Problem Solving Approach to Mathematics for Elementary School Teachers 12th edition Billstein Test Bank

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

Determine whether the following is a statement. If it is, then also classify the statement as true or false.

1) Why don't you come here?
A) Not a statement B) False statement C) True statement
Answer: A

2) This room is big.
A) True statement B) Not a statement C) False statement
Answer: B

3) $5 - 1 = 4$
A) True statement B) Not a statement C) False statement
Answer: A

4) $7x + y = 3$
A) False statement B) True statement C) Not a statement
Answer: C

5) Can you bring the book?
A) True statement B) Not a statement C) False statement
Answer: B

6) $x + y = x - y$, where $y = 0$
A) False statement B) True statement C) Not a statement
Answer: B

7) $12 = 3y$
A) Not a statement B) False statement C) True statement
Answer: A

8) $2.4 = 5.2$
A) False statement B) Not a statement C) True statement
Answer: A

9) The state of California is in North America.
A) Not a statement B) False statement C) True statement
Answer: C

10) Brazil is in Asia.
A) True statement B) Not a statement C) False statement
Answer: C

Use a quantifier to make the following true or false, as indicated, where x is a natural number.

11) $x + x = 6$ (make true)
A) There is no natural number x such that $x + x = 6$.
B) For all natural numbers x, $x + x = 6$.
C) There exists a natural number x such that $x + x = 6$.
D) For every natural number x, $x + x = 6$.
Answer: C

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12) $x^3 = 8$ (make true)

A) No natural number x exists such that $x^3 = 8$.

B) Every natural number x satisfies $x^3 = 8$.

C) There exists a natural number x such that $x^3 = 8$.

D) Three natural numbers x exist such that $x^3 = 8$.

Answer: C

13) $2x + 1 = 5 - x$ (make true)

A) No natural number x exists such that $2x + 1 = 5 - x$.

B) There exists a natural number x such that $2x + 1 = 5 - x$.

C) Only two natural numbers x exist such that $2x + 1 = 5 - x$.

D) For every natural number x, $2x + 1 = 5 - x$.

Answer: B

14) $12x = 5x + 7x$ (make false)

A) For every natural number x, $12x = 5x + 7x$.

B) There is no natural number x such that $12x = 5x + 7x$.

C) More than one natural number x exists such that $12x = 5x + 7x$.

D) There exists a natural number x such that $12x = 5x + 7x$.

Answer: B

15) $x - 13 = 13 - x$ (make false)

A) For $x = 13$, $x - 13 = 13 - x$.

B) There exists a natural number x such that $x - 13 = 13 - x$.

C) At least one natural number x exists such that $x - 13 = 13 - x$.

D) There is no natural number x such that $x - 13 = 13 - x$.

Answer: D

16) $4x = 7x$ (make false)

A) There is no natural number x such that $4x = 7x$.

B) For every natural number x, $4x = 7x$.

C) No natural number x satisfies $4x = 7x$.

Answer: B

Write the statement indicated.

17) Write the negation of the following:

The test is difficult.

A) The test is not difficult.

B) The test is not very easy.

C) The test is very difficult.

D) The test is not easy.

Answer: A

18) Write the negation of the following:

$8 + 2 = 10$

A) $8 + 2 = 12$

B) $8 + 2 = 2 + 8$

C) The sum of 8 and 2 is ten.

D) $8 + 2 \neq 10$

Answer: D

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SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

19) Negate the following: The store is sometimes open on Sunday.

Answer: The store is never open on Sunday.

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

Construct a truth table for the statement.

20) $\sim p \wedge \sim s$

A)

p	s	$(\sim p \wedge \sim s)$
T	T	T
T	F	F
F	T	F
F	F	T

B)

p	s	$(\sim p \wedge \sim s)$
T	T	F
T	F	F
F	T	F
F	F	F

C)

p	s	$(\sim p \wedge \sim s)$
T	T	F
T	F	F
F	T	F
F	F	T

D)

p	s	$(\sim p \wedge \sim s)$
T	T	F
T	F	T
F	T	T
F	F	T

Answer: C

21) $s \vee \sim(r \wedge p)$

A)

s	r	p	$s \vee \sim(r \wedge p)$
T	T	T	T
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	F

B)

s	r	p	$s \vee \sim(r \wedge p)$
T	T	T	T
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	T

Answer: B

22) $(p \wedge \sim q) \wedge t$

A)

p	q	t	$(p \wedge \sim q) \wedge t$
T	T	T	F
T	T	F	F
T	F	T	F
T	F	F	F
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	T

B)

p	q	t	$(p \wedge \sim q) \wedge t$
T	T	T	F
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	F
F	T	F	F
F	F	T	F
F	F	F	F

Answer: B

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23) $\sim((w \wedge q) \vee s)$

A)

w	q	s	$\sim((w \wedge q) \vee s)$
T	T	T	T
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	T
F	T	F	F
F	F	T	T
F	F	F	F

B)

w	q	s	$\sim((w \wedge q) \vee s)$
T	T	T	F
T	T	F	F
T	F	T	F
T	F	F	T
F	T	T	F
F	T	F	T
F	F	T	F
F	F	F	T

Answer: B

24) $w \vee (w \wedge \sim w)$

A)

w	$w \vee (w \wedge \sim w)$
T	T
F	T

B)

w	$w \vee (w \wedge \sim w)$
T	F
F	F

C)

w	$w \vee (w \wedge \sim w)$
T	T
F	F

D)

w	$w \vee (w \wedge \sim w)$
T	F
F	T

Answer: C

25) $(t \wedge p) \vee (\sim t \wedge \sim p)$

A)

t	p	$(t \wedge p) \vee (\sim t \wedge \sim p)$
T	T	F
T	F	F
F	T	T
F	F	T

B)

t	p	$(t \wedge p) \vee (\sim t \wedge \sim p)$
T	T	T
T	F	F
F	T	F
F	F	T

C)

t	p	$(t \wedge p) \vee (\sim t \wedge \sim p)$
T	T	T
T	F	T
F	T	T
F	F	F

D)

t	p	$(t \wedge p) \vee (\sim t \wedge \sim p)$
T	F	F
F	T	F

Answer: B

26) $\sim(\sim(s \vee p))$

A)

s	p	$\sim(\sim(s \vee p))$
T	T	T
T	F	T
F	T	T
F	F	F

B)

s	p	$\sim(\sim(s \vee p))$
T	T	T
T	F	T
F	T	F
F	F	F

C)

s	p	$\sim(\sim(s \vee p))$
T	F	T
F	T	F

D)

s	p	$\sim(\sim(s \vee p))$
T	T	F
T	F	F
F	T	F
F	F	T

Answer: A

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27) $\sim(s \vee t) \wedge \sim(t \wedge s)$

A)

s	t	$\sim(s \vee t) \wedge \sim(t \wedge s)$
T	T	F
T	F	F
F	T	F
F	F	T

B)

s	t	$\sim(s \vee t) \wedge \sim(t \wedge s)$
T	T	F
T	F	F
F	T	T
F	F	F

C)

s	t	$\sim(s \vee t) \wedge \sim(t \wedge s)$
T	T	F
T	F	F
F	T	F
F	F	F

D)

s	t	$\sim(s \vee t) \wedge \sim(t \wedge s)$
T	T	F
T	F	T
F	T	T
F	F	F

Answer: A

28) $(p \wedge w) \wedge (\sim w \vee t)$

A)

p	w	t	$(p \wedge w) \wedge (\sim w \vee t)$
T	T	T	F
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	T
F	T	F	F
F	F	T	T
F	F	F	T

B)

p	w	t	$(p \wedge w) \wedge (\sim w \vee t)$
T	T	T	T
T	T	F	F
T	F	T	F
T	F	F	F
F	T	T	F
F	T	F	F
F	F	T	F
F	F	F	F

Answer: B

Letting r stand for "The food is good," p stand for "I eat too much," and q stand for "I'll exercise," write the following in symbolic form.

29) If I eat too much, then I'll exercise.

A) $r \rightarrow p$ B) $p \vee q$ C) $q \rightarrow p$ D) $p \rightarrow q$

Answer: D

30) If I exercise, then I won't eat too much.

A) $p \rightarrow q$ B) $q \rightarrow \sim p$ C) $r \wedge p$ D) $\sim(p \rightarrow q)$

Answer: B

31) If the food is good, then I eat too much.

A) $r \rightarrow p$ B) $r \wedge p$ C) $p \rightarrow q$ D) $p \rightarrow r$

Answer: A

32) If the food is good and if I eat too much, then I'll exercise.

A) $r \rightarrow (p \wedge q)$ B) $(r \wedge p) \rightarrow q$ C) $r \wedge (p \rightarrow q)$ D) $p \rightarrow (r \wedge q)$

Answer: B

33) If the food is good or if I eat too much, I'll exercise.

A) $r \rightarrow (p \vee q)$ B) $(r \wedge p) \rightarrow q$ C) $r \rightarrow p \rightarrow q$ D) $(r \vee p) \rightarrow q$

Answer: D

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34) If the food is not good, I won't eat too much.

A) $\sim r \rightarrow \sim p$ B) $r \rightarrow \sim p$ C) $\sim(r \rightarrow p)$ D) $\sim p \rightarrow \sim r$

Answer: A

35) I'll exercise if I eat too much.

A) $p \vee q$ B) $q \rightarrow p$ C) $p \rightarrow q$ D) $q \wedge p$

Answer: C

36) The food is good and if I eat too much, then I'll exercise.

A) $r \wedge (p \rightarrow q)$ B) $(r \vee p) \rightarrow q$ C) $(r \rightarrow p) \vee q$ D) $(r \wedge p) \rightarrow q$

Answer: A

37) I'll exercise if I don't eat too much.

A) $\sim(p \rightarrow q)$ B) $\sim p \wedge q$ C) $\sim p \rightarrow q$ D) $\sim p \vee q$

Answer: C

38) If I exercise, then the food won't be good and I won't eat too much.

A) $(q \wedge \sim r) \rightarrow \sim p$ B) $q \rightarrow \sim(r \wedge p)$ C) $\sim(r \wedge p) \rightarrow q$ D) $q \rightarrow (\sim r \wedge \sim p)$

Answer: D

Restate in a logically equivalent form.

39) It is not true that both this book is interesting and the book is about stars.

A) Either this book is not interesting or it is not about stars.
B) This book is both interesting and about stars.
C) Either this book is interesting or it is about stars.
D) This book cannot be both interesting and about stars.

Answer: A

40) If a number is divisible by 4, then it is divisible by 2.

A) If a number is not divisible by 4, then it is divisible by 2.
B) If a number is not divisible by 4, then it is not divisible by 2.
C) If a number is divisible by 4, then it is not divisible by 2.
D) If a number is not divisible by 2, then it is not divisible by 4.

Answer: D

41) If it is clean, then it was washed.

A) If it was not washed, then it is not clean. B) If it is clean, then it was not washed.
C) If it is clean, then it was washed. D) If it is not clean, then it was not washed.

Answer: A

42) It is not true that today I both went to school and read a book.

A) Today, I read a book but did not go to school.
B) Today, I either did not go to school or I did not read a book.
C) Today, I went to school and read a book.
D) Today, I did not read a book and did not go to school.

Answer: B

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43) The flowers are not blooming or it is not winter.
A) It is not true that it is winter and the flowers are not blooming.
B) It is not true that both the flowers are blooming and it is winter.
C) The flowers are blooming and it is winter.
D) It is not true that the flowers are blooming and it is winter.

Answer: B

44) If a triangle is equilateral, then its sides are equal.
A) If a triangle is not equilateral, then its sides are equal.
B) If the sides of a triangle are not equal, then it is not equilateral.
C) If the sides of a triangle are not equal, then it is equilateral.
D) If the sides of a triangle are equal, then it is not equilateral.

Answer: B

45) It is not tasty or it is not sour.
A) If it is tasty, then it is sour.
B) It is not true that it is both tasty and sour.
C) If it is not tasty, then it is not sour.
D) If it is sour, then it is tasty.

