

CSE 204

B.Tech. IIIrd SEMESTER EXAMINATION, 2024-25

B. TECH.

Discrete Mathematics

(CSE)

[Signature]

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Paper ID

(To be filled in the
OMR Sheet)

Date (तिथि) : _____

2135

अनुक्रमांक (अंकों में) :

Roll No. (In Figures) :

अनुक्रमांक (शब्दों में) : _____

Roll No. (In Words) : _____

Time : 1:30 Hrs.

समय : 1:30 घण्टे

Max. Marks : 75

अधिकतम अंक : 75

नोट : पुस्तिका में 50 प्रश्न दिये गये हैं, सभी प्रश्न करने होंगे। प्रत्येक प्रश्न 1.5 अंक का होगा।

Important Instructions :

1. The candidate will write his/her Roll Number only at the places provided for, i.e. on the cover page and on the OMR answer sheet at the end and nowhere else.
2. Immediately on receipt of the question booklet, the candidate should check up the booklet and ensure that it contains all the pages and that no question is missing. If the candidate finds any discrepancy in the question booklet, he/she should report the invigilator within 10 minutes of the issue of this booklet and a fresh question booklet without any discrepancy be obtained.

महत्वपूर्ण निर्देश :

1. अभ्यर्थी अपने अनुक्रमांक केवल उन्हीं स्थानों पर लिखेंगे जो इसके लिए दिये गये हैं, अर्थात् प्रश्न पुस्तिका के मुख्य पृष्ठ तथा साथ दिये गये ओ०एम०आर० उत्तर पत्र पर, तथा अन्यत्र कहीं नहीं लिखेंगे।
2. प्रश्न पुस्तिका मिलते ही अभ्यर्थी को जाँच करके सुनिश्चित कर लेना चाहिए कि इस पुस्तिका में पूरे पृष्ठ हैं और कोई प्रश्न छूटा तो नहीं है। यदि कोई विसंगति है तो प्रश्न पुस्तिका मिलने के 10 मिनट के भीतर ही कक्ष परिप्रेक्षक को सूचित करना चाहिए और बिना त्रुटि की दूसरी प्रश्न पुस्तिका प्राप्त कर लेना चाहिए।

1. If $A = 1$ and $B = 0$, then in terms of Boolean algebra $A + \bar{B} =$

(A) B

(B) $\bar{A}$

(C) A

(D) None of these

2. The Boolean function with the k-map :

		AB			
		00	01	11	10
CD	00	0	1	1	0
	01	0	1	1	1
	11	1	1	1	1
	10	0	1	1	0

(A) $(A+C)D+B$

(B) $(A+B)C+D$

(C) $(A+D)C+B$

(D) $(A+C).B+D$

3. The Boolean expression $\bar{A}.B + A.\bar{B} + A.B$ is equivalent to :

(A) $A+B$

(B) $A.B$

(C) $\overline{A+B}$

(D) $\bar{A}.B$

4. How many different Boolean function of degree n are there ?

(A) 2^{2^n}

(B) $(2^2)^2$

(C) 2^{2n-1}

(D) $2^{2n} - 1$

5. The Boolean $AB + AB' + A'C + AC$ is unaffected by the value of the Boolean variable -

$$A(B+B') + C(A'+A)$$

$$A + C$$

- (A) A
(B) B
(C) C
(D) A, B & C

6. Simplify the following using k-map -

$$F(A, B, C, D) = \Sigma(0, 2, 5, 7, 8, 10, 13, 15)$$

- (A) $BD + B'D'$
(B) $AC + A'C'$
(C) $BC + B'C'$
(D) $AD + A'D'$



7. Truth table :

A	B	F(A,B)
F	F	T
F	T	T
T	F	F
T	T	T

From the given truth table $f(A, B)$ is equivalent to :

- (A) $\bar{B} \rightarrow \bar{A}$
(B) $\bar{A} \rightarrow \bar{B}$
(C) $B \rightarrow A$
(D) $A \leftrightarrow B$

$$A \rightarrow B$$

8. Power set of empty set has exactly _____ subset.

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

9. Consider the following TRUTH table :

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

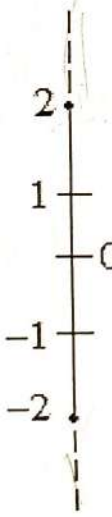
Y=

- (A) $AB + \bar{B}$
- (B) B
- (C) $\bar{A}B$
- (D) $\bar{A}B + \bar{B}$
10. Consider the vocabulary with only four propositions A,B,C and D. How many models are there for the following sentence ?
- (A) 8
- (B) 7
- (C) 15
- (D) 16
11. Consider the group G with 40 elements. What is the largest possible size of a subgroup of G other than G itself ?
- (A) 8
- (B) 10
- (C) 2
- (D) 0
12. If $x * y = x + y + xy$ then $(G,*)$ is _____ :
- (A) Monoid
- (B) Abelian group
- (C) Commutative semigroup
- (D) Cyclic group

