

Ch. 2 The Basic Concepts of Set Theory

2.1 Symbols and Terminology

1 List Elements in Set

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

List the elements in the set.

- 1) $\{x \mid x \text{ is a whole number between 1 and 5}\}$
A) $\{2, 3, 4\}$ B) $\{1, 2, 3, 4, 5\}$ C) $\{1, 2, 3, 4\}$ D) $\{2, 3, 4, 5\}$
- 2) $\{x \mid x \text{ is an integer between } -8 \text{ and } -4\}$
A) $\{-7, -6, -5\}$ B) $\{-8, -7, -6, -5, -4\}$ C) $\{-8, -7, -6, -5\}$ D) $\{-7, -6, -5, -4\}$
- 3) $\{x \mid x \text{ is a negative multiple of 5}\}$
A) $\{-5, -10, -15, \dots\}$ B) $\{0, -5, -10, \dots\}$ C) $\{5, 10, 15, \dots\}$ D) $\{-5, -25, -125, \dots\}$
- 4) $\{x \mid x \text{ is an integer greater than } -6\}$
A) $\{-5, -4, -3, \dots\}$ B) $\{-5, -4, -3, -2\}$ C) $\{-7, -8, -9, \dots\}$ D) $\{-7, -8, -9\}$
- 5) The set of all whole numbers greater than 6 and less than 10
A) $\{7, 8, 9\}$ B) $\{6, 7, 8, 9, 10\}$ C) $\{6, 7, 8, 9\}$ D) $\{7, 8, 9, 10\}$
- 6) $\{x \mid x \text{ is a counting number multiple of 2}\}$
A) $\{2, 4, 6, \dots\}$ B) $\{0, 2, 4, 6, \dots\}$ C) $\emptyset$ D) $\{4, 6, 8, \dots\}$
- 7) $\{x \mid x \text{ is a counting number less than } -2\}$
A) $\emptyset$ B) $\{\dots, -5, -4, -3\}$ C) $\{-1, 0, 1, \dots\}$ D) $\{-3, -4, -5, \dots\}$
- 8) The set of all positive integer powers of 3.
A) $\{3, 9, 27, 81, 243, \dots\}$ B) $\{3, 6, 9, 12, 15, \dots\}$
C) $\{1, 8, 27, 64, 125, \dots\}$ D) $\{1, 3, 9, 27, 81, 243, \dots\}$
- 9) $\{x \mid x \text{ is an even integer smaller than 8}\}$
A) $\{\dots, -6, -4, -2, 0, 2, 4, 6\}$ B) $\{0, 2, 4, 6\}$
C) $\{\dots, -6, -4, -2, 2, 4, 6\}$ D) $\{2, 4, 6\}$
- 10) The set of the days of the week
A) $\{\text{Friday, Monday, Saturday, Sunday, Thursday, Tuesday, Wednesday}\}$
B) $\{\text{Saturday, Sunday}\}$
C) $\{\text{Tuesday, Thursday}\}$
D) $\{\text{Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Sunday}\}$

2 Use Set-Builder Notation

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

Write the set in set-builder notation.

- 1) $\{9\}$
A) $\{x \mid x \text{ is the natural number } 9\}$ B) $\{x\}$
C) $\{x \mid x \text{ is a natural number}\}$ D) $\{x \text{ is a constant}\}$

- 2) {2, 4, 6, 8}
- A) $\{x \mid x \text{ is an even natural number less than } 10\}$
 C) $\{x \mid x \text{ is any even integer less than } 10\}$
- B) {2, 4, 6, 8}
 D) $\{x \mid x \text{ is any even natural number}\}$
- 3) {15, 16, 17, 18}
- A) $\{x \mid x \text{ is an integer between } 14 \text{ and } 19\}$
 C) $\{x \mid x \text{ is an integer between } 15 \text{ and } 18\}$
- B) {15, 16, 17, 18}
 D) $\{x \mid x \text{ is an integer less than } 19\}$
- 4) {-6, -5, -4, -3, ...}
- A) $\{x \mid x \text{ is an integer greater than } -7\}$
 C) $\{x \mid x \text{ is any integer}\}$
- B) {-6, -5, -4, -3}
 D) $\{x \mid x \text{ is an integer between } -7 \text{ and } -2\}$
- 5) {..., -3, -2, -1, 0, 1, 2, 3, ...}
- A) $\{x \mid x \text{ is an integer}\}$
 C) $\{x \mid x \text{ is any integer greater than } -3\}$
- B) $\{x \mid x \text{ is a natural number}\}$
 D) {-3, -2, -1, 0, 1, 2, 3}
- 6) {18, 24, 30, 36, ..., 78}
- A) $\{x \mid x \text{ is a multiple of } 6 \text{ between } 12 \text{ and } 84\}$
 C) $\{x \mid x \text{ is a multiple of } 6 \text{ greater than } 18\}$
- B) $\{x \mid x \text{ is a multiple of } 6 \text{ between } 18 \text{ and } 78\}$
 D) $\{x \mid x \text{ is a multiple of } 6\}$
- 7) {-3, -1, 1, 3, 5, ...}
- A) $\{x \mid x \text{ is an odd integer greater than } -4\}$
 B) $\{x \mid x \text{ is an integer greater than } -4\}$
 C) $\{x \mid x \text{ is an odd integer}\}$
 D) $\{x \mid x \text{ is an odd integer between } -4 \text{ and } 6\}$
- 8) {2, 4, 8, 16, 32, ...}
- A) $\{x \mid x \text{ is a positive integer power of } 2\}$
 C) $\{x \mid x \text{ is a positive multiple of } 2\}$
- B) $\{x \mid x \text{ is an integer power of } 2\}$
 D) $\{x \mid x \text{ is a positive multiple of } 4\}$
- 9) The set of all calculus books
- A) $\{x \mid x \text{ is a calculus book}\}$
 C) {any calculus book}
- B) {x is a calculus book}
 D) {a calculus book}
- 10) The set of all cars owned by students
- A) $\{x \mid x \text{ is a car owned by a student}\}$
 C) {x is a car}
- B) $\{x \mid x \text{ is a student with a car}\}$
 D) {x is a student with a car}

3 Identify Set as Finite or Infinite

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

Identify the set as finite or infinite.

- 1) {7, 8, 9, ..., 28}
- A) Finite
 B) Infinite
- 2) $\left\{1, \frac{1}{4}, \frac{1}{16}, \frac{1}{64}, \dots\right\}$
- A) Infinite
 B) Finite
- 3) $\{x \mid x \text{ is a counting number larger than } 815\}$
- A) Infinite
 B) Finite
- 4) $\{x \mid x \text{ is an odd counting number}\}$
- A) Infinite
 B) Finite

5) $\{x \mid x \text{ is a 12-headed lizard}\}$

A) Finite

B) Infinite

6) $\{x \mid x \text{ is a fraction between 60 and 61}\}$

A) Infinite

B) Finite

7) $\{x \mid x \text{ is a prime number}\}$

A) Infinite

B) Finite

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

A) Finite

B) Infinite

4 Find $n(A)$ for Set

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

Find $n(A)$ for the set.

1) $A = \{0, 2, 4, 6, 8\}$

A) $n(A) = 5$

B) $n(A) = 4$

C) $n(A) = 8$

D) $n(A) = 2$

2) $A = \{200, 201, 202, \dots, 2000\}$

A) $n(A) = 1801$

B) $n(A) = 2000$

C) $n(A) = 1800$

D) $n(A) = 4$

3) $A = \{x \mid x \text{ is a month in the year}\}$

A) $n(A) = 12$

B) $n(A) = 1$

C) $n(A) = 52$

D) $n(A) = 24$

4) $A = \{x \mid x \text{ is a number on a clock face}\}$

A) $n(A) = 12$

B) $n(A) = 24$

C) $n(A) = 6$

D) $n(A) = 3$

5) $A = \{x \mid x \text{ is a second in a minute}\}$

A) $n(A) = 60$

B) $n(A) = 12$

C) $n(A) = \text{Infinite}$

D) $n(A) = 120$

6) $A = \{2, 2, 3, 3, \dots, 6, 6\}$

A) $n(A) = 5$

B) $n(A) = 10$

C) $n(A) = 3$

D) $n(A) = 6$

7) $A = \{-7, -6, -5, \dots, 0\}$

A) $n(A) = 8$

B) $n(A) = 4$

C) $n(A) = 1$

D) $n(A) = 7$

8) $A = \left\{\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \dots, \frac{1}{29}, \frac{1}{30}\right\}$

A) $n(A) = 29$

B) $n(A) = 30$

C) $n(A) = \text{Infinite}$

D) $n(A) = 31$

9) $A = \left\{\frac{1}{2}, -\frac{1}{2}, \frac{2}{3}, -\frac{2}{3}, \frac{3}{4}, -\frac{3}{4}, \dots, \frac{19}{20}, -\frac{19}{20}\right\}$

A) $n(A) = 38$

B) $n(A) = 40$

C) $n(A) = 19$

D) $n(A) = \text{Infinite}$

5 Determine Whether Set Is Well Defined

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

Determine whether or not the set is well defined.

1) $\{x \mid x \text{ is a tennis player who has won at Wimbledon}\}$

A) Well defined

B) Not well defined

2) $\{x \mid x \text{ is a low-fat ice cream}\}$

A) Not well defined

B) Well defined

3) $\{x \mid x \text{ is a football team that has won the Super Bowl}\}$

A) Well defined

B) Not well defined

4) $\{x \mid x \text{ is a adventure book in the library}\}$

A) Not well defined

B) Well defined

5) $\{x \mid x \text{ is a stock on the AmEx today}\}$

A) Well defined

B) Not well defined

6) $\{x \mid x \text{ is an expensive boat on the Great Lakes}\}$

A) Not well defined

B) Well defined

7) $\{x \mid x \text{ is a four-year college in Utah}\}$

A) Well defined

B) Not well defined

6 Decide Whether Number Is in Set

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

Complete the blank with either $\in$ or $\notin$ to make the statement true.