Answer: B

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

46) Translate into symbolic form the following statement and explain: If it is not warm and sunny, then we cannot go to the beach.

Answer: p: "It is warm." q: " It is sunny." r: "We go to the beach." Then, $\sim(p \wedge q) \rightarrow \sim r$

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

47)

Answer:

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

Write the statement indicated.

48) State the converse of the following:
If the four sides of a rectangle are equal, then it is a square.
A) If the four sides of a rectangle are not equal, then it is not a square.
B) If the four sides of a rectangle are equal, then it is not a square.
C) If it is a square, then the four sides of a rectangle are equal.
D) If it is not a square then the four sides of the rectangle are not equal.

Answer: C

49) State the converse of the following:
If you study hard, then your grades will be good.
A) If your grades are good, then you studied hard.
B) If you do not study hard, then your grades will not be good.
C) If you study hard, then your grades will not be good.
D) If your grades are not good, then you did not study hard.

Answer: A

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50) State the inverse of the following:
If you practice, then you will win.
A) If you do not practice, then you will not win.
B) If you practice, then you will not win.
C) If you do not win, then you did not practice.
D) If you win, then you practiced.
Answer: A

51) State the inverse of the following:
If it is snowy, then it is cold.
A) If it is snowy, then it is not cold.
B) If it is not cold, then it is not snowy.
C) If it is not snowy, then it is not cold.
D) If it is cold, then it is snowy.
Answer: C

52) State the contrapositive of the following:
If it is pouring, then it is raining.
A) If it is pouring, then it is not raining.
B) If it is not raining, then it is not pouring.
C) If it is raining, then it is pouring.
D) If it is not pouring, then it is not raining.
Answer: B

53) State the contrapositive of the following:
If he is happy, then he is smiling.
A) If he is happy, then he is not smiling.
B) If he is smiling, then he is happy.
C) If he is not smiling, then he is not happy.
D) If he is not happy, then he is not smiling.
Answer: C

Determine whether the statements are logically equivalent.

54) $\sim p \wedge \sim q$ and $\sim(p \vee q)$
A) Yes
B) No
Answer: A

55) $\sim p \vee \sim q$ and $\sim(p \wedge q)$
A) Yes
B) No
Answer: A

56) $q \wedge \sim p$ and $\sim p \rightarrow \sim q$
A) Yes
B) No
Answer: B

57) $\sim(\sim q)$ and q
A) Yes
B) No
Answer: A

58) $q \rightarrow p$ and $\sim q \vee p$
A) Yes
B) No
Answer: A

59) $\sim q \wedge p$ and $\sim q \rightarrow p$
A) Yes
B) No
Answer: B

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60) $q \rightarrow p$ and $\sim p \rightarrow \sim q$

A) Yes B) No

Answer: A

61) $\sim(q \rightarrow p)$ and $q \wedge \sim p$

A) Yes B) No

Answer: A

62) $p \rightarrow q$ and $\sim q \rightarrow \sim p$

A) Yes B) No

Answer: A

63) $q \rightarrow p$ and $p \rightarrow q$

A) Yes B) No

Answer: B

Determine the validity of the argument.

64) Not all that glitters is gold.
My ring glitters.
Therefore my ring is not gold.

A) Valid B) Not valid

Answer: B

65) Football and studying don't mix.
Don is a football player.
Therefore Don does not study.

A) Valid B) Not valid

Answer: A

66) Some investments are risky.
Real estate is an investment.
Therefore real estate is risky.

A) Valid B) Not valid

Answer: B

67) All businessmen wear suits.
Aaron wears suits.
Therefore Aaron is a businessman.

A) Not valid B) Valid

Answer: A

68) Some TV shows are comedies.
All comedies are hits.
Therefore some TV shows are hits.

A) Not valid B) Valid

Answer: B

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69) Not all cars are considered sporty.
Not all cars are safe at high speeds.
Therefore sports cars are safe at high speeds.
A) Valid B) Not valid

Answer: B

70) Sailboats need a windy day to sail.
Today is a windy day.
Therefore today is a good day for sailing sailboats.
A) Not valid B) Valid

Answer: A

71) Martians are green.
Roger is not green.
Therefore Roger is not a Martian.
A) Not valid B) Valid

Answer: B

72) Martians are green.
Frogs are green.
Therefore frogs are Martians.
A) Valid B) Not valid

Answer: B

73) Some winter days are cold.
Today, it is cold.
Therefore it is winter.
A) Not valid B) Valid

Answer: A

Write a valid conclusion based on the statements.

74) If I get robbed, I will go to court.
I got robbed.
A) I will not get robbed in court. B) I will get robbed in court.
C) I will go to court. D) I will not go to court.

Answer: C

75) It is either day or night. If it is daytime, then the squirrels are scurrying. It is not nighttime.
A) Squirrels do not scurry during the day. B) The squirrels are scurrying.
C) Squirrels do not scurry at night. D) The squirrels are not scurrying.

Answer: B

76) All birds have wings. None of my pets are birds. All animals with wings can flap them.
A) All my pets can flap their wings. B) None of my pets can flap their wings.
C) All birds can flap their wings. D) No birds can flap their wings.

Answer: C

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77) Every man with a mind can think. A distracted man can't think. A man who is not distracted can apply himself.
A) Every man with a mind is distracted.
B) Every man with a mind can apply himself.
C) Every distracted man can apply himself.
D) Every man who can apply himself has a mind.

Answer: B

78) All fish can dream. Any dead animal is unable to dream. All live animals have a heartbeat.
A) Any dead fish can dream.
B) Any dead animal has no heartbeat.
C) All live animals can dream.
D) All fish have a heartbeat.

Answer: D

79) If it's not Saturday, then Dad will shave. If Dad has whiskers, then he did not shave. If it's Saturday, then Dad will take us to the game.
A) If Dad has whiskers, then he will take us to the game.
B) If Dad takes us to the game, then he has whiskers.
C) If Dad shaves, then it's not Saturday.
D) If Dad did not shave, then he has whiskers.

Answer: A

80) If you pay your taxes, then you are a good citizen. People who do not pay their taxes did not receive a tax bill. If it is April, then you will receive a tax bill. It is April.
A) You are not a good citizen.
B) You are a good citizen.
C) You did not pay your taxes.
D) You did not receive a tax bill.

Answer: B

81) Students who watch television while doing homework jeopardize their grades. Students with grades in jeopardy get grounded. Being grounded includes being barred from watching television.
A) Students who watch TV will be barred from watching TV.
B) Students who watch TV will be grounded.
C) Students who are grounded watch TV while doing homework.
D) Students who watch TV while doing homework will not be allowed to watch TV.

Answer: D

82) Smiling people are happy. Alert people are not happy. Careful drivers are alert. Careless drivers have accidents.
A) People who smile are alert.
B) Careful drivers have accidents.
C) People who smile have accidents.
D) Careful drivers are happy.

Answer: C

83) Hard workers sweat. Sweat brings on a chill. Anyone who doesn't have a cold never felt a chill. Anyone who works doesn't have a cold.
A) Hard workers don't go to work.
B) Anyone who has a cold works hard.
C) Hard workers don't get colds.
D) Anyone who sweats works hard.

Answer: A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

84) Determine the validity of the following conclusion and explain: If you walk fast, then you will reach the bus stop on time. If you reach the bus stop on time, then you will catch the bus. If you walk fast, then you will catch the bus.

Answer: Valid. p: "You walk fast." q: "You will reach the bus stop on time." r: "You will catch the bus." So, $p \to q$ and $q \to r$, therefore by the chain rule $p \to r$.

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85) Write a valid conclusion based on the following statements: The mall is closed if and only if it is Sunday. The mall is closed.

Answer: It is Sunday. (The mall is closed only on Sundays.)

86) Write a valid conclusion based on the following statements: The store is open today if and only if it is not Saturday or Sunday. The store is not open today.

Answer: Today is Saturday or Sunday.

87) Write a valid conclusion based on the following statements: The store is open today if and only if it is not Saturday or Sunday. Today is Saturday.

Answer: The store is not open today.

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

Write in if–then form.

88) I will lose weight if I diet.

A) If I don't diet, then I won't lose weight.
B) If I lose weight, then I'll diet.
C) If I diet, then I gain weight.
D) If I diet, then I'll lose weight.

Answer: D

89) I will go to class only if you go.

A) If I don't go to class, you don't go to class.
B) If I go to class, then you go to class.
C) If I go to class, then you don't go to class.
D) If you go to class, then I'll go to class.

Answer: D

90) Practice is necessary for making the team.

A) If you practice, then you will make the team.
B) If you make the team, then you won't have to practice.
C) If you make the team, then you must practice.
D) If you don't practice, then you won't make the team.

Answer: A

91) An even number is divisible by two.

A) If a number isn't divisible by two, then it isn't even.
B) If a number is divisible by two, then it is odd.
C) If a number is even, then it is divisible by two.
D) If a number isn't even, then it is not divisible by two.

Answer: C

92) $x = 8$ only if $2x + 3 = 19$.

A) If $x = 8$, then $2x + 3 = 19$.
B) If $2x + 3 = 19$, then $x = 8$.
C) If $x \neq 8$, then $2x + 3 = 19$.
D) If $2x + 3 \neq 19$, then $x = 8$.

Answer: B

93) $x = 9$ if $2x + 9 = 27$.

A) If $2x + 9 \neq 27$, then $x = 9$.
B) If $2x + 9 = 27$, then $x = 9$.
C) If $x \neq 9$, then $2x + 9 = 27$.
D) If $x = 9$, then $2x + 9 = 9$.

Answer: B

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94) I won't go until it's 7 pm.
A) If it's not 7 pm, then I won't go.
B) If I go, then it's 7 pm.
C) If it's 7 pm, then I'll go.
D) If I don't go, then it's not 7 pm.

Answer: B

95) Showing up at the party is enough to get a door prize.
A) If you get a door prize then you don't have to show up at the party.
B) If you got a door prize then you showed up at the party.
C) If you don't show up at the party, then you will not get a door prize.
D) If you show up at the party then you will get a door prize.

Answer: D

Write the set as indicated.

96) List the whole numbers between 1 and 5.
A) {2, 3, 4, 5}
B) {1, 2, 3, 4}
C) {2, 3, 4}
D) {1, 2, 3, 4, 5}

Answer: C

97) List the set of all whole numbers greater than 5 and less than 9.
A) {5, 6, 7, 8, 9}
B) {6, 7, 8}
C) {6, 7, 8, 9}
D) {5, 6, 7, 8}

Answer: B

98) List the counting numbers that are multiples of 5.
A) {5, 10, 15, . . .}
B) ∅
C) {10, 15, 20, . . .}
D) {0, 5, 10, 15, . . .}

Answer: A

99) List the set of states that border California.
A) {Oregon, Nevada, Arizona}
B) {Oregon, Nevada, Utah}
C) {Washington, Utah, Arizona}
D) {Nevada, Utah}

Answer: A

100) Write {2} using set–builder notation.
A) {x|x is all natural numbers}
B) {x|x is the natural number 2}
C) {x}
D) {x is a constant}

Answer: B

101) Write {2, 4, 6, 8} using set–builder notation.
A) {x|x is any even natural number}
B) {2, 4, 6, 8}
C) {x|x is an even natural number less than 10}
D) {x|x is any natural number}

Answer: C

102) Write {17, 18, 19, 20} using set–builder notation.
A) {17, 18, 19, 20}
B) {x|x is a natural number between 17 and 20}
C) {x|x is a natural number less than 21}
D) {x|x is a natural number between 16 and 21}

Answer: D

103) Write {8, 12, 16, 20, ... 48} using set–builder notation.
A) {x|x is a multiple of 4 between 8 and 48}
B) {x|x is a multiple of 4}
C) {x|x is a multiple of 4 greater than 8}
D) {x|x is a multiple of 4 between 4 and 52}

Answer: D

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104) Write the odd natural numbers less than 39 using set–builder notation.

