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(2nd Semester)

BACHELOR OF COMPUTER APPLICATIONS

Paper No. : BCA–202

[Mathematics—II (Discrete Mathematics)]

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

*The figures in the margin indicate full marks
for the questions*

1. *(a)* In a survey, it is found that 20 people like product *A*, 30 people like product *B* and 28 like product *C*. If 15 people like products *A* and *B*; 16 people like products *B* and *C*; 12 people like products *C*

and *A* and 8 people like all the three products, find—

(i) how many people are surveyed in all;

(ii) how many like product *B* only. 5

(b) In a Boolean algebra *B*, prove that
$$(x + y)' = x' \cdot y' \text{ for all } x, y \in B.$$ 5

Or

(c) Let $\langle L, \leq \rangle$ be a lattice in which $*$ and $\oplus$ denote the operation of meet and join respectively. For any $a, b \in L$, show that
$$a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$$ 5

(d) In Boolean algebra $B \ \forall \ x, y, z \in B$, prove that
$$x + x' \cdot (x + y) + y \cdot z = x + y$$ 5

2. *(a)* Without truth table, show that
$$(P \wedge Q) \vee (\rceil P \vee (\rceil P \vee Q)) \Leftrightarrow (\rceil P \vee Q)$$ 5

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(d) The 2nd, 3rd and 4th terms in the expansion of $(x+y)^n$ are 240, 720 and 1080 respectively. Find the values of x, y and n.　　5

4. *(a)* Show that the set $G = \{1, \omega, \omega^2\}$, where ω is an imaginary cube root of unity, is a group with respect to multiplication.　　5

(b) Prove that the set $G = \{0, 1, 2, 3, 4, 5\}$ is a finite Abelian group of order 6 with respect to addition modulo 6.　　5

Or

(c) If H_1 and H_2 are two subgroups of a group G, then show that $H_1 \cap H_2$ is also a subgroup of G.　　5

(d) State and prove Lagrange's theorem.　　5

5. *(a)* Define bipartite graphs. Draw the graph of $k_{2,\,4}$; $k_{3,\,3}$ and $k_{3,\,5}$.　　2+3=5

(b) Show that in any digraph, the sum of all in-degrees is equal to the sum of all out-degrees and each sum being equal to the number of edges.　　5

(b) Obtain the principal conjunctive normal form of the formula

$$(\rceil P \to R) \wedge (Q \rightleftharpoons P).$$　　5

Or

(c) By using the truth table, prove that

$$(P \to Q) \wedge (Q \to R) \Rightarrow P \to R$$　　5

(d) Obtain the principal disjunctive normal form of

$$P \to ((P \to Q) \wedge \rceil (\rceil Q \vee \rceil P))$$　　5

3. *(a)* A committee of 5 is to be formed out of 6 men and 4 ladies. In how many ways can this be done, when—

　(i) at least 2 ladies are included;

　(ii) at most 2 ladies are included?　　5

(b) How many numbers are there between 100 and 1000, which have exactly one of their digits as 8?　　5
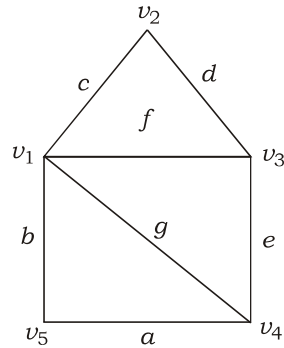
Or

(c) Find the 10th term in the expansion of

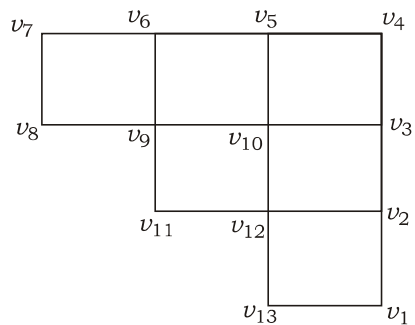$$\left(\frac{a}{b} - \frac{2b}{a^2} \right)^{15}$$　　5