1) $-5 \underline{\hspace{1cm}} \{5, 7, 9, \dots, 17\}$

A) $\notin$

B) $\in$

2) $0 \underline{\hspace{1cm}} \{-1, 1, 3, 12, 22\}$

A) $\notin$

B) $\in$

3) $\{7\} \underline{\hspace{1cm}} \{\{4\}, \{5\}, \{6\}, \{7\}, \{8\}\}$

A) $\in$

B) $\notin$

4) $5 \underline{\hspace{1cm}} \{10, 9, 8, 7\}$

A) $\notin$

B) $\in$

5) $7 \underline{\hspace{1cm}} \{6, 11, 5, 7, 15\}$

A) $\in$

B) $\notin$

6) $12 \underline{\hspace{1cm}} \{10, 11, 12, 13\}$

A) $\in$

B) $\notin$

7) $a \underline{\hspace{1cm}} \{A, B, C, \dots, Z\}$

A) $\notin$

B) $\in$

8) $7 \underline{\hspace{1cm}} \{2, 3, 4, \dots, 7\}$

A) $\in$

B) $\notin$

9) $\{6\} \underline{\hspace{1cm}} \{7 - 3, 8 - 3, 9 - 3, 10 - 3\}$

A) $\notin$

B) $\in$

10) $7 \underline{\hspace{1cm}} \{8 + 5, 6 + 5, 4 + 5, 2 + 5\}$

A) $\in$

B) $\notin$

7 Determine Truth of Statement: Sets I

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

Tell whether the statement is true or false.

- | | |
|--|----------|
| 1) $10 \in \{20, 30, 40, 50, 60\}$ | |
| A) True | B) False |
| 2) $\{4, 6, 13\} = \{0, 4, 6, 13\}$ | |
| A) True | B) False |
| 3) $17 \notin \{16, 14, 13, \dots, 1\}$ | |
| A) True | B) False |
| 4) $\{8\} = \{x \mid x \text{ is an even counting number between 10 and 16}\}$ | |
| A) True | B) False |
| 5) $\{59, 60, 59, 60\} = \{59, 60\}$ | |
| A) True | B) False |
| 6) $\{2, 12, 28, 10, 31\} = \{31, 12, 10, 82, 2\}$ | |
| A) True | B) False |
| 7) $\{x \mid x \text{ is a counting number greater than 35}\} = \{35, 36, 37, \dots\}$ | |
| A) True | B) False |
| 8) $13 \notin \{x \mid x \text{ is an even counting number}\}$ | |
| A) True | B) False |
| 9) $k \notin \{p, a, k, h, v\}$ | |
| A) True | B) False |
| 10) $\{s, q, y, o, d\} = \{o, d, q, s, y\}$ | |
| A) True | B) False |

8 Determine Truth of Statement: Sets II

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

Write true or false for the following statement.

Let $A = \{3, 5, 7, 9, 11, 13\}$

$B = \{3, 5, 9, 11\}$

$C = \{5, 9, 13\}$

- | | |
|---|----------|
| 1) $13 \notin C$ | |
| A) True | B) False |
| 2) $9 \in B$ | |
| A) True | B) False |
| 3) Every element of B is also an element of C. | |
| A) True | B) False |
| 4) $A = \{x \mid x \text{ is an odd counting number greater than 1 and less than 15}\}$ | |
| A) True | B) False |

- 5) $0 \in A$
 A) True B) False
- 6) Every element of C is also an element of A.
 A) True B) False
- 7) $\{x \mid x \text{ is an odd counting number less than } 15\} = A$
 A) True B) False
- 8) $\{13\} \in B$
 A) True B) False

2.2 Venn Diagrams and Subsets

1 Determine Subset Relationships

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

Use $\subseteq$ or $\not\subseteq$ in the blank to make a true statement.

- 1) $\{4, 6, 8\} \underline{\hspace{1cm}} \{3, 4, 5, 6, 8\}$
 A) $\subseteq$ B) $\not\subseteq$
- 2) $\{16, 23, 28\} \underline{\hspace{1cm}} \{14, 23, 28, 38\}$
 A) $\not\subseteq$ B) $\subseteq$
- 3) $\{e, d, j, h\} \underline{\hspace{1cm}} \{e, d, j, h, p\}$
 A) $\subseteq$ B) $\not\subseteq$
- 4) $\emptyset \underline{\hspace{1cm}} \emptyset$
 A) $\subseteq$ B) $\not\subseteq$
- 5) $\{1, 3, 5\} \underline{\hspace{1cm}} \{x \mid x \text{ is an odd counting number}\}$
 A) $\subseteq$ B) $\not\subseteq$
- 6) $\{k, m, i\} \underline{\hspace{1cm}} \{k, k, m, m, i, i\}$
 A) $\subseteq$ B) $\not\subseteq$
- 7) $\{x \mid x \text{ is a counting number larger than } 5\} \underline{\hspace{1cm}} \{7, 8, 9, \dots\}$
 A) $\not\subseteq$ B) $\subseteq$

2 Identify Proper Subsets

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

Decide whether $\subset$, $\subsetneq$, both, or neither can be placed in the blank to make a true statement.

- 1) $\{11, 12, 13\} \underline{\hspace{1cm}} \{10, 11, 12, 13\}$
 A) Both $\subset$ and $\subsetneq$ B) $\subset$ C) $\subsetneq$ D) Neither
- 2) $\emptyset \underline{\hspace{1cm}} \{3, 19, 26, 32\}$
 A) Both $\subset$ and $\subsetneq$ B) $\subset$ C) $\subsetneq$ D) Neither
- 3) $\{7, 8, 9\} \underline{\hspace{1cm}} \{7, 8, 9\}$
 A) $\subsetneq$ B) $\subset$ C) Both $\subset$ and $\subsetneq$ D) Neither
- 4) $\{0\} \underline{\hspace{1cm}} \emptyset$
 A) Neither B) $\subset$ C) $\subsetneq$ D) Both $\subset$ and $\subsetneq$

5) $\{a, b\} \underline{\hspace{1cm}} \{z, a, y, b, x, c\}$

A) Both $\subset$ and $\subseteq$

B) $\subset$

C) $\subseteq$

D) Neither

6) $\{s, r, t\} \underline{\hspace{1cm}} \{s, r, t\}$

A) $\subseteq$

B) $\subset$

C) Both $\subseteq$ and $\subset$

D) Neither

3 Determine Truth of Statement: Subsets

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

Determine whether the statement is true or false.

Let $A = \{1, 3, 5, 7\}$

$B = \{5, 6, 7, 8\}$

$C = \{5, 8\}$

$D = \{2, 5, 8\}$

$U = \{1, 2, 3, 4, 5, 6, 7, 8\}$

1) $C \subset D$

A) True

B) False

2) $\emptyset \subseteq A$

A) True

B) False

3) $\{6, 5, 8, 7\} \subseteq B$

A) True

B) False

4) $D \subseteq B$

A) True

B) False

5) $A \neq \{7, 5, 3, 1\}$

A) True

B) False

6) $\{5\} \subseteq D$

A) True

B) False

7) $\{0\} \subseteq U$

A) True

B) False

8) $\{8, 5, 2\} \subset D$

A) True

B) False

9) $C \not\subseteq B$

A) True

B) False

10) $C \not\subseteq A$

A) True

B) False

4 Find Number of Subsets

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

Find the number of subsets of the set.

1) $\{9, 10, 11\}$

A) 8

B) 3

C) 6

D) 7

- 2) $\{x \mid x \text{ is an even number between 19 and 31}\}$
 A) 64 B) 5 C) 32 D) 29
- 3) $\{0\}$
 A) 2 B) 1 C) 0 D) 4
- 4) $\{\text{mom, dad, son, daughter}\}$
 A) 16 B) 12 C) 8 D) 14
- 5) $\{\text{math, English, history, science, art}\}$
 A) 32 B) 16 C) 28 D) 24
- 6) $\{x \mid x \text{ is a day of the week}\}$
 A) 128 B) 124 C) 127 D) 256
- 7) $\{1, 2, 3, \dots, 9\}$
 A) 512 B) 16 C) 508 D) 1024

5 Find Number of Proper Subsets

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

Find the number of proper subsets of the set.

- 1) $\{12, 13, 14\}$
 A) 7 B) 2 C) 5 D) 6
- 2) $\{x \mid x \text{ is an even number between 11 and 25}\}$
 A) 127 B) 24 C) 64 D) 128
- 3) $\{0\}$
 A) 1 B) 2 C) 0 D) 4
- 4) $\{\text{car, boat, truck, train}\}$
 A) 15 B) 16 C) 8 D) 14
- 5) $\{\text{poetry, drama, speech, art, film}\}$
 A) 31 B) 32 C) 16 D) 24
- 6) $\{x \mid x \text{ is a day of the week}\}$
 A) 127 B) 128 C) 64 D) 256
- 7) $\{1, 2, 3, \dots, 6\}$
 A) 63 B) 64 C) 58 D) 127

6 Find Complement of Set

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

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

- 1) $T = \{2, 4, b, d\}$
 A) $\{1, 5, a, c, e\}$ B) $\{1, 3, 5, a, c, e\}$
 C) $\{1, 5, a, e\}$ D) $\{1, 2, 4, 5, a, b, c, d, e\}$
- 2) $W = \{1, 5, e, d, a\}$
 A) $\{2, 4, b, c\}$ B) $\{2, 3, 4, b, c\}$ C) $\{2, 3, 4, a, b, c\}$ D) $\{1, 2, 4, b, c\}$

- 3) $V = \{1, 2, 4, 5, a, b, c, e\}$
 A) $\{d\}$ B) $\emptyset$ C) $\{u\}$ D) $\{3, d\}$
- 4) $T = \{a, b, c, d\}$
 A) $\{1, 2, 4, 5, e\}$ B) $\{1, 2, 3, 4, 5, e\}$ C) $\{e\}$ D) $\{1, 2, 4, 5\}$
- 5) $G = \{a\}$
 A) $\{1, 2, 4, 5, b, c, d, e\}$ B) $\{1, 2, 3, 4, 5, b, c, d, e\}$
 C) $\{u, v\}$ D) $\{1, 2, 5, b, c, d, e\}$
- 6) $P = \emptyset$
 A) U B) $\emptyset$ C) $\emptyset'$ D) $\{0\}$
- 7) $P = \{a, b, d, e, 1, 2, 4, 5\}$
 A) $\{c\}$ B) U C) $\emptyset$ D) $\{c, 3\}$
- 8) $R = \{1, 2, 5, b, d\}$
 A) $\{4, a, c, e\}$ B) $\{3, 4, a, c, e\}$ C) $\{4, a, b, c, e\}$ D) $\{3, 4, a, b, c, e\}$
- 9) $T = U$
 A) $\emptyset$ B) U C) T D) $\{U - T\}$
- 10) $P = \{e, a, c, 4, 5\}$
 A) $\{1, 2, b, d\}$ B) $\{1, 2, 3, b, d\}$ C) $\{b, d, 1, 2, 3\}$ D) $\{1, 2, b, c, d\}$

7 Solve Apps: Find Complement/Intersection

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

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

<u>Alabama</u>	<u>Arkansas</u>	<u>Louisiana</u>
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.

