7. a. From a group consisting of 6 boys and 7 girls, in how many ways can we select a group of 8+2=10
   I. 3 boys and 4 girls
   II. 4 persons which has atleast one girl.
   III. 4 persons which has atleast one boy.
   IV. 4 persons that has both boys and girls.
   b. Prove by mathematical method $n! \geq 2^{n-1}, for\ n = 1,2,3 ....$

8. a. Define proposition with an example. 2+6+2=10
   b. Define conjunction and disjunction for any two propositions p and q. Construct the truth table for both the connectives.
   c. Write down the primal and dual form of the idempotent law and identity law.

= = *** = =

BACHELOR OF COMPUTER APPLICATION
SECOND SEMESTER (REPEAT)
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: ***1X20=20***

1. A function $f: X \to Y$ is a one-one function if
   a. $f(x_1) = f(x_2)$ whenever $x_1 = x_2$
   b. $f(x_1) = f(x_2)$ whenever $x_1 \neq x_2$
   c. $f(x_1) \neq f(x_2)$ whenever $x_1 = x_2$
   d. None of these

2. If $A = \{1,2,3\}$ and $B = \{w, x, y, z\}$, then the number of functions $f: A \to B$ is:
   a. 64
   b. 81
   c. 12
   d. None of these.

3. The function $f: \mathbb{Z} \to \mathbb{N}$ defined as $f(x) = \begin{cases} 2x - 1, & if\ x > 0 \\ -2x, & if\ x \leq 0 \end{cases}$. Then the value of $f(1)$ and $f(-1)$ are:
   a. 1 and −2
   b. 1 and 2
   c. −1 and −2
   d. None of these

4. The function $f: A \to A$ defined as $f(x) = x$ where $x \in A$ is a
   a. Constant function
   b. Identity function
   c. Both (a) and (b)
   d. None of these

5. Consider the following statement:
   P: A graph with n vertices and $n - 1$edges is called tree.
   Q: A tree is a connected graph.
   a. Only P is true.
   b. Only Q is true
   c. Both P and Q are true
   d. Both P and Q are false.

6. The chromatic number of C_5 and C_6 are:
   a. 5 and 6 respectively.
   b. 2 and 3 respectively
   c. 3 and 2 respectively
   d. None of these.

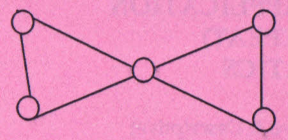
7. Consider the following statement:
   P: Every tree with two or more vertices has chromatic number 2.
   Q: Chromatic number of K_n is n.
   a. P is true, Q is false
   b. P is false, Q is true
   c. P and Q are true.
   d. None of these.

8. A graph with 8 vertices and 6 faces. Then the number of edges of the graph is:
   a. 14
   b. 12
   c. 16
   d. None of these

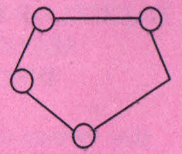
9. The order of −1 in the group $G = \{1, -1, i, -i\}$ with respect to multiplication is
   a. 1
   b. 2
   c. 3
   d. 4

10. Which of the following graph has Hamiltonian path but not Hamiltonian cycle?

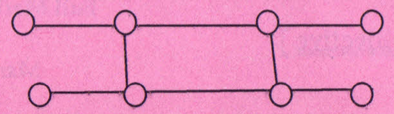
a.



b.



c.



d. None of these

11. Which of the following is true?
   a. $P(n,n) = 2!.$ b. $C(n,n) = 1$
   c. $P(n,2) = 2!.$ d. None of these

12. The value of $C(5,2)$ is
   a. 5 b. 10
   c. 15 d. 20

13. The proposition $(p \to \sim p) \to \sim p$ is
   a. Tautology b. Contradiction
   c. Either tautology or contradiction d. None of these

14. If p is true, then the truth value of $p \wedge \sim p$ will be
   a. T b. F
   c. Cannot be said d. None of these

15. For the sequence 4,12,36,..., the recurrence relation is
   a. $a_{n+1} = 2$ b. $a_{n+1} = a_n$
   c. $a_{n+1} = 3a_n$ d. None of these

16. Which of the following is not true
   a. A cyclic group is always abelian b. The identity in a group is unique
   c. In a ring R, $(R,+)$ is a group d. None of these

17. The dual of $p \vee T \equiv T$ is
   a. $p \vee T \equiv F$ b. $p \vee F \equiv F$
   c. $p \wedge T \equiv T$ d. $p \wedge F \equiv F$

18. Which of the following is not a group
   a. $(R,.)$ b. $(Z,+)$
   c. $(R,+)$ d. None of these

19. A poset $(L,\leq)$ is called lattice if every pair of elements in L has
   a. Supremum b. Infimum
   c. Both supremum and infimum d. Neither supremum nor infimum

20. An ordered arrangement of r elements of a set containing n distinct elements is called a/an
   a. r- permutation of n elements b. r-combination of n elements
   c. Pigeonhole principle d. None of these

-- --- --

(PART-B : Descriptive)

Time : 2 hrs. 40 min. **Marks : 50**

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

1. a. Define conditional and biconditional propositions and also give the truth tables. 6+4=10
   b. What is equivalence of propositions. Show that $(p \to q) \leftrightarrow \sim p \vee q$.

2. a. Define group with an example. 4+6=10
   b. Show that the set Q^+ of all positive rational numbers forms an abelian group under the operation $*$ defined by $a * b = \frac{1}{2}ab;\ a,b \in Q^+$.

3. If $S = \{1,2,3,4,5\}$ and if the function $f,g,h: S \to S$ are given by: 4+3+3=10
   $f = \{(1,2),(2,1),(3,4),(4,5),(5,3)\}$
   $g = \{(1,3),(2,5),(3,1),(4,2),(5,4)\}$
   $h = \{(1,2),(2,2),(3,4),(4,3),(5,1)\}$
   (Here $(a,b) \in f \Rightarrow f(b) = a, (p,q) \in g \Rightarrow g(q) = p\ (x,y) \in h \Rightarrow h(y) = x$)
   a. Verify whether $f \circ g = g \circ f$.
   b. Explain why f and g have inverse but h does not.
   c. Find f^{-1} and g^{-1}.

4. If $f: \mathbb{Z} \to \mathbb{N}$ is defined by $f(x) = \begin{cases} 2x-1, if\ x > 0 \\ -2x, \quad if\ x \leq 0 \end{cases}$ 6+4=10
   a. Prove that f is one-one and onto
   b. Determine f^{-1}.

5. a. Define Decomposition of a graph. Prove that - A graph containing m edges $\{e_1.e_2,\cdots,e_m\}$ can be decomposed into $2^{m-1}-1$ different ways into pairs subgraphs G_1 and G_2. 6+4=10
   b. Define Complete Graph, Regular Graph and Planer Graph.

6. a. State Handshaking theorem. A graph consists of four vertices each of degree m and an isolated vertex. Find the number of edge of the graph. 2+4+4=10
   b. Find adjacent matrix and incident matrix of the following graph:

1
1 5
2 9 8 5
2 6 7 4
3 4
3