {6}, {7}, {2, 6}, {2, 7}, {6, 7}
B) {2}, {6}, {7}, {2, 6}, {2, 7}, {6, 7}, {2, 6, 7}
C) ∅, {2}, {6}, {7}, {2, 6}, {2, 7}, {6, 7}, {2, 6, 7}
D) {2}, {6}, {7}, {2, 6}, {2, 7}, {6, 7}

Answer: A

132) A committee is to be formed. Possible candidates for the committee are Eric, Frances, Greg, and Jose. Denoting these four people by e, f, g, j, list all possible committees of two people (ie list all possible subsets of size two).

A) {e, f}, {e, g}, {e, j}, {f, g}, {f, j}, {g, j}, {f, e}, {g, e}
B) {e, f}, {e, g}, {f, g}, {g, j}
C) {e, f}, {e, g}, {e, j}, {f, j}, {g, j}
D) {e, f}, {e, g}, {e, j}, {f, g}, {f, j}, {g, j}

Answer: D

133) A committee is to be formed. Possible candidates for the committee are Eric, Frances, Greg, and Jose. Denoting these four people by e, f, g, j, list all possible committees if the committee is to contain at least two people and may contain up to four people.

A) {e, f}, {e, g}, {e, j}, {f, g}, {f, j}, {g, j}, {e, f, g}, {e, f, j}, {f, g, j}, {e, f, g, j}
B) {e, f}, {e, g}, {e, j}, {f, j}, {e, f, g}, {e, f, j}, {e, g, j}, {f, g, j}, {e, f, g, j}
C) {e, f}, {e, g}, {e, j}, {f, g}, {f, j}, {g, j}, {e, f, g}, {e, f, j}, {e, g, j}, {f, g, j}, {e, f, g, j}
D) {e, f}, {e, g}, {e, j}, {f, g}, {f, j}, {g, j}, {e, f, g}, {e, f, j}, {e, g, j}, {f, g, j}

Answer: C

134) An adventure travel company has reservations from four people (Lee, Maria, Nancy, and Pablo) for its white water rafting trip on June 1st. However the company knows that any of these people may fail to show up on the day of the trip. Denoting these four people by l, m, n, p, list all possibilities for the group of people who show up on June 1st for the rafting trip (ie list all possible subsets of {l, m, n, p}).

A) ∅, {l}, {m}, {n}, {p}, {l, m}, {l, n}, {m, n}, {m, p}, {n, p}, {l, m, n}, {l, m, p}, {l, n, p}, {m, n, p}
B) {l}, {m}, {n}, {p}, {l, m}, {l, n}, {l, p}, {m, n}, {m, p}, {n, p}, {l, m, n}, {l, m, p}, {l, n, p}, {m, n, p}, {m, n, l}, {l, m, n, p}
C) ∅, {l}, {m}, {n}, {p}, {l, m}, {l, n}, {l, p}, {m, n}, {m, p}, {n, p}, {l, m, n}, {l, m, p}, {l, n, p}, {m, n, p}, {l, m, n, p}
D) {l}, {m}, {n}, {p}, {l, m}, {l, n}, {l, p}, {m, n}, {m, p}, {n, p}, {l, m, n}, {l, m, p}, {l, n, p}, {m, n, p}, {l, m, n, p}

Answer: C

135) A committee is to be formed. Possible candidates for the committee are Anne, Daniel, Raul, Sarah, and Teresa. Denoting these five people by a, d, r, s, t, list all possible committees of three people (ie list all possible subsets of size three).

A) {a, d, r}, {a, d, s}, {a, d, t}, {a, r, s}, {a, r, t}, {a, s, t}, {d, r, s}, {d, r, t}, {d, s, t}, {r, s, t}, {d, a, r}, {s, t, d}
B) {a, d, r}, {a, d, s}, {a, d, t}, {a, r, s}, {d, r, s}, {d, r, t}, {d, s, t}, {r, s, t}
C) {a, d, r}, {a, d, s}, {a, d, t}, {a, r, s}, {a, r, t}, {a, s, t}, {d, r, s}, {d, r, t}, {d, s, t}, {r, s, t}
D) {a, d, r}, {a, d, s}, {a, d, t}, {a, r, s}, {a, r, t}, {a, s, t}, {d, r, t}, {d, s, t}, {r, s, t}

Answer: C

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List the elements in the set .
Let U = {q, r, s, t, u, v, w, x, y, z}
A = {q, s, u, w, y}
B = {q, s, y, z}
C = {v, w, x, y, z}.

136) A ∪ C
A) {q, s, u, v, w, x, y, z}
B) {w, y}
C) {q, s, u, v, w, y, z}
D) {q, s, u, w, y, v, w, x, y, z}
Answer: A

137) B ∩ C
A) {q, s, v, w, x, y, z}
B) {y}
C) {w, y, z}
D) {y, z}
Answer: D

138) A ∩ B'
A) {r, s, t, u, v, w, x, z}
B) {t, v, x}
C) {u, w}
D) {q, s, t, u, v, w, x, y}
Answer: C

139) (A ∪ B)'
A) {r, s, t, u, v, w, x, z}
B) {s, u, w}
C) {t, v, x}
D) {r, t, v, x}
Answer: D

140) (A ∩ B)'
A) {s, u, w}
B) {t, v, x}
C) {q, s, t, u, v, w, x, y}
D) {r, t, u, v, w, x, z}
Answer: D

141) A' ∪ B
A) {q, r, s, t, v, x, y, z}
B) {s, u, w}
C) {r, s, t, u, v, w, x, z}
D) {q, s, t, u, v, w, x, y}
Answer: A

142) C' ∪ A'
A) {q, s, u, v, w, x, y, z}
B) {q, r, s, t, u, v, x, z}
C) {w, y}
D) {s, t}
Answer: B

143) C' ∩ A'
A) {q, r, s, t, u, v, x, z}
B) {w, y}
C) {q, s, u, v, w, x, y, z}
D) {r, t}
Answer: D

144) C – A
A) {w, y}
B) {v, x, z}
C) {q, s, u, v, x, z}
D) {q, s, u}
Answer: B

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145) A' – C

A) {q, s, u, v, x, z} B) {r, t} C) {v, x, z} D) {q, s, u}

Answer: B

146) A ∪ (B ∩ C)

A) {q, w, y} B) {q, r, w, y, z} C) {q, s, u, w, y, z} D) {q, y, z}

Answer: C

147) A ∩ (B ∪ C)

A) {q, r, w, y, z} B) {q, y, z} C) {q, s, w, y} D) {q, s, u, w, y, z}

Answer: C

148) (A' ∪ C) ∩ B'

A) {v, x} B) {y, z} C) {r, t, u, v, w, s, y, z} D) {r, t, v, w, x}

Answer: D

149) (B' ∩ C)' ∪ A

A) {q, r, s, t, u, w, y, z} B) {q, s, u, v, w, x, y}

C) {q, r, s, t, u, v, w, x, y} D) {q, s, u, y}

Answer: A

150) (A ∪ B')' ∩ C'

A) {v, w, x, y} B) ∅ C) {q, r, s, t, u, z} D) {q, r, s, t, u}

Answer: B

151) B ∩ (A – C)

A) {q, s, u, y} B) {q, s, u, y, z}

C) {q, s} D) {q, r, s, t, u, v, w, x, y}

Answer: C

152) (A ∩ B') ∪ (B ∩ A')

A) {u, w, z} B) {u, w, y, z} C) {q, s, y} D) {q, s, u, w, y, z}

Answer: A

Let U = {all soda pops}, A = {all diet soda pops}, B = {all cola soda pops}, C = {all soda pops in cans}, and D = {all caffeine–free soda pops}. Describe the set in words.