- 1) The set of crops in U .
 A) $\{c, h, n, p, r, s, t, w\}$ B) $\{s, p, c, h, w, s, r, t, h, w, s, n, r, c, t\}$
 C) $\{s, p, c, h, w, r, t, n, c\}$ D) $\{s, p, c, w, r, t, n\}$
- 2) The set of crops in A' .
 A) $\{n, r, t\}$ B) $\{h, n, r, t\}$ C) $\{r, t\}$ D) $\{c, h, n, r, s, t, w\}$
- 3) The set of crops in both A and K
 A) $\{h, s, w\}$ B) $\{c, h, p, r, s, t, w\}$ C) $\{c, p, r, t\}$ D) $\{c, h, s, t, w\}$
- 4) The set of crops in both L and K
 A) $\{r, s, t\}$ B) $\{c, h, n, r, s, t, w\}$ C) $\{c, h, n, w\}$ D) $\{c, n, r, s, t\}$
- 5) The set of crops in both L and K'
 A) $\{c, n\}$ B) $\{r, s, t\}$ C) $\{c, n, p\}$ D) $\{h, w\}$

- 6) The set of crops in both A and L'
 A) {h, p, w} B) {c, s} C) {h, n, t, w} D) {n, r, t}
- 7) The set of crops in both A' and K'
 A) {n} B) {c, p, r, t} C) $\emptyset$ D) {c, n, p, r, t}
- 8) The set of crops common to A, K, and L
 A) {s} B) {n, p, s} C) {n, p} D) {c, h, n, p, r, s, t, w}
- 9) The set of crops in either A or L or both
 A) {c, h, n, p, r, s, t, w} B) {h, n, p, r, t, w} C) {c, s} D) {c, n, p}
- 10) The set of crops in either A' or L or both
 A) {c, n, r, s, t} B) {h, p, w} C) {n, r, t} D) {h, n, p, r, t, w}

8 List Subsets of Set

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

Solve the problem.

- 1) List all possible subsets of the set {m, n}.
 A) {m}, {n}, {m, n}, $\emptyset$ B) {m}, {n}, $\emptyset$
 C) {m}, {n}, {m, n} D) {m}, {n}
- 2) List all possible proper subsets of the set {2, 6, 7}.
 A) $\emptyset$, {2}, {6}, {7}, {2, 6}, {2, 7}, {6, 7} B) $\emptyset$, {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}
- 3) 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} B) {e, f}, {e, g}, {e, j}, {f, j}, {g, j}
 C) {e, f}, {e, g}, {f, g}, {g, j} D) {e, f}, {e, g}, {e, j}, {f, g}, {f, j}, {g, j}, {f, e}, {g, e}
- 4) 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}, {e, g, 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}
 D) {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}
- 5) 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) $\emptyset$, {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}
 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}, {l, m, n, p}
 C) $\emptyset$, {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}
 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}, {m, n, l}, {l, m, n, p}

- 6) 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}
- B) {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}
- C) {a, d, r}, {a, d, s}, {a, d, t}, {a, r, s}, {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, s}, {d, r, t}, {d, s, t}, {r, s, t}, {d, a, r}, {s, t, d}

2.3 Set Operations

1 Use Set Operations I

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

List the elements in the set .

Let $U = \{q, r, s, t, u, v, w, x, y, z\}$

$A = \{q, s, u, w, y\}$

$B = \{q, s, y, z\}$

$C = \{v, w, x, y, z\}$.

1) $A \cup C$

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

C) {q, s, u, v, w, y, z}

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

D) {w, y}

2) $B \cap C$

A) {y, z}

B) {q, s, v, w, x, y, z}

C) {y}

D) {w, y, z}

3) $A \cap B'$

A) {u, w}

C) {r, s, t, u, v, w, x, z}

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

D) {t, v, x}

4) $(A \cup B)'$

A) {r, t, v, x}

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

C) {t, v, x}

D) {s, u, w}

5) $(A \cap B)'$

A) {r, t, u, v, w, x, z}

C) {s, u, w}

B) {t, v, x}

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

6) $A' \cup B$

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

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

B) {s, u, w}

D) {r, s, t, u, v, w, x, z}

7) $C' \cup A'$

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

C) {w, y}

B) {s, t}

D) {q, s, u, v, w, x, y, z}

8) $C' \cap A'$

A) {r, t}

C) {w, y}

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

D) {q, s, u, v, w, x, y, z}

9) $C - A$

A) {v, x, z}

B) {q, s, u}

C) {w, y}

D) {q, s, u, v, x, z}

10) $A' - C$

A) {r, t}

B) {v, x, z}

C) {q, s, u}

D) {q, s, u, v, x, z}

2 Use Set Operations II

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

List the elements in the set .

Let $U = \{q, r, s, t, u, v, w, x, y, z\}$

$A = \{q, s, u, w, y\}$

$B = \{q, s, y, z\}$

$C = \{v, w, x, y, z\}$.

- 1) $A \cup (B \cap C)$
A) $\{q, s, u, w, y, z\}$ B) $\{q, w, y\}$ C) $\{q, y, z\}$ D) $\{q, r, w, y, z\}$
- 2) $A \cap (B \cup C)$
A) $\{q, s, w, y\}$ B) $\{q, y, z\}$ C) $\{q, r, w, y, z\}$ D) $\{q, s, u, w, y, z\}$
- 3) $(A' \cup C) \cap B'$
A) $\{r, t, v, w, x\}$ B) $\{y, z\}$ C) $\{r, t, u, v, w, s, y, z\}$ D) $\{v, x\}$
- 4) $(B' \cap C)' \cup A$
A) $\{q, r, s, t, u, w, y, z\}$ B) $\{q, s, u, v, w, x, y\}$
C) $\{q, s, u, y\}$ D) $\{q, r, s, t, u, v, w, x, y\}$
- 5) $(A \cup B')' \cap C'$
A) $\emptyset$ B) $\{q, r, s, t, u, z\}$ C) $\{q, r, s, t, u\}$ D) $\{v, w, x, y\}$
- 6) $B \cap (A - C)$
A) $\{q, s\}$ B) $\{q, s, u, y, z\}$
C) $\{q, s, u, y\}$ D) $\{q, r, s, t, u, v, w, x, y\}$
- 7) $(A \cap B') \cup (B \cap A')$
A) $\{u, w, z\}$ B) $\{u, w, y, z\}$ C) $\{q, s, u, w, y, z\}$ D) $\{q, s, y\}$

3 Describe Set in Words

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

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

- 1) $A \cap B$
A) All diet cola soda pops B) All diet and all cola soda pops
C) All diet or all cola soda pops D) All soda pops
- 2) $A' \cap C$
A) All non-diet soda pops in cans
B) All non-diet soda pops and all soda pops in cans
C) All diet soda pops in cans
D) All diet soda pops and all soda pops in cans
- 3) $A \cap B \cap D$
A) All diet, caffeine-free cola soda pops
B) All diet, caffeine-free cola pops in cans
C) All soda pops not in cans
D) All diet and all cola and all caffeine-free soda pops

- 4) $(A \cup B) \cup D$
 A) All diet or all cola or all caffeine-free soda pops
 B) All diet, caffeine-free cola soda pops
 C) All soda pops not in cans
 D) All soda pops
- 5) $(A \cap B) \cap C'$
 A) All diet cola soda pops not in cans
 B) All diet and all cola soda pops not in cans
 C) All non-diet, non-cola soda pops not in cans
 D) All cola soda pops not in cans
- 6) $(A \cup D) \cap C'$
 A) All diet soda pops not in cans or all caffeine-free soda pops not in cans
 B) All diet, caffeine-free soda pops not in cans
 C) All non-diet, non-caffeine-free soda pops not in cans
 D) All non-cola soda pops not in cans
- 7) $(A' \cap B') \cup C$
 A) All non-diet non-cola soda pops or all soda pops in cans
 B) All non-diet non-cola soda pops in cans
 C) All non-diet soda pops and all non-cola soda pops in cans
 D) All non-diet non-cola soda pops and all soda pops not in cans
- 8) $(A - D) \cap B$
 A) All diet cola soda pops that contain caffeine
 B) All diet caffeine-free cola soda pops
 C) All non-diet, caffeine-free cola soda pops
 D) All diet soda pops that contain caffeine and all cola soda pops
- 9) $(B \cap C') \cup (C \cap B')$
 A) All cola soda pops not in cans or all non-cola soda pops in cans
 B) All cola soda pops in cans and all non-cola soda pops not in cans
 C) All cola soda pops and all soda pops in cans
 D) All non-cola soda pops not in cans

4 Solve Apps: Find Union/Intersection of Sets

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

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

<u>Alabama</u>	<u>Arkansas</u>	<u>Louisiana</u>
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.

