UBCCAT404 - Paper-IV : Mathematics

_____

Notes :   1.   All questions are compulsory and carry equal marks.
          2.   Draw a neat and labelled diagram wherever necessary.
          3.   Avoid vague answers.

Either:

1. a) Define set? Explain different operation on sets.   **4**

    b) If A and B are finite set, then $|A \cup B| = |A| + |B| - |A \cap B|$.   **4**

<div align="center">

OR

</div>

    c) Construct the truth table   **4**
        i) $(P \vee Q)$ ii) $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R)$

    d) Prove that statement is time by using mathematical induction.   **4**
        $$1 + 2 + 3 + 4 + ----- + n = \frac{n(n+1)}{2}$$

Either:

2. a) Given the truth values of P and Q as T and those of R and S as F. Find the truth values of   **4**
            the following.
        i) $(P \wedge (Q \wedge R)) \vee \neg((P \vee Q) \wedge (R \vee S))$
        ii) $(\neg(P \wedge Q) \vee \neg R) \vee (((\neg P \wedge Q) \vee 7R) \vee S)$

    b) Show that following formula is tautology or not.   **4**

        i) $((P \wedge Q) \rightleftarrows P)$ ii) $((\neg Q \wedge P) \neg Q)$

<div align="center">

OR

</div>

    c) Show that,   **4**
        $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$

    d) Obtain the principle disjunctive normal form of   **4**
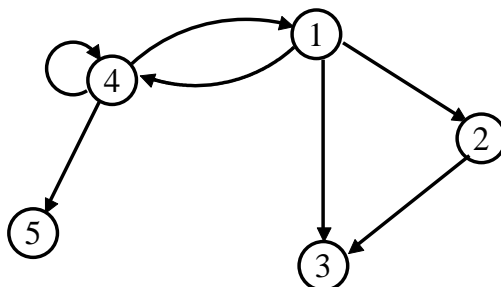 $(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$

Either:

3. a) Determine the value of the following.   **4**
        i) 5_{P_3} ii) 9_{P_3}

b) How many distinguishable permutation of the ladder in the word **4**
   i) MISSI SSIPPI   ii) BOOLEAN

<div align="center">**OR**</div>

c) If $P = \{(1,2),(2,4),(3,3)\}$ and $Q = \{(1,3),(2,4)(4,2)\}$ **4**
   And $P \cup Q, P \cap Q, \text{Dom}(P), \text{Dom}(P \cup Q), \text{Ram}(P), \text{Ram}(Q)$ and $(\text{Ram}(P \cap Q))$

d) Find the relation determined by the diagraph and give id's matrix along with In-degree **4**
   and Out-degree.

Either:

4. a) Consider the binary operation on Q, the set of relational number defined by **4**
   $$a * b = \frac{ab}{2} \; \forall\, a, b \in Q$$
   Determine whether $*$ is
   i) Associative   ii) Commutative

b) Prove the left cancellation law **4**
   $ab = ac \Rightarrow b = c \, \forall\, a, b, c \in G$ (left cancellation law)

<div align="center">**OR**</div>

c) Let $(\{x, y\}, \bullet)$ be a semigroup, where $x \cdot x = y$ show that, **4**
   i) $x \cdot y = y \cdot x$
   ii) $y \cdot y = y$

d) Explain the following. **4**
   i) Group   ii) Subgroup

5. Solve all the question.

a) Prove that **2**
   $$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

b) What is tautology, explain it with suitable example. **2**

c) Explain any one properties of Relations. **2**

d) Write a short note on Abelian Group. **2**

<div align="center">************</div>