

8. a) The Pre-order, In-order and Post-order of a binary tree is given by:

Pre-order : A B D H I E C F J K G L M

In- order : H D I B E A J F K C G L M

Post-order: H I D E B J K F M L G C A. Find the Binary tree.

b) Let R be a relation defined on a set $S = \{a,b,c,d\}$ given by

$R = \{(a, a), (a, c), (a, d), (b, c), (b, d), (c, d), (a, a), (b, b), (c, c), (d, d)\}$. Draw the directed graph of the relation.

c) State the Pigeon-hole Principle. (5+3+2=10)

BACHELOR OF COMPUTER APPLICATION
SECOND SEMESTER
DISCRETE MATHEMATICS
BCA – 204

(Use separate answer scripts for Objective & Descriptive)

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. If A and B are sets, then $B \cap (B - A)$ is equal to:
a) B-A b) A-B c) B d) A
2. Which of the following is true?
a) (R, \circ) is a group but not commutative.
b) (R, \circ) is a commutative group.
c) (R, \circ) is not a semigroup
d) (R, \circ) is not monoid.
3. The number of binary operation in a lattice is:
a) 1 b) ≤ 2 c) 2 d) > 2
4. $P \rightarrow Q$ is false when:
a) Both P and Q are true b) Both P and Q are false
c) P is true and Q is false d) P is false and Q is true
5. Find the negation of: There exists a dog that is 25 years old.
a) Some dog is not 25 years old.
b) All dog is 25 years old.
c) Every dog is 25 years old.
d) Every dog is not 25 years old.
6. The number of spanning trees for a complete graph with 5 vertices is:
a) 125 b) 25 c) 625 d) none of these
7. Which of the following is true?
a) Every infinite lattice is bounded.
b) Every finite lattice is bounded.
c) Every finite lattice is not lower bounded.
d) All of these.
8. Which of the following is true?
a) $a+a=1, a.a=0$ b) $a+a=a, a.a=a$
c) $a+a'=0, a.a'=1$ d) None of these

9. The set N of natural numbers where $x * y = \max\{x, y\}$ is a.....

- a) Ring b) Complete lattice
c) Semigroup d) Field

10. Circle has.....

- a) No vertices b) only 1 vertices
c) 8 vertices d) none of the above

11. Hasse diagram are drawn:

- a) Partially ordered sets b) Lattices
c) Boolean algebra d) Poset

12. The maximum degree of any vertex in a simple graph with n vertices is:

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

13. Let $A = \{\phi, \{\phi\}, \{\phi, \{\phi\}\}\}$. Then the number of elements of the set A is:

- a) Zero b) 1 c) 4 d) 3

14. A set B contains four elements. The number of element of the power set $P(B)$ is:

- a) 8 b) 12 c) 14 d) 16

15. Let $P =$ The sun rises in the west, $Q =$ Sum of 7 and 11 equals 30. Then the value of $P \rightarrow Q$ is:

- a) false b) true
c) not defined d) all false

16. Suppose $F: R \rightarrow R$ given by $F(X) = 3X+2$. Then $F(X)$ is:

- a) one to one b) onto
c) one to one onto d) none of them

17. The set Z with binary operation $*$ such that $x*y = x^y$. Then Z is:

- a) semi-group b) not semi Group
c) monoid d) none

18. The number of ways to paint 12 offices so that 3 of them are green, 2 of them pink, 2 of them yellow and the remaining one blue is:

- a) 12345 b) 166320 c) 165320 d) 165120

19. A ring $R(+, \cdot)$ is called commutative if:

- a) $(R,+)$ is commutative b) (R,\cdot) commutative
c) both (a) & (b) d) none

20. A planar graph of 6 vertices and 9 edges has r regions. The value of r is:

- a) 4 b) 5 c) 6 d) 7

(PART B : Descriptive)

Time: 2 hrs. 40 min.

Marks: 50

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

1. a) State distributive law used in set theory. Illustrate the law with Venn diagram. (5)

b) Define lattices. What is Principle of Extension in Set Theory? (5)

2. a) Let $f(x) = x^2 + 3 \sin x$ and $g(x) = \cos^2 x + \tan x$ and $h(x) = 3x+2$,

Find: (i) $((f \circ g) \circ h)(x)$, (ii) $(g \circ f)(x)$.

b) Prove that the inter section of two sub-groups is again a sub-group.

c) Define Ring. (2+5+3=10)

3. a) Let $U = \{1,2,3,4,5,6,7,8,9,10\}$ and $A = \{2,4,6,8\}$ $B = \{1,3,5,7\}$ and

$C = \{1,4,8,10\}$. Verify the D' Morgan's law.

b) Prove that the relation defined in the set of integers Z by aRb iff $a-b$ is an integer is an equivalence relation. (5+5=10)

4. a) Let G be the set of all non-zero real numbers and the operation $*$ is defined as $a*b = ab/2$. Is G abelian group? Discuss.

b) Define coset. Show with an example that union of two subgroups may not be a sub-group? (5+2+3=10)

5. a) What do you mean by Bipartite Graph?

b) Prove that the complete graph K_5 is not planar.

c) What is Chromatic number of a graph? Give example of two graphs where one has chromatic number 2 and the other has 3. (2+5+1+2=10)

6. a) Show that $(P \rightarrow Q) \wedge (R \rightarrow Q) \Leftrightarrow (P \vee R) \rightarrow Q$ (5+3+2=10)

b) Find the generating function of the numeric functions:

(i) $a_r = 7 \times 3^r$, $r \geq 0$ and (ii) $a_r = 3^{r+2}$ $r \geq 0$.

7. a) Let a be any element of a Boolean algebra B . Prove the following: (2)

i) Uniqueness of complement: if $a + x = 1$ and $a * x = 0$, then $x = a'$.

ii) Involution law: $(a')' = a$.

b) Show by mathematical induction $1+2+3+\dots+n = (n(n+1))/2$. (3)

c) Symbolically represent the following statement: "All birds are beautiful." (5)

(5)