- 1) $A \cap K$
 A) {h, s, w} B) {c, h, p, r, s, t, w} C) {c, p, r, t} D) {c, h, s, t, w}
- 2) $L \cap K$
 A) {r, s, t} B) {c, h, n, r, s, t, w} C) {c, h, n, w} D) {c, n, r, s, t}
- 3) $K' \cap L$
 A) {c, n} B) {r, s, t} C) {c, n, p} D) {h, w}

- 4) $L' \cap A$
 A) $\{h, p, w\}$ B) $\{c, s\}$ C) $\{h, n, t, w\}$ D) $\{n, r, t\}$
- 5) $A' \cap K'$
 A) $\{n\}$ B) $\{c, p, r, t\}$ C) $\emptyset$ D) $\{c, n, p, r, t\}$
- 6) $A \cap K \cap L$
 A) $\{s\}$ B) $\{n, p, s\}$ C) $\{n, p\}$ D) $\{c, h, n, p, r, s, t, w\}$
- 7) $A \cup L$
 A) $\{c, h, n, p, r, s, t, w\}$ B) $\{h, n, p, r, t, w\}$ C) $\{c, s\}$ D) $\{c, n, p\}$
- 8) $K \cup L$
 A) $\{c, h, n, r, s, t, w\}$ B) $\{c, h, n, w\}$ C) $\{r, s, t\}$ D) $\{n, r, t\}$
- 9) $A' \cup L$
 A) $\{c, n, r, s, t\}$ B) $\{h, p, w\}$ C) $\{n, r, t\}$ D) $\{h, n, p, r, t, w\}$
- 10) $L' \cup K'$
 A) $\{c, h, n, p, w\}$ B) $\{p\}$ C) $\{r, s, t\}$ D) $\{c, h, p, s, w\}$

5 Determine Truth of Statement: Cardinal Numbers

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

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.

- 1) $n(A \cup B) = n(A) - n(B)$
 A) True B) False
- 2) $n(A - B) = n(B - A)$
 A) True B) False
- 3) If $B \subseteq A$, $n(B) = n(A - B)$.
 A) True B) False
- 4) If $B \subseteq A$, $n(B) = n(A) - n(A - B)$.
 A) True B) False
- 5) $n(A \cap B) = n(B \cap A)$
 A) True B) False
- 6) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
 A) True B) False
- 7) $n(A \cap B) = n(A) - n(B)$
 A) True B) False
- 8) $n(A \cup B) + n(A \cap B) = n(A) + n(B)$
 A) True B) False

6 Identify Equal Sets/Equal Ordered Pairs

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

Tell whether the statement is true or false.

1) $\{2, 9, 15\} = \{0, 2, 9, 15\}$

A) True

B) False

2) $\{53, 54, 53, 54\} = \{53, 54\}$

A) True

B) False

3) $\{5, 16, 25, 8, 35\} = \{35, 16, 8, 52, 5\}$

A) True

B) False

4) $(17, 1) = (1, 17)$

A) True

B) False

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

A) True

B) False

6) $(13 + 16, 12 + 16) = (13, 12)$

A) True

B) False

7) $\{(3, 1), (0, 6), (-4, -2)\} = \{(-4, -2), (3, 1), (6, 0)\}$

A) True

B) False

7 Find Cartesian Product

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

Find the Cartesian product.

1) $A = \{4, 6, 3\}$

$B = \{2, 6\}$

Find $A \times B$.

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

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

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

D) $\{(4, 2), (6, 6)\}$

2) $A = \{i, a\}$

$B = \{t, d, m\}$

Find $A \times B$.

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

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

C) $\{(i, t), (a, t), (i, d), (a, d)\}$

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

3) $A = \{0\}$

$B = \{16, 26, 36\}$

Find $B \times A$.

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

B) $\{0\}$

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

D) $\{0, 0, 0\}$

- 4) $A = \{4, 2, 6, 8\}$
 $B = \{0, 1\}$
Find $B \times A$.
A) $\{(0, 4), (0, 2), (0, 6), (0, 8), (1, 4), (1, 2), (1, 6), (1, 8)\}$
B) $\{(4, 0), (2, 0), (6, 0), (8, 0), (4, 1), (2, 1), (6, 1), (8, 1)\}$
C) $\{(4, 0), (4, 1), (2, 0), (2, 1)\}$
D) $\{0, 1, 4, 2, 6, 8\}$

8 Find Cardinal Number: Cartesian Products

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

Find the indicated cardinal number.

- 1) Find $n(A \times B)$ given that $A = \{2\}$ and $B = \{1, 3\}$.
A) 2 B) 1 C) 3 D) 4
- 2) Find $n(A \times C)$ given that $A = \{2\}$ and $C = \{4, 5, 6\}$.
A) 3 B) 1 C) 2 D) 4
- 3) Find $n(D \times B)$ given that $B = \{1, 3\}$ and $D = \{7, 8, 9, 10\}$.
A) 8 B) 7 C) 16 D) 12
- 4) Find $n(C \times D)$ given that $C = \{4, 5, 6\}$ and $D = \{7, 8, 9, 10\}$.
A) 12 B) 81 C) 27 D) 7
- 5) Find $n(E)$, given that $n(C \times E) = 18$ and $C = \{4, 5, 6\}$.
A) 6 B) 3 C) 9 D) 54
- 6) Find $n(F)$, given that $n(B \times F) = 18$ and $B = \{1, 3\}$.
A) 9 B) 36 C) 6 D) 54
- 7) Find $n(G)$, given that $n(D \times G) = 20$ and $D = \{7, 8, 9, 10\}$.
A) 5 B) 9 C) 4 D) 24
- 8) Find $n(A \times B)$ given that $n(A) = 31$ and $n(B) = 9$.
A) 279 B) 40 C) 22 D) 49
- 9) Find $n(B)$ given that $n(A \times B) = 7$ and $n(A) = 1$.
A) 7 B) 1 C) 6 D) 8
- 10) Find $n(A)$ given that $n(A \times B) = 20$ and $n(B) = 2$.
A) 10 B) 2 C) 18 D) 22

9 Place Elements in Venn Diagram

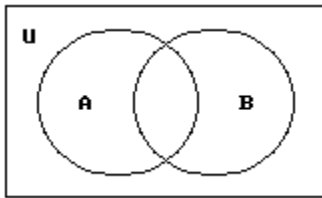
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

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

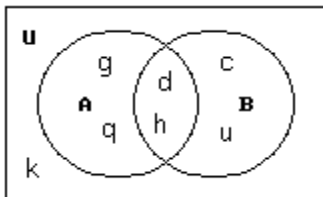
1) Let $U = \{c, d, g, h, k, u, q\}$

$A = \{d, h, g, q\}$

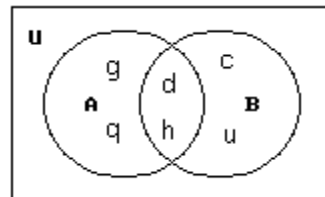
$B = \{c, d, h, u\}$



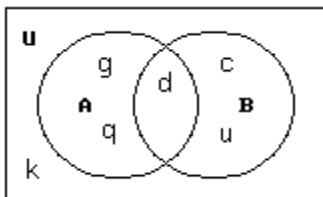
A)



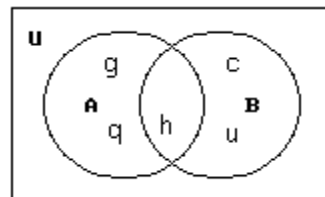
B)



C)



D)

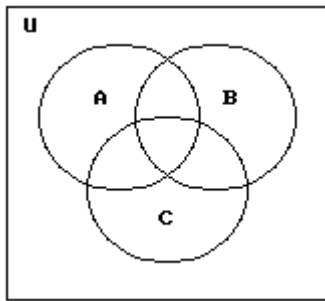


2) Let $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$

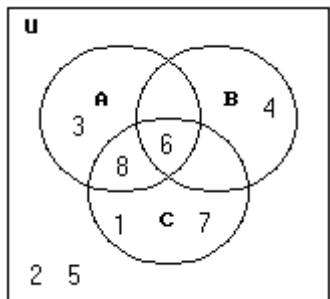
$A = \{3, 6, 8\}$

$B = \{4, 6\}$

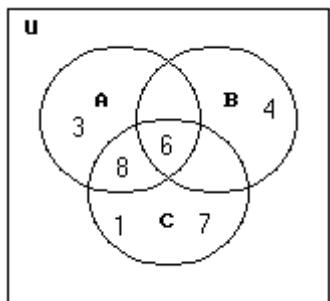
$C = \{1, 6, 7, 8\}$



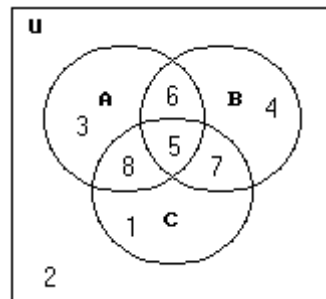
A)



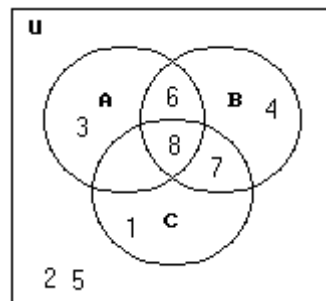
C)



B)



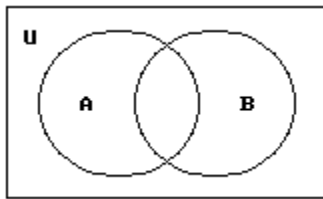
D)



3) Let $U = \{c, e, g, f, n, m, t\}$

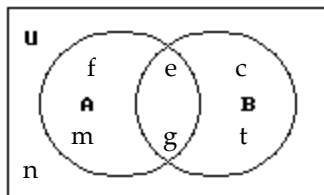
$A = \{e, g, f, m\}$

$B = \{c, e, g, t\}$

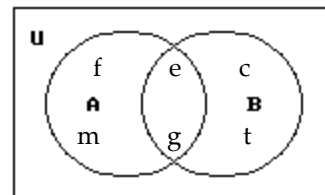


A)

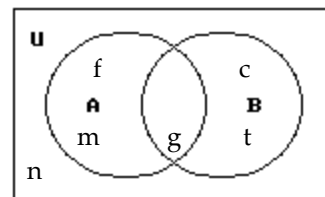
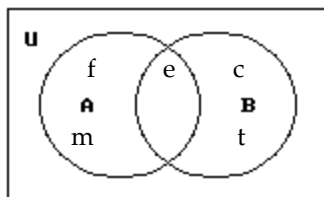
B)



C)



D)