153) A ∩ B

A) All diet cola soda pops B) All soda pops

C) All diet or all cola soda pops D) All diet and all cola soda pops

Answer: A

154) A' ∩ C

A) All non–diet soda pops in cans

B) All diet soda pops in cans

C) All diet soda pops and all soda pops in cans

D) All non–diet soda pops and all soda pops in cans

Answer: A

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155) $A \cap B \cap D$

A) All diet, caffeine–free cola pops in cans
B) All soda pops not in cans
C) All diet, caffeine–free cola soda pops
D) All diet and all cola and all caffeine–free soda pops

Answer: C

156) $(A \cup B) \cup D$

A) All diet or all cola or all caffeine–free soda pops
B) All soda pops
C) All diet, caffeine–free cola soda pops
D) All soda pops not in cans

Answer: A

157) $(A \cap B) \cap C'$

A) All non–diet, non–cola soda pops not in cans
B) All cola soda pops not in cans
C) All diet and all cola soda pops not in cans
D) All diet cola soda pops not in cans

Answer: D

158) $(A \cup D) \cap C'$

A) All non–cola soda pops not in cans
B) All non–diet, non–caffeine–free soda pops not in cans
C) All diet soda pops not in cans or all caffeine–free soda pops not in cans
D) All diet, caffeine–free soda pops not in cans

Answer: C

159) $(A' \cap B') \cup C$

A) All non–diet non–cola soda pops or all soda pops in cans
B) All non–diet soda pops and all non–cola soda pops in cans
C) All non–diet non–cola soda pops in cans
D) All non–diet non–cola soda pops and all soda pops not in cans

Answer: A

160) $(A - D) \cap B$

A) All diet caffeine–free cola soda pops
B) All non–diet, caffeine–free cola soda pops
C) All diet soda pops that contain caffeine and all cola soda pops
D) All diet cola soda pops that contain caffeine

Answer: D

161) $(B \cap C') \cup (C \cap B')$

A) All cola soda pops and all soda pops in cans
B) All cola soda pops in cans and all non–cola soda pops not in cans
C) All non–cola soda pops not in cans
D) All cola soda pops not in cans or all non–cola soda pops in cans

Answer: D

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The lists below show five agricultural crops in Alabama, Arkansas, and Louisiana.

Alabama	Arkansas	Louisiana
soybeans (s)	soybeans (s)	soybeans (s)
peanuts (p)	rice (r)	sugarcane (n)
corn (c)	cotton (t)	rice (r)
hay (h)	hay (h)	corn (c)
wheat (w)	wheat (w)	cotton (t)

Let U be the smallest possible universal set that includes all of the crops listed, and let A, K and L be the sets of five crops in Alabama, Arkansas, and Louisiana, respectively. Find each of the following sets.

162) $A \cap K$
A) {h, s, w} B) {c, h, s, t, w} C) {c, h, p, r, s, t, w} D) {c, p, r, t}
Answer: A

163) $L \cap K$
A) {c, n, r, s, t} B) {c, h, n, w} C) {r, s, t} D) {c, h, n, r, s, t, w}
Answer: C

164) $K' \cap L$
A) {r, s, t} B) {c, n, p} C) {c, n} D) {h, w}
Answer: C

165) $L' \cap A$
A) {n, r, t} B) {h, n, t, w} C) {h, p, w} D) {c, s}
Answer: C

166) $A' \cap K'$
A) {c, p, r, t} B) ∅ C) {n} D) {c, n, p, r, t}
Answer: C

167) $A \cap K \cap L$
A) {c, h, n, p, r, s, t, w} B) {s} C) {n, p} D) {n, p, s}
Answer: B

168) $A \cup L$
A) {h, n, p, r, t, w} B) {c, s} C) {c, h, n, p, r, s, t, w} D) {c, n, p}
Answer: C

169) $K \cup L$
A) {c, h, n, w} B) {c, h, n, r, s, t, w} C) {n, r, t} D) {r, s, t}
Answer: B

170) $A' \cup L$
A) {h, p, w} B) {c, n, r, s, t} C) {h, n, p, r, t, w} D) {n, r, t}
Answer: B

171) $L' \cup K'$
A) {p} B) {r, s, t} C) {c, h, p, s, w} D) {c, h, n, p, w}
Answer: D

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Let A and B be sets with cardinal numbers, n(A) = a and n(B) = b, respectively. Decide whether the statement is true or false.

172) $n(A \cup B) = n(A) - n(B)$
A) True B) False
Answer: B

173) $n(A - B) = n(B - A)$
A) True B) False
Answer: B

174) If $B \subseteq A$, $n(B) = n(A - B)$.
A) True B) False
Answer: B

175) If $B \subseteq A$, $n(B) = n(A) - n(A - B)$.
A) True B) False
Answer: A

176) $n(A \cap B) = n(B \cap A)$
A) True B) False
Answer: A

177) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
A) True B) False
Answer: A

178) $n(A \cap B) = n(A) - n(B)$
A) True B) False
Answer: B

179) $n(A \cup B) + n(A \cap B) = n(A) + n(B)$
A) True B) False
Answer: A

Tell whether the statement is true or false.

180) $\{2, 9, 15\} = \{0, 2, 9, 15\}$
A) True B) False
Answer: B

181) $\{53, 54, 53, 54\} = \{53, 54\}$
A) True B) False
Answer: A

182) $\{5, 16, 25, 8, 35\} = \{35, 16, 8, 52, 5\}$
A) True B) False
Answer: B

183) $(17, 1) = (1, 17)$
A) True B) False
Answer: B

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184) $(1 - 10, 10 - 15) = (-9, -5)$

A) True B) False

Answer: A

185) $(13 + 16, 12 + 16) = (13, 12)$

A) True B) False

Answer: B

186) $\{(3, 1), (0, 6), (-4, -2)\} = \{(-4, -2), (3, 1), (6, 0)\}$

A) True B) False

Answer: B

Find the Cartesian product.

187) $A = \{4, 6, 3\}$
$B = \{2, 6\}$
Find $A \times B$.

A) $\{(2, 4), (2, 6), (2, 3), (6, 4), (6, 6), (6, 3)\}$ B) $\{(4, 2), (4, 6), (6, 2), (6, 6), (3, 2), (3, 6)\}$
C) $\{(4, 2), (6, 3), (3, 2)\}$ D) $\{(4, 2), (6, 6)\}$

Answer: B

188) $A = \{i, a\}$
$B = \{t, d, m\}$
Find $A \times B$.

A) $\{(i, t), (i, d), (i, m), (a, t), (a, d), (a, m)\}$ B) $\{(i, t), (t, a), (i, d), (d, a), (i, m), (m, a)\}$
C) $\{(i, t), (a, t), (i, d), (a, d)\}$ D) $\{(t, i), (t, a), (d, i), (d, a), (m, i), (m, a)\}$

Answer: A

189) $A = \{0\}$
$B = \{16, 26, 36\}$
Find $B \times A$.

A) $\{(0, 16), (0, 26), (0, 36)\}$ B) $\{0, 0, 0\}$
C) $\{0\}$ D) $\{(16, 0), (26, 0), (36, 0)\}$

Answer: D

190) $A = \{4, 2, 6, 8\}$
$B = \{0, 1\}$
Find $B \times A$.

A) $\{(4, 0), (2, 0), (6, 0), (8, 0), (4, 1), (2, 1), (6, 1), (8, 1)\}$
B) $\{0, 1, 4, 2, 6, 8\}$
C) $\{(0, 4), (0, 2), (0, 6), (0, 8), (1, 4), (1, 2), (1, 6), (1, 8)\}$
D) $\{(4, 0), (4, 1), (2, 0), (2, 1)\}$

Answer: C

Find the indicated cardinal number.

191) Find $n(A \times B)$ given that $A = \{2\}$ and $B = \{1, 3\}$.

A) 3 B) 1 C) 2 D) 4

Answer: C

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192) Find $n(A \times C)$ given that $A = \{2\}$ and $C = \{4, 5, 6\}$.

A) 3 B) 2 C) 4 D) 1

Answer: A

193) Find $n(D \times B)$ given that $B = \{1, 3\}$ and $D = \{7, 8, 9, 10\}$.

A) 7 B) 8 C) 12 D) 16

Answer: B

194) Find $n(C \times D)$ given that $C = \{4, 5, 6\}$ and $D = \{7, 8, 9, 10\}$.

A) 12 B) 7 C) 27 D) 81

Answer: A

195) Find $n(E)$, given that $n(C \times E) = 18$ and $C = \{4, 5, 6\}$.

