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# INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

B.Tech III Semester End Examinations (Supplementary) - February, 2018

**Regulation: IARE – R16**

## DISCRETE MATHEMATICAL STRUCTURES (Common for CSE | IT)

**Time: 3 Hours**

**Max Marks: 70**

**Answer ONE Question from each Unit**

**All Questions Carry Equal Marks**

**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Show that  $(P \wedge Q) \vee (\neg P \wedge Q) \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q) \Leftrightarrow T$ . [7M]
- (b) Explain the principal disjunctive and principal conjunctive normal forms and obtain the principal disjunctive normal form of  $(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$ . [7M]
2. (a) State Tautology and Contradiction. Verify whether the implications are Tautology or Contradiction using truth tables.
  - i.  $[P \rightarrow (Q \rightarrow R)]$
  - ii.  $[(P \rightarrow Q) \wedge (Q \rightarrow R)] \rightarrow (P \rightarrow R)$  [7M]
- (b) Explain the steps involved in principal conjunctive normal form and obtain the principal Conjunctive normal form of  $(P \wedge Q) \vee (\neg P \wedge R)$ . [7M]

### UNIT – II

3. (a) Define the following properties of binary relation with suitable examples reflexive, symmetric, transitive, ir-reflexive and anti-symmetric [7M]
- (b) Let  $(L, \leq)$  be a lattice,  $*$  and  $\oplus$  be two operations such that  $a * b = \text{glb} \{a, b\}$ ,  $a \oplus b = \text{lub} \{a, b\}$ . Prove that both  $*$  and  $\oplus$  satisfy Commutative law, Associative law, Absorption law and Idempotent law. [7M]
4. (a) If the relations R and S are compatibility relations, prove that  $R \cap S$  is compatibility relation. [7M]
- (b) Let  $P = \{ 1, 2, 3, 4, 6, 12 \}$  and  $\leq$  be the relation on P such that  $x \leq y$  if and only if x divides y. Draw the Hasse diagram for the poset  $(P, \leq)$ . [7M]

### UNIT – III

5. (a) Suppose that the license plates of a certain state require 3 English letters followed by 4 digits,
  - i. How many different plates can be manufactured if repetition of letters and digits are allowed?
  - ii. How many plates are possible if only the letters can be repeated?
  - iii. How many are possible if only the digits can be repeated?
  - iv. How many are possible if no repetitions are allowed at all? [7M]
- (b) State Multinomial theorem and Find the coefficient of  $w^2 x^2 y^2 z^2$  in the expansion of  $(w + x + y + z + 1)^{10}$  [7M]

6. (a) Suppose that 200 faculty members can speak French and 50 can speak Russian, while only 20 can speak both French and Russian. How many faculty members can speak either French or Russian? Use principle of inclusion-exclusion. [7M]
- (b) Find the term independent of  $x$  in the expansion of  $(x^2 + \frac{1}{x})^{12}$ . [7M]

**UNIT – IV**

7. (a) Find the coefficient of  $x^{14}$  in  $(1 + x + x^2 + x^3)^{10}$ . [7M]
- (b) Find a particular solution to the following in homogeneous recurrence relation  $a_n - 5a_{n-1} + 6a_{n-2} = 4^n$  for  $n \geq 2$ . [7M]
8. (a) Find the complete solution to the homogeneous recurrence relation  $a_n - 5a_{n-1} + 6a_{n-2} = 4^n$  for  $n \geq 2$ . [7M]
- (b) Solve the recurrence relation  $a_n = a_{n-1} + 2n + 1$  where  $a_0=1$  by substitution method. [7M]

**UNIT – V**

9. (a) Define with an example: [7M]
- (i) Euler circuit
- (ii) Hamiltonian circuit
- (b) Is the following pair of graphs isomorphic? Justify your answer [7M]

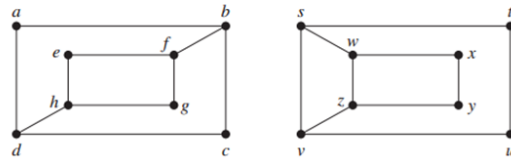


Figure 1

10. (a) Find the depth first spanning tree for the following graph in the order of the vertices is [7M]
- i. a,b,c,d,e,f,g,h
- ii. a,b,c,d,h,g,f,e

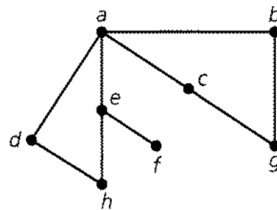


Figure 2

- (b) Determine the chromatic number of the following graph. (Give a careful argument to show that fewer colors will not suffice.) [7M]

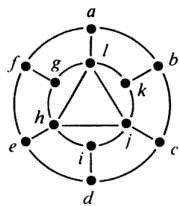


Figure 3

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