Question Paper Code   **13683**

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025
Second Semester

Computer Science and Business Systems
24BSMA204 - DISCRETE MATHEMATICS FOR COMPUTER SCIENCE
Regulations - 2024

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K-Level	CO

1. Let P: We should be honest., Q: We should be dedicated., R: We should be overconfident. Then 'We should be honest or dedicated but not overconfident.' is best represented by?   *1   K1   CO1*
   (a) ~P V ~Q V R   (b) P ∧ ~Q ∧ R   (c) P V Q ∧ R   (d) P V Q ∧ ~R

2. The contrapositive of p → q is the proposition of _____   *1   K1   CO1*
   (a) ¬ p → ¬ q   (b) ¬ q → ¬ p   (c) q → p   (d) ¬ q → p

3. A relation represents an equation where the next term is dependent on the previous term is called ---------   *1   K1   CO2*
   (a) Binomial relation   (b) Recurrence relation   (c) Void relation   (d) None of the above

4. According to principle of mathematical induction, if $P = m^{k+1} + 5$ is true then _____ must be true.   *1   K1   CO2*
   (a) $P(k) = 3m^k$ (b) $P(k) = m^k + 5$ (c) $P = m^{k+2} + 5$ (d) $P(k) = m^{k+1}$

5. The elements of the set $\{1, i, -i, -1\}$ forms a   *1   K1   CO3*
   (a) semi group   (b) subgroup   (c) cyclic group   (d) abelian group

6. If H_1 and H_2 are subgroups of the group G, Then, which one of the following is also a subgroup of G?   *1   K1   CO3*
   (a) $H_1 \cup H_2$ (b) $H_1 \cap H_2$ (c) $H_1 \Delta H_2$ (d) none of these

7. In Boolean algebra, the complement of 1 is: *1   K1   CO4*
   (a) 1   (b) 0   (c) -1   (d) not defined

8. The dual of $A + 0 = A$ is   *1   K1   CO4*
   (a) $A \cdot 1 = A$ (b) $A + 1 = A$ (c) $A \cdot 0 = A$ (d) $A + 0 = 1$

9. A Hamiltonian path in a graph   *1   K1   CO5*
   (a) Visits every edge exactly once   (b) Visits every vertex exactly once
   (c) Visits every vertex and edge exactly once   (d) Must be a cycle

10. According to Euler's formula for planar graphs   *1   K1   CO6*
    (a) $V - E + F = 2$ (b) $V + E = 2$ (c) $V - E = F$ (d) $F = V + E$

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. Prove that $(p \to q) \Rightarrow p \to (p \wedge q)$.   *2   K2   CO1*

12. Is the statement $(\forall x)\big(P(x) \vee Q(x)\big) \Rightarrow (\forall x)P(x) \vee (\forall x)Q(x)$ valid?   *2   K2   CO1*

13. In any group of 100 people, several will have birthdays in the same month. At least how many must have birth days in the same month.   *2   K2   CO2*

14. Solve $S(k) - 10S(k-1) + 9S(k-2) = 0, S(0) = 3, S(1) = 11$.   *2   K3   CO2*

15. Define a Group with example.   *2   K1   CO3*

16. Let a and b are any two elements of a group $(G, *)$, then show that G is abelian iff and only if $(a*b)^2 = a^2 * b^2$.   *2   K2   CO3*

17. Prove that in a Boolean algebra, the complement of every element is unique.   *2   K2   CO4*

18. In a Boolean algebra, prove that $ab + abc + a'b + ab'c = b + ac$.   *2   K2   CO4*

19. State and prove the hand shaking theorem.   *2   K2   CO5*

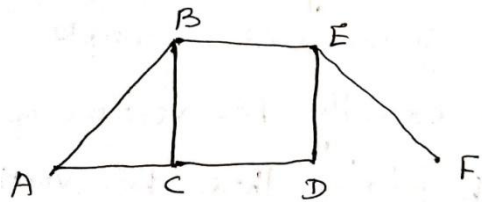*K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create*   **13683**

20. Find the number of vertices, the number of edges and the degree of each vertex in the following graph. Also verify the handshaking theorem.

	2	K2 CO5

21. Define binary tree with an example.   2   K1   CO6

22. Define planar graphs.   2   K1   CO6

PART - C ($6 \times 11 = 66$ Marks)
Answer ALL Questions

23. a) Determine the principal conjunctive normal form and principal disjunctive normal form of $p \rightarrow ((p \rightarrow q) \wedge \neg(\neg q \vee \neg p))$.   11   K3   CO1

    OR

    b) Verify the validity of the following argument: 11   K3   CO1
    Every living thing is a plant or an animal. Rama's dog is alive and it is not a plant. All animals have hearts. Therefore, Rama's dog has a heart.

24. a) Prove by using Mathematical induction $3^n + 7^n - 2$ is divisible by 8, for $n \geq 1$.   11   K3   CO2

    OR

    b) Solve the recurrence relation   11   K3   CO2
    $a_{n+2} + 3a_{n+1} + 2a_n = 3^n$, $n \geq 0$ .given that $a_0 = 0$ and $a_1 = 1$

25. a) If R is a relation defined on Z such that $a\,R\,b$ if and only if $a^2 - b^2$ is divisible by 3, show that R is an equivalence relation.   11   K3   CO3

    OR

    b) State and prove Lagrange's theorem.   11   K3   CO3

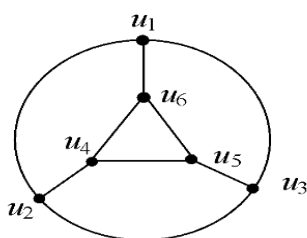26. a) State and prove De Morgan's laws in Boolean algebra.   11   K3   CO4

    OR

    b) Minimise the function $f(a,b,c,d) = \Sigma(1,2,4,5,6,11,12,13,14,15)$ using Karnaugh map method.   11   K3   CO4

27. a) Determine whether the following graphs are isomorphic or not.   11   K3   CO5
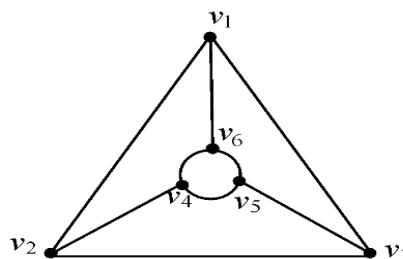
    OR

    b) Prove that the maximum number of edges in a simple disconnected group G with n vertices and k components is $\dfrac{(n-k)(n-k+1)}{2}$.   11   K3   CO5

28. a) Prove that a connected planar graph with n vertices and e edges has $e - n + 2$ regions.   11   K3   CO6

    OR

    b) Prove that a simple graph G has a spanning tree if and only if G is connected.   11   K3   CO6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create