A) $\{x \in N | x < 38\}$ B) $\{x \in N | x \leq 37$ and x is odd$\}$

C) $\{x \in N | x < 39\}$ D) $\{x \in N | x \leq 39$ and x is odd$\}$

Answer: B

Rewrite the statement using mathematical symbols.

105) P is the set of even numbers less than 30 and more than 20.

A) P = {22, 24, 26, 28} B) P = {20, 22, 24, 26, 28}

C) Q = {20, 22, 24, 26, 28, 30} D) Q = {22, 24, 26, 28, 30}

Answer: A

106) The set A with elements Indiana and Minnesota is not equal to the set B with elements Kansas and Virginia.

A) A = {Indiana, Arizona} , B = {Kansas, Virginia} , $A \neq B$

B) A = {Indiana, Minnesota} , B = {Kansas, Virginia} , $A \neq B$

C) A = {Indiana, Minnesota} , B = {Kansas, Virginia} , $A \not\subset B$

D) B = {Indiana, Minnesota} , A = {Kansas, Virginia} , $B \neq A$

Answer: B

107) Q is equal to the set of letters in the word wed.

A) $Q \subset \{w, e, d\}$ B) Q = {w, e, d} C) $Q \in \{w, e, d\}$ D) Q = {w, e, e, d}

Answer: B

108) The set A is the set containing only the element 6.

A) A = { } B) A = {6} C) $A \in \{7, 6\}$ D) $A \subset \{6\}$

Answer: B

109) a is an element of {k, a, d, z, t}.

A) $a \in \{k, a, d, z, t\}$ B) $a \subset \{k, a, d, z, t\}$ C) $\{a\} \in \{k, a, d, z, t\}$ D) $\{a\} \subseteq \{k, a, d, z, t\}$

Answer: A

Indicate which symbol, $\in$ or $\notin$, makes the statement true.

110) 0 __ $\varnothing$

A) $\notin$ B) $\in$

Answer: A

111) $\varnothing$ __ $\varnothing$

A) $\in$ B) $\notin$

Answer: B

112) 3 __ {1, 2, 3, . . . , 10}

A) $\in$ B) $\notin$

Answer: A

113) {3} __ {1, 2, 3, . . . , 10}

A) $\in$ B) $\notin$

Answer: B

114) 27 __ $\{x \mid x = 3^n$ and $n \in N\}$

A) $\notin$ B) $\in$

Answer: B

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SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

115) Is the set of good software packages in the market well–defined?

Answer: No, since "good" is a subjective term.

116) Is the set of multiples of 5 between 1 and 100 well–defined?

Answer: Yes, you can list the elements.

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

117) Is it possible or not possible to set up a one–to–one correspondence between {0, 6, 9, 19} and {6, 9, 19}?

A) Possible B) Not possible

Answer: B

118) Is it possible or not possible to set up a one–to–one correspondence between {Mon, Tue, Wed} and {Oct, Nov, Dec}?

A) Possible B) Not possible

Answer: A

119) Is it possible or not possible to set up a one–to–one correspondence between {a, b, c, d} and {A, B, C, D}?

A) Possible B) Not possible

Answer: A

120) Is it possible or not possible to set up a one–to–one correspondence between {0} and {333}?

A) Possible B) Not possible

Answer: A

121) Is it possible or not possible to set up a one–to–one correspondence between ∅ and {37}?

A) Possible B) Not possible

Answer: B

122) How many one–to–one correspondences are there between two sets with 4 elements each?

A) 24 B) None C) 6 D) 2

Answer: A

123) How many one–to–one correspondences are there between the sets {x, y, z, u, v} and {2, 4, 6, 7, 9} if in each correspondence x must correspond to 7 and z to 6?

A) 21 B) 120 C) 16 D) 6

Answer: D

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

124) There are five seats available for a show. Ten people are in the line for the tickets to these seats. Illustrate the utility of one–to–one correspondence with this example.

Answer: Each seat corresponds to one person who can take the seat. Thus, only five people should be given tickets for the show. If more than five tickets are issued, then some people will be without seats.

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

Do the following represent equal sets?

125) {p, q, r, s} = {q, s, r, p}
A) Yes B) No
Answer: A

126) {28, 30, 32, 34, 36} = {30, 32, 34, 36}
A) Yes B) No
Answer: B

127) {7, 7, 12, 12, 15} = {7, 12, 15}
A) Yes B) No
Answer: A

Find n(A) for the set A.

128) A = {3, 5, 7, 9, 11}
A) n(A) = 11 B) n(A) = 5 C) n(A) = 2 D) n(A) = 4
Answer: B

129) A = {700, 701, 702, . . ., 7000}
A) n(A) = 6300 B) n(A) = 6301 C) n(A) = 7000 D) n(A) = 4
Answer: B

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

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

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

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

134) A = {x|x ∈ N and 17 ≤ x ≤ 25}
A) 42 B) 9 C) 7 D) 43
Answer: B

Rewrite the statement using mathematical symbols.

135) P is the set of even numbers less than 50 and more than 40.
A) Q = {40, 42, 44, 46, 48, 50} B) P = {42, 44, 46, 48}
C) Q = {42, 44, 46, 48, 50} D) P = {40, 42, 44, 46, 48}
Answer: B

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136) The set consisting of the elements k and y is a proper subset of {k, b, e, y, u}.
A) {k, y} ∈ {k, b, e, y, u} B) {k, y} ⊂ {k, b, e, y, u} C) {k, y} ~ {k, b, e, y, u} D) {k, y} ⊆ {k, b, e, y, u}
Answer: B

137) The set consisting of the elements k and z is not a proper subset of {c, f, z, u}.
A) {k, z} ⊄ {c, f, z, u} B) {k, z} ∈ {c, f, z, u} C) {k, z} ⊆ {c, f, z, u} D) {k, z} ~ {c, f, z, u}
Answer: A

Write a statement that represents the relationship between the following.

138) A = {x| x is a letter from the word "garage"} and B = {y| y is a letter from the word "rage"}
A) A ≠ B B) A ∈ B C) A = B D) A ⊂ B
Answer: C

139) P = {9, 11, 13, 15, 17} and Q = {2, 4, 6, 8, 10}
A) P ∈ Q B) P ≠ Q C) P = Q D) P ∉ Q
Answer: B

140) M = ∅ and N = { }
A) N ∈ M B) M ≠ N C) M = N D) M ⊂ N
Answer: C

141) A = {b, f, n, t, e, r} and r
A) r = A B) r ⊂ A C) r ∈ A D) r ⊆ A
Answer: C

142) C = {x| x is a letter of the alphabet} and D = {x| x is a letter in the word math}
A) D = C B) D ⊂ C C) C ⊈ D D) D ⊄ C
Answer: B

143) A = {7, 8, 9} and B = {x| 7 ≤ x ≤ 9, x ∈ N}
A) A ⊈ B B) A ⊂ B C) A ⊆ B D) B ⊂ A
Answer: C

144) ∅ and B = {a, b, c, d, e}
A) ∅ ⊄ B B) ∅ ∈ B C) ∅ ⊂ B D) ∅ = B
Answer: C

145) A = {x|2 < x < 6, x ∈ N} and 2
A) 2 = A B) 2 ∈ A C) 2 ⊂ A D) 2 ∉ A
Answer: D

146) A = {a, e, i, o, u} and B = {e, o, i, u, a}
A) A = B B) e ⊆ B C) a = A D) A ⊂ B
Answer: A

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SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

147) A is the set of all the letters of the alphabet and B is the set of vowels. What kind of relationship exists between the two sets? Also, if C is the set of consonants what is the relationship between B and C?

Answer: $B \subset A$, $C = \overline{B}$

148) Given that $n(P) = 10$ and $P \subset Q$, what is the least number of elements that set Q can have? Is there a maximum limit on the number of elements that set Q can have?

Answer: 11, No

149) If $P \subseteq Q$ and $Q \subseteq P$, then what can be said about the equality of the two sets?

Answer: $P = Q$

150) U is the universal set and B is a proper subset of U. Write a relationship between the cardinal numbers of U, B and $\overline{B}$.

Answer: $n(U) = n(B) + n(\overline{B})$

151) A is the set of all even natural numbers, and B is the set of all odd natural numbers. Describe a universal set for A and B. Also, with respect to this universal set, give a relationship between A and B.

Answer: The universal set is the set of all natural numbers. Also, $A = \overline{B}$ and $B = \overline{A}$.

152) $P = \{a, b, c, d, e, f\}$. How many subsets of the set P can be made?

Answer: 64

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

Use the Fundamental Counting Principle to solve the problem.

153) A restaurant offers 7 entrees and 11 desserts. In how many ways can a person order a two–course meal?

A) 18 B) 20 C) 77 D) 154

Answer: C

154) In how many ways can a girl choose a two–piece outfit from 5 blouses and 7 skirts?

A) 14 B) 12 C) 70 D) 35

Answer: D

155) How many ways are there to arrange 6 unique CD's in order along a shelf?

A) 30 B) 36 C) 720 D) 120

Answer: C

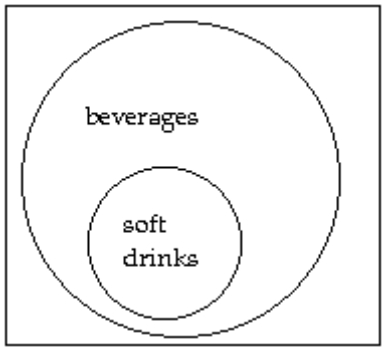
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SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

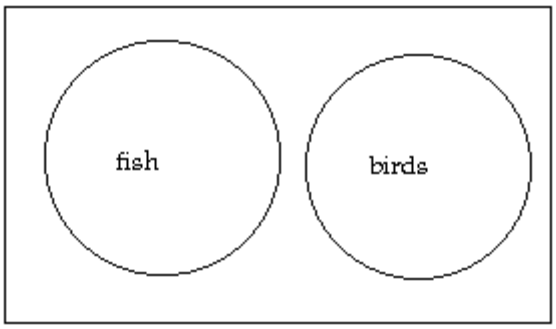
156) Draw a Venn diagram showing the relationship between beverages and soft drinks.

Answer:



157) Draw a Venn diagram showing the relationship between fish and birds.

Answer:



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

Determine whether the following is true or false.

158) $A \cup \overline{A}$ is equal to the universal set U.

A) True B) False

Answer: A

159) $n(A \cup B) \neq n(A) + n(B) - n(A \cap B)$

A) True B) False

Answer: B

160) $A - B = (A \cup B) - B$

A) True B) False

Answer: A

161) $A \cup \varnothing = A \cap \varnothing$

A) True B) False

Answer: B

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162) $A \cap (B \cap C) = (A \cap B) \cap C$

A) True B) False

Answer: A

163) $(A - B) \cup A = B$

A) True B) False

Answer: B

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

A) True B) False

Answer: B

165) $A \cap \overline{B} = A - B$

A) True B) False

Answer: A

166) $\overline{A \cup B} = \overline{A} \cap \overline{B}$

A) True B) False

Answer: A

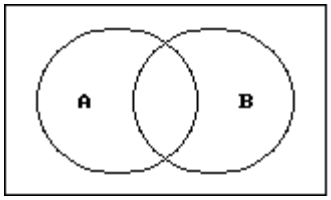
167) $\overline{A \cap B} = A \cup B$

A) True B) False

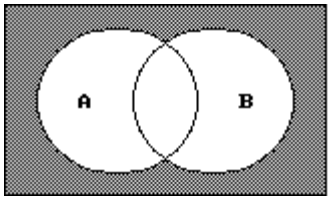
Answer: B

Shade the portion of the diagram that represents the given set.