A) 6 B) 54 C) 3 D) 9

Answer: A

196) Find $n(F)$, given that $n(B \times F) = 18$ and $B = \{1, 3\}$.

A) 6 B) 36 C) 54 D) 9

Answer: D

197) Find $n(G)$, given that $n(D \times G) = 20$ and $D = \{7, 8, 9, 10\}$.

A) 24 B) 5 C) 4 D) 9

Answer: B

198) Find $n(A \times B)$ given that $n(A) = 31$ and $n(B) = 9$.

A) 279 B) 22 C) 49 D) 40

Answer: A

199) Find $n(B)$ given that $n(A \times B) = 7$ and $n(A) = 1$.

A) 1 B) 7 C) 6 D) 8

Answer: B

200) Find $n(A)$ given that $n(A \times B) = 20$ and $n(B) = 2$.

A) 2 B) 18 C) 22 D) 10

Answer: D

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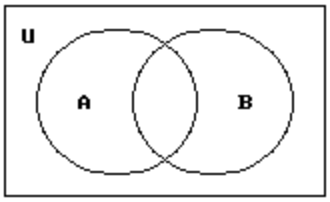
For the given sets, construct a Venn diagram and place the elements in the proper region.

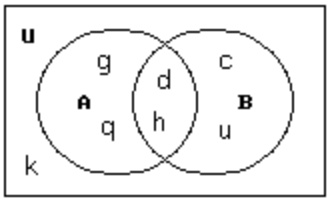
201) Let U = {c, d, g, h, k, u, q}

A = {d, h, g, q}

B = {c, d, h, u}



A)



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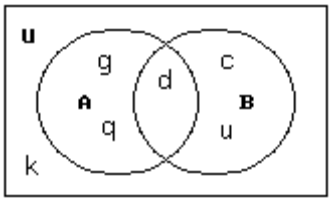

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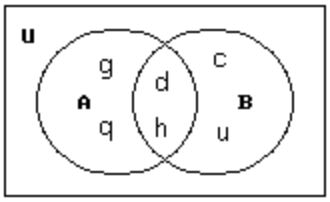
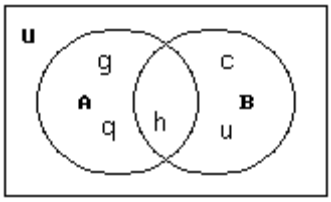


D)



Answer: A

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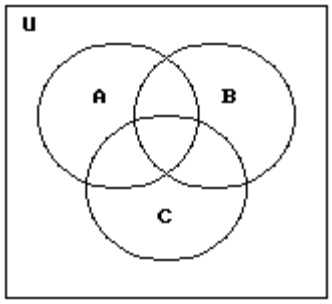
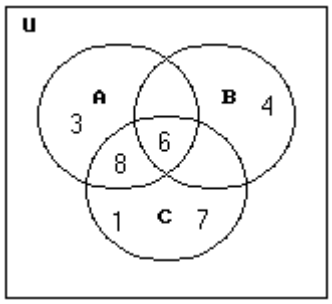
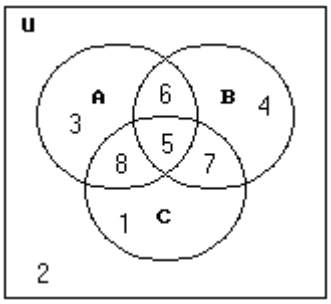
202) Let U = {1, 2, 3, 4, 5, 6, 7, 8}
A = {3, 6, 8}
B = {4, 6}
C = {1, 6, 7, 8}



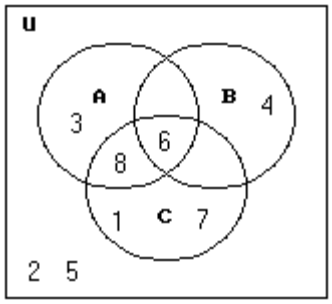
A)



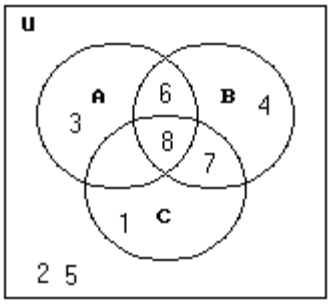
B)



C)



D)



Answer: C

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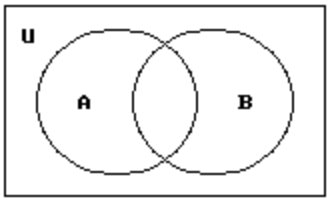
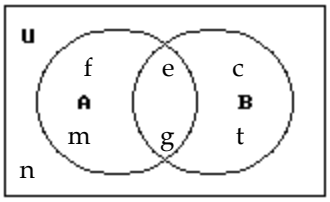
203) Let U = {c, e, g, f, n, m, t}
A = {e, g, f, m}
B = {c, e, g, t}



A)



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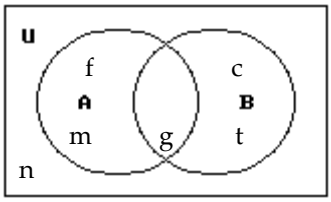

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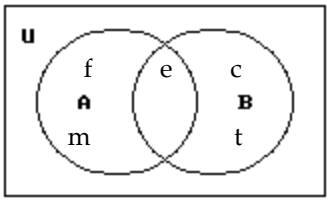
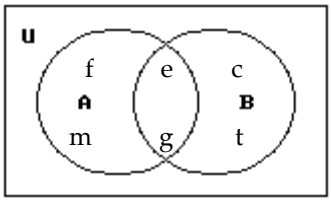
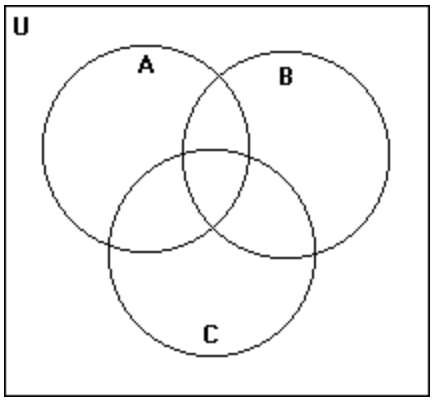


D)



Answer: A

204) U = {2, 4, 6, 8, 10, 12}
A = {2, 6, 10}
B = {2, 4, 8}
C = {2, 8, 10, 12}



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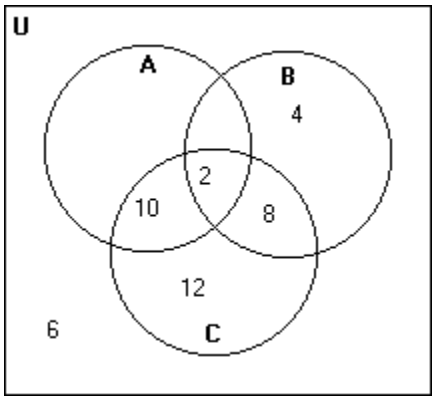
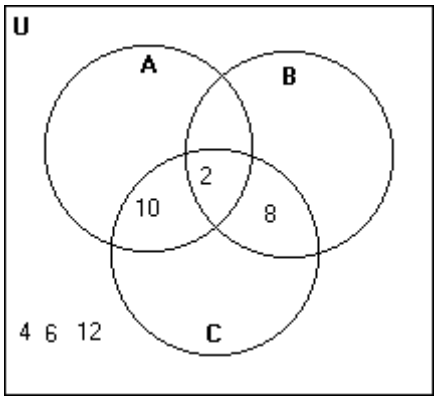
A)



B)



