

BCA –DISCRETE MATHEMATICS

For Off Campus BCA Programme

UNIT 1

1. The range of the function $f(x) = (x^2 - x) / (x^2 + 2x)$ is

- a) \mathbb{R}
- b) $\mathbb{R} - \{1\}$
- c) $\mathbb{R} - \{-1/2, 1\}$
- d) None of these

2. The range of the function $f(x) = x+2 / |x+2|, x \neq -2$ is

- a) $\{-1, 1\}$
- b) $\{-1, 0, 1\}$
- c) $\{1\}$
- d) $(0, \infty)$

3. The domain of the function $f(x) = \sqrt{5|x| - x^2 - 6}$ is

- a) $(-3, -2) \cup (2, 3)$
- b) $[-3, -2) \cup [2, 3)$
- c) $[-3, -2] \cup [2, 3]$
- d) None of these

4. Which one of the following is not a function?

- a) $\{(x, y): x, y \in \mathbb{R}, x^2 = y\}$
- b) $\{(x, y): x, y \in \mathbb{R}, y^2 = x\}$
- c) $\{(x, y): x, y \in \mathbb{R}, x = y^3\}$
- d) $\{(x, y): x, y \in \mathbb{R}, y = x^3\}$

5. The sequence of the binary digits representing the outcomes of parity checks in Hamming codes is known as _____.

- a) Look-up entry
- b) Hamming distance
- c) Radix
- d) Syndrome

6. If $3f(x) + 5f(1/x) = 1/x - 3$ for all non zero x , then $f(x) =$

- a) $1/14 (3/x + 5x - 6)$
- b) $1/14 (-3/x + 5x - 6)$
- c) $1/14 (-3/x + 5x + 6)$
- d) None of these

7. The domain of definition of $f(x) = \sqrt{4x - x^2}$ is

- a) $R = [0, 4]$
 b) $R = (0, 4)$
 c) $(0, 4)$
 d) $[0, 4]$
8. If $R = \{(2, 1), (4, 7), (1, 2), \dots\}$ then write the linear relation between the components of the ordered pairs of the relation R .
 a) $y = 3x + 6$
 b) $y = 2x - 5$
 c) $y = 3x - 5$
 d) $y = 2x + 5$
9. Let R be a relation from a set A to a set B , then
 a) $R = A \cup B$
 b) $R = A \cap B$
 c) $R \subseteq A \times B$
 d) $R \subseteq B \times A$
10. If R is a relation from a finite set A having m elements to a finite set B having n elements, then the number of relations from A to B is
 a) 2^{mn}
 b) $2^{mn} - 1$
 c) $2mn$
 d) m^n
11. The Hamming code is a method of _____.
 a) Error detection
 b) Error correction
 c) Error encapsulation
 d) (a) and (b)
12. If R is a relation from a set $A = \{11, 12, 13\}$ to set $B = \{8, 10, 12\}$ defined by $y = x - 3$ then write R^{-1}
 a) $\{(8, 13), (11, 10)\}$
 b) $\{(8, 11), (10, 13)\}$
 c) $\{(10, 11), (8, 12)\}$
 d) $\{(0)\}$
13. If $R = \{(x, y) : x, y \in \mathbb{Z}, x^2 + y^2 \leq 4\}$ is a relation on \mathbb{Z} , then domain of R is
 a) $\{0, 1, 2\}$
 b) $\{0, -1, -2\}$
 c) $\{-2, -1, 0, 2\}$
 d) None of these
14. 'Hamming Code' is used in
 a) Programming code

b) Data communication

c) AutoCAD

d) None of the above.

15. Let $A = \{1, 2, 3, 5\}$, $B = \{4, 6, 9\}$ and R be a relation from A to B defined by $R = \{(x, y) : x - y \text{ is odd}\}$. Write R in the roster form.

a) $R = \{1, 2, 3, 5, 4, 6, 9\}$

b) $R = \{(1, 4), (1, 6), (2, 9), (3, 4), (3, 6), (5, 4), (5, 6)\}$

c) $R = \{(1, 2), (1, 3), (1, 5), (2, 9), (3, 4), (3, 6), (5, 4), (5, 6)\}$

d) None of these

16. Let A and B be two sets such that $n(A) = 3$ and $n(B) = 2$. If $(x, 1)$, $(y, 2)$, $(z, 1)$ are in $A \times B$, write A and B

a) $A = \{x, y, 2\}$ $B = \{1, z\}$

b) $A = \{x, 1, z\}$ $B = \{y, 2\}$

c) $A = \{1, 2, z\}$ $B = \{x, y\}$

d) $A = \{x, y, z\}$ $B = \{1, 2\}$

17. Which of the following is true

a) $a \subseteq \{b, c, a\}$

b) $\{a\} \notin \{a, b, c\}$

c) $\{a, b\} = \{a, a, b, b, a\}$

d) The set $\{x : x + 8 = 8\}$ is a null set

18. The Hamming distance between 100 and 001 is _____.

a) 0

b) 1

c) 2

d) 3

19. Which are subsets of which: $A = \{x : x \text{ satisfies } x^2 - 8x + 12 = 0\}$, $B = \{2, 4, 6\}$, $C = \{2, 4, 6, 8, \dots\}$, $D = \{6\}$

a) $D \subset A \subset B \subset C$

b) $A \subset B \subset D \subset C$

c) $C \subset A \subset B \subset D$

d) $B \subset A \subset C \subset D$

20. A set consisting of single element is called

a) Null set

b) Singleton set

c) Infinite set

d) Empty set

21. The set of animals living on earth is:

a) Finite set

b) Infinite set

c) Empty set

d) Null set

22. In a survey of 700 students in a college, 180 were listed as drinking Limca, 275 as drinking Mrinda and 95 were listed as both drinking Limca and Miranda. Find how many students were drinking neither Limca nor Miranda.