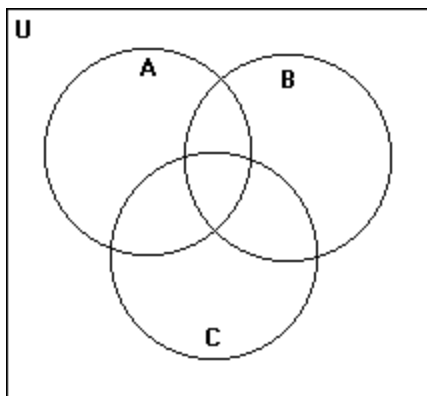


4) $U = \{2, 4, 6, 8, 10, 12\}$

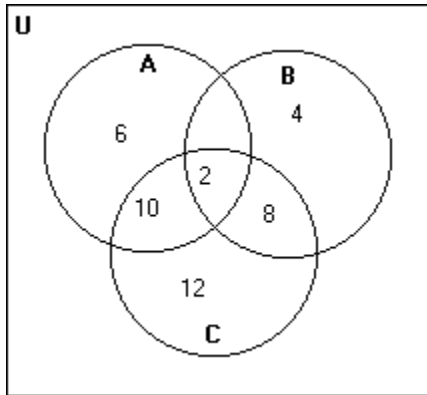
$A = \{2, 6, 10\}$

$B = \{2, 4, 8\}$

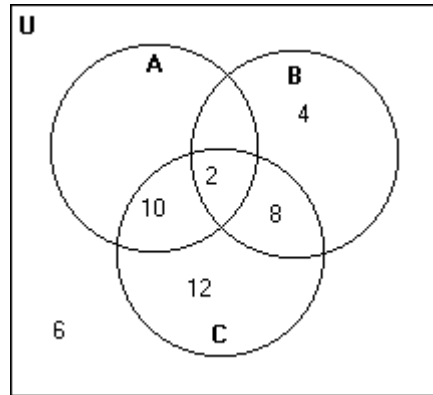
$C = \{2, 8, 10, 12\}$



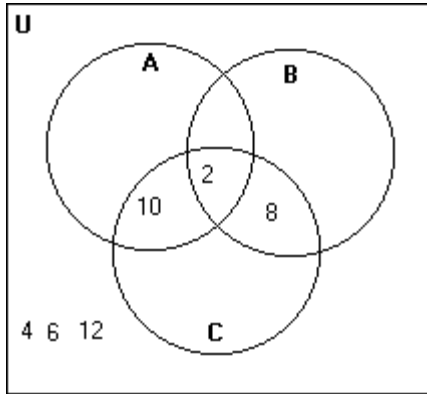
A)



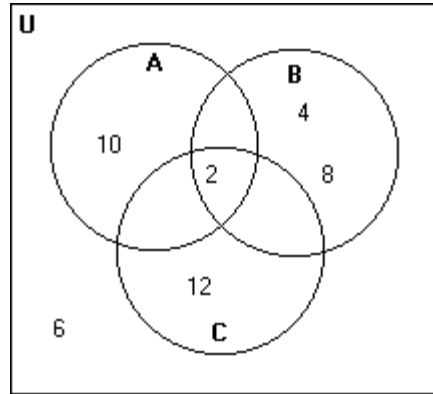
B)



C)



D)

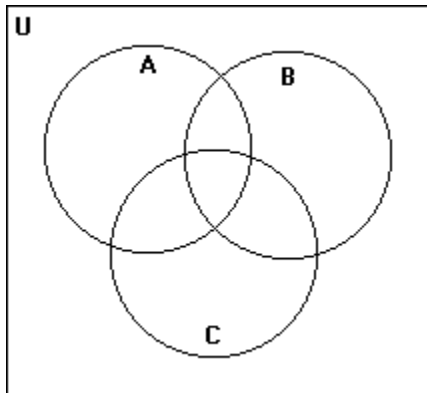


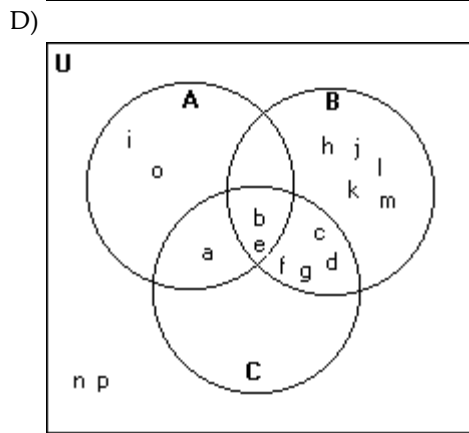
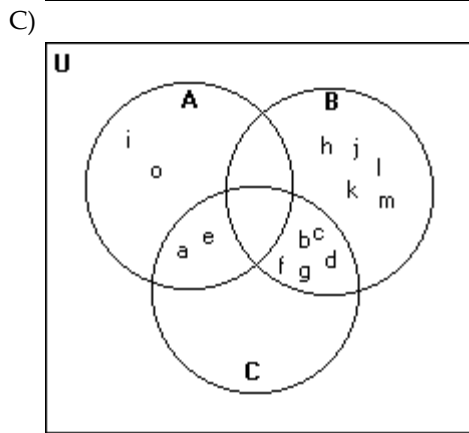
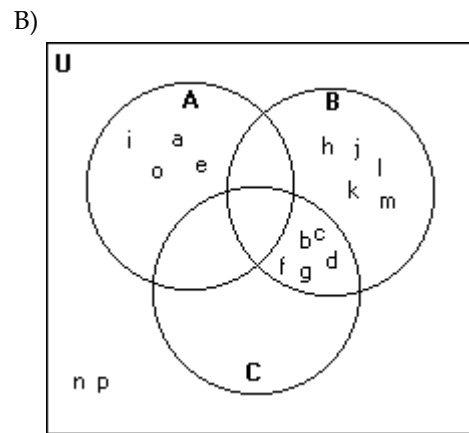
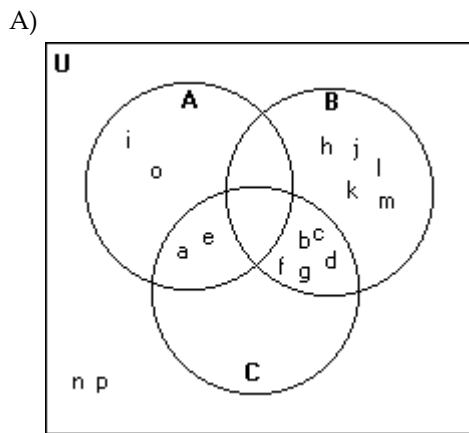
5) $U = \{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p\}$

$A = \{a, e, i, o\}$

$B = \{b, c, d, f, g, h, j, k, l, m\}$

$C = \{a, b, c, d, e, f, g\}$



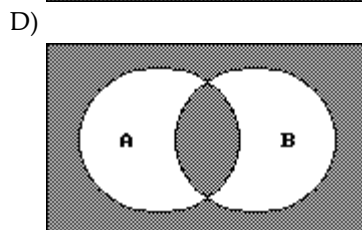
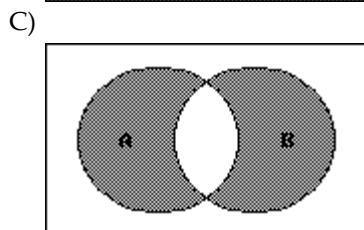
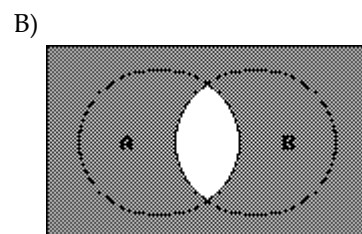
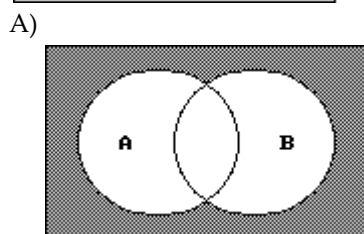
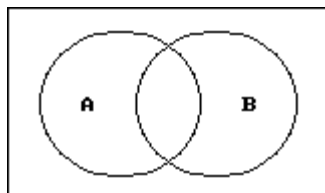


10 Shade Venn Diagram

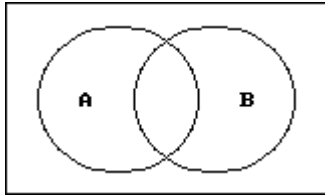
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Shade the regions representing the set.

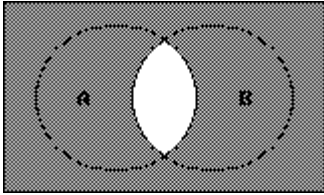
1) $A' \cap B'$



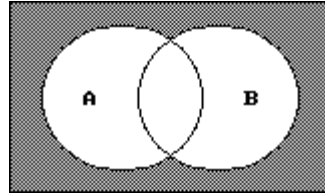
2) $A' \cup B'$



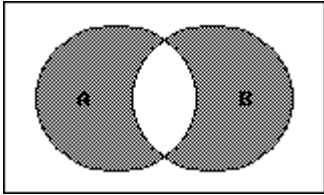
A)



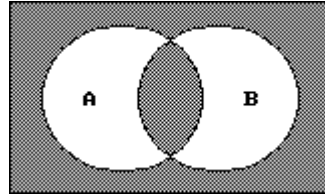
B)



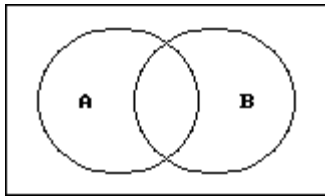
C)



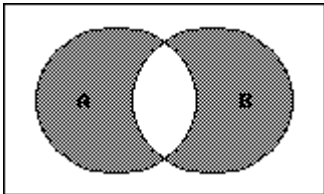
D)



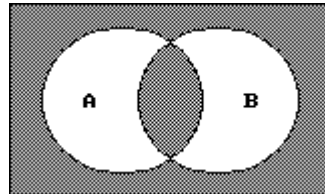
3) $(A \cup B) \cap (A \cap B)'$



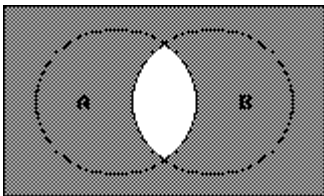
A)



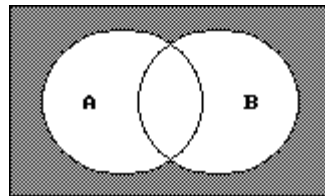
B)



