Total No. of Questions : 8] *[Total No. of Printed Pages : 3*

Roll No .....

MCA-102

M.C.A. I Semester

Examination, June 2020

Mathematical Foundation of Computer Science

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) If A, B and C are three sets, prove that :

$$A \cap (B \in\ ) = (A \cap B) - (A \cap C)$$ 7

b) Show that the relation R = {(*a*, *b*) : *a*, *b* ∈ I and *a* – *b* is divisible by 3} is an equivalence relation. 7

2. a) Find the following statements are contradiction or tautology. 7

i) $\sim (P \wedge Q) \leftrightarrow (\sim P) \vee (\sim Q)$

ii) $(P \vee Q) \wedge \{P \vee (\sim Q)\} \wedge \{(\sim P) \vee Q\} \wedge \{(\sim P) \vee (\sim Q)\}$

b) Define the following terms with examples : 7

i) Poset

ii) Chain

iii) Lattice

3. a) Prove that the set Z of a all integers with binary operation * defined a * b = a + b + $\forall a,b \in z$ is an abelian group. 7

   b) The intersection of any two normal subgroups of a group is a normal subgroup. 7

4. a) A simple graph with *n* vertices and K components can have at most $(n-k)(n-k+1)/2$ edges, prove it. 7

   b) Define a rooted tree, a binary tree and a spanning tree. Prove that every connected graph has at least one spanning tree. 7

5. a) Let a be *a* numeric function, where : 7

$$a_r = \begin{cases} 0 & , \quad 0 \le r \le 2 \\ 2^{-r} + 7, & r \ge 3 \end{cases}$$

   find forward and backward difference of *a*.

   b) Determine the discrete numeric function corresponding to the following generating function : 7

$$A(z) = \frac{z^5}{\left(5 - 6z + z^2\right)}$$

6. a) Prove that $7^{2n} + 2^{3n-3} \cdot 3^{n-1}$ is divisible by 25, for all $n \in N$. 7

   b) Show that the set of integers which are divisors of 60 is partially ordered set. Also draw its Hasse diagram. 7

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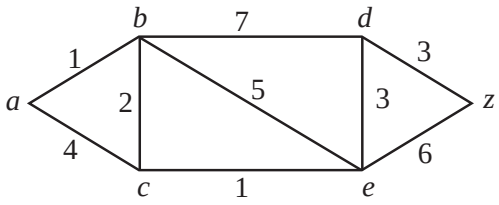
7. a) Prove that any two right cosets of a subgroup are either disjoint or identical. 7

b) Find the shortest path between *a* and *z* for the graph. 7



8. a) Define the following : 7

i) Reducible polynomial

ii) Primitive polynomial

iii) Switching circuit

b) Determine the particular solution for the differential equation. 7

$$a_r - 3a_{r-1} + 2a_{r-2} = 2^r$$

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