a) 315

b) 390

c) 340

d) 350

23. A market research group conducted a survey of 2000 consumers and reported that 1720 consumers liked product A and 1450 consumers liked product B. What is the least number that must have liked both the products?

a) 1200

b) 980

c) 769

d) 1170

24. In order that a code is 't' error correcting, the minimum Hamming distance should be:

a) t

b) $2t-1$

c) $2t$

d) $2t+1$

25. If X and Y are two sets such that $n(X) = 17$, $n(Y) = 23$ and $n(X \cup Y) = 38$, find $n(X \cap Y)$

a) 40

b) 2

c) 25

d) 1

26. A college awarded 38 medals in football, 15 in basket and 20 to cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, How many received medals in exactly two of the three sports?

a) 9

b) 8

c) 6

d) 10

27. If $A = \{ 1, 3, 5, 7 \}$, $B = \{ 2, 4, 6, 8, 10 \}$ and let $R = \{ (1, 8), (3, 6), (5, 2), (1, 4) \}$ be a relation from A to B, then domain is

a) $\{ 8, 6, 2 \}$

b) $\{ 1, 2, 4 \}$

c) $\{ 1, 3, 5 \}$

d) $\{ 6, 2, 4 \}$

28. To guarantee the detection of up to 5 errors in all cases, the minimum Hamming distance in a block code must be _____.

a) 5

b) 6

c) 11

d) None of the above

29. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function given by $f(x) = x^2 + 1$. Find $f^{-1} \{ 26 \}$

a) $\{ 25, 5 \}$

b) $\{ 5, 0 \}$

c) $\{ 1, 5 \}$

d) $\{ -5, 5 \}$

30. Find the range of the function $f(x) = x^2 - 9 / x - 3$

a) $\mathbb{R} - \{ 3 \}$

b) $\{ 0 \}$

c) $\mathbb{R} - \{ 6 \}$

d) $\{ 6, 3 \}$

31. Let truth values of p be F and q be T. Then truth value of $\sim(\sim p \vee q)$ is:

a) T

- b) **F**
- c) either T or F
- d) neither T nor F

32. The following i.e $(1 + 1/1) (1 + 1/2) (1 + 1/3) \dots (1+1/n)$ for all $n \in \mathbb{N}$ is true for

- a) n^2+1
- b) **$n+1$**
- c) $2n+2$
- d) $2n + 1$

33. For all $n \in \mathbb{N}$ $2 \cdot 7^n + 3 \cdot 5^n - 5$ is divisible by

- a) 21
- b) 23
- c) **24**
- d) 19

34. For all $n \in \mathbb{N}$ then by induction $4 + 8 + 12 + \dots + 4n$ is true for

- a) **$2n (n+1)$**
- b) $n^2 + 1$
- c) $2n^2 + 1$
- d) None of these

35. $3^{2n+2} - 8n - 9$ is divisible by what for all $n \in \mathbb{N}$

- a) 5
- b) **8**
- c) 7
- d) 9

36. $5^{2n} - 1$ is divisible by what for all $n \in \mathbb{N}$

- a) 23
- b) **24**
- c) 21
- d) 27

37. If $p(n)$ is the statement " $n (n+1)(n+2)$ is a multiple for 12" it is false for

- a) $p(2)$
- b) $p(6)$
- c) **$p(5)$**
- d) $p(8)$

38. If p and q are two statements, then $\sim (p \wedge q) \vee \sim (q \Leftrightarrow p)$ is:

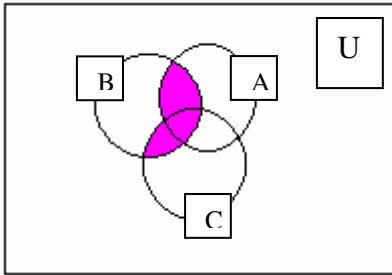
- a) Tautology
- b) Contradiction
- c) **Neither tautology nor contradiction**

d) Semi tautology

39. $n(n + 1)(n + 5)$ is a multiple of what for all $n \in \mathbb{N}$

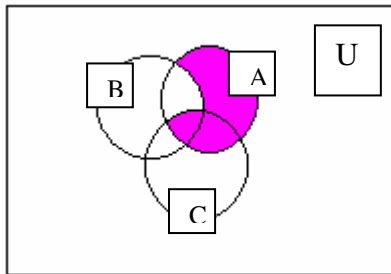
- a) 3
- b) 5
- c) 8
- d) 9

40. What is represented by the shaded region in the Venn diagram?



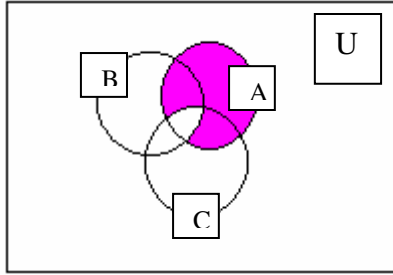
- a) $A \cap B$
- b) $A \cap (B \cup C)$
- c) $(A \cap C) \cup (B \cap C)$
- d) Both (b) and (c)

41. What is represented by the shaded region in the Venn diagram?



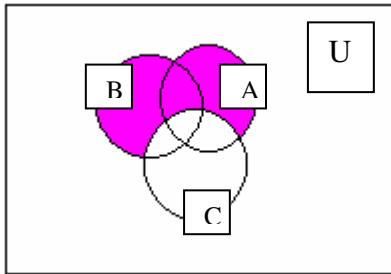
- a) $A - (B \cup C)$
- b) $(A \cap C) - B$
- c) $A - (B \cup C)$
- d) $(A \cup C) - B$