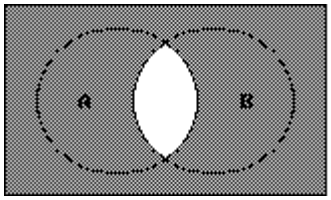
168) $\overline{A} \cap \overline{B}$



A)



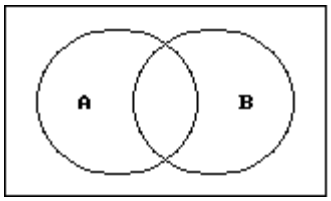
B)



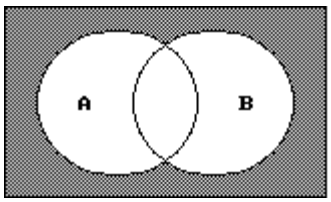
Answer: A

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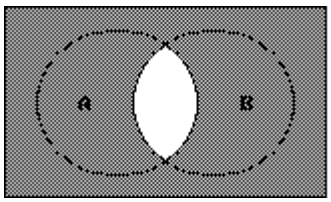
169) $\overline{A} \cup \overline{B}$



A)

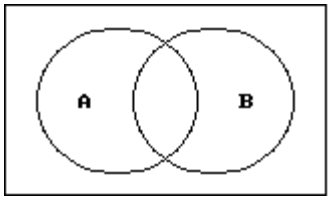


B)

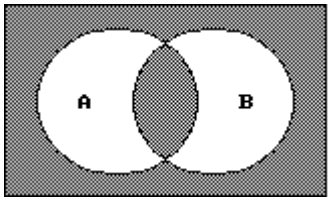


Answer: B

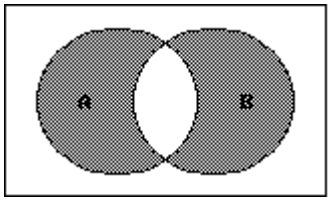
170) $(A \cup B) \cap \overline{(A \cap B)}$



A)

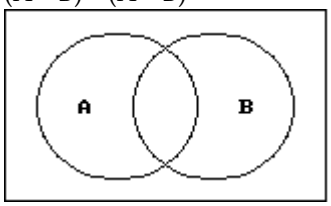


B)

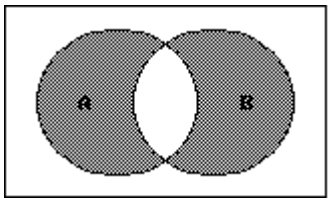


Answer: B

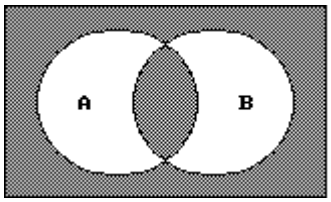
171) $(A \cap B) \cup \overline{(A \cup B)}$



A)



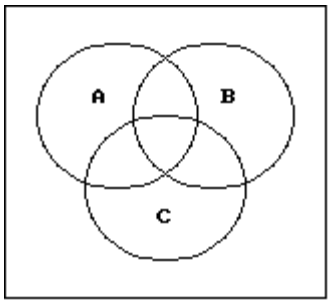
B)



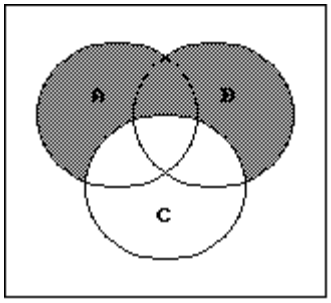
Answer: B

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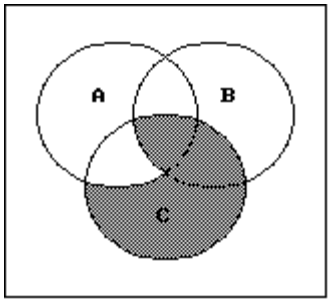
172) $\overline{C} \cap (A \cup B)$



A)

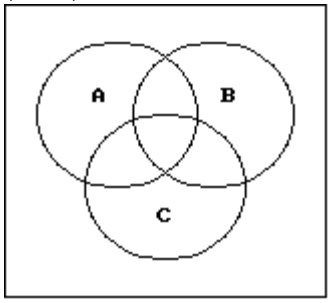


B)

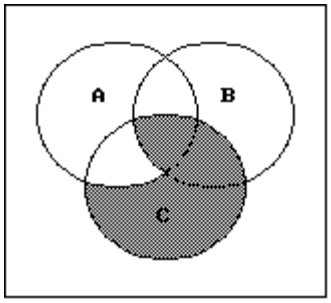


Answer: A

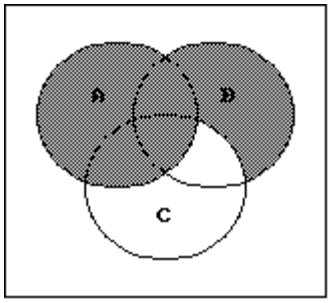
173) $(\overline{A} \cup B) \cap C$



A)



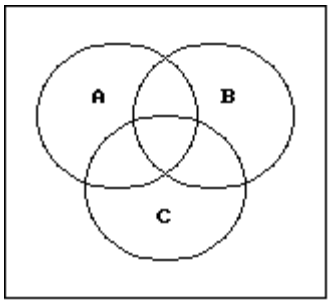
B)



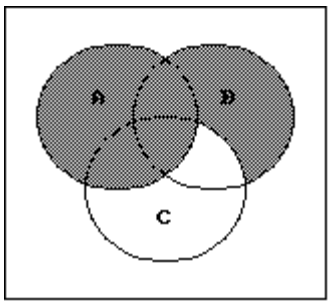
Answer: A

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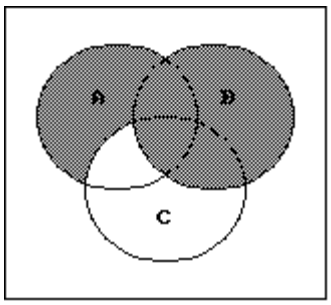
174) $A \cup (B \cap \overline{C})$



A)



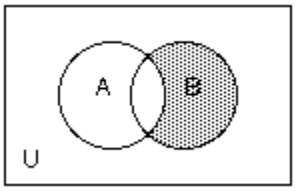
B)



Answer: A

Use set notation to identify the shaded region.

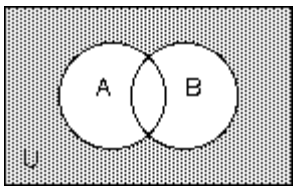
175)



A) $A \cap \overline{B}$ B) $B \cap \overline{A}$ C) $B - \overline{A}$ D) $A - B$

Answer: B

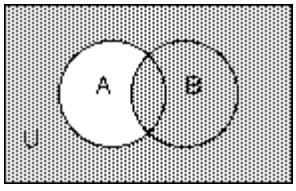
176)



A) $\overline{A} \cap \overline{B}$ B) $A \cup B$ C) $A - B$ D) $\overline{A \cap B}$

Answer: A

177)

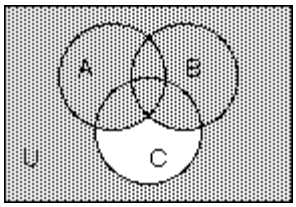


A) $B - A$ B) $\overline{A} \cup B$ C) $\overline{A} \cap B$ D) $\overline{A \cap B}$

Answer: B

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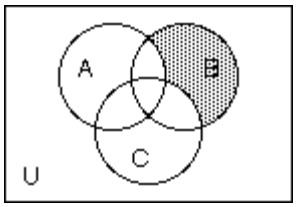
178)



A) $(A \cup B) \cup \overline{C}$ B) $(A \cap B) \cup \overline{C}$ C) $\overline{A \cup B \cup C}$ D) $A \cup B \cap \overline{C}$

Answer: A

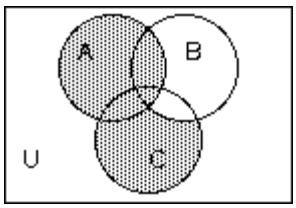
179)



A) $\overline{A} \cap \overline{C} \cap B$ B) $B - (A \cap C)$ C) $\overline{B} - (A \cup B)$ D) $B \cap \overline{A \cap C}$

Answer: A

180)



A) $A \cup C - B$ B) $C \cap \overline{B} \cup A$ C) $\overline{B} \cap A \cup C$ D) $A \cup C$

Answer: B

Use sets to solve the problem.

181) Results of a survey of fifty students indicate that 30 like red jelly beans, 29 like green jelly beans, and 17 like both red and green jelly beans. How many of the students surveyed like neither red nor green jelly beans?

A) 17 B) 13 C) 12 D) 8

Answer: D

182) 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 no cats?

A) 15 B) 10 C) 22 D) 27

Answer: C

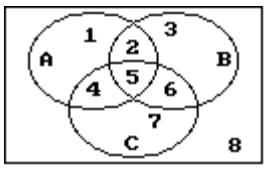
183) Monticello residents were surveyed concerning their preferences for candidates Moore and Allen in an upcoming election. Of the 800 respondents, 300 support neither Moore nor Allen, 100 support both Moore and Allen, and 250 support only Moore. How many residents support Allen?

A) 250 B) 150 C) 400 D) 100

Answer: A

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184) The circles in the Venn diagram represent customers who prefer products A, B, and C, respectively. Which of the regions numbered one through eight describe customers who prefer Products A or C?



A) 4,5 B) 2,4,5,6 C) 1,2,4,5,6,7 D) 2,5,6

Answer: C

185) 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 650 responses with the following results:

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

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

91 were interested in reruns but not an interview show.

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

65 were interested in a documentary and reruns.

39 were interested in an interview show and reruns.

52 were interested in none of the three.

How many are interested in exactly one kind of show?

A) 322 B) 302 C) 312 D) 292

Answer: C

186) A survey of 240 families showed that

91 had a dog;
70 had a cat;
31 had a dog and a cat;
91 had neither a cat nor a dog nor a parakeet;
7 had a cat and dog and a parakeet.

How many had a parakeet only?

A) 24 B) 19 C) 29 D) 34

Answer: B

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187) A survey of a group of 117 tourists was taken in St. Louis. The survey showed the following:

66 of the tourists plan to visit Gateway Arch;

49 plan to visit the zoo;

11 plan to visit the Art Museum and the zoo, but not the Gateway Arch;

14 plan to visit the Art Museum and the Gateway Arch, but not the zoo;

19 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) 12 B) 49 C) 101 D) 37

Answer: A

Find the Cartesian product or cardinal number as requested.

188) A = {6, 10, 12}
B = {5, 10}
Find A × B.

A) {(6, 5), (10, 10)}
B) {(6, 5), (10, 12), (12, 5)}
C) {(6, 5), (6, 10), (10, 5), (10, 10), (12, 5), (12, 10)}
D) {(5, 6), (5, 10), (5, 12), (10, 6), (10, 10), (10, 12)}

Answer: C

189) A = {i, a}
B = {t, d, m}
Find A × B.

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

Answer: D

190) A = {0}
B = {11, 21, 31}
Find B × A.

A) {0, 0, 0}
B) {0}
C) {(0, 11), (0, 21), (0, 31)}
D) {(11, 0), (21, 0), (31, 0)}

Answer: D

191) A = {4, 3, 8, 7}
B = {0, 1}
Find B × A.

A) {0, 1, 4, 3, 8, 7}
B) {(0, 4), (0, 3), (0, 8), (0, 7), (1, 4), (1, 3), (1, 8), (1, 7)}
C) {(4, 0), (4, 1), (3, 0), (3, 1)}
D) {(4, 0), (3, 0), (8, 0), (7, 0), (4, 1), (3, 1), (8, 1), (7, 1)}

Answer: B

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192) Write {(k, 3), (k, 4), (j, 3), (j, 4)} as a Cartesian product.

A) {k, j} × {3, 4} B) {k, j, 3, 4} × {1} C) {3, 4} × {k, j} D) {k, 3} × {j, 4}

Answer: A

193) A = {15, 3, 10}
B = {5, 12}
Find n(A × B).

A) 12 B) 5 C) 9 D) 6

Answer: D

194) n(A) = 21
n(B) = 9
Find n(A × B).

A) 12 B) 39 C) 30 D) 189

Answer: D

195) n(A × B) = 32
n(A) = 4
Find n(B).

A) 36 B) 4 C) 8 D) 28

Answer: C

196) n(A × B) = 90
n(B) = 10
Find n(A).