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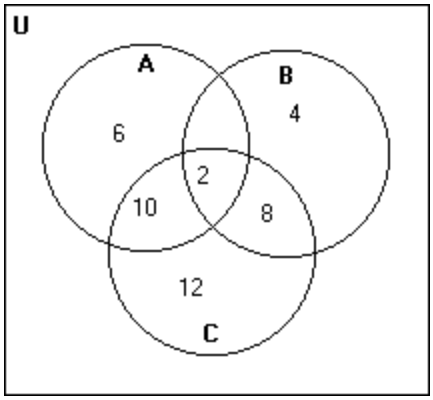
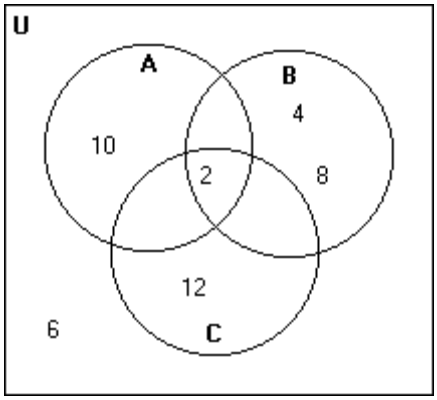
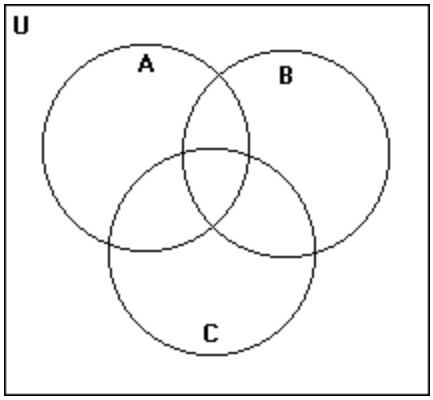


D)



Answer: C

205) U = {a, b, c, d, e, f, g, h, i,j , k, l, m, n, o, p}
A = {a, e, i, o}
B = {b, c, d, f, g, h, j, k, l, m}
C = {a, b, c, d, e, f, g}



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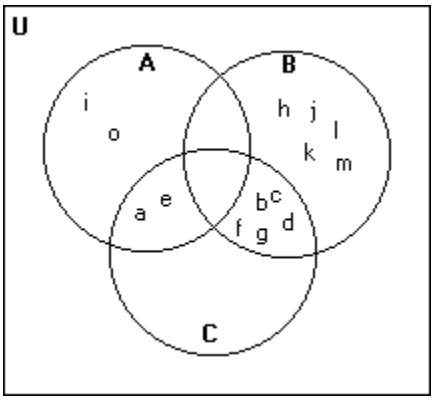
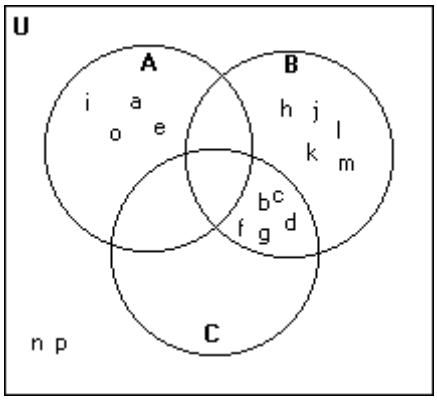
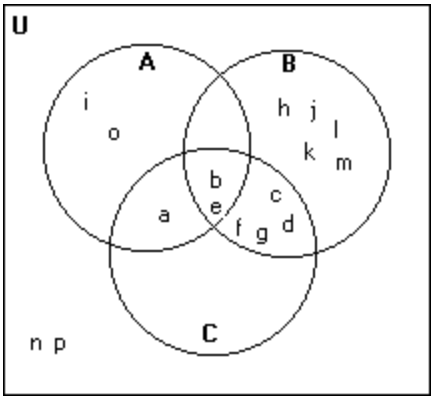
A)



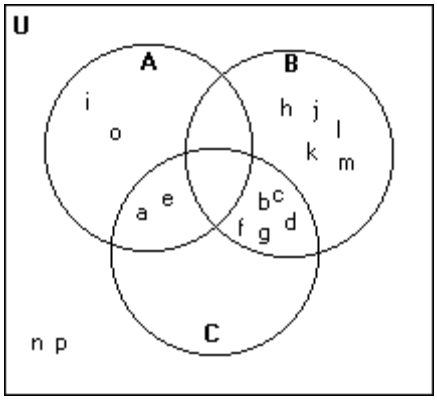
B)



C)



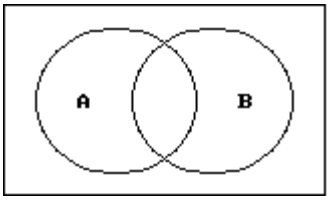
D)



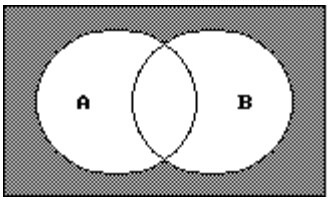
Answer: D

Shade the regions representing the set.

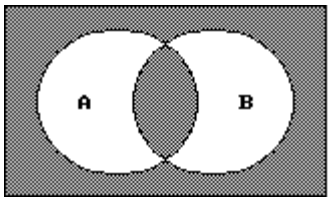
206) A' ∩ B'



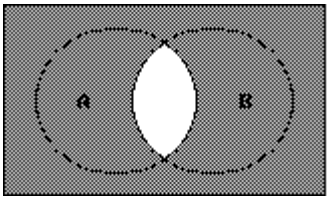
A)



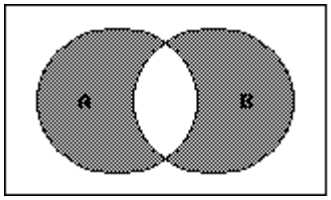
B)



C)



D)



Answer: A

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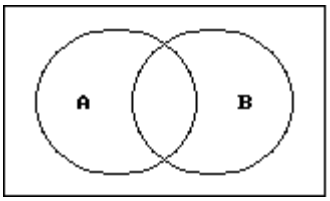
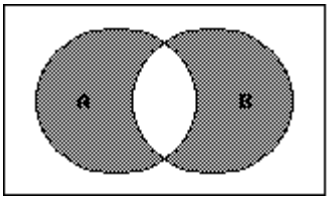
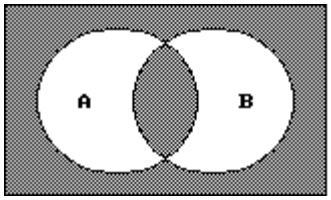
207) A' ∪ B'



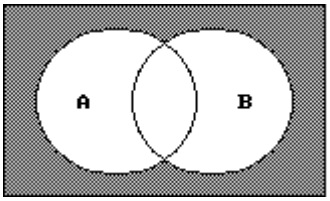
A)



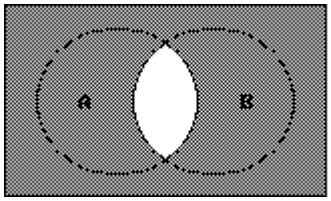
B)



C)

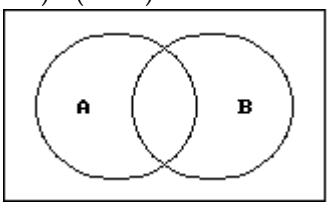


D)

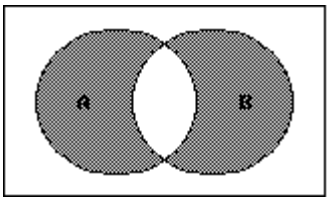


Answer: D

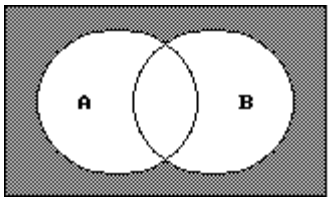
208) (A ∪ B) ∩ (A ∩ B)'



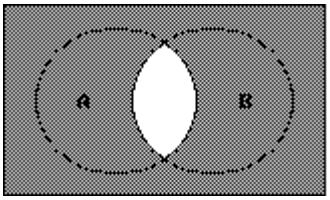
A)



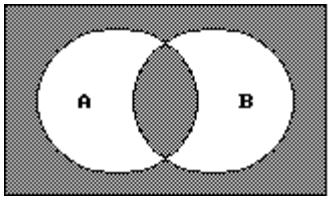
B)



C)



D)