42. What is represented by the shaded region in the Venn diagram?



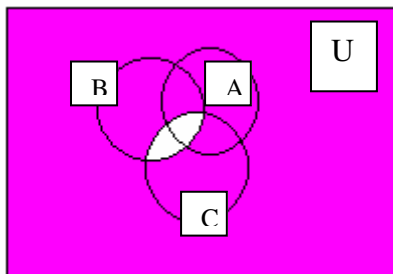
- a) $(A \cup B) - C$
- b) $A \cap C$
- c) $A - (B \cap C)$
- d) $(A - B) \cup C$

43. What is represented by the shaded region in the Venn diagram?



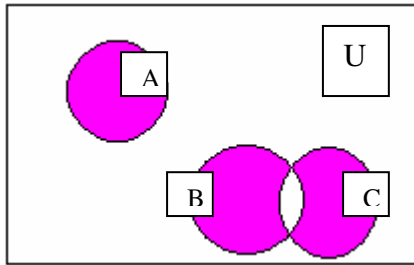
- a) $(A \cup B) \cap C$
- b) $(A \cup B) - C$
- c) Both
- d) None

44. What is represented by the shaded region in the Venn diagram?



- a) $(A \cup B \cup C)^c$
- b) $A \cup (B \cap C)^c$
- c) Both (a) and (b)
- d) $(A - B) \cup (A \cap C)$

45. What is represented by the shaded region in the Venn diagram?



- a) $A \cup \{(B-C)\}$
- b) $A \cap \{(C \cap B)\}$
- c) $A \cup \{(B-C) \cap (C-B)\}$
- d) $A \cup \{(B-C) \cup (C-B)\}$

46. What does the DeMorgan's law state?

- a) $(A \cup B)' = A' \cap B'$
- b) $(A \cap B)' = A' \cup B'$
- c) $\emptyset' = U$
- d) Both (a) and (b)

47. Let truth values of p be F and q be T. Then truth value of $\sim(\sim p \vee q)$ is ;

- a) T
- b) F
- c) either T or F
- d) neither T nor F

48. Two statements are equivalent if the last columns of their truth tables are identical

- a) $\sim p \wedge \sim q \sim (p \vee q)$
- b) $(\sim p \wedge q) \vee (\sim q \wedge \sim p)$
- c) $p \vee (q \wedge \sim p)$
- d) $(\sim p \wedge q) \vee \sim q$

49. Let f be defined by $f(x) = x^2 - 4$ and g be defined by $g(x) = (x^2 - 16)/x + 4$ $x \neq -4, \mu x = -4$

Find μ such that $f(x) = g(x)$. For x is

- a) -7

- b) -6
- c) -8
- d) -9

50. Let $A = \{ x : x \in \mathbb{N} \}$

$$B = \{ x : x = 2n, n \in \mathbb{N} \}$$

$$C = \{ x : x = 2n - 1, n \in \mathbb{N} \}$$

$$D = \{ x : x \text{ is a prime natural number} \}$$

Find $B \cap D$

- a) {2}
- b) $D - \{2\}$
- c) B
- d) \emptyset

Unit 2-

1. In set theoretic notation, the rule of sum can be written as: $n(A \cup B) =$ _____.

- (A) $n(A) + m(B)$
- (B) $n(A) + n(B)$
- (C) $n(B) + n(A)$
- (D) None of the above

2. In this notation $n(A \cup B) = n(A) + n(B)$, $n(A)$ and $n(B)$ denotes _____

- (A) The number of elements in set (A) and (B)
- (B) The number of elements in set (A)
- (C) The number of elements in set (B)
- (D) Either (B) or (C)

3. In this notation $n(A \cup B) = n(A) + n(B)$, $n(A)$ and $n(B)$ is also known as _____.

- (A) Cardinality
- (B) Combination

- (C) Permutation
- (D) All of the above

4. The basic difference between them lies in the _____ of the elements.

- (A) Arrangement
- (B) Sequence
- (C) Naming
- (D) Ordering

5. Ordering matters in _____.

- (A) Sequence
- (B) Combination
- (C) Permutation
- (D) All of the above

6. In combination the ordering _____ matters.

- (A) Does
- (B) Does not
- (C) Not certain
- (D) SISO

7. A circular permutation is a type of permutation in which the number of circular arrangements of n persons is _____.

- (A) $(n-2)!$
- (B) $n!$
- (C) $(n-1)!$
- (D) $(n-3)!$

8. In simple permutation it is _____.

- (A) $n!$
- (B) $n1$
- (C) $(n-1)!$
- (D) None of the above

9. In _____ analysis we intend to determine the number of logical possibilities of occurrence of events without looking into individual cases.

- (A) State
- (B) Circular

- (C) Combinatorial
- (D) None of the above

10. In set theoretical notation, the rule of sum can be interoperated as

- (A) $n(A \cup B) = n(A) + n(B)$
- (B) $n(B \cup A)$
- (C) $m(A \cup B) = n(A) + n(B)$
- (D) All of the above

11. The rule of _____ is expressed as: $n(A \cup B) = n(A) + n(B)$ using notation of sets.

- (A) Product
- (B) Sum
- (C) Simplification
- (D) Both (B) and (C)

12. In rule of sum _____ stands for number of elements in set A.

- (A) $m(A)$
- (B) $n(B)$
- (C) $m(B)$
- (D) $n(A)$

13. $n(B)$ stands for number of elements in set B in _____

- (A) Rule of Product
- (B) Ordered Samples
- (C) Rule of Sum
- (D) None of the above

14. In rule of sum _____ stands for number of elements of union of these sets.

- (A) $n(A \cup B)$
- (B) $n(A \cap B)$
- (C) $n(A \supset B)$
- (D) $n(B \cup A)$

15. The rule of product is expressed as: $n(A \times B) =$ _____.

- (A) $m(A) \times n(A)$
- (B) $n(A) \times n(B)$
- (C) $n(B) \times n(A)$
- (D) None of the above

16. How many 8-digit telephone numbers are possible, if only even digits may be used?

- (A) $(4)^8$
- (B) $(4)^6$
- (C) $(4)^2$
- (D) $(4)^4$

17. How many 8-digit telephone numbers are possible, if the number must be a multiple of 100?

- (A) 3×4^9
- (B) 6×5^6
- (C) 9×10^5
- (D) None of the above

18. If there are things represented by a , β , γ , then the selections that can be made from these, taken two at a time are, ,.

