REV-01
BCA/01/05

2025/05

BACHELOR OF COMPUTER APPLICATION
SECOND SEMESTER ((REPEAT)
DISCRETE MATHEMATICS
BCA – 203 (OLD COURSE)

Duration : 3 hrs. Full Marks : 70

(**PART-A: Objective**)

Time : 20 min. Marks : 20

Choose the correct answer from the following: ***1×20=20***

1. The complete graph K_p is regular of degree ________
   a. p
   b. p-1
   c. P + 1
   d. p(p-1)/2

2. Every ________ chromatic graph may not be a tree
   a. 1
   b. 2
   c. 3
   d. 4

3. If $f:R \rightarrow R$ is defined by $f(x) = x^2 - 3x+5$ then $f^{-1}(3)$ = ________
   a. {1,2}
   b. 5
   c. 3
   d. {-2,5}

4. What is the value of n{P[P(P(ϕ)]}
   a. 0
   b. ϕ
   c. 4
   d. 3

5. A and B be two sets having two elements in common. If n(A)=5 and n(B)=3, then n {(A x B) ∩ (B x A)} = ________
   a. 15
   b. 3
   c. 5
   d. 4

6. If ' * ' is a binary operation in Q^+ defined by a*b = a b/2, Where a, b∈ Q^+ (Set of all positive rational). If (Q^+, *) is an abelian group, then the inverse of a is ______
   a. 4/a
   b. 9/a
   c. 2
   d. 3

7. A finite integral domain is a ______
   a. Ring
   b. Group
   c. Field
   d. Vector space

8. The statement $[p\wedge (p\vee q)] \vee \sim p$ is a ______
   a. tautology
   b. Contradiction
   c. contingency
   d. None of these

9. The negation of $p \rightarrow (p\vee \sim q)$ is ______
   a. $p \wedge (\sim p \wedge q)$
   b. $p \vee (\sim p \wedge q)$
   c. $p \vee (p \wedge \sim q)$
   d. $p \vee (\sim p \vee q)$

10. If ${}^{n}P_4 = 2\,{}^{5}P_3$, then ________

a. 4
b. 3
c. 5
d. 2

11. If ${}^{2n}C_3 : {}^{n}C_3 = 11 : 1$, then n = ________

a. 6
b. 11
c. 3
d. 12

12. A ________ is a set S with relation R on S which is reflexive, anti-symmetric and transitive.

a. Equivalence relation
b. Partially ordered set
c. Both (a) and (b)
d. None of these

13. A lattice (L, ∧, v) is called a modular lattice if it satisfies the following condition $x \le z \Rightarrow x \vee (y \wedge z) =$ ______

a. $(x \vee y) \wedge (x \vee z)$
b. $(x \vee y) \wedge z$
c. $(x \vee y) \vee z$
d. $(x \wedge y) \vee z$

14. If L is a ________ lattice, then it is a modular lattice

a. Distributive
b. Commutative
c. Associative
d. Absorption law

15. Write down the domain of the relation R, where R= { (x, y) :x and y are integers, xy = 4 }

a. { -2, 2, 1, -1, 4, -4 }
b. { 1, 2, 4}
c. { -4, 4 }
d. { -2, 2, 1, 4, -4 }

16. If there is one and only one path between every pair of vertices in G, then G is a ______

a. Isolated
b. Pendent
c. Complete
d. Tree

17. In a complete graph K_8, the number of edges is ______

a. 28
b. 8
c. 56
d. 64

18. If the function f and g are given by f = { (1,2), (3, 5), (4, 1) } and g ={ (2, 3), (5, 1), (1,3) }, then gof = ______

a. { (1,3), (3,1), (4,3) }
b. { (3,1), (1,3), (3,4)}
c. { (2,5), (5, 2), (5,1) }
d. { (5, 2), (2,5), (1,5)}

19. A tree contains at least ______ vertices

a. One
b. Two
c. Three
d. Four

20. The number of points and lines in the complete bipartite graph $K_{7,8}$ is ______ and ______

a. 7,8
b. 8, 7
c. 15, 56
d. 15, 64

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PART-B : Descriptive

Time : 2 hrs. 40 min. Marks: 50

[Answer question no.1 & any four (4) from the rest]

1. a. Verify whether the following propositions are tautology, contradiction and contingency 3+ 3= 6
   (i) $\{[p \rightarrow (q \vee r)] \wedge (\sim q)\} \rightarrow (p \rightarrow r)$
   (ii) $[(p \vee \sim q) \wedge (\sim p \vee \sim q)] \vee q$

   b. In an examination, a candidate has to pass in each of the 5 subjects. In how many ways can he fail? 4

2. a. Define Euler and Hamiltonian graphs with figures. 5

   b. Prove that a tree T with 'n' vertices has 'n-1' edges. 5

3. a. In a class, 18 students offered physics; 23 offered chemistry and 24 offered mathematics. Of these, 13 are in both chemistry and mathematics; 12 in physics and chemistry; 11 in mathematics and physics and 6 in all three subjects. Find: 2+2+2 =6
   (i) how many students are there in the class;
   (ii) how many offered mathematics but not chemistry;
   (iii) how many are taking exactly one of the three subjects.

   b. Let $f: R \rightarrow R$: $f(x) = x^2 + 3x + 1$ and $g: R \rightarrow R$: $g(x) = 2x - 3$ Find : 1+1+1+1=4
   (i) fog (ii) gof (iii) fof (iv) gog

4. a. Solve the recurrence relation $a_n = a_{n-1} + a_{n-2}$, for $n \geq 2$ with the initial conditions $a_0 = 1$ and $a_1 = 1$. 5+5=10

   b. Solve the recurrence relation by using the generating function $a_{n+2} - 6a_{n+1} + 8a_n = 0$, with the initial conditions: $a_0 = 1$, $a_1 = 4$

5. a. How many different arrangements can be made by using all the letters in the word 'MATHEMATICS'. How many of them begin with C ? How many of them begin with T ? 2+2+2 =6

   b. Define injective and surjective function. Show that the function f: $R \rightarrow \{\sqrt{2}\}$ defined by $f(x) = x/(x^2 - 2)$, $x \neq \sqrt{2}$ is surjective but not injective. 1+1+2 =4

a. What do you mean by Hasse diagram of a poset? 5

Let $P = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24\}$ be ordered by the relation 'a divides b'. Draw the Hasses diagram of P

b. Prove that a lattice is a partially ordered set. 5

7. **a.** If R is a Boolean ring, then prove that R is a commutative ring. 4

   b. If G is a group, then prove that 3+3=6

   i) the identity element of G is unique
   ii) every element in G has unique inverse in G

8. Prove that the complete graph of five vertices is a non-planar 10

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