A) 10 B) 80 C) 100 D) 9

Answer: D

197) n(A) = 2
n(B) = 5
n(C) = 3
n(A × B × C) = ?

A) 10 B) 3 C) 7 D) 30

Answer: D

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Ch. 2 Introduction to Logic and Sets

2.1 Reasoning and Logic: An Introduction

1 Analyze statements and their truth values.

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

Determine whether the following is a statement. If it is, then also classify the statement as true or false.

1) Why don't you come here?
A) Not a statement B) True statement C) False statement

2) This room is big.
A) Not a statement B) True statement C) False statement

3) $5 - 1 = 4$
A) True statement B) False statement C) Not a statement

4) $7x + y = 3$
A) Not a statement B) True statement C) False statement

5) Can you bring the book?
A) Not a statement B) True statement C) False statement

6) $x + y = x - y$, where $y = 0$
A) True statement B) False statement C) Not a statement

7) $12 = 3y$
A) Not a statement B) True statement C) False statement

8) $2.4 = 5.2$
A) False statement B) True statement C) Not a statement

9) The state of California is in North America.
A) True statement B) False statement C) Not a statement

10) Brazil is in Asia.
A) False statement B) True statement C) Not a statement

2 Understand quantifiers and negation of statements.

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

Use a quantifier to make the following true or false, as indicated, where x is a natural number.

1) $x + x = 6$ (make true)
A) There exists a natural number x such that $x + x = 6$.
B) For every natural number x, $x + x = 6$.
C) There is no natural number x such that $x + x = 6$.
D) For all natural numbers x, $x + x = 6$.

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2) $x^3 = 8$ (make true)

A) There exists a natural number x such that $x^3 = 8$.

B) No natural number x exists such that $x^3 = 8$.

C) Every natural number x satisfies $x^3 = 8$.

D) Three natural numbers x exist such that $x^3 = 8$.

3) $2x + 1 = 5 - x$ (make true)

A) There exists a natural number x such that $2x + 1 = 5 - x$.

B) No natural number x exists such that $2x + 1 = 5 - x$.

C) For every natural number x, $2x + 1 = 5 - x$.

D) Only two natural numbers x exist such that $2x + 1 = 5 - x$.

4) $12x = 5x + 7x$ (make false)

A) There is no natural number x such that $12x = 5x + 7x$.

B) For every natural number x, $12x = 5x + 7x$.

C) There exists a natural number x such that $12x = 5x + 7x$.

D) More than one natural number x exists such that $12x = 5x + 7x$.

5) $x - 13 = 13 - x$ (make false)

A) There is no natural number x such that $x - 13 = 13 - x$.

B) For $x = 13$, $x - 13 = 13 - x$.

C) There exists a natural number x such that $x - 13 = 13 - x$.

D) At least one natural number x exists such that $x - 13 = 13 - x$.

6) $4x = 7x$ (make false)

A) For every natural number x, $4x = 7x$.

B) There is no natural number x such that $4x = 7x$.

C) No natural number x satisfies $4x = 7x$.

Write the statement indicated.

7) Write the negation of the following:
The test is difficult.

A) The test is not difficult.

B) The test is not easy.

C) The test is very difficult.

D) The test is not very easy.

8) Write the negation of the following:
$8 + 2 = 10$

A) $8 + 2 \neq 10$

B) The sum of 8 and 2 is ten.

C) $8 + 2 = 12$

D) $8 + 2 = 2 + 8$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

9) Negate the following: The store is sometimes open on Sunday.

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3 Work with symbols, truth tables, compound statements, and logical equivalence.

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

Construct a truth table for the statement.

1) ~p ∧ ~s

A)

p	s	(~p ∧ ~s)
T	T	F
T	F	F
F	T	F
F	F	T

B)

p	s	(~p ∧ ~s)
T	T	T
T	F	F
F	T	F
F	F	T

C)

p	s	(~p ∧ ~s)
T	T	F
T	F	T
F	T	T
F	F	T

D)

p	s	(~p ∧ ~s)
T	T	F
T	F	F
F	T	F
F	F	F

2) s ∨ ~(r ∧ p)

A)

s	r	p	s ∨ ~(r ∧ p)
T	T	T	T
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	T

B)

s	r	p	s ∨ ~(r ∧ p)
T	T	T	T
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	F

3) (p ∧ ~q) ∧ t

A)

p	q	t	(p ∧ ~q) ∧ t
T	T	T	F
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	F
F	T	F	F
F	F	T	F
F	F	F	F

B)

p	q	t	(p ∧ ~q) ∧ t
T	T	T	F
T	T	F	F
T	F	T	F
T	F	F	F
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	T

4) ~((w ∧ q) ∨ s)

A)

w	q	s	~((w ∧ q) ∨ s)
T	T	T	F
T	T	F	F
T	F	T	F
T	F	F	T
F	T	T	F
F	T	F	T
F	F	T	F
F	F	F	T

B)

w	q	s	~((w ∧ q) ∨ s)
T	T	T	T
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	T
F	T	F	F
F	F	T	T
F	F	F	F

5) w ∨ (w ∧ ~w)

A)

w	w ∨ (w ∧ ~w)
T	T
F	F

B)

w	w ∨ (w ∧ ~w)
T	F
F	T

C)

w	w ∨ (w ∧ ~w)
T	F
F	F

D)

w	w ∨ (w ∧ ~w)
T	T
F	T

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6) $(t \wedge p) \vee (\sim t \wedge \sim p)$

A)

t	p	$(t \wedge p) \vee (\sim t \wedge \sim p)$
T	T	T
T	F	F
F	T	F
F	F	T

B)

t	p	$(t \wedge p) \vee (\sim t \wedge \sim p)$
T	T	F
T	F	F
F	T	T
F	F	T

C)

t	p	$(t \wedge p) \vee (\sim t \wedge \sim p)$
T	F	F
F	T	F

D)

t	p	$(t \wedge p) \vee (\sim t \wedge \sim p)$
T	T	T
T	F	T
F	T	T
F	F	F

7) $\sim(\sim(s \vee p))$

A)

s	p	$\sim(\sim(s \vee p))$
T	T	T
T	F	T
F	T	T
F	F	F

B)

s	p	$\sim(\sim(s \vee p))$
T	T	F
T	F	F
F	T	F
F	F	T

C)

s	p	$\sim(\sim(s \vee p))$
T	F	T
F	T	F

D)

s	p	$\sim(\sim(s \vee p))$
T	T	T
T	F	T
F	T	F
F	F	F

8) $\sim(s \vee t) \wedge \sim(t \wedge s)$

A)

s	t	$\sim(s \vee t) \wedge \sim(t \wedge s)$
T	T	F
T	F	F
F	T	F
F	F	T

B)

s	t	$\sim(s \vee t) \wedge \sim(t \wedge s)$
T	T	F
T	F	F
F	T	F
F	F	F

C)

s	t	$\sim(s \vee t) \wedge \sim(t \wedge s)$
T	T	F
T	F	T
F	T	T
F	F	F

D)

s	t	$\sim(s \vee t) \wedge \sim(t \wedge s)$
T	T	F
T	F	F
F	T	T
F	F	F

9) $(p \wedge w) \wedge (\sim w \vee t)$

A)

p	w	t	$(p \wedge w) \wedge (\sim w \vee t)$
T	T	T	T
T	T	F	F
T	F	T	F
T	F	F	F
F	T	T	F
F	T	F	F
F	F	T	F
F	F	F	F

B)

p	w	t	$(p \wedge w) \wedge (\sim w \vee t)$
T	T	T	F
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	T
F	T	F	F
F	F	T	T
F	F	F	T

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Letting r stand for "The food is good," p stand for "I eat too much," and q stand for "I'll exercise," write the following in symbolic form.

10) If I eat too much, then I'll exercise.
A) $p \rightarrow q$ B) $p \vee q$ C) $r \rightarrow p$ D) $q \rightarrow p$

11) If I exercise, then I won't eat too much.
A) $q \rightarrow \sim p$ B) $\sim(p \rightarrow q)$ C) $r \wedge p$ D) $p \rightarrow q$

12) If the food is good, then I eat too much.
A) $r \rightarrow p$ B) $p \rightarrow r$ C) $r \wedge p$ D) $p \rightarrow q$

13) If the food is good and if I eat too much, then I'll exercise.
A) $(r \wedge p) \rightarrow q$ B) $r \rightarrow (p \wedge q)$ C) $r \wedge (p \rightarrow q)$ D) $p \rightarrow (r \wedge q)$

14) If the food is good or if I eat too much, I'll exercise.
A) $(r \vee p) \rightarrow q$ B) $r \rightarrow (p \vee q)$ C) $(r \wedge p) \rightarrow q$ D) $r \rightarrow p \rightarrow q$

15) If the food is not good, I won't eat too much.
A) $\sim r \rightarrow \sim p$ B) $\sim(r \rightarrow p)$ C) $r \rightarrow \sim p$ D) $\sim p \rightarrow \sim r$

16) I'll exercise if I eat too much.
A) $p \rightarrow q$ B) $q \rightarrow p$ C) $p \vee q$ D) $q \wedge p$

17) The food is good and if I eat too much, then I'll exercise.
A) $r \wedge (p \rightarrow q)$ B) $(r \wedge p) \rightarrow q$ C) $(r \rightarrow p) \vee q$ D) $(r \vee p) \rightarrow q$

18) I'll exercise if I don't eat too much.
A) $\sim p \rightarrow q$ B) $\sim(p \rightarrow q)$ C) $\sim p \wedge q$ D) $\sim p \vee q$

19) If I exercise, then the food won't be good and I won't eat too much.
A) $q \rightarrow (\sim r \wedge \sim p)$ B) $q \rightarrow \sim(r \wedge p)$ C) $(q \wedge \sim r) \rightarrow \sim p$ D) $\sim(r \wedge p) \rightarrow q$

Restate in a logically equivalent form.

20) It is not true that both this book is interesting and the book is about stars.
A) Either this book is not interesting or it is not about stars.
B) Either this book is interesting or it is about stars.
C) This book cannot be both interesting and about stars.
D) This book is both interesting and about stars.

21) If a number is divisible by 4, then it is divisible by 2.
A) If a number is not divisible by 2, then it is not divisible by 4.
B) If a number is divisible by 4, then it is not divisible by 2.
C) If a number is not divisible by 4, then it is divisible by 2.
D) If a number is not divisible by 4, then it is not divisible by 2.

22) If it is clean, then it was washed.
A) If it was not washed, then it is not clean.
B) If it is not clean, then it was not washed.
C) If it is clean, then it was washed.
D) If it is clean, then it was not washed.

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23) It is not true that today I both went to school and read a book.
A) Today, I either did not go to school or I did not read a book.
B) Today, I went to school and read a book.
C) Today, I read a book but did not go to school.
D) Today, I did not read a book and did not go to school.

24) The flowers are not blooming or it is not winter.
A) It is not true that both the flowers are blooming and it is winter.
B) It is not true that the flowers are blooming and it is winter.
C) It is not true that it is winter and the flowers are not blooming.
D) The flowers are blooming and it is winter.

25) If a triangle is equilateral, then its sides are equal.
A) If the sides of a triangle are not equal, then it is not equilateral.
B) If the sides of a triangle are not equal, then it is equilateral.
C) If the sides of a triangle are equal, then it is not equilateral.
D) If a triangle is not equilateral, then its sides are equal.

26) It is not tasty or it is not sour.
A) It is not true that it is both tasty and sour.
B) If it is tasty, then it is sour.
C) If it is sour, then it is tasty.
D) If it is not tasty, then it is not sour.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

27) Translate into symbolic form the following statement and explain: If it is not warm and sunny, then we cannot go to the beach.

4 Use Euler diagrams to test logical relationships. (no exercises available)

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

1)

5 Write the converse, inverse, and contrapositive.

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

Write the statement indicated.