- (A) $\beta\gamma$
- (B) $\gamma\alpha$
- (C) $\alpha\beta$
- (D) All the above

19. A football stadium has 4 gates on the South boundary and 3 gates on the North boundary. In how many ways can a person enter through an South gate and leave by a North gate?

- (A) 12
- (B) 11
- (C) 21
- (D) None of the above

20. A football stadium has 4 gates on the South boundary and 3 gates on the North boundary. In how many different ways in all can a person enter and get out through different gates?

- (A) 45
- (B) 42
- (C) 24
- (D) Both (A) and (B)

21. In how many different ways, can 3 rings of a lock be combined when each ring has 10 digits 0 to 9?

- (A) 1000
- (B) 1001
- (C) 1100

(D) None of the above

22. If the lock opens with only one combination of 3 digits, how many unsuccessful events are possible?

(A) 777

(B) 888

(C) 998

(D) 999

23. The number of ways of selecting one thing at a time, from n different things, is n and hence, $nC1 =$ _____.

(A) C

(B) n

(C) 1

(D) All of the above

24. The number of ways of selecting all the n things is 1 and hence $nCn =$ _____.

(A) 4

(B) 0

(C) 2

(D) 1

25. The number of ways of arranging one thing at a time from n different things is n , and hence $= n$.

(A) $P1$

(B) $nP1$

(C) $P2$

(D) $nP2$

26. In nCr and nPr , r must be necessarily _____ than n and its maximum value is n .

(A) More

(B) Equal

(C) Less

(D) None of the above

27. The number of permutations of n different things taken r at a time is

(A) $n!$

(B) $n(n-1)(1-n)$

(C) $n(n-2)(n-3)\dots(n+r-1)$

(D) $n(n-1)(n-2)\dots(n-r+1)$.

28. The number of permutations of n things taken r at a time is the same as the number of ways in which r blank spaces can be filled up by the _____ things.

(A) n

(B) r

(C) $r!$

(D) All of the above

29. We have $nPn = n(n-1)(n-2)\dots$ to n factors $= n(n-1)(n-2)\dots 3.2.1 =$ _____ .

(A) $3*4$

(B) $n!$

(C) $2*3$

(D) None of the above

30. If a certain operation can be performed in any one of the m ways, and then, a second operation can be performed in any one of the n ways, then both the operations can be performed in any one of the _____.

(A) mn

(B) nm

(C) m

(D) Either (A) or (B)

31. How many numbers between 1,000 and 10,000 can be formed with the digits 1, 3, 5, 7, 9, when each digit being used only once in each number?

(A) 101

(B) 120

(C) 140

(D) 150

32. Eleven papers are set for the engineering examination of which, two are in Mathematics. In how many ways can the papers be arranged, if the two Mathematics papers do not come together?

(A) $8 \times 7!$

(B) $7 \times 4!$

(C) $9 \times 10!$

(D) $10 \times 9!$

33. There are 35 micro computers in a computer centre. Each microcomputer has 18 ports. How many different ports are there in the centre?

- (A) 666 ports
- (B) 620 ports
- (C) 625 ports
- (D) 630 ports

34. How many functions are there from a set with P elements to one with Q elements?

- (A) PQ functions from a set with P elements, to one with Q elements.
- (B) Q^P functions from a set with P elements, to one with Q elements.
- (C) Q functions from a set with P elements, to one with P elements.
- (D) PQ functions from a set with P elements, to one with P elements.

35. In how many ways can the letters of the word EDINBURGH be arranged, with the vowels only in the odd places?

- (A) 43,200 ways.
- (B) 43000 ways
- (C) 23074 ways
- (D) None of the above

36. How many numbers between 5,000 and 10,000 can be formed from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9, each digit not appearing more than once in each number?

- (A) 1463
- (B) 1102
- (C) 2368
- (D) 1680

37. In how many ways can 6 different beads be strung together to form a necklace?

- (A) $5!$
- (B) $1!$
- (C) Null
- (D) $11!$

38. In any arrangement or sampling, if order does not matter then it is a _____ .

- (A) Permutation
- (B) Multinomial
- (C) Combination
- (D) Either (A) or (B)

39. The number of permutations of n different things taken r at a time when the things can be repeated any number of times is.

- (A) n
- (B) r
- (C) nr
- (D) $n!$

40. _____ means a mathematical expression consisting of two or more than two terms, for example; $a_1x_1 + a_2x_2 + a_3x_3 + \dots + a_kx_k$.

- (A) Multinomial
- (B) Combination
- (C) Permutation
- (D) None of the above

Unit-3

1. Which of the following proposition is true?

(A) Paris is in England.

(B) 5 is a prime number

(C) $4 - 6 = 4$

(D) $2 \in \{1,3,5,7\}$

2. Which of the following is a proposition?

(A) Where are you going?

(B) $x + y < 5$

(C) New Delhi is the capital of India.

(D) $x + 2 = 5$

3. Which of the following word can be added to one or more propositions to create new propositions?

(A) OR.

(B) AND.