Answer: A

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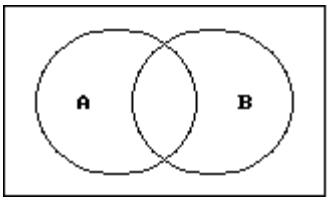
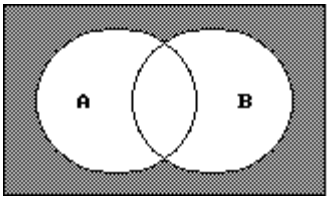
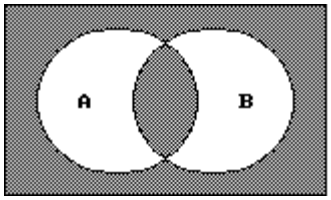
209) $(A \cap B) \cup (A \cup B)'$



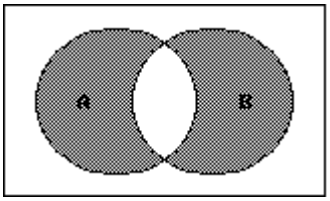
A)



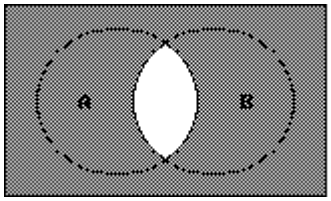
B)



C)



D)



Answer: B

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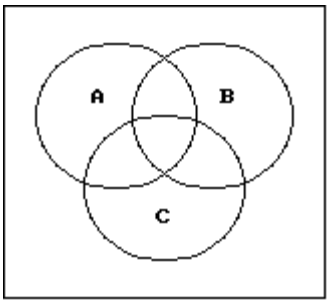
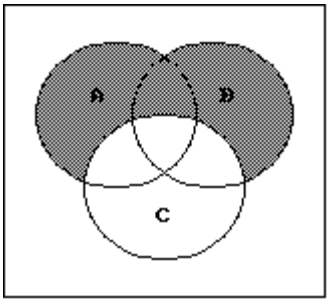
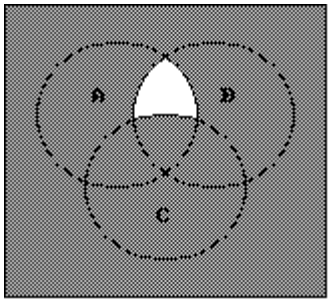
210) $(A \cap B \cap C')'$



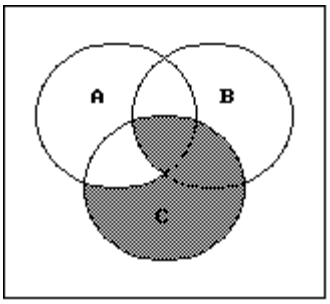
A)



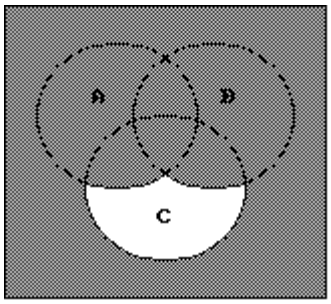
B)



C)



D)



Answer: B

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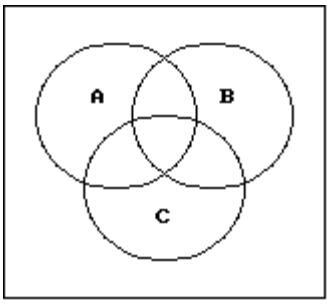
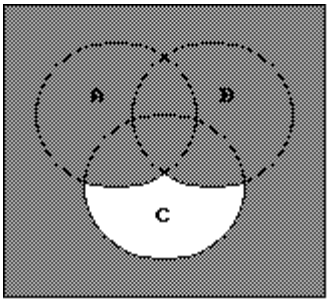
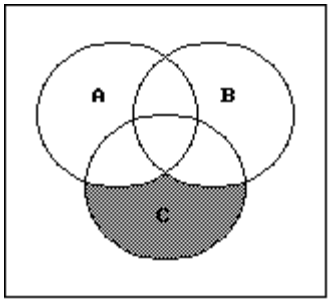
211) $(A \cup B \cup C')'$



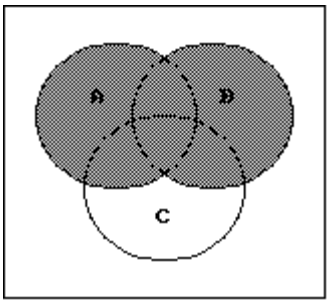
A)



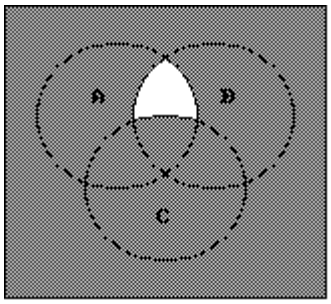
B)



C)



D)



Answer: B

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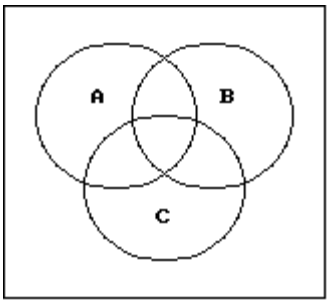
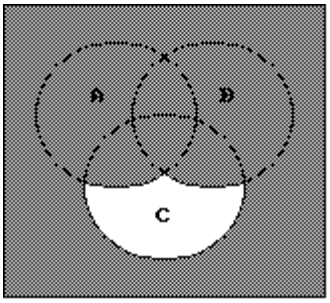
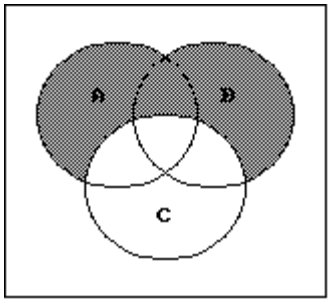
212) C' ∩ (A ∪ B)



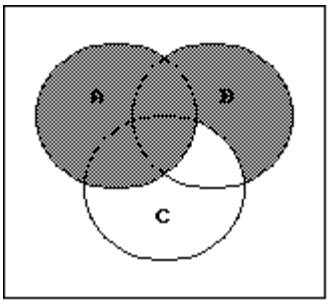
A)



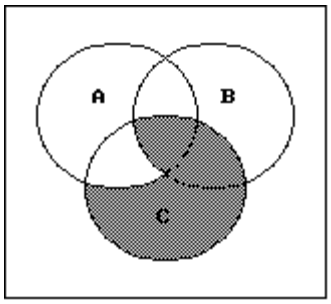
B)



C)



D)



Answer: B

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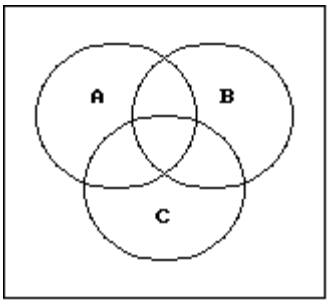
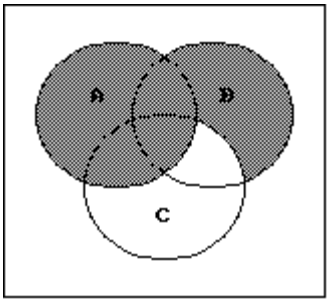
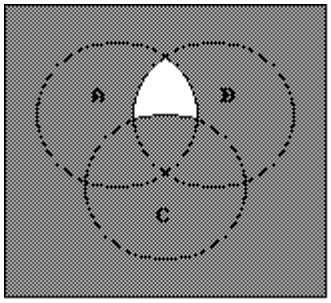
213) $(A' \cup B) \cap C$



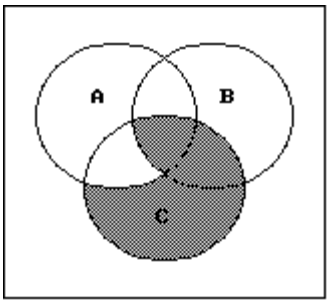
A)



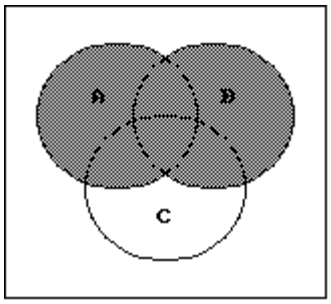
B)



C)



D)