1) State the converse of the following:
If the four sides of a rectangle are equal, then it is a square.
A) If it is a square, then the four sides of a rectangle are equal.
B) If the four sides of a rectangle are not equal, then it is not a square.
C) If it is not a square then the four sides of the rectangle are not equal.
D) If the four sides of a rectangle are equal, then it is not a square.

2) State the converse of the following:
If you study hard, then your grades will be good.
A) If your grades are good, then you studied hard.
B) If you do not study hard, then your grades will not be good.
C) If your grades are not good, then you did not study hard.
D) If you study hard, then your grades will not be good.

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3) State the inverse of the following:
If you practice, then you will win.
A) If you do not practice, then you will not win.
B) If you win, then you practiced.
C) If you do not win, then you did not practice.
D) If you practice, then you will not win.

4) State the inverse of the following:
If it is snowy, then it is cold.
A) If it is not snowy, then it is not cold.
B) If it is cold, then it is snowy.
C) If it is not cold, then it is not snowy.
D) If it is snowy, then it is not cold.

5) State the contrapositive of the following:
If it is pouring, then it is raining.
A) If it is not raining, then it is not pouring.
B) If it is raining, then it is pouring.
C) If it is not pouring, then it is not raining.
D) If it is pouring, then it is not raining.

6) State the contrapositive of the following:
If he is happy, then he is smiling.
A) If he is not smiling, then he is not happy.
B) If he is smiling, then he is happy.
C) If he is not happy, then he is not smiling.
D) If he is happy, then he is not smiling.

6 Determine if two statements are logically equivalent.

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

Determine whether the statements are logically equivalent.

1) $\sim p \wedge \sim q$ and $\sim(p \vee q)$
A) Yes
B) No

2) $\sim p \vee \sim q$ and $\sim(p \wedge q)$
A) Yes
B) No

3) $q \wedge \sim p$ and $\sim p \rightarrow \sim q$
A) Yes
B) No

4) $\sim(\sim q)$ and q
A) Yes
B) No

5) $q \rightarrow p$ and $\sim q \vee p$
A) Yes
B) No

6) $\sim q \wedge p$ and $\sim q \rightarrow p$
A) Yes
B) No

7) $q \rightarrow p$ and $\sim p \rightarrow \sim q$
A) Yes
B) No

8) $\sim(q \rightarrow p)$ and $q \wedge \sim p$
A) Yes
B) No

9) $p \rightarrow q$ and $\sim q \rightarrow \sim p$
A) Yes
B) No

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10) $q \rightarrow p$ and $p \rightarrow q$

A) Yes B) No

7 Form valid conclusions and analyze the validity of an argument.

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

Determine the validity of the argument.

1) Not all that glitters is gold.
My ring glitters.
Therefore my ring is not gold.

A) Not valid B) Valid

2) Football and studying don't mix.
Don is a football player.
Therefore Don does not study.

A) Valid B) Not valid

3) Some investments are risky.
Real estate is an investment.
Therefore real estate is risky.

A) Not valid B) Valid

4) All businessmen wear suits.
Aaron wears suits.
Therefore Aaron is a businessman.

A) Not valid B) Valid

5) Some TV shows are comedies.
All comedies are hits.
Therefore some TV shows are hits.

A) Valid B) Not valid

6) Not all cars are considered sporty.
Not all cars are safe at high speeds.
Therefore sports cars are safe at high speeds.

A) Not valid B) Valid

7) Sailboats need a windy day to sail.
Today is a windy day.
Therefore today is a good day for sailing sailboats.

A) Not valid B) Valid

8) Martians are green.
Roger is not green.
Therefore Roger is not a Martian.

A) Valid B) Not valid

9) Martians are green.
Frogs are green.
Therefore frogs are Martians.

A) Not valid B) Valid

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10) Some winter days are cold.
Today, it is cold.
Therefore it is winter.
A) Not valid B) Valid

Write a valid conclusion based on the statements.

11) If I get robbed, I will go to court.
I got robbed.
A) I will go to court. B) I will not go to court.
C) I will get robbed in court. D) I will not get robbed in court.

12) It is either day or night. If it is daytime, then the squirrels are scurrying. It is not nighttime.
A) The squirrels are scurrying. B) The squirrels are not scurrying.
C) Squirrels do not scurry at night. D) Squirrels do not scurry during the day.

13) All birds have wings. None of my pets are birds. All animals with wings can flap them.
A) All birds can flap their wings. B) All my pets can flap their wings.
C) No birds can flap their wings. D) None of my pets can flap their wings.

14) Every man with a mind can think. A distracted man can't think. A man who is not distracted can apply himself.
A) Every man with a mind can apply himself. B) Every man with a mind is distracted.
C) Every distracted man can apply himself. D) Every man who can apply himself has a mind.

15) All fish can dream. Any dead animal is unable to dream. All live animals have a heartbeat.
A) All fish have a heartbeat. B) Any dead fish can dream.
C) All live animals can dream. D) Any dead animal has no heartbeat.

16) If it's not Saturday, then Dad will shave. If Dad has whiskers, then he did not shave. If it's Saturday, then Dad will take us to the game.
A) If Dad has whiskers, then he will take us to the game.
B) If Dad did not shave, then he has whiskers.
C) If Dad takes us to the game, then he has whiskers.
D) If Dad shaves, then it's not Saturday.

17) If you pay your taxes, then you are a good citizen. People who do not pay their taxes did not receive a tax bill. If it is April, then you will receive a tax bill. It is April.
A) You are a good citizen. B) You did not receive a tax bill.
C) You did not pay your taxes. D) You are not a good citizen.

18) Students who watch television while doing homework jeopardize their grades. Students with grades in jeopardy get grounded. Being grounded includes being barred from watching television.
A) Students who watch TV while doing homework will not be allowed to watch TV.
B) Students who watch TV will be grounded.
C) Students who are grounded watch TV while doing homework.
D) Students who watch TV will be barred from watching TV.

19) Smiling people are happy. Alert people are not happy. Careful drivers are alert. Careless drivers have accidents.
A) People who smile have accidents. B) People who smile are alert.
C) Careful drivers are happy. D) Careful drivers have accidents.

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20) Hard workers sweat. Sweat brings on a chill. Anyone who doesn't have a cold never felt a chill. Anyone who works doesn't have a cold.

A) Hard workers don't go to work.
B) Anyone who sweats works hard.
C) Anyone who has a cold works hard.
D) Hard workers don't get colds.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

21) Determine the validity of the following conclusion and explain: If you walk fast, then you will reach the bus stop on time. If you reach the bus stop on time, then you will catch the bus. If you walk fast, then you will catch the bus.

22) Write a valid conclusion based on the following statements: The mall is closed if and only if it is Sunday. The mall is closed.

23) Write a valid conclusion based on the following statements: The store is open today if and only if it is not Saturday or Sunday. The store is not open today.

24) Write a valid conclusion based on the following statements: The store is open today if and only if it is not Saturday or Sunday. Today is Saturday.

8 Work with conditionals and bi–conditionals.

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

Write in if–then form.

1) I will lose weight if I diet.

A) If I diet, then I'll lose weight.
B) If I lose weight, then I'll diet.
C) If I don't diet, then I won't lose weight.
D) If I diet, then I gain weight.

2) I will go to class only if you go.

A) If you go to class, then I'll go to class.
B) If I go to class, then you go to class.
C) If I don't go to class, you don't go to class.
D) If I go to class, then you don't go to class.

3) Practice is necessary for making the team.

A) If you practice, then you will make the team.
B) If you make the team, then you must practice.
C) If you don't practice, then you won't make the team.
D) If you make the team, then you won't have to practice.

4) An even number is divisible by two.

A) If a number is even, then it is divisible by two.
B) If a number is divisible by two, then it is odd.
C) If a number isn't even, then it is not divisible by two.
D) If a number isn't divisible by two, then it isn't even.

5) $x = 8$ only if $2x + 3 = 19$.

A) If $2x + 3 = 19$, then $x = 8$.
B) If $x = 8$, then $2x + 3 = 19$.
C) If $x \neq 8$, then $2x + 3 = 19$.
D) If $2x + 3 \neq 19$, then $x = 8$.

6) $x = 9$ if $2x + 9 = 27$.

A) If $2x + 9 = 27$, then $x = 9$.
B) If $x = 9$, then $2x + 9 = 9$.
C) If $2x + 9 \neq 27$, then $x = 9$.
D) If $x \neq 9$, then $2x + 9 = 27$.

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7) I won't go until it's 7 pm.
A) If I go, then it's 7 pm.
B) If it's 7 pm, then I'll go.
C) If I don't go, then it's not 7 pm.
D) If it's not 7 pm, then I won't go.

8) Showing up at the party is enough to get a door prize.
A) If you show up at the party then you will get a door prize.
B) If you got a door prize then you showed up at the party.
C) If you don't show up at the party, then you will not get a door prize.
D) If you get a door prize then you don't have to show up at the party.

2.2 Describing Sets

1 Understand set language and structure as applied to elementary mathematics.

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

Write the set as indicated.

1) List the whole numbers 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) List the set of all whole numbers greater than 5 and less than 9.
A) {6, 7, 8}
B) {5, 6, 7, 8, 9}
C) {5, 6, 7, 8}
D) {6, 7, 8, 9}

3) List the counting numbers that are multiples of 5.
A) {5, 10, 15, . . .}
B) {0, 5, 10, 15, . . .}
C) ∅
D) {10, 15, 20, . . .}

4) List the set of states that border California.
A) {Oregon, Nevada, Arizona}
B) {Washington, Utah, Arizona}
C) {Nevada, Utah}
D) {Oregon, Nevada, Utah}

5) Write {2} using set-builder notation.
A) {x|x is the natural number 2}
B) {x}
C) {x|x is all natural numbers}
D) {x is a constant}

6) Write {2, 4, 6, 8} using set-builder notation.
A) {x|x is an even natural number less than 10}
B) {2, 4, 6, 8}
C) {x|x is any natural number}
D) {x|x is any even natural number}

7) Write {17, 18, 19, 20} using set-builder notation.
A) {x|x is a natural number between 16 and 21}
B) {17, 18, 19, 20}
C) {x|x is a natural number between 17 and 20}
D) {x|x is a natural number less than 21}

8) Write {8, 12, 16, 20, ... 48} using set-builder notation.
A) {x|x is a multiple of 4 between 4 and 52}
B) {x|x is a multiple of 4 between 8 and 48}
C) {x|x is a multiple of 4 greater than 8}
D) {x|x is a multiple of 4}

9) Write the odd natural numbers less than 39 using set-builder notation.
A) $\{x \in N | x \leq 37$ and x is odd$\}$
B) $\{x \in N | x < 38\}$
C) $\{x \in N | x < 39\}$
D) $\{x \in N | x \leq 39$ and x is odd$\}$

Rewrite the statement using mathematical symbols.

10) P is the set of even numbers less than 30 and more than 20.
A) P = {22, 24, 26, 28}
B) Q = {20, 22, 24, 26, 28, 30}
C) P = {20, 22, 24, 26, 28}
D) Q = {22, 24, 26, 28, 30}

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11) The set A with elements Indiana and Minnesota is not equal to the set B with elements Kansas and Virginia.
A) A = {Indiana, Minnesota} , B = {Kansas, Virginia} , $A \neq B$
B) B = {Indiana, Minnesota} , A = {Kansas, Virginia} , $B \neq A$
C) A = {Indiana, Minnesota} , B = {Kansas, Virginia} , $A \not\subset B$
D) A = {Indiana, Arizona} , B = {Kansas, Virginia} , $A \neq B$

12) Q is equal to the set of letters in the word wed.
A) Q = {w, e, d} B) Q = {w, e, e, d} C) $Q \in \{w, e, d\}$ D) $Q \subset \{w, e, d\}$

13) The set A is the set containing only the element 6.
A) A = {6} B) A = { } C) $A \in \{7, 6\}$ D) $A \subset \{6\}$

14) a is an element of {k, a, d, z, t}
A) $a \in \{k, a, d, z, t\}$ B) $\{a\} \in \{k, a, d, z, t\}$ C) $\{a\} \subseteq \{k, a, d, z, t\}$ D) $a \subset \{k, a, d, z, t\}$

Indicate which symbol, $\in$ or $\notin$, makes the statement true.