(C) NOT.

(D) All of the above.

4. If p and q are propositions then the propositions ' p and q ', is true when both p and q are true and is false otherwise. This condition is called as _____.

(A) Conjunction of p and q

(B) Disjunction of p and q

(C) Negation of p

(D) Negation of q

5. How the disjunction of p and q is denoted?

(A) $p \wedge q$

(B) $p \vee q$

(X) $\neg p$

(D) $\sim p$

6. Find the conjunction of the propositions p and q where p is the proposition 'Today is Sunday' and q is the proposition 'It is raining today'.

(A) 'It is raining today and today is Sunday'.

(B) 'Today is Sunday and it is not raining today'.

(C) 'Today is Sunday or it is raining today'

(D) 'Today is Sunday and it is raining today'

7. Which of the following symbolic form represents the statement 'Jeff speaks French but not English', if p be 'Jeff speaks French' and let q be 'Jeff speaks English'.

(A) $\sim p \wedge \sim q$

(B) $p \wedge \sim q$

(C) $p \wedge q$

(D) $\sim(\sim q)$

8. The exclusive or of p and q is denoted by

(A) \vee

(B) $\rightarrow \square$

(C) \oplus

(D) \neg

9. Let p and q be propositions. The implication $p \rightarrow q$ is false when p is _____ and q is _____ and true otherwise

(A) False, false

(B) True, false

(C) True, true

(D) False, true

10. In the implication $p \rightarrow q$, p is called the _____ and q is called the _____.

(A) Premise, consequence

(B) Consequence, premise

(C) Conjunction, disjunction

(D) None of the above

11. Let p denote 'It is below freezing' and let q denote 'It is snowing'. What is the symbolic form of the statement 'It is not snowing if it is below freezing'?

(A) $p \rightarrow q$

(B) $q \rightarrow p$

(C) $\sim p \rightarrow q$

(D) $p \rightarrow \square \sim q$

12. Let p and q be the propositions

p : You drive over 80 kms per hour.

q : You get a speeding ticket.

Write the proposition for the statement 'If you do not drive over 80 kms per hour, then you will not get a speeding ticket' in symbolic form.

(A) $p \rightarrow q$

(B) $q \rightarrow p$

(C) $\sim p \rightarrow \sim q$

(D) $\sim p \rightarrow q$

13. The biconditional $p \leftrightarrow q$ is true when both the implications $p \rightarrow q$ and $q \rightarrow p$ are _____.

(A) True

(B) False

(C) Either true or false

(D) None of the above

14. The other common way of expressing the biconditional proposition of p and q

(A) $p = q$

(B) $p \leftrightarrow q$

(C) $p + q$

(D) $p \wedge q$

15. Let p denote 'He is poor' and let q denote 'He is unhappy'. What is the symbolic form using p and q of the statement 'Being rich is a necessary and sufficient condition to being happy'?

(A) $p \leftrightarrow q$

(B) $\sim p \leftrightarrow \sim q$

(C) $\sim p \leftrightarrow q$

(D) $p \leftrightarrow \sim q$

16. In general, if there are n distinct components in a proposition or formula, we need to consider _____ possible combinations of truth values in order to obtain the truth table.

(A) 2^n

(B) 2^{n+1}

(C) 2^{n-1}

(D) None of the above

17. The words which combine simple statements to form a compound statement are called _____.

(A) Propositions

(B) Connectives

(C) Negation

(D) None of the above

18. The connectives _____ and _____ may be placed between any two statements p and q to form the compound statements.

(A) \wedge, \leftrightarrow

(B) \vee, \oplus

(C) $\leftrightarrow, \rightarrow$

(D) \wedge, \vee

19. The statement $\sim p$ is true when p is _____ and $\sim p$ is false when p is _____.

(A) True, true

(B) False, true

(C) True, false

(D) False, False

20. The compound statement $p \wedge q$ is true if and only if both p and q are _____.

(A) False

(B) True

(C) Either A or B

(D) None of the above

21. $a + (b \cdot c) = (a + b) \cdot (a + c)$; $a \cdot (b + c) = (a \cdot b) + (a \cdot c)$ is referred as _____ of Boolean Algebra

(A) Commutative Law

(B) Identity Law

(C) Distributive Law

(D) Complement Law

22. The dual of any statement in a Boolean algebra B is the statement obtained by interchanging the operations _____ and _____.

(A) +, -

(B) +, /

(C) -, /

(D) +, .

23. A non-zero element 'a' in a Boolean algebra is called an _____.

(A) Molecule

(B) Atom

(C) Literal

(D) None of the above

24. A literal or product of two or more literals in which no two literals involve the same variable.

(A) Atom

(B) Complement

(C) Isomorphic form

(D) Fundamental product

25. Every _____ Boolean algebra $(B, +, \cdot, ')$ has 2^n elements for some positive integer n .

(A) Finite

(B) Infinite

(C) Either A or B

(D) None of the above

26. All Boolean algebras of order 2^n are _____ to each other.
- (A) Complement
 - (B) Dual
 - (C) Isomorphic**
 - (D) Complemented variable
27. When a fundamental product p_1 is said to contain in another fundamental product p_2
- (A) If the literals of p_1 are also literals of p_2
 - (B) If the literals of p_1 are also literals of p_2**
 - (C) If no two literals involve in the same variable
 - (D) None of the above
28. The atom of the Boolean Algebra B^4 is
- (A) (1,0,0,0), (0,1,0,0), (0,0,1,0) and (0,0,0,1)**
 - (B) (0,1) and (1,0)
 - (C) (1,0,0,1), (0,1,1,0), (0,0,0,0) and (0,1,0,1)
 - (D) (1,1,0,0), (0,1,0,1), (1,0,1,0) and (0,0,0,1)
29. $((a' + c)(b' + c'))' = (a' + c)' + (b' + c') = ac' + bc$ is the transformation of which of the following into a sum of products?
- (A) $((a' + c)(a' + c'))'$
 - (B) $((a' + b)(b' + c'))'$
 - (C) $((a' + c)(b' + c'))'$**
 - (D) None of the above
30. Which of the following is the technique that employs Boolean graphical representation of logical function?
- (A) Histogram
 - (B) Bar diagram
 - (C) PERT chart