(**5**)

Or

(c)   Write the adjacency and incidence matrices for the following graph :   5

(d)   Define Hamiltonian circuits. Check whether the following graph has Hamiltonian circuit or not :   5

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Booklet No. A

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2 0 1 7

(2nd Semester)

BACHELOR OF COMPUTER APPLICATIONS

Paper No. : BCA–202

[Mathematics—II (Discrete Mathematics)]

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—I

(*Marks* : 15)

I. Put a Tick (✓) mark against the correct answer in the brackets provided :　　　　　　1×10=10

　1. Two sets P and Q are said to be disjoin, if

　　(a)　$P \cap Q = P$　　　(　　)

　　(b)　$P \cup Q = U$　　　(　　)

　　(c)　$P \cap Q = \phi$　　　(　　)

　　(d)　$P \cap Q = \{0\}$　　　(　　)

2. Both the join and meet operations are

    (a) commutative   ( )

    (b) associative   ( )

    (c) distributive   ( )

    (d) All of the above   ( )

3. Which of the following is not a statement?

    (a) The earth is round.   ( )

    (b) Close the door.   ( )

    (c) $7 + 4 < 9$ ( )

    (d) India is a country.   ( )

4. Which of the following implications is true?

    (a) $P \vee Q \Rightarrow P$ (   )

    (b) $P \Rightarrow P \wedge Q$ (   )

    (c) $P \vee Q \Rightarrow Q$ (   )

    (d) $\rceil P \Rightarrow P \rightarrow Q$ (   )

5. If $^{n}P_4 = 20 \times {}^{n}P_2$, then the value of n is

    (a) 7   (   )

    (b) 6   (   )

    (c) 4   (   )

    (d) 8   (   )

6. The term independent of x in the expansion of $\left(x^2 + \dfrac{1}{x}\right)^9$ is

   (a) 76   (   )

   (b) 84   (   )

   (c) 96   (   )

   (d) 68   (   )

7. An algebraic structure $(G, *)$ is said to be a semi-group in the binary operation $*$ is

   (a) associative   (   )

   (b) commutative   (   )

   (c) distributive   (   )

   (d) All of the above   (   )

8. A necessary and sufficient condition for a non-empty subset H of a group G to be a subgroup is that $HH^{-1} =$

   (a) H^{-1} (   )

   (b) 1   (   )

   (c) 0   (   )

   (d) H (   )

(**5**)

9. A vertex of degree zero is called

    (a) isolated vertex ( )

    (b) terminal vertex ( )

    (c) cut point ( )

    (d) cut vertex ( )

10. Let G be a connected graph with n vertices, then the number of edges in the spanning tree of G is

    (a) n ( )

    (b) $\dfrac{n}{2}$ ( )

    (c) $n-1$ ( )

    (d) $\dfrac{n(n-1)}{2}$ ( )

II. Tick (✓) either True or False : 1×5=5

1. In Boolean algebra $B, \forall x, y \in B$ such that $x + (x \cdot y) = y$ ( )

   True ( ) / False ( )

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2. Binomial expansion of $(a + b)^n$ has $(n + 1)$ terms.

True (   ) / False (   )

3. In mathematical logic, $P \wedge T \Leftrightarrow P$

True (   ) / False (   )

4. In any group, the identity element e is always of order two.

True (   ) / False (   )

5. A graph is said to be regular, if every vertex has the same degree.

True (   ) / False (   )

SECTION—II

(*Marks* : 10)

III. Answer the following questions : 2×5=10

   1. If A and B are two sets such that $n(A) = 40$, $n(B) = 25$ and $n(A \cup B) = 53$, find $n(A \cap B)$.

2. How many 9-digit numbers of different digits can be formed?

3. Write the truth table for biconditional statement.

4. Define planar and non-planar graph.

5. Find the order of each element of the multiplicative group $\{1, -1, i, -i\}$.

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