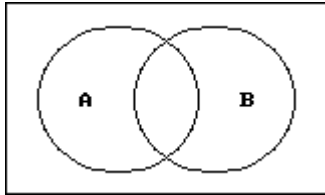
C)



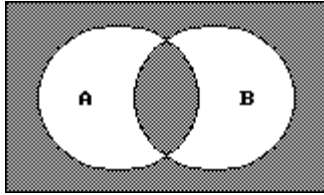
D)



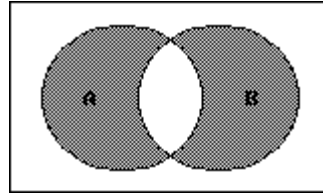
4) $(A \cap B) \cup (A \cup B)'$



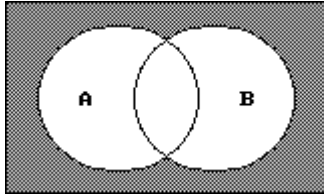
A)



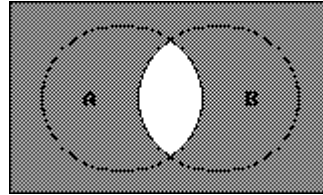
B)



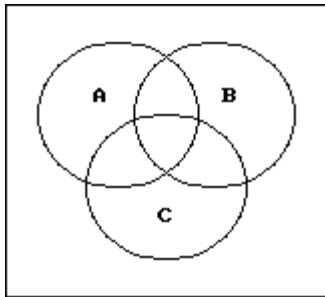
C)



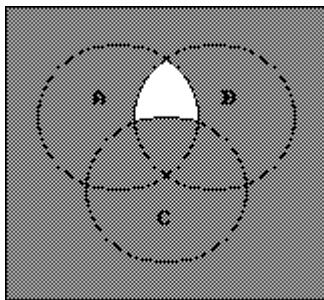
D)



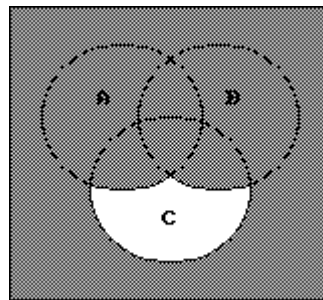
5) $(A \cap B \cap C)'$



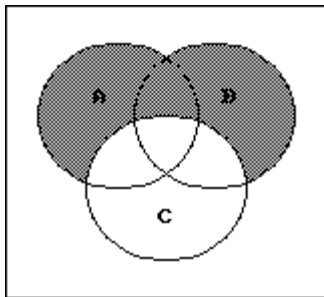
A)



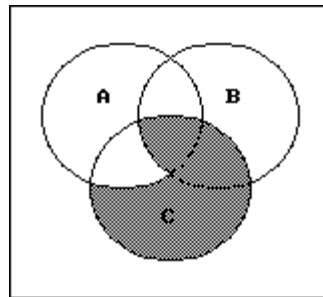
B)



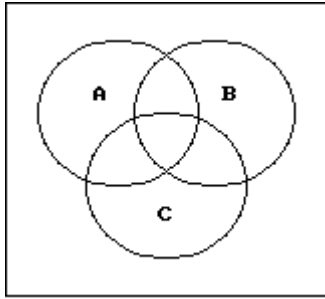
C)



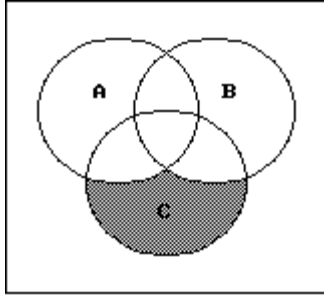
D)



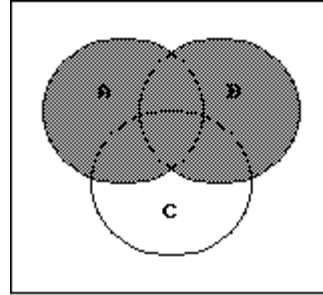
6) $(A \cup B \cup C)'$



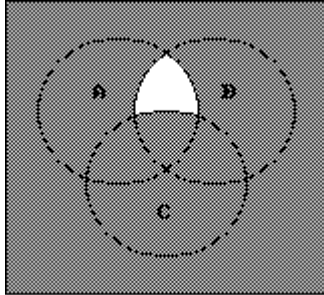
A)



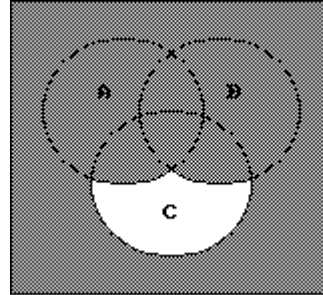
B)



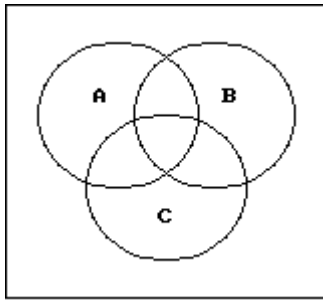
C)



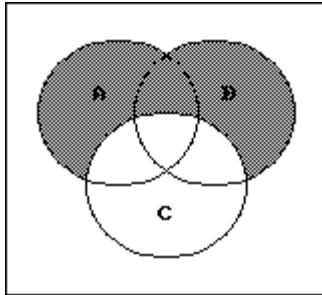
D)



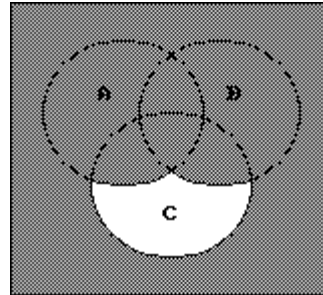
7) $C' \cap (A \cup B)$



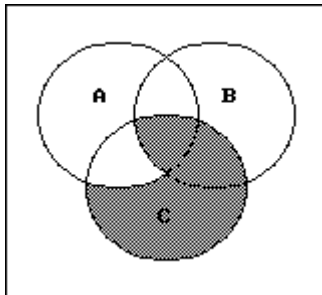
A)



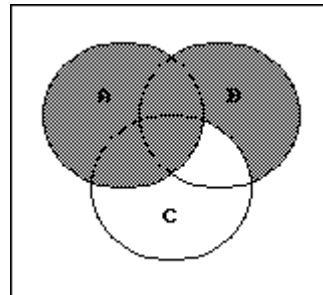
B)



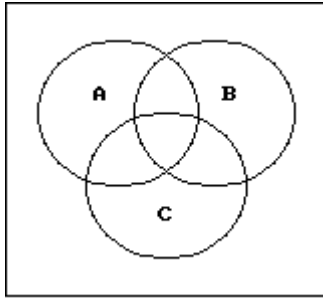
C)



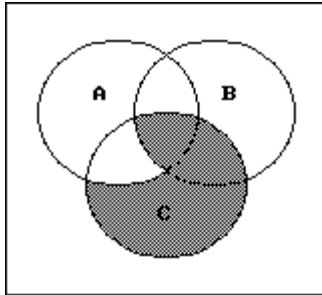
D)



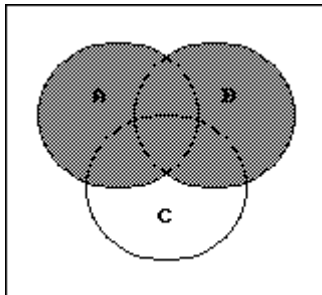
8) $(A' \cup B) \cap C$



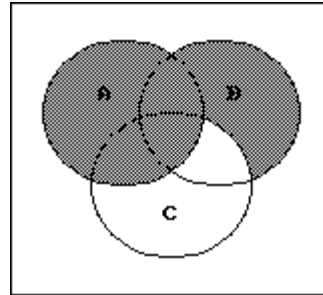
A)



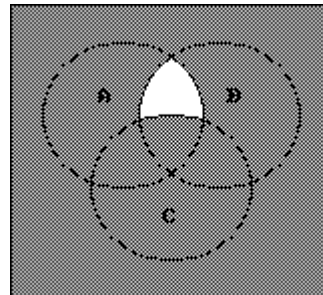
C)



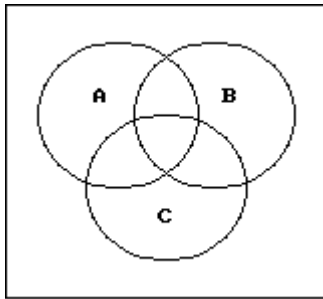
B)



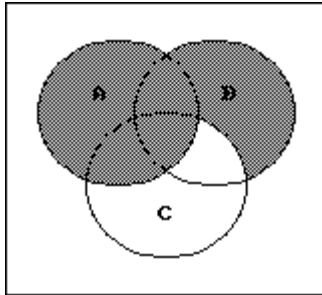
D)



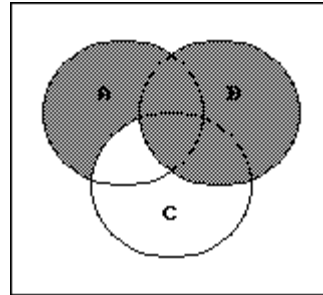
9) $A \cup (B \cap C')$



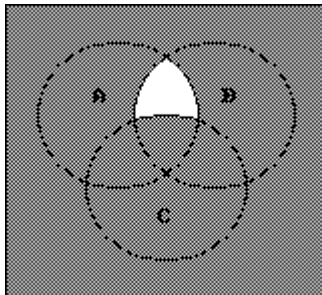
A)



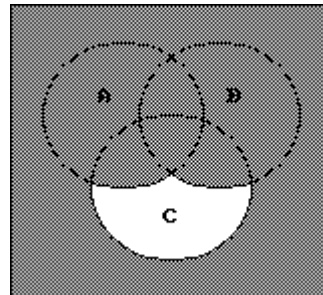
B)



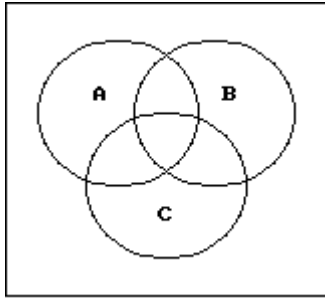
C)