(D) Karnaugh map

31. In a K-map each block is referred to as a _____.

(A) Sector

(B) Cell

(C) Compartment

(D) None of the above

32. Arrange the following steps involved in deducing an expression whiel simplifying logical function using K-Map:

1. Prepare the truth table of the given Boolean expression.

2. Group the adjacent ones in the K-map and cancel out variables that undergo a change of state.

3. Draw the skeleton K-map based on the given expression. [A 'skeleton' K-map refers to a K-map in n variables without any values filled with respect to the given expression.]

4. Fill in the cells of the K-map based on the values obtained from the truth table.

(A) 4,3,2,1

(B) 2,4,3,1

(C) 3, 1, 4,2

(D) 1,3,2,4

33. In case of a 4 variable K-map, how many possible groupings of 4 variables are teher involving any cell?

(A) 6

(B) 7

(C) 5

(D) 4

34. An implicant if it is not a subset of another implicant of the function.

(A) Do not care conditions

(B) Prime implicant

(C) Essential implicant

(D) Even implicant

35. In which method, every minterm and a set of 2^k minterms ($k < n$), forming a set of adjacent minterms or the simplified product term, is obtained by minterms of the set.

(A) Do not care conditions

(B) De Morgan law

(C) Tautology

(D) Quine- Mcclusky algorithm

36. All the dominating rows and columns of a prime implicant can be removed to obtain a _____ sum without affecting the table.

(A) Minimal

(B) Maximal

(C) Minimax

(D) Maximin

37. Which of the following symbol is used to indicate prime - implicant table with essential prime implicants

(A) %

(B) *

(C) ^

(D) #

38. A statement formula is said to be in the normal form (or canonical form) if

(A) Negation has not been used for a group of letters

(B) Distributive law has been applied

(C) Paranthesis has not been used for the same connective

(D) All of the above

39. A product of the variables and their negations in a formula is called an _____ product.

(A) Fundamental

(B) Maximal

(C) Elementary

(D) Minimal

40. A formula which is equivalent to a given formula and which consists of a product of elementary sums

(A) Disjunctive normal

(B) Conjunctive normal

(C) Principal disjunctive normal

(D) Principal conjunctive normal

41. Which of the following is also known as product of sums canonical forms?

(A) Principal conjunctive normal

(B) Principal disjunctive normal

(C) Disjunctive normal form

(D) Conjunctive normal form

42. A very common rule of inference which is also called affirming the antecedent or the law of detachment.

(A) Modus ponens

(B) Rule P

(C) Rule T

(D) Chains of inference

43. If searching is made from problem to its solution, it is called

(A) Backward chain

(B) Forward chain

(C) Upward chain

(D) Downward chain

44. A statement formula which is false regardless of the truth values of the statements
- (A) Tautology
 - (B) Contingency
 - (C) Contradiction**
 - (D) None of the above
45. A straight forward method to determine whether a given formula is a tautology is to _____.
- (A) Construct its truth table**
 - (B) Find conjunctive normal form
 - (C) Either A or B
 - (D) None of the above
46. When an argument which is valid must lead to a true conclusion?
- (A) If it has true consequences
 - (B) If it has false consequences
 - (C) If it has true premises**
 - (D) If it has false premises
47. The method of proof is by 'reduction to absurdity' it is also known as
- (A) Reductio-ad-absurdum**
 - (B) Modus ponens
 - (C) Modus tollens
 - (D) None of the above
48. The set of resolvents of $\{\phi_1, \phi_2\}$ is shown as _____
- (A) $\text{Res}(\phi_2, \phi_1)$
 - (B) $\text{Res}(\phi_1, \phi_2)$**
 - (C) Both A and B

(D) None of the above

49. When a statement formula is called contingency?

(A) A statement formula which is false regardless of the truth values of the statements

(B) A statement formula which is true regardless of the truth values of the state

(C) A statement formula which is neither A nor B

(D) None of the above

50. In constructing substitution instances of a formula, substitutions are made for the _____ proposition (without connectives) and never for the _____ proposition.

(A) Compound, Simple

(B) Simple, compound

(C) Substitution, compound

(D) Simple, substitution

51. The Karnaugh map method is applicable to solve a given Boolean function of upto _____ variables.

(A) 5

(B) 6

(C) 4

(D) 3

52. Two rows (or columns) i and j of a prime implicant table which have x 's in exactly the same rows (or columns) are said to be _____.

(A) Unequal

(B) Equal

(C) True

(D) False

53. When row i is said to dominate row j ?

(A) If rows i and j are of the prime implicant table

- (B) If rows i and j are of the essential implicant table
- (C) If rows i and j are of the do not care condition
- (D) None of the above

54. According to De Morgan's law, $(A \cup B)' = ?$

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

55. A necessary and sufficient condition for an elementary sum to be tautology is it contains atleast one pair of factors in which one is the _____ of the other.

- (A) Conjunction
- (B) Negation**
- (C) Disjunction
- (D) None of the above

56. Different disjunctive (or conjunctive) normal forms for a given formula can be obtained if the _____ are applied in different ways.