Answer: C

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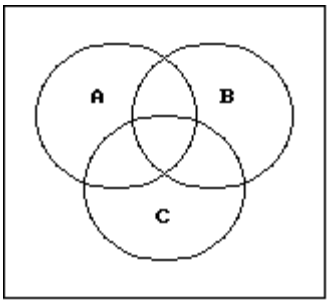
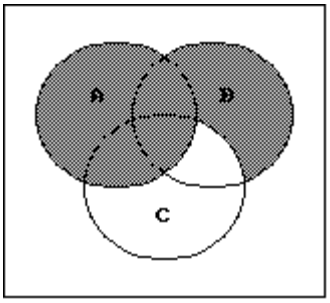
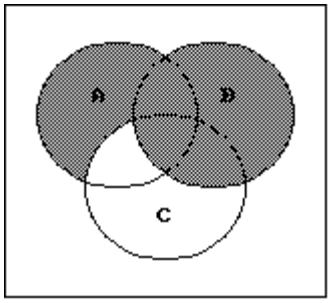
214) $A \cup (B \cap C')$



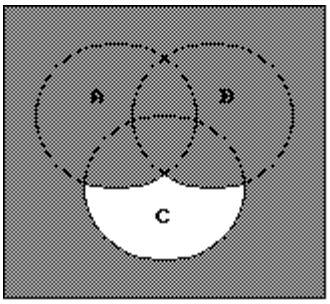
A)



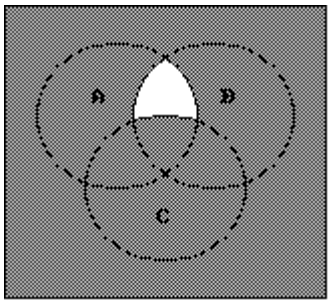
B)



C)



D)



Answer: A

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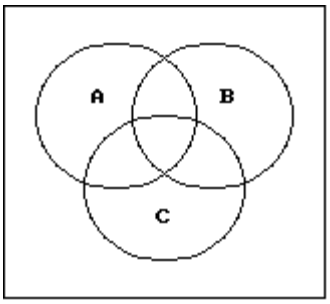
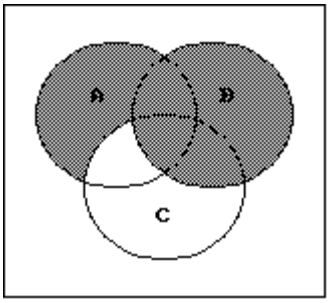
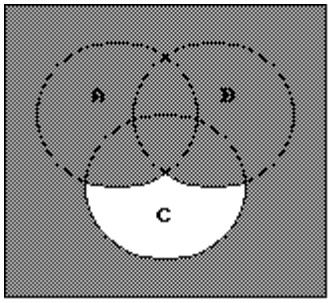
215) B ∪ (A ∩ C')



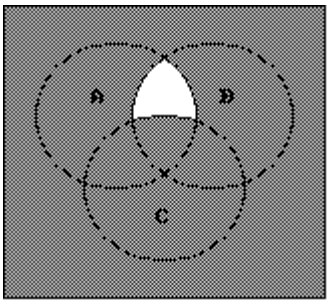
A)



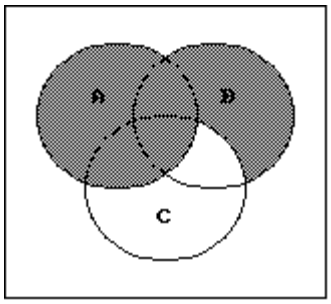
B)



C)



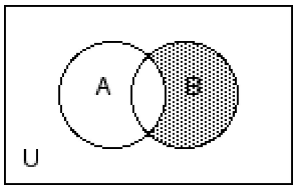
D)



Answer: A

Write a description of the shaded region using the symbols A, B, C, ∪, ∩, –, and ′ as needed.

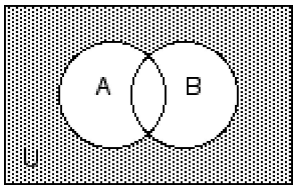
216)



A) B – A′ B) A – B C) B ∩ A′ D) A ∩ B′

Answer: C

217)



A) A ∪ B B) A′ ∩ B′ C) A – B D) (A ∩ B)′

Answer: B

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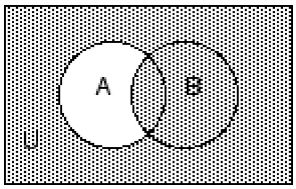
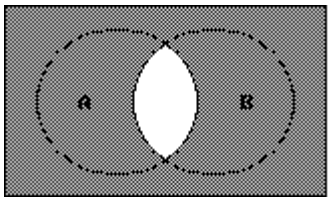
218)



A) $(A \cap B)'$ B) $B - A$ C) $A' \cup B$ D) $A' \cap B$

Answer: C

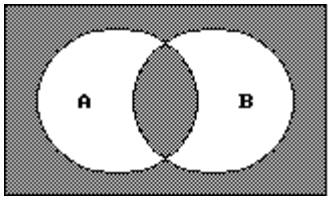
219)



A) $(A \cup B)'$ B) $A' \cap B'$ C) $A \cap B$ D) $(A \cap B)'$

Answer: D

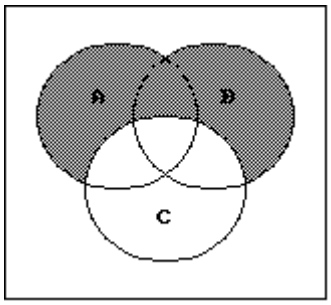
220)



A) $A' \cap B'$ B) $(A - B) \cup (B - A)$ C) $(A \cap B) \cup (A \cup B)'$ D) $(A \cap B) \cup (A \cap B)'$

Answer: C

221)



A) $(A \cup B) \cap C'$ B) $(A \cup B) \cap C$ C) $(A \cap B) \cap C'$ D) $(A \cup B) \cup C'$

Answer: A

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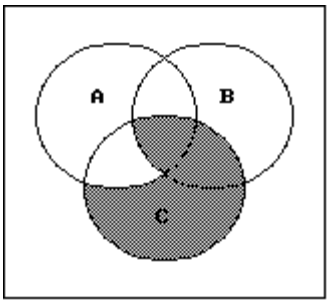
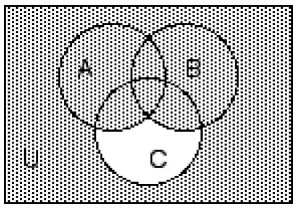
222)



A) $(A' \cup B) \cap C$ B) $(A' \cap B) \cup C$ C) $(A \cup B') \cap C$ D) $A' \cap C$

Answer: A

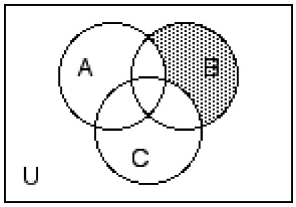
223)



A) $A \cup B \cap C'$ B) $(A \cup B) \cup C'$ C) $(A \cap B) \cup C'$ D) $(A \cup B \cup C)'$

Answer: B

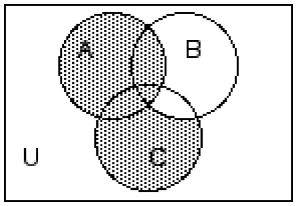
224)



A) $B - (A \cap C)$ B) $(B - A) \cup C$ C) $A' \cap C' \cap B$ D) $B \cap (A \cap C)'$

Answer: C

225)



A) $B' \cap A \cup C$ B) $C \cap B' \cup A$ C) $A \cup C - B$ D) $A \cup C$

Answer: B

Decide whether the given statement is always true or not always true.