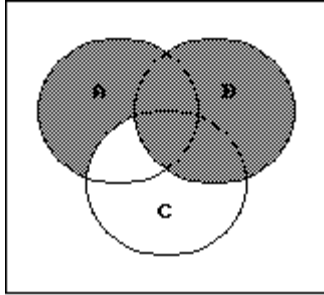
D)



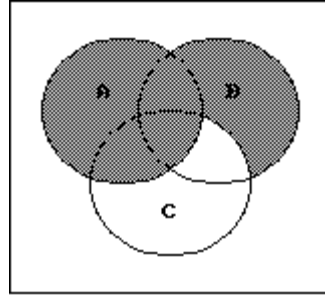
10) $B \cup (A \cap C')$



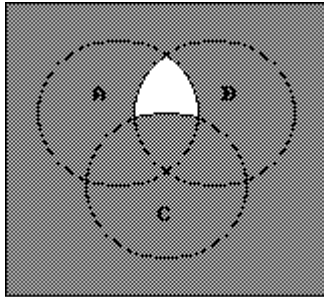
A)



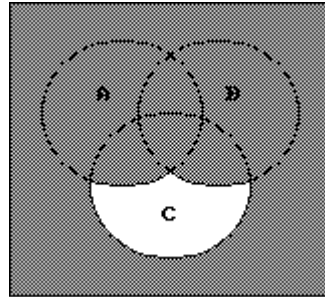
B)



C)



D)

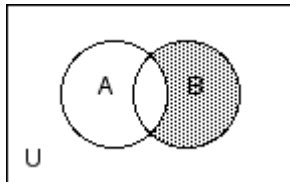


11 Describe Shaded Area of Venn Diagram

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

Write a description of the shaded region using the symbols A , B , C , $\cup$, $\cap$, $\neg$, and $'$ as needed.

1)



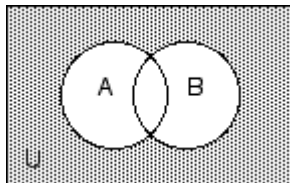
A) $B \cap A'$

B) $A \cap B'$

C) $A - B$

D) $B - A'$

2)



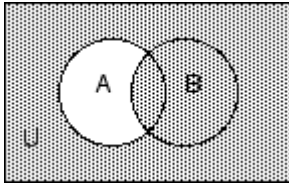
A) $A' \cap B'$

B) $A - B$

C) $(A \cap B)'$

D) $A \cup B$

3)



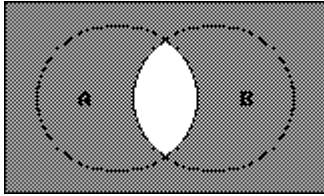
A) $A' \cup B$

B) $B - A$

C) $A' \cap B$

D) $(A \cap B)'$

4)



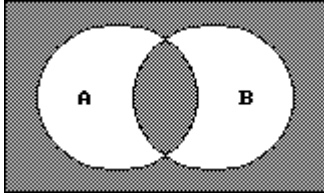
A) $(A \cap B)'$

B) $A \cap B$

C) $(A \cup B)'$

D) $A' \cap B'$

5)



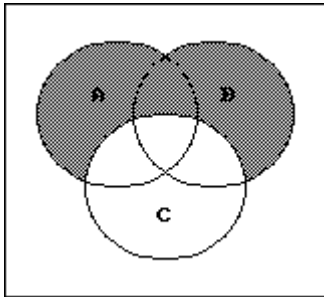
A) $(A \cap B) \cup (A \cup B)'$

B) $A' \cap B'$

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

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

6)



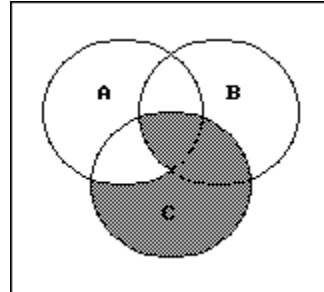
A) $(A \cup B) \cap C'$

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

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

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

7)



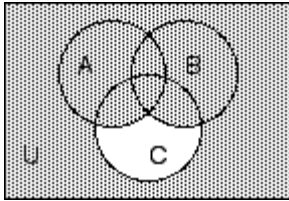
A) $(A' \cup B) \cap C$

B) $A' \cap C$

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

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

8)



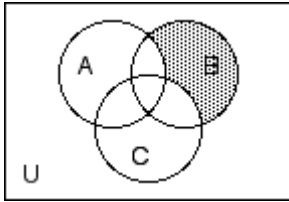
A) $(A \cup B) \cup C'$

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

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

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

9)



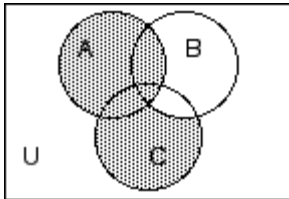
A) $A' \cap C' \cap B$

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

C) $(B - A) \cup C$

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

10)



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

B) $A \cup C$

C) $A \cup C - B$

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

12 Decide Whether Statement Is/Is Not Always True

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

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

1) $A \cap A' = \emptyset$

A) Always true

B) Not always true

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

A) Not always true

B) Always true

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

A) Always true

B) Not always true

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

A) Always true

B) Not always true

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

A) Not always true

B) Always true

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

A) Not always true

B) Always true

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

A) Not always true

B) Always true

8) $A - A' = A$

A) Always true

B) Not always true

9) $A \cup (B \cap C)' = A \cup (B' \cup C')$
 A) Always true

B) Not always true

10) $A \cap (B \cup C) = (A \cap B) \cup C$
 A) Not always true

B) Always true

13 Describe Conditions Under Which Statement Is True

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

Describe the conditions under which the statement is true.

- | | | | |
|---|----------------|-----------------------|-----------------------|
| 1) $A \cap B = A$
A) $A \subseteq B$ | B) Always true | C) $B \subseteq A$ | D) $B = \emptyset$ |
| 2) $A \cup \emptyset = U$
A) $A = U$ | B) Always true | C) $A \neq \emptyset$ | D) $A = \emptyset$ |
| 3) $A \cup B = B$
A) $A \subseteq B$ | B) Always true | C) $B \subseteq A$ | D) $A = \emptyset$ |
| 4) $A \cap A' = A$
A) $A = \emptyset$ | B) Always true | C) $A = U$ | D) $A \neq \emptyset$ |
| 5) $A \cap B' = A$
A) $A \cap B = \emptyset$ | B) Always true | C) $B \subseteq A$ | D) $B = \emptyset$ |
| 6) $A \cup B = A$
A) $B \subseteq A$ | B) Always true | C) $A \subseteq B$ | D) $B = \emptyset$ |

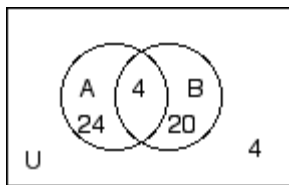
2.4 Surveys and Cardinal Numbers

1 Determine Cardinality from Venn Diagram

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

Find the cardinal number of the set.

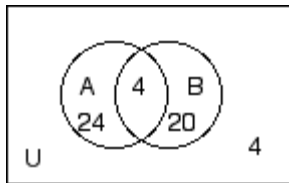
- 1) The numbers in the Venn Diagram below represent cardinalities.



Find $n(A \cup B)$.

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

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



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

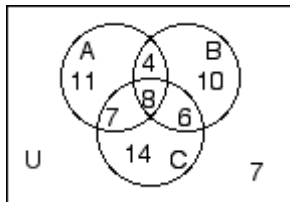
A) 24

B) 4

C) 28

D) 20

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



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

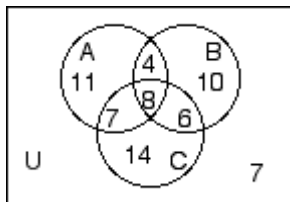
A) 14

B) 13

C) 21

D) 27

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



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

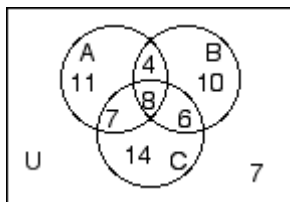
A) 7

B) 15

C) 6

D) 11

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



Find $n(B \cup C)$

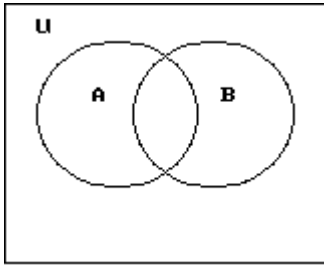
A) 49

B) 14

C) 42

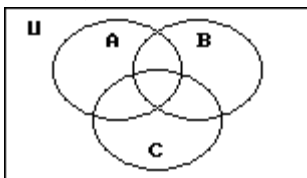
D) 60

- 6) Given: $n(U) = 60$
 $n(A) = 29$
 $n(B) = 25$
 $n(A \cap B) = 1$
Find $n(A \cup B)'$.



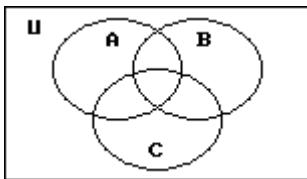
- A) 7 B) 6 C) 53 D) 54

- 7) Given:
 $n(U) = 136$
 $n(A) = 44$
 $n(B) = 64$
 $n(A \cap B) = 17$
 $n(A \cap C) = 20$
 $n(A \cap B \cap C) = 9$
 $n(A' \cap B \cap C') = 38$
 $n(A' \cap B' \cap C') = 33$
Find $n(C)$.