- (A) Commutative laws
- (B) Identity laws
- (C) Complement laws
- (D) Distributive laws**

57. If a formula is a tautology, then clearly all the minterms appear in its _____.

- (A) Conjunctive normal form
- (B) Disjunctive normal form
- (C) Principal disjunctive normal form**
- (D) Principal conjunctive normal form

58. The maxterms are the duals of _____.

(A) Other maxterm

(B) Minterm

(C) Product of sum

(D) Sum of product

59. Which of the following rule states that 'A premise may be introduced at any point in the derivation'?

(A) Rule P

(B) Rule T

(C) Chain rule modus ponens

(D) Reductio-ad- absurdum

60. Reductio-ad absurdum is an argument and is also known as a _____.

(A) Proof by resolution

(B) Proof by contradiction

(C) Proof by adopting a premise

(D) Substitution instance

Unit-4

1. Who is considered as the father of Graph theory?

(E) Euler

(F) Floyd

(G) Warshall

(H) Djikshtra

2. The four lands and the seven bridges are represented by vertices and edges respectively in G . This problem is called as _____

(E) Boruvka's algorithm

(F) Prim's algorithm

(G) Koingsberg Bridge problem

(H) Kruksal's algorithm

3. A connected acyclic graph G

(E) Acyclic graph

(F) Tree

(G) Open graph

(H) Close graph

4. Every _____ vertices in a tree, are joined by a unique path.

(E) Three

(F) Two

(G) Four

(H) Five

5. If G is a tree on n vertices, then G has _____ edges.

(E) n

(F) $n-2$

(G) $n+1$

(H) $n-1$

6. In a directed tree (every edge assigned with a direction), a particular vertex is called a root if that vertex is of degree _____.

(E) Zero

(F) One

(G) Two

(H) More than two

7. In which type of tree, every edge is directed away from the root?
- (E) k-ary tree
 - (F) Rooted tree**
 - (G) Balanced tree
 - (H) Spanning tree
8. If there is only one vertex with degree 2 and the remaining vertices are of degree 1 or 2 then a tree is called as
- (E) Balanced tree
 - (F) Rooted tree
 - (G) Binary tree**
 - (H) k-ary tree
9. A tree containing every vertex of G
- (E) Spanning tree**
 - (F) k-ary tree
 - (G) Rooted tree
 - (H) None of the above
10. When a simple graph is said to be connected?
- (E) If there exists more than one spanning tree
 - (F) If there exists atleast one spanning tree**
 - (G) If there exists one spanning tree and one binary tree
 - (H) If there exists a rooted with height 4
11. A systematic method for visiting every vertex of an ordered rooted tree
- (E) Traversal algorithm**
 - (F) Kruksal algorithm
 - (G) Prim's algorithm

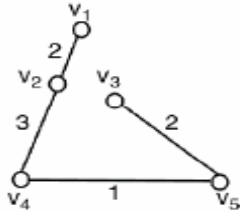
- (H) None of the above
12. Faster algorithms can be obtained by combining _____ and _____.
- (E) Kruksal algorithm, Prim algorithm
- (F) Boruvka's algorithm, Kruksal algorithm
- (G) Djikshtra algorithm, Warshall's algorithm
- (H) Prim's algorithm , Boruvka's algorithm**
13. How many iterations of the outer loop are taken by Boruvka's algorithm before termination?
- (E) $V(\log O)$
- (F) $O(E \log V)$
- (G) $O(\log V)$**
- (H) None of the above
14. Boruvka's algorithm starts by examining every vertex _____ selecting the cheapest edge from that vertex to another in the graph.
- (E) All at once
- (F) One by one**
- (G) Left to right
- (H) Right to left
15. Every vertex or set of connected vertices is termed as
- (A) Component**
- (B) Node
- (C) Vertex
- (D) Edge
16. Every _____ in the graph finds its lightest edge, and then the vertices at the ends of each lightest edge are marked.
- (E) Node

(F) Vertex

(G) Component

(H) All of the above

17. The weight of the following optimal spanning tree is:



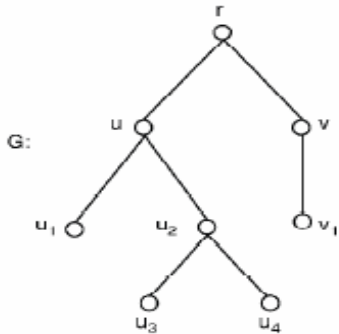
(E) 6

(F) 8

(G) 7

(H) 10

18. The tree shown below is :



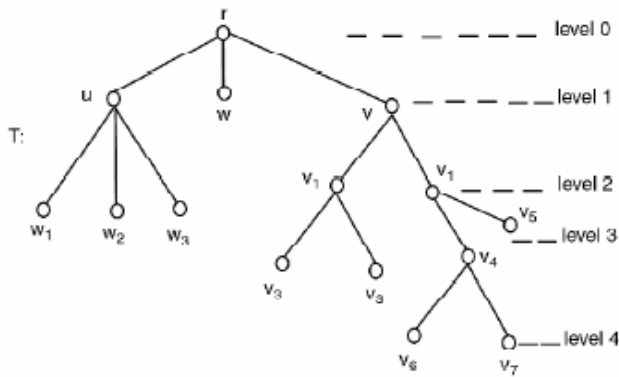
(E) Rooted tree

(F) Spanning tree

(G) Balanced tree

(H) None of the above

19. What is the height of the tree shown below:



(E) 5

(F) 6

(G) 3

(H) 4

20. When a rooted k -ary tree of height h is balanced?

(E) If all the leaves are at level h or $(h + 1)$

(F) If all the leaves are at level h or $(h - 1)$

(G) If all the leaves are at level h or $(h + 2)$

(H) If all the leaves are at level h or $(h - 2)$

21. In rooted tree, those vertices which have children are called _____ .

(E) Internal vertices

(F) External edges

(G) Internal vertices

(H) Internal edges

22. In a rooted tree, the length of the path from the root to this vertex is

(E) Level of a vertex v

(F) Height of a rooted tree

(G) Longest path from the root

(H) Number of leaves

23. In which type of traversing the following algorithm is followed:

Step 1: Visit root r and then list r .