15) 0 __ $\emptyset$
A) $\notin$ B) $\in$

16) $\emptyset$ __ $\emptyset$
A) $\notin$ B) $\in$

17) 3 __ {1, 2, 3, . . . , 10}
A) $\in$ B) $\notin$

18) {3} __ {1, 2, 3, . . . , 10}
A) $\notin$ B) $\in$

19) 27 __ $\{x \mid x = 3^n \text{ and } n \in N\}$
A) $\in$ B) $\notin$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

20) Is the set of good software packages in the market well–defined?

21) Is the set of multiples of 5 between 1 and 100 well–defined?

2 Use one–to–one correspondence to describe pairs of sets.

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

Provide an appropriate response.

1) Is it possible or not possible to set up a one–to–one correspondence between {0, 6, 9, 19} and {6, 9, 19}?
A) Not possible B) Possible

2) Is it possible or not possible to set up a one–to–one correspondence between {Mon, Tue, Wed} and {Oct, Nov, Dec}?
A) Possible B) Not possible

3) Is it possible or not possible to set up a one–to–one correspondence between {a, b, c, d} and {A, B, C, D}?
A) Possible B) Not possible

4) Is it possible or not possible to set up a one–to–one correspondence between {0} and {333}?
A) Possible B) Not possible

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5) Is it possible or not possible to set up a one–to–one correspondence between ∅ and {37}?
A) Not possible B) Possible

6) How many one–to–one correspondences are there between two sets with 4 elements each?
A) 24 B) 6 C) 2 D) None

7) How many one–to–one correspondences are there between the sets {x, y, z, u, v} and {2, 4, 6, 7, 9} if in each correspondence x must correspond to 7 and z to 6?
A) 6 B) 16 C) 21 D) 120

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

8) There are five seats available for a show. Ten people are in the line for the tickets to these seats. Illustrate the utility of one–to–one correspondence with this example.

3 Compare sets using set language.

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

Do the following represent equal sets?

1) {p, q, r, s} = {q, s, r, p}
A) Yes B) No

2) {28, 30, 32, 34, 36} = {30, 32, 34, 36}
A) Yes B) No

3) {7, 7, 12, 12, 15} = {7, 12, 15}
A) Yes B) No

4 Find the cardinality of sets.

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

Find n(A) for the set A.

1) A = {3, 5, 7, 9, 11}
A) n(A) = 5 B) n(A) = 4 C) n(A) = 11 D) n(A) = 2

2) A = {700, 701, 702, . . ., 7000}
A) n(A) = 6301 B) n(A) = 7000 C) n(A) = 6300 D) n(A) = 4

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

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

7) A = {x|x ∈ N and 17 ≤ x ≤ 25}
A) 9 B) 43 C) 7 D) 42

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5 Use subset terminology.

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

Rewrite the statement using mathematical symbols.

1) P is the set of even numbers less than 50 and more than 40.
A) P = {42, 44, 46, 48}
B) Q = {40, 42, 44, 46, 48, 50}
C) P = {40, 42, 44, 46, 48}
D) Q = {42, 44, 46, 48, 50}

2) The set consisting of the elements k and y is a proper subset of {k, b, e, y, u}
A) {k, y} ⊂ {k, b, e, y, u}
B) {k, y} ⊆ {k, b, e, y, u}
C) {k, y} ~ {k, b, e, y, u}
D) {k, y} ∈ {k, b, e, y, u}

3) The set consisting of the elements k and z is not a proper subset of {c, f, z, u}
A) {k, z} ⊄ {c, f, z, u}
B) {k, z} ⊆ {c, f, z, u}
C) {k, z} ~ {c, f, z, u}
D) {k, z} ∈ {c, f, z, u}

Write a statement that represents the relationship between the following.

4) A = {x| x is a letter from the word "garage"} and B = {y| y is a letter from the word "rage"}
A) A = B
B) A ≠ B
C) A ⊂ B
D) A ∈ B

5) P = {9, 11, 13, 15, 17}and Q = {2, 4, 6, 8, 10}
A) P ≠ Q
B) P = Q
C) P ∈ Q
D) P ∉ Q

6) M = ∅ and N = { }
A) M = N
B) M ≠ N
C) M ⊂ N
D) N ∈ M

7) A = {b, f, n, t, e, r} and r
A) r ∈ A
B) r = A
C) r ⊆ A
D) r ⊂ A

8) C = {x| x is a letter of the alphabet} and D = {x| x is a letter in the word math}
A) D ⊂ C
B) D = C
C) D ⊄ C
D) C ⊈ D

9) A = {7, 8, 9} and B = {x| 7 ≤ x ≤ 9, x ∈ N}
A) A ⊆ B
B) A ⊈ B
C) A ⊂ B
D) B ⊂ A

10) ∅ and B = {a, b, c, d, e}
A) ∅ ⊂ B
B) ∅ ∈ B
C) ∅ ⊄ B
D) ∅ = B

11) A = {x|2 < x < 6, x ∈ N} and 2
A) 2 ∉ A
B) 2 ∈ A
C) 2 ⊂ A
D) 2 = A

12) A = {a, e, i, o, u} and B = {e, o, i, u, a}
A) A = B
B) a = A
C) e ⊆ B
D) A ⊂ B

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

13) A is the set of all the letters of the alphabet and B is the set of vowels. What kind of relationship exists between the two sets? Also, if C is the set of consonants what is the relationship between B and C?

14) Given that n(P) = 10 and P ⊂ Q , what is the least number of elements that set Q can have? Is there a maximum limit on the number of elements that set Q can have?

15) If P ⊆ Q and Q ⊆ P, then what can be said about the equality of the two sets?

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16) U is the universal set and B is a proper subset of U. Write a relationship between the cardinal numbers of U, B and $\overline{B}$.

17) A is the set of all even natural numbers, and B is the set of all odd natural numbers. Describe a universal set for A and B. Also, with respect to this universal set, give a relationship between A and B.

18) P = {a, b, c, d, e, f} . How many subsets of the set P can be made?

6 Apply the Fundamental Counting Principle.

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

Use the Fundamental Counting Principle to solve the problem.

1) A restaurant offers 7 entrees and 11 desserts. In how many ways can a person order a two-course meal?
A) 77 B) 18 C) 154 D) 20

2) In how many ways can a girl choose a two-piece outfit from 5 blouses and 7 skirts?
A) 35 B) 12 C) 70 D) 14

3) How many ways are there to arrange 6 unique CD's in order along a shelf?
A) 720 B) 120 C) 36 D) 30

7 Draw Venn diagrams representing sets.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) Draw a Venn diagram showing the relationship between beverages and soft drinks.

2) Draw a Venn diagram showing the relationship between fish and birds.

2.3 Other Set Operations and Their Properties

1 Understand properties of set and logic operations.

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

Determine whether the following is true or false.

1) $A \cup \overline{A}$ is equal to the universal set U.
A) True B) False

2) $n(A \cup B) \neq n(A) + n(B) - n(A \cap B)$
A) True B) False

3) $A - B = (A \cup B) - B$
A) True B) False

4) $A \cup \emptyset = A \cap \emptyset$
A) True B) False

5) $A \cap (B \cap C) = (A \cap B) \cap C$
A) True B) False

6) $(A - B) \cup A = B$
A) True B) False

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

A) True B) False

8) $A \cap \overline{B} = A - B$

A) True B) False

9) $\overline{A \cup B} = \overline{A} \cap \overline{B}$

A) True B) False

10) $\overline{A \cap B} = A \cup B$

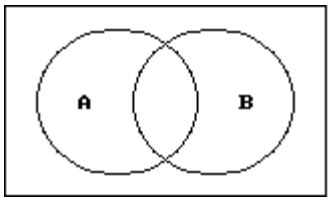
A) True B) False

2 Use Venn diagrams to show sets formed using operations and logic connectives.

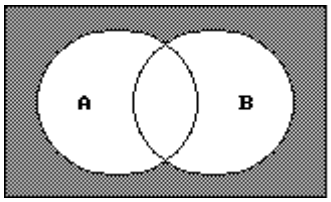
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Shade the portion of the diagram that represents the given set.

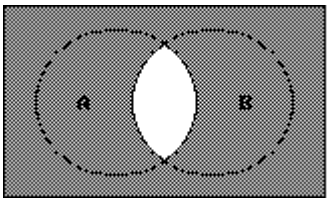
1) $\overline{A} \cap \overline{B}$



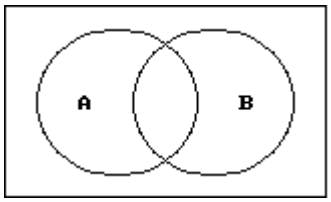
A)



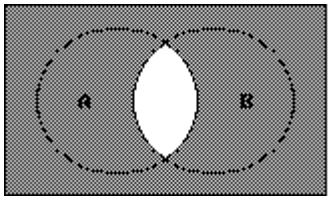
B)



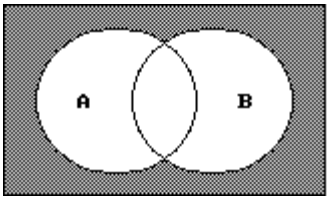
2) $\overline{A} \cup \overline{B}$



A)



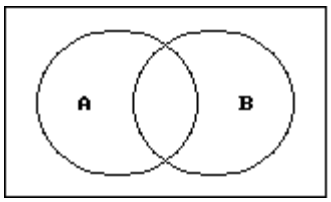
B)



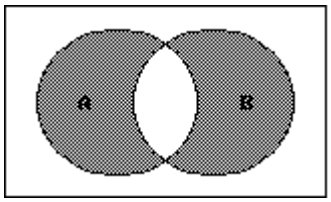
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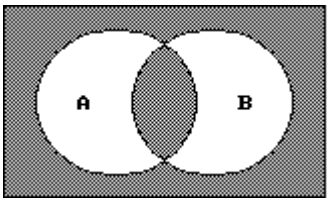
3) $(A \cup B) \cap \overline{(A \cap B)}$



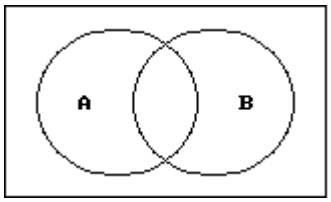
A)



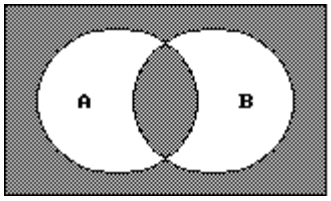
B)



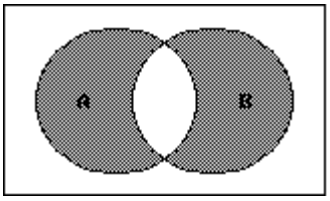
4) $(A \cap B) \cup \overline{(A \cup B)}$



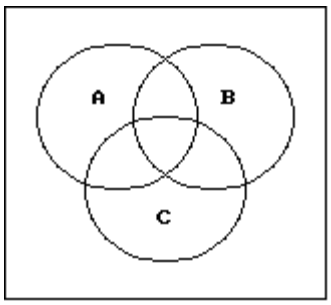
A)



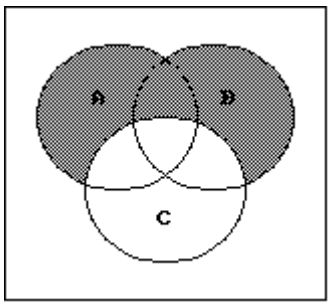
B)



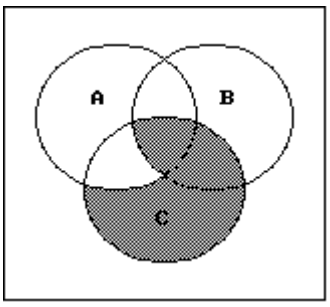
5) $\overline{C} \cap (A \cup B)$



A)