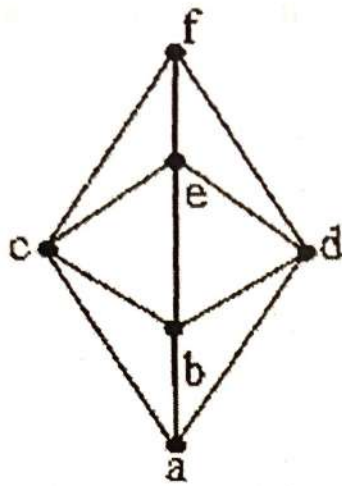
13. The set of rational numbers from an abelian group under _____ :
- (A) Association
 - (B) Closure
 - ☒ (C) Multiplication
 - (D) Addition
14. If minimum cost edge of a graph is unique, then that edge will be added to any MST. Choose the correct option.
- (A) False
 - (B) Maximum cost edge is added
 - ☒ (C) True
 - (D) Minimum cost edge need not be unique
15. Spanning trees have a special class of depth first search trees named _____.
- (A) Euclidean minimum spanning tree
 - (B) Tremaux trees
 - (C) Complete bipartite graphs
 - (D) Decision trees
16. If C_n is the n^{th} cyclic graph, where $n > 3$ and n is odd. Determine the value of $X(C_n)$ -
- (A) 32572
 - (B) 16631
 - (C) 3
 - (D) 310
17. Determine the density of a planar graph with 34 edges and 13 nodes.
- ☒ (A) 22/21
 - (B) 12/23
 - (C) 328
 - (D) 576

18. _____ is the maximum number of edges in an acyclic undirected graph with K vertices.
- (A) $K - 1$
 - (B) K^2
 - (C) $2K + 3$
 - (D) $K^3 + 4$
19. Bridge can not be a part of _____ a simple cycle.
- (A) A tree
 - (B) A clique with size ≥ 3 whose
 - (C) Every edge is a bridge
 - (D) A graph which contains cycles
20. The number of edges in a regular graph of degree 46 and 8 vertices is _____.
- (A) 347
 - (B) 230
 - (C) 184
 - (D) 186
21. If G is the forest with 54 vertices and 17 connected components, G has _____ total number of edges.
- (A) 38
 - (B) 37
 - (C) $17/54$
 - (D) $17/53$
22. Triangle free graphs have the property of clique number is _____ :
- (A) Less than 2
 - (B) Equal to 2
 - (C) Greater than 3
 - (D) More than 10

23. If each and every vertex in G has degree at most 23 then G can have a vertex coloring of _____ :
- (A) 24
 - (B) 23
 - (C) 176
 - (D) 54
24. In a 7- node dissected acyclic graph, the number of Hamiltonian cycle is to be _____ :
- (A) 728
 - (B) 450
 - (C) 360
 - (D) 260
25. The spectrum of a graph is _____ if and only if it is _____ graph.
- (A) Symmetric, bipartite
 - (B) Transitive, bipartite
 - (C) Cyclic , Euler
 - (D) Reflexive, planar
26. All closed walks are of _____ length in a bipartite graph.
- (A) Infinite
 - (B) Even
 - (C) Odd
 - (D) Odd prime
27. Bipartite graphs are used in _____ :
- (A) Modern coding theory
 - (B) Colouring graphs
 - (C) Neural networks
 - (D) Chemical bonds

28. The time complexity to test whether a graph is bipartite or not is said to be _____ using depth first search.
- (A) $O(n^3)$
 - ☒ (B) Linear time
 - (C) $O(1)$
 - (D) $O(n \log n)$
29. $[P(A), \subseteq], A = \{a, b, c\}$ -
- (A) It is a complemented lattice
 - (B) It is a Boolean algebra
 - (C) It distributive algebra
 - ☒ (D) It is a lattice
- 30.
- 
- ☒ (A) Complete lattice
 - ☒ (B) Bounded lattice
 - ☒ (C) Complemented lattice
 - (D) None of these

31.



- (A) It is a lattice only
- (B) It is a distributive lattice
- (C) It is a complemented lattice
- (D) It is a Boolean algebra

32. $\{2, 3, 4, 9, 12, 18, \}, /$

What is it ?