Step 2: For each child of r from left to right, list the root of first sub-tree then next sub-tree and so on until we complete listing the roots of sub-trees at level 1.

Step 3: Repeat step 2, until we arrive at the leaves of the given tree

Step 4: Stop.

(E) Reverse-order traversal

(F) In-order traversal

(G) Post-order traversal

(H) Pre-order traversal

24. Which algorithm is an example of dynamic programming?

(E) Floyd's algorithm

(F) Warshall's algorithm

(G) Dijkstra algorithm

(H) Boruvka's algorithm

25. Floyd–Warshall algorithm computes the shortest paths between all pairs of _____.

(E) Edges

(F) Vertices

(G) Both A and B

(H) None of the above

26. To sort a list of elements there are _____ methods.

(A) Several

(B) 2

(C) 10

(D) None of the above

27. A _____ proceeds by iteratively splitting lists into two sublists of equal size (nearly) until each sublist consists of one element.
- (A) Bubble Sort
 - (B) Insertion Sort
 - (C) Shell Sort
 - (D) Merge Sort
28. A graph G is said to be _____ if there exists some geometric representation of G which can be drawn on a plane such that no two of its edges intersect.
- (A) Non-Planar
 - (B) Planar
 - (C) Circular
 - (D) Both (A) and (B)
29. A graph that cannot be drawn on a plane without a cross over between its edges is called _____.
- (A) Non Planar.
 - (B) Planar
 - (C) Straight
 - (D) None of the above
30. A drawing of a geometric representation of a graph on any surface, such that, no edges intersect is called _____.
- (A) Intersection
 - (B) Cross-section
 - (C) Embedding
 - (D) All of the above
31. To show a graph G is non-planar we have to prove that of all possible geometric representations of G , none can be embedded in a _____.
- (A) Plane
 - (B) Line
 - (C) Circle
 - (D) Motion
32. The complete graph of five vertices is _____.
- (A) Planar
 - (B) Circular

(C) Non-planar

(D) Straight

33. In the plane, a continuous non-self intersecting curve whose origin and terminus coincide is said to be a _____ curve.

(A) Jordan

(B) Uniform

(C) Line

(D) None of the above

34. If j is a Jordan curve in the plane π , then _____ is a union of two disjoint connected open sets called the interior and the exterior of j .

(A) J

(B) $\pi - j$

(C) $j - \Pi$

(D) All of the above

35. If G , a connected planar graph has n vertices, e edges and r regions, then, $n - e + r = 2$

(A) Surface Formula

(B) Line Formula

(C) Euler's Formula

(D) None of the above

36. If G is a simple connected planar graph on n vertices, e edges and r regions and does not contain any triangle, then $2r \leq e \leq$ _____ .

(A) $(2n - 4)$

(B) $(2n - 4)$

(C) $(4n - 2)$

(D) $(4n - 1)$

37. If G is a connected simple planar graph without loops and has n vertices, $e \geq 2$ edges and r regions, then, $3/2 r \leq e \leq$ _____ .

(A) $(4n - 6)$

(B) $(3n - 6)$

(C) $(6n - 2)$

(D) None of the above

38. A subdivision of a graph G is obtained by inserting _____ (of degree 2) into the edges of G .

(A) Line

- (B) Column
- (C) Vertices
- (D) Row

39. A graph is planar if it contains no subgraph that is isomorphic to or is a subdivision of K_5 or $K_{3,3}$.

- (A) Kuratowski Theorem
- (B) Euclid Theorem
- (C) Jordan Curve Theorem
- (D) Either (A) or (B)

40. A trail that traverses every edge of G is called a _____ trail of G .

- (A) Connected
- (B) Line
- (C) Euler
- (D) None of the above

41. An Euler tour is a tour which traverses _____ edge exactly once.

- (A) Selected
- (B) Each
- (C) 1
- (D) 0

42. A graph is _____ if it contains an Euler tour.

- (A) Eulerian
- (B) Non- Eulerian
- (C) Straight
- (D) Curve

43. A connected graph G has an Eulerian trail iff G has exactly _____ odd vertices.

- (A) Three
- (B) Four
- (C) Zero
- (D) Two

44. Eulerian circuit of D is a circuit which contains every edges of _____.

- (A) D
- (B) G
- (C) F

(D) None of the above

45. A _____ graph that contains an Eulerian circuit is called Eulerian digraph.

(A) Undirected

(B) Uniform

(C) Directed

(D) Either (A) or (C)

46. Let D be a connected directed graph. D is Eulerian iff $d^+(v) = d^-(v), \forall v \in G$, (G is called _____ digraph).

(A) Balanced

(B) Unbalanced

(C) Joint

(D) None of the above

47. It is an algorithm for graph search solving the single-source shortest path problem for a weighted graph having _____ edge path costs, producing a tree that gives the shortest path.

(A) Positive

(B) Non-Negative

(C) Negative

(D) Neutral

48. Floyd's algorithm finds the paths which has _____ value between all the vertices of a graph.

(A) Maximum

(B) 1

(C) Null

(D) Least

49. Floyd's requires _____ representation of the graph.

(A) Matrix

(B) Graphical

(C) Data

(D) All of the above

50. Floyd-Warshall algorithm is an algorithm for graph analysis that finds _____ paths in a graph that is weighted and directed.

(A) Longest

(B) Easiest

(C) Shortest

(D) Both (A) and (B)