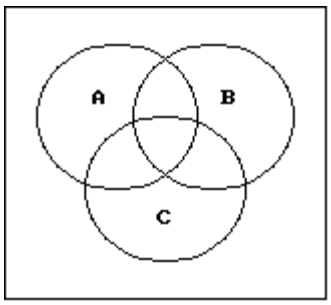
B)



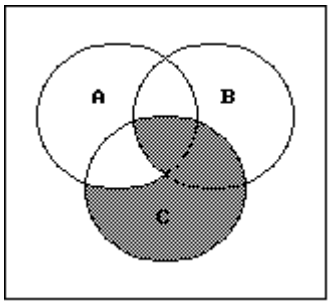
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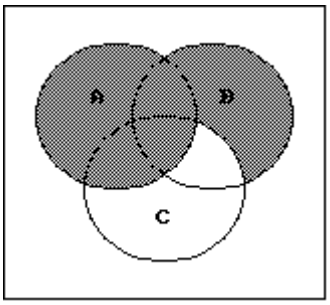
6) $(\overline{A} \cup B) \cap C$



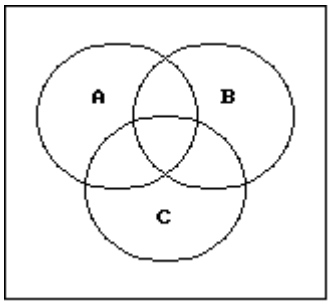
A)



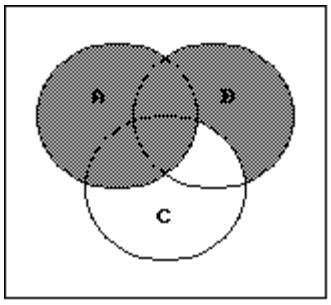
B)



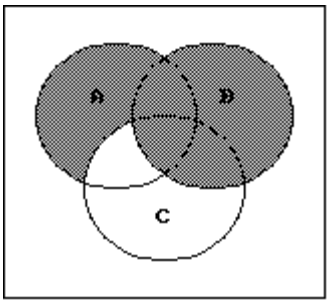
7) $A \cup (B \cap \overline{C})$



A)

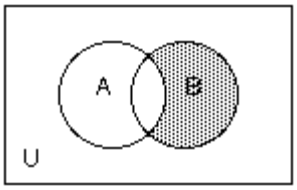


B)



Use set notation to identify the shaded region.

8)

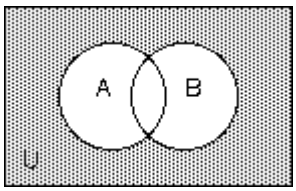


A) $B \cap \overline{A}$ B) $A \cap \overline{B}$ C) $A - B$ D) $B - \overline{A}$

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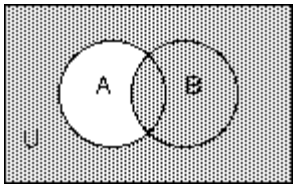
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9)



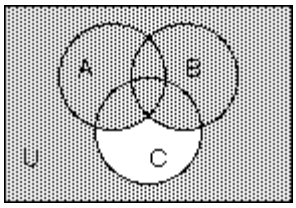
A) $\overline{A} \cap \overline{B}$ B) A – B C) $\overline{A \cap B}$ D) A ∪ B

10)



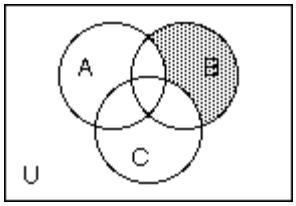
A) $\overline{A} \cup B$ B) B – A C) $\overline{A} \cap B$ D) $\overline{A \cap B}$

11)



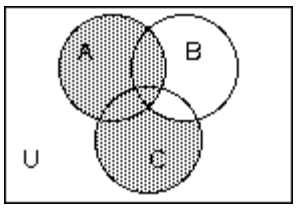
A) $(A \cup B) \cup \overline{C}$ B) $(A \cap B) \cup \overline{C}$ C) $A \cup B \cap \overline{C}$ D) $\overline{A \cup B \cup C}$

12)



A) $\overline{A} \cap \overline{C} \cap B$ B) $B \cap \overline{A \cap C}$ C) $\overline{B}$ – (A ∪ B) D) B – (A ∩ C)

13)



A) $C \cap \overline{B} \cup A$ B) A ∪ C C) A ∪ C – B D) $\overline{B} \cap A \cup C$

3 Use Venn diagrams to sort and reason with data.

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

Use sets to solve the problem.

1) Results of a survey of fifty students indicate that 30 like red jelly beans, 29 like green jelly beans, and 17 like both red and green jelly beans. How many of the students surveyed like neither red nor green jelly beans?
A) 8 B) 13 C) 12 D) 17

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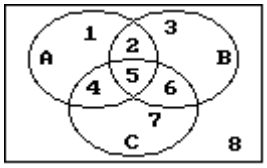
2) Mrs. Bollo's second grade class of thirty students conducted a pet ownership survey. Results of the survey indicate that 8 students own a cat, 15 students own a dog, and 5 students own both a cat and a dog. How many of the students surveyed own no cats?

A) 22 B) 10 C) 15 D) 27

3) 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 Allen?

A) 250 B) 100 C) 150 D) 400

4) The circles in the Venn diagram represent customers who prefer products A, B, and C, respectively. Which of the regions numbered one through eight describe customers who prefer Products A or C?



A) 1,2,4,5,6,7 B) 4,5 C) 2,5,6 D) 2,4,5,6

5) 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 650 responses with the following results:

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

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

91 were interested in reruns but not an interview show.

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

65 were interested in a documentary and reruns.

39 were interested in an interview show and reruns.

52 were interested in none of the three.

How many are interested in exactly one kind of show?

A) 312 B) 322 C) 302 D) 292

6) A survey of 240 families showed that

91 had a dog;
70 had a cat;
31 had a dog and a cat;
91 had neither a cat nor a dog nor a parakeet;
7 had a cat and dog and a parakeet.

How many had a parakeet only?

A) 19 B) 24 C) 29 D) 34

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7) A survey of a group of 117 tourists was taken in St. Louis. The survey showed the following:

66 of the tourists plan to visit Gateway Arch;

49 plan to visit the zoo;

11 plan to visit the Art Museum and the zoo, but not the Gateway Arch;

14 plan to visit the Art Museum and the Gateway Arch, but not the zoo;

19 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) 12 B) 101 C) 49 D) 37

4 Find and explain Cartesian products.

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

Find the Cartesian product or cardinal number as requested.

1) A = {6, 10, 12}
B = {5, 10}
Find A × B.
A) {(6, 5), (6, 10), (10, 5), (10, 10), (12, 5), (12, 10)}
B) {(6, 5), (10, 12), (12, 5)}
C) {(5, 6), (5, 10), (5, 12), (10, 6), (10, 10), (10, 12)}
D) {(6, 5), (10, 10)}

2) A = {i, a}
B = {t, d, m}
Find A × 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 = {11, 21, 31}
Find B × A.
A) {(11, 0), (21, 0), (31, 0)}
B) {0}
C) {(0, 11), (0, 21), (0, 31)}
D) {0, 0, 0}

4) A = {4, 3, 8, 7}
B = {0, 1}
Find B × A.
A) {(0, 4), (0, 3), (0, 8), (0, 7), (1, 4), (1, 3), (1, 8), (1, 7)}
B) {(4, 0), (3, 0), (8, 0), (7, 0), (4, 1), (3, 1), (8, 1), (7, 1)}
C) {(4, 0), (4, 1), (3, 0), (3, 1)}
D) {0, 1, 4, 3, 8, 7}

5) Write {(k, 3), (k, 4), (j, 3), (j, 4)} as a Cartesian product.
A) {k, j} × {3, 4}
B) {3, 4} × {k, j}
C) {k, 3} × {j, 4}
D) {k, j, 3, 4} × {1}

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6) A = {15, 3, 10}
B = {5, 12}
Find n(A × B).
A) 6 B) 5 C) 12 D) 9

7) n(A) = 21
n(B) = 9
Find n(A × B).
A) 189 B) 30 C) 12 D) 39

8) n(A × B) = 32
n(A) = 4
Find n(B).
A) 8 B) 4 C) 28 D) 36

9) n(A × B) = 90
n(B) = 10
Find n(A).
A) 9 B) 10 C) 80 D) 100

10) n(A) = 2
n(B) = 5
n(C) = 3
n(A × B × C) = ?
A) 30 B) 10 C) 7 D) 3

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Ch. 2 Introduction to Logic and Sets
Answer Key

2.1 Reasoning and Logic: An Introduction

1 Analyze statements and their truth values.

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

2 Understand quantifiers and negation of statements.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) The store is never open on Sunday.

3 Work with symbols, truth tables, compound statements, and logical equivalence.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A
17) A
18) A
19) A
20) A
21) A
22) A
23) A
24) A
25) A
26) A
27) p: "It is warm." q: " It is sunny." r: "We go to the beach." Then, $\sim(p \wedge q) \rightarrow \sim r$

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4 Use Euler diagrams to test logical relationships. (no exercises available)

1)

5 Write the converse, inverse, and contrapositive.

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

6 Determine if two statements are logically equivalent.

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

7 Form valid conclusions and analyze the validity of an argument.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A
17) A
18) A
19) A
20) A
21) Valid. p: "You walk fast." q: "You will reach the bus stop on time." r: "You will catch the bus." So, $p \rightarrow q$ and $q \rightarrow r$, therefore by the chain rule $p \rightarrow r$.
22) It is Sunday. (The mall is closed only on Sundays.)
23) Today is Saturday or Sunday.
24) The store is not open today.

8 Work with conditionals and bi–conditionals.

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

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8) A

2.2 Describing Sets

1 Understand set language and structure as applied to elementary mathematics.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A
17) A
18) A
19) A
20) No, since "good" is a subjective term.
21) Yes, you can list the elements.

2 Use one–to–one correspondence to describe pairs of sets.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) Each seat corresponds to one person who can take the seat. Thus, only five people should be given tickets for the show. If more than five tickets are issued, then some people will be without seats.

3 Compare sets using set language.

1) A
2) B
3) A

4 Find the cardinality of sets.

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

5 Use subset terminology.

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

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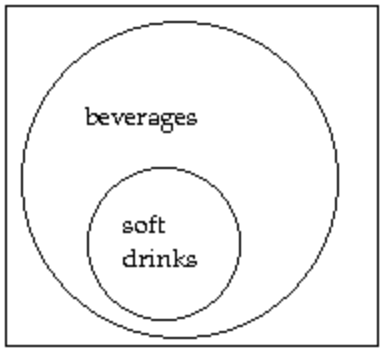
8) A
9) A
10) A
11) A
12) A
13) $B \subset A$, $C = \overline{B}$
14) 11, No
15) P = Q
16) $n(U) = n(B) + n(\overline{B})$
17) The universal set is the set of all natural numbers. Also, $A = \overline{B}$ and $B = \overline{A}$.
18) 64

6 Apply the Fundamental Counting Principle.

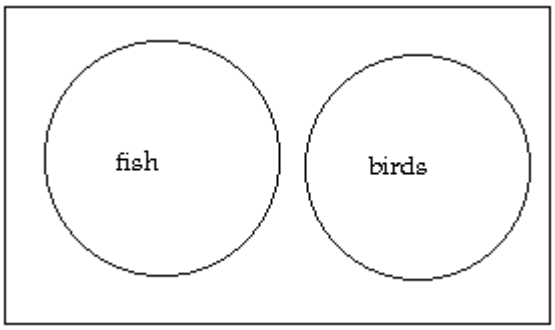
1) A
2) A
3) A

7 Draw Venn diagrams representing sets.

1)



2)



2.3 Other Set Operations and Their Properties

1 Understand properties of set and logic operations.

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

2 Use Venn diagrams to show sets formed using operations and logic connectives.

1) A

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2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A

3 Use Venn diagrams to sort and reason with data.

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

4 Find and explain Cartesian products.

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

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