226) $A \cap A' = \varnothing$

A) Always true B) Not always true

Answer: A

227) $(A \cup B) \subseteq A$

A) Not always true B) Always true

Answer: A

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228) $(A \cap B) \subseteq B$

A) Not always true B) Always true

Answer: B

229) $(A \cap B)' = A' \cup B'$

A) Not always true B) Always true

Answer: B

230) $(A \cup B)' = A' \cup B'$

A) Not always true B) Always true

Answer: A

231) If $A \subseteq B$, then $A \cup B = A$

A) Always true B) Not always true

Answer: B

232) If $B \subseteq A$, then $A \cap B = A$

A) Always true B) Not always true

Answer: B

233) $A - A' = A$

A) Always true B) Not always true

Answer: A

234) $A \cup (B \cap C)' = A \cup (B' \cup C')$

A) Not always true B) Always true

Answer: B

235) $A \cap (B \cup C) = (A \cap B) \cup C$

A) Always true B) Not always true

Answer: B

Describe the conditions under which the statement is true.

236) $A \cap B = A$

A) $B = \varnothing$ B) $A \subseteq B$ C) $B \subseteq A$ D) Always true

Answer: B

237) $A \cup \varnothing = U$

A) $A = \varnothing$ B) Always true C) $A \neq \varnothing$ D) $A = U$

Answer: D

238) $A \cup B = B$

A) Always true B) $A = \varnothing$ C) $A \subseteq B$ D) $B \subseteq A$

Answer: C

239) $A \cap A' = A$

A) $A = \varnothing$ B) $A = U$ C) $A \neq \varnothing$ D) Always true

Answer: A

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240) $A \cap B' = A$

A) $B \subseteq A$ B) Always true C) $B = \varnothing$ D) $A \cap B = \varnothing$

Answer: D

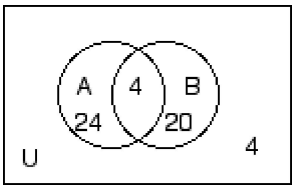
241) $A \cup B = A$

A) $A \subseteq B$ B) Always true C) $B = \varnothing$ D) $B \subseteq A$

Answer: D

Find the cardinal number of the set.

242) The numbers in the Venn Diagram below represent cardinalities.

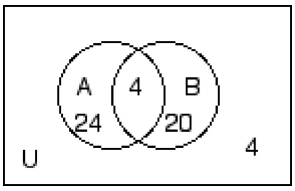


Find $n(A \cup B)$.

A) 48 B) 24 C) 4 D) 52

Answer: A

243) The numbers in the Venn Diagram below represent cardinalities.

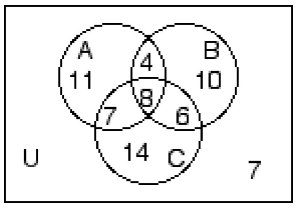


Find $n(A \cap B')$.

A) 20 B) 4 C) 24 D) 28

Answer: C

244) The numbers in the Venn Diagram below represent cardinalities.



Find $n(A' \cap B' \cap C)$

A) 13 B) 14 C) 21 D) 27

Answer: B

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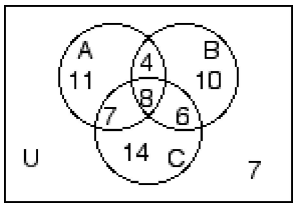
245) The numbers in the Venn Diagram below represent cardinalities.

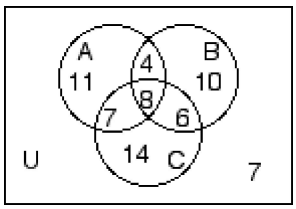


Find n(A ∩ B' ∩ C)

A) 6 B) 7 C) 11 D) 15

Answer: B

246) The numbers in the Venn Diagram below represent cardinalities.



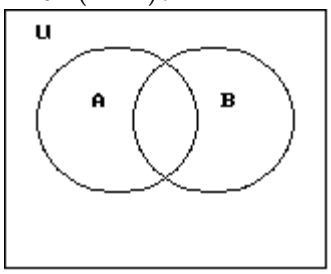
Find n(B ∪ C)

A) 60 B) 49 C) 14 D) 42

Answer: B

247) Given: n(U) = 60
n(A) = 29
n(B) = 25
n(A ∩ B) = 1

Find n(A ∪ B)'.



A) 54 B) 6 C) 53 D) 7

Answer: D

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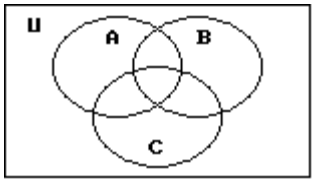
248) Given:

$$\begin{aligned} n(U) &= 136 \\ n(A) &= 44 \\ n(B) &= 64 \\ n(A \cap B) &= 17 \\ n(A \cap C) &= 20 \\ n(A \cap B \cap C) &= 9 \\ n(A' \cap B \cap C') &= 38 \\ n(A' \cap B' \cap C') &= 33 \end{aligned}$$

Find n(C).



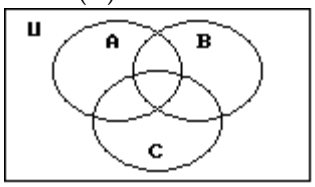
A) 28 B) 23 C) 41 D) 12

Answer: C

249) Given:

$$\begin{aligned} n(A) &= 50 \\ n(B) &= 58 \\ n(C) &= 52 \\ n(A \cap B) &= 10 \\ n(A \cap C) &= 12 \\ n(B \cap C) &= 6 \\ n(A \cap B \cap C) &= 4 \\ n(A' \cap B' \cap C') &= 101 \end{aligned}$$

Find n(U)



A) 136 B) 237 C) 247 D) 186

Answer: B

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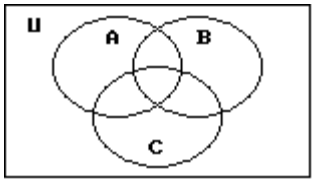
250) Given: $n(A \cup B \cup C) = 69$
$n(A \cap B \cap C) = 10$
$n(A \cap B) = 22$
$n(A \cap C) = 19$
$n(B \cap C) = 17$
$n(A) = 51$
$n(B) = 34$
$n(C) = 32$

Find $n(A' \cap B \cap C)$



A) 7 B) 8 C) 9 D) 6

Answer: A

Find the cardinal number of the indicated set. Use the cardinal number formula.

251) If $n(A) = 5$, $n(B) = 11$ and $n(A \cap B) = 3$, what is $n(A \cup B)$?

A) 13 B) 16 C) 12 D) 14

Answer: A

252) If $n(A) = 40$, $n(B) = 117$ and $n(A \cup B) = 137$, what is $n(A \cap B)$?

A) 22 B) 20 C) 10 D) 60

Answer: B

253) If $n(B) = 24$, $n(A \cap B) = 5$, and $n(A \cup B) = 42$, find $n(A)$.

A) 18 B) 21 C) 23 D) 25

Answer: C

254) If $n(A) = 10$, $n(A \cup B) = 28$, and $n(A \cap B) = 6$, find $n(B)$.

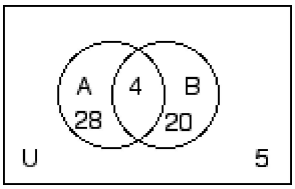
A) 25 B) 23 C) 18 D) 24

Answer: D

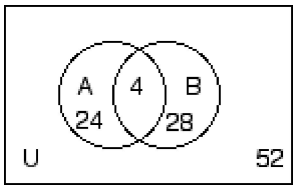
Draw an appropriate Venn diagram and use the given information to fill in the number of elements in each region.