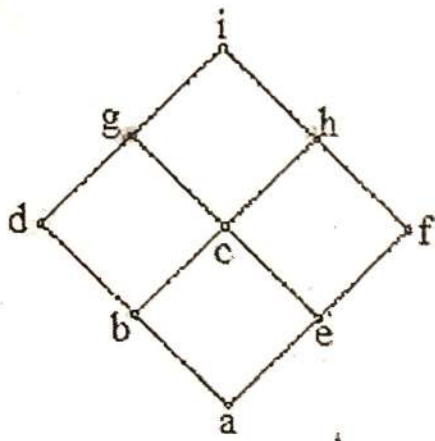
- (A) It is a lattice
- (B) It is a Boolean algebra
- ☒ (C) It is a complemented lattice
- (D) It is POSET



33. What are the properties of bounded lattice ?

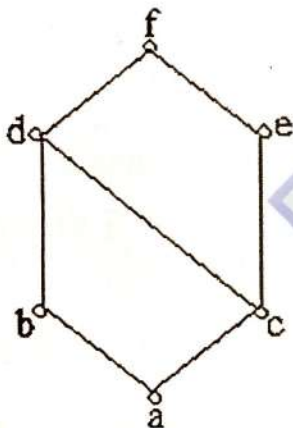
- (A) $GLB = 1, LUB = 0$
- (B) $GLB = 0, LUB = 1$
- (C) $GLB = a, LUB = b$
- ☒ (D) $GLB = LUB = 1$

34.



- (A) Complement lattice
- (B) Distributive lattice
- (C) Boolean algebra
- (D) Not a lattice

35.



- (A) It is a complemented lattice
- (B) It is a distributive lattice
- (C) It is a lattice
- (D) Both (A) and (C)

36. A free semilattice has the _____ property :

- (A) Intersection
- (B) Commutative and associative
- (C) Identity
- (D) Universal

37. Every poset that is a complete semilattice must always be a _____ :
- (A) Sub lattice
 - ☒ (B) Complete lattice
 - ☒ (C) Free lattice
 - (D) Partial lattice
38. In the Poset $(\mathbb{Z}^+, 1)$ (Where $\mathbb{Z}^+$ is the set of all positive integers and 1 divides relation) are the integers 9 and 351 comparable ?
- 27
- ☒ (A) Comparable
 - (B) Not comparable
 - (C) Comparable but not determined
 - (D) Determined but not comparable
39. If f is a function defined for $\mathbb{R}$ to $\mathbb{R}_1$ is given by $f(x) = 3x - 5$ then $f^{-1}(x)$ is given by _____ :
- $y = 3x - 5$
 $y + 5 = 3x$
3
 $x = \frac{y+5}{3}$
- (A) $1/(3x-5)$
 - ☒ (B) $(x+5)/3$
 - (C) Does not exist since it is not a bijection
 - (D) None of these
40. For an inverse to exist it is necessary that a function should be _____ :
- (A) Injection
 - ☒ (B) Bijection
 - (C) Surjection
 - (D) None of these

41. What is the domain of the function $f(x)=x^{1/2}$?

- (A) $(2, \infty)$
- (B) $(-\infty, 1)$
- (C) $(0, \infty)$
- (D) None of these

42. The inverse of function $f(x)=x^3+2$ is _____ :

- (A) $f^{-1}(y)=(y-2)^{1/2}$
- (B) $f^{-1}(y)=(y-2)^{1/3}$
- (C) $f^{-1}(y)=(y)^{1/3}$
- (D) $f^{-1}(y)=(y-2)$

43. Let f and g be the composition of from the set of integers to itself, defined by $f(x)=2x+1$ & $g(x)=3x+4$, then the composition of f and g is _____ :

- (A) $6x+9$
- (B) $6x+7$
- (C) $6x+6$
- (D) $6x+8$

44. Which of the following is onto ?

- (A) $f(a,b)=a+b$
- (B) $f(a,b)=a$
- (C) $f(a,b)=|b|$
- (D) $f(a,b)=a-b$

45. The value of $\lfloor 1/2 \cdot \lfloor 5 / 2 \rfloor \rfloor$ is :

- (A) 1
- ☒ (B) 2
- (C) 3
- (D) 0.5

46. What is the cardinality of the set of odd positive integers less than 10 ?

- (A) 10
- ☒ (B) 5
- (C) 3
- (D) 20

1, 3, 5, 7, 9

47. What is the cardinality of the power set of the set $\{0,1,2\}$?

- ☒ (A) 8
- (B) 6
- (C) 7
- (D) 9

$\{\emptyset\}$ $\{0\}$ $\{1\}$ $\{2\}$ $\{0,1\}$ $\{0,2\}$ $\{1,2\}$ $\{0,1,2\}$

48. The difference of $\{1,2,3\}$ and $\{1,2,5\}$ is the set _____ :

- (A) $\{1\}$
- (B) $\{5\}$
- ☒ (C) $\{3\}$
- (D) $\{2\}$

49. If the set contains 3 elements then the number of subset is :

(A) 6

$\{a, b, c\}$

(B) 3

(C) 12

☒ (D) 8

50. Let $A(1), A(2), A(3), \dots, A(100)$ be 100 sets such that the number of elements in $A(i) = i+1$ and $A(1)$ is subset of $A(2)$, $A(2)$ is subset of $A(3)$, $A(99)$ is subset of $A(100)$. The number of elements in union of all the sets are :

$n(A(1) \cup A(2) \cup A(3) \cup \dots \cup A(100))$.

(A) 99

(B) 100

(C) 101

(D) 102