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

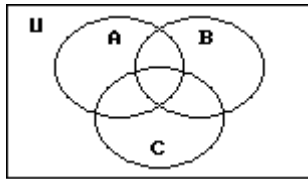
- 8) Given:
 $n(A) = 50$
 $n(B) = 58$
 $n(C) = 52$
 $n(A \cap B) = 10$
 $n(A \cap C) = 12$
 $n(B \cap C) = 6$
 $n(A \cap B \cap C) = 4$
 $n(A' \cap B' \cap C') = 101$
Find $n(U)$



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

- 9) 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) 6 C) 8 D) 9

2 Use Formula to Find Cardinal Number

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

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

- 1) If $n(A) = 5$, $n(B) = 11$ and $n(A \cap B) = 3$, what is $n(A \cup B)$?
 A) 13 B) 12 C) 14 D) 16
- 2) If $n(A) = 40$, $n(B) = 117$ and $n(A \cup B) = 137$, what is $n(A \cap B)$?
 A) 20 B) 10 C) 22 D) 60
- 3) If $n(B) = 24$, $n(A \cap B) = 5$, and $n(A \cup B) = 42$, find $n(A)$.
 A) 23 B) 21 C) 25 D) 18
- 4) If $n(A) = 10$, $n(A \cup B) = 28$, and $n(A \cap B) = 6$, find $n(B)$.
 A) 24 B) 25 C) 23 D) 18

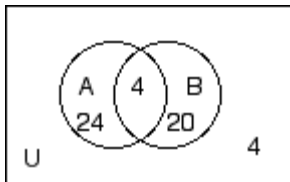
3 Draw Venn Diagram, Label Size of Each Region

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

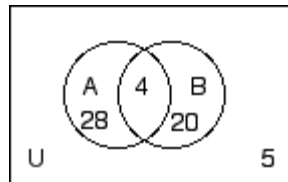
Draw an appropriate Venn diagram and use the given information to fill in the number of elements in each region.

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

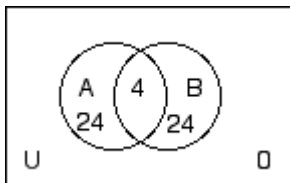
A)



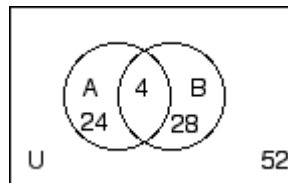
B)



C)

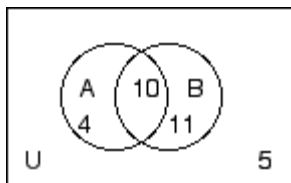


D)

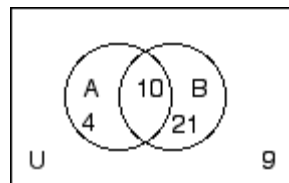


2) $n(A) = 14$, $n(B) = 21$, $n(A \cup B) = 25$, $n(B') = 9$

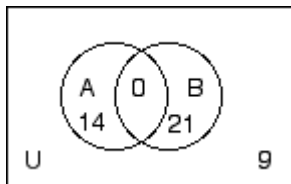
A)



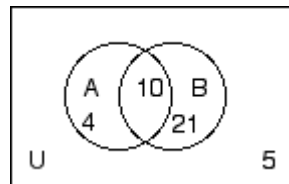
B)



C)

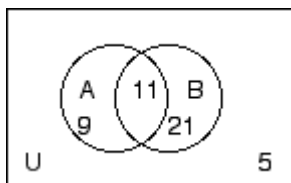


D)

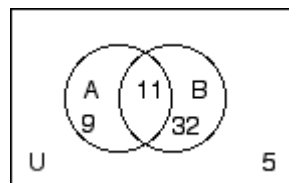


3) $n(A') = 26$, $n(B) = 32$, $n(A \cap B) = 11$, $n(A' \cup B') = 35$

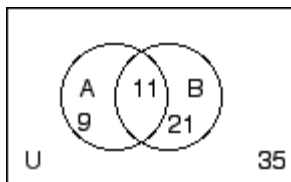
A)



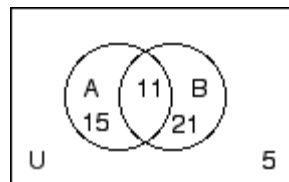
B)



C)

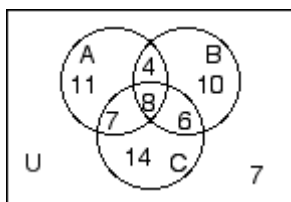


D)

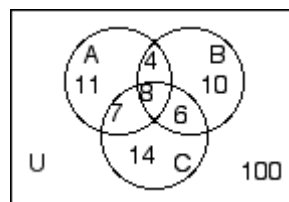


4) $n(A) = 30$, $n(B) = 28$, $n(C) = 35$, $n(A \cap B) = 12$, $n(A \cap C) = 15$, $n(B \cap C) = 14$, $n(U) = 67$

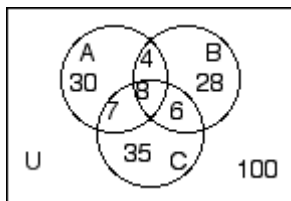
A)



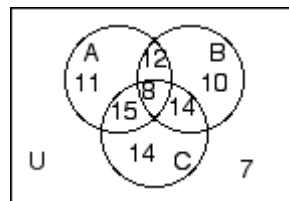
B)



C)

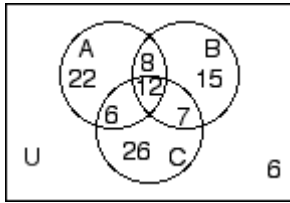


D)

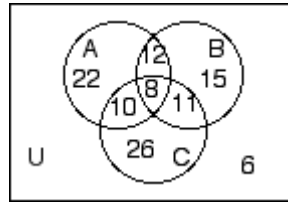


5) $n(A) = 48$, $n(B') = 60$, $n(C) = 51$, $n(A \cap B) = 20$, $n(B \cap C) = 19$, $n(A \cap C) = 18$, $n(A \cap B \cap C) = 12$, $n(A \cup B) = 70$

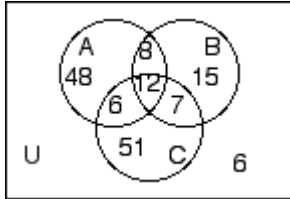
A)



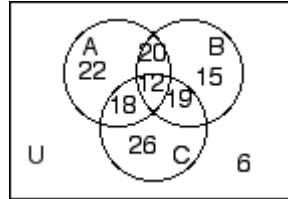
B)



C)

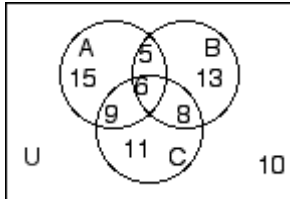


D)

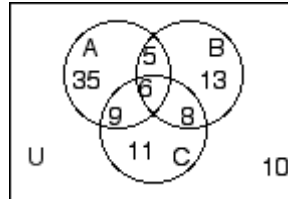


6) $n(A) = 35$, $n(A \cap B') = 24$, $n(A \cap C) = 15$, $n(B \cap C) = 14$, $n(A' \cap B' \cap C') = 10$, $n(A \cap B \cap C) = 6$, $n(B \cup C) = 52$, $n(B \cap C') = 18$

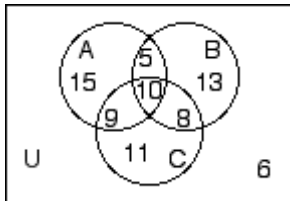
A)



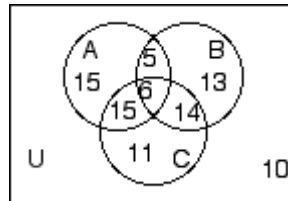
B)



C)



D)



4 Solve Apps: Use Venn Diagram with Survey

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

Solve the problem.

- 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) 8 C) 18 D) 15
- 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) 150 B) 250 C) 100 D) 300

- 3) 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) 408 B) 418 C) 398 D) 388

- 4) 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) 11 B) 16 C) 21 D) 26

- 5) 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) 13 B) 96 C) 46 D) 34

- 6) 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) 25 B) 29 C) 37 D) 18

7) 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.

$$n(A) = 45 \quad n(A \cap B) = 12$$

$$n(B) = 55 \quad n(A \cap C) = 15$$

$$n(C) = 40 \quad n(B \cap C) = 23$$

$$n(A \cap B \cap C) = 2$$

How many students were not taking any of these electives?

A) 49

B) 10

C) 59

D) 51

Ch. 2 The Basic Concepts of Set Theory

Answer Key

2.1 Symbols and Terminology

1 List Elements in Set

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

2 Use Set-Builder Notation

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

3 Identify Set as Finite or Infinite

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A

4 Find $n(A)$ for Set

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A

5 Determine Whether Set Is Well Defined

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A

6 Decide Whether Number Is in Set

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

7 Determine Truth of Statement: Sets I

- 1) B
- 2) B
- 3) A
- 4) B
- 5) A
- 6) B
- 7) B
- 8) A
- 9) B
- 10) A

8 Determine Truth of Statement: Sets II

- 1) B
- 2) A
- 3) B
- 4) A
- 5) B
- 6) A
- 7) B
- 8) B

2.2 Venn Diagrams and Subsets

1 Determine Subset Relationships

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A

2 Identify Proper Subsets

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A

3 Determine Truth of Statement: Subsets

- 1) A
- 2) A
- 3) A
- 4) B
- 5) B
- 6) A

- 7) B
- 8) B
- 9) B
- 10) A

4 Find Number of Subsets

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A

5 Find Number of Proper Subsets

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A

6 Find Complement of Set

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

7 Solve Apps: Find Complement/Intersection

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

8 List Subsets of Set

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A

2.3 Set Operations

1 Use Set Operations I

- 1) A
- 2) A
- 3) A

- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

2 Use Set Operations II

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A

3 Describe Set in Words

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A

4 Solve Apps: Find Union/Intersection of Sets

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

5 Determine Truth of Statement: Cardinal Numbers

- 1) B
- 2) B
- 3) B
- 4) A
- 5) A
- 6) A
- 7) B
- 8) A

6 Identify Equal Sets/Equal Ordered Pairs

- 1) B
- 2) A
- 3) B
- 4) B
- 5) A
- 6) B
- 7) B

7 Find Cartesian Product

- 1) A
- 2) A
- 3) A
- 4) A

8 Find Cardinal Number: Cartesian Products

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

9 Place Elements in Venn Diagram

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A

10 Shade Venn Diagram

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

11 Describe Shaded Area of Venn Diagram

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

12 Decide Whether Statement Is/Is Not Always True

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A

10) A

13 Describe Conditions Under Which Statement Is True

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A

2.4 Surveys and Cardinal Numbers

1 Determine Cardinality from Venn Diagram

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A

2 Use Formula to Find Cardinal Number

- 1) A
- 2) A
- 3) A
- 4) A

3 Draw Venn Diagram, Label Size of Each Region

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A

4 Solve Apps: Use Venn Diagram with Survey

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A