255) $n(U) = 52$, $n(A) = 28$, $n(A \cap B) = 4$, $n(B') = 28$

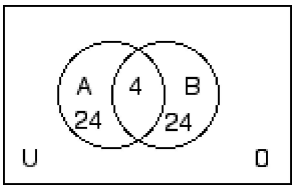
A)



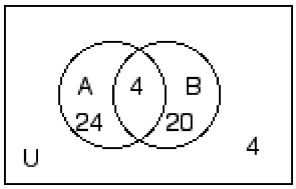
B)



C)



D)



Answer: D

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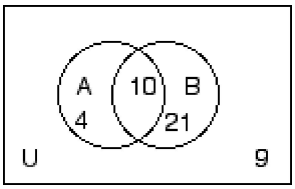
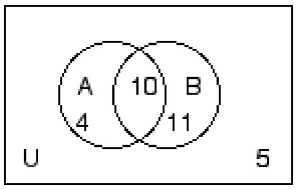
256) $n(A) = 14$, $n(B) = 21$, $n(A \cup B) = 25$, $n(B') = 9$

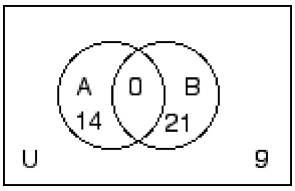
A)



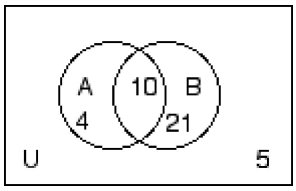
B)



C)



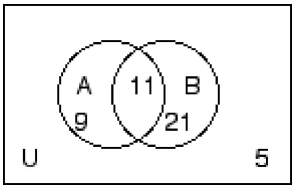
D)



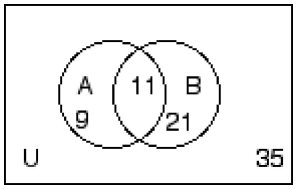
Answer: B

257) $n(A') = 26$, $n(B) = 32$, $n(A \cap B) = 11$, $n(A' \cup B') = 35$

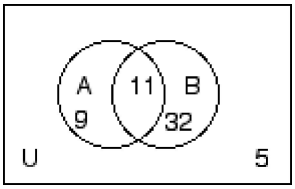
A)



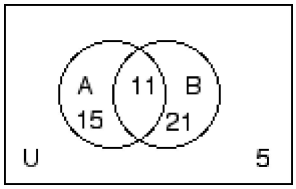
B)



C)



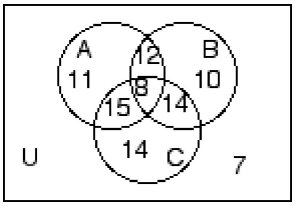
D)



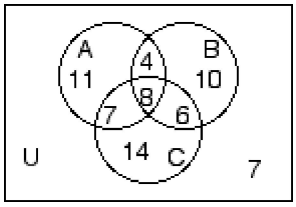
Answer: A

258) $n(A) = 30$, $n(B) = 28$, $n(C) = 35$, $n(A \cap B) = 12$, $n(A \cap C) = 15$, $n(B \cap C) = 14$, $n(U) = 67$

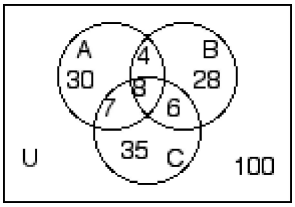
A)



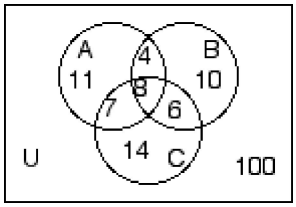
B)



C)



D)



Answer: B

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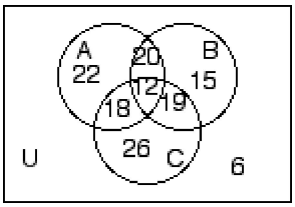
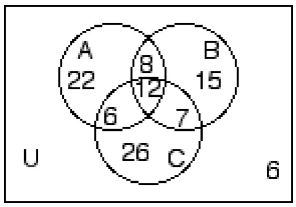
259) $n(A) = 48$, $n(B') = 60$, $n(C) = 51$, $n(A \cap B) = 20$, $n(B \cap C) = 19$, $n(A \cap C) = 18$, $n(A \cap B \cap C) = 12$, $n(A \cup B) = 70$

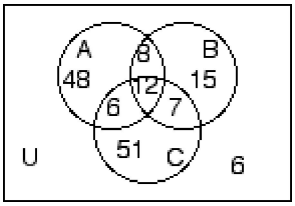
A)



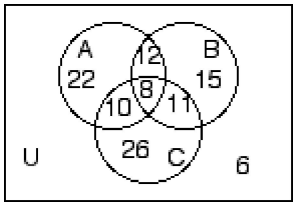
B)



C)



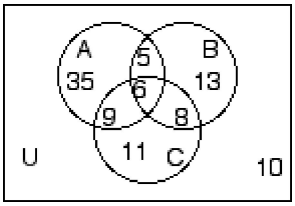
D)



Answer: B

260) $n(A) = 35$, $n(A \cap B') = 24$, $n(A \cap C) = 15$, $n(B \cap C) = 14$, $n(A' \cap B' \cap C') = 10$, $n(A \cap B \cap C) = 6$, $n(B \cup C) = 52$, $n(B \cap C') = 18$

A)



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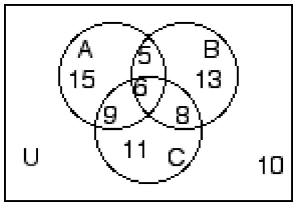
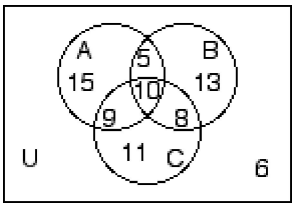
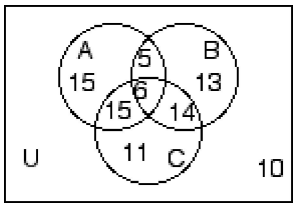


C)



D)



Answer: B

Solve the problem.

261) Mrs. Bollo's second grade class of thirty students conducted a pet ownership survey. Results of the survey indicate that 8 students own a cat, 15 students own a dog, and 5 students own both a cat and a dog. How many of the students surveyed own only a cat?

A) 3 B) 15 C) 8 D) 18

Answer: A

262) Monticello residents were surveyed concerning their preferences for candidates Moore and Allen in an upcoming election. Of the 800 respondents, 300 support neither Moore nor Allen, 100 support both Moore and Allen, and 250 support only Moore. How many residents support only Allen?

A) 250 B) 100 C) 300 D) 150

Answer: D

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263) A local television station sent out questionnaires to determine if viewers would rather see a documentary, an interview show, or reruns of a game show. There were 850 responses with the following results:

255 were interested in an interview show and a documentary, but not reruns.

34 were interested in an interview show and reruns but not a documentary.

119 were interested in reruns but not an interview show.

204 were interested in an interview show but not a documentary.

85 were interested in a documentary and reruns.

51 were interested in an interview show and reruns.

68 were interested in none of the three.

How many are interested in exactly one kind of show?

A) 418 B) 398 C) 408 D) 388

Answer: C

264) A survey of 160 families showed that

59 had a dog;
46 had a cat;
19 had a dog and a cat;
63 had neither a cat nor a dog nor a parakeet;
3 had a cat, a dog, and a parakeet.

How many had a parakeet only?

A) 21 B) 26 C) 16 D) 11

Answer: D

265) A survey of a group of 112 tourists was taken in St. Louis. The survey showed the following:

60 of the tourists plan to visit Gateway Arch;
46 plan to visit the zoo;
11 plan to visit the Art Museum and the zoo, but not the gateway Arch;
12 plan to visit the Art Museum and the Gateway Arch, but not the zoo;
16 plan to visit the Gateway Arch and the zoo, but not the Art Museum;
7 plan to visit the Art Museum, the zoo, and the Gateway Arch;
16 plan to visit none of the three places.

How many plan to visit the Art Museum only?

A) 46 B) 13 C) 96 D) 34

Answer: B

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266) In a survey of 280 people, a travel company asked people about places they plan to visit in the next 5 years. The results were as follows:
48 plan to visit Europe
58 plan to visit Latin America
34 plan to visit Asia
14 plan to visit Europe and Latin America
12 plan to visit Latin America and Asia
11 plan to visit Europe and Asia
4 plan to visit all three

How many people plan to visit exactly two of these places?
A) 18 B) 29 C) 25 D) 37

Answer: C

267) A survey of 141 college students was done to find out what elective courses they were taking. Let A = the set of those taking art, B = the set of those taking basketweaving, and C = the set of those taking canoeing. The study revealed the following information.
$n(A) = 45$ $n(A \cap B) = 12$
$n(B) = 55$ $n(A \cap C) = 15$
$n(C) = 40$ $n(B \cap C) = 23$
$n(A \cap B \cap C) = 2$

How many students were not taking any of these electives?
A) 59 B) 51 C) 10 D) 49

Answer: D

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