

1C7105	Roll No. : _____	Total Printed Pages : <span style="border: 1px solid black; padding: 2px;">3</span>
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**M. C. A. (Sem. I) (Main/Back) Examination, January - 2011**  
**MCA-105 Discrete Mathematics**

Time : 3 Hours]

[Total Marks : 80  
[Min. Passing Marks : 32

*Attempt all questions.*

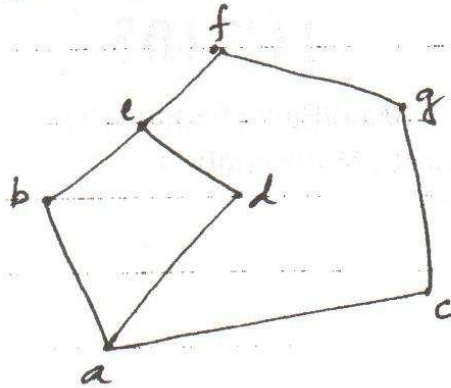
Use of following supporting material is permitted during examination.  
(Mentioned in form No. 205)

1. \_\_\_\_\_ Nil                                  2. \_\_\_\_\_ Nil

- 1
- (a) Define disjoint sets.
  - (b) How many relations can be defined on a set which contains  $n$  elements?
  - (c) Define coset of a subgroup.
  - (d) Write the numeric function for which  $a_0=1$  and  $a_r = 7a_{r-1}$ ,  $r \geq 1$ .
  - (e) What do you mean by Eulerian Path?
  - (f) Explain logical equivalence of two propositions by using suitable example.
  - (g) Define homomorphism of groups.
  - (h) How many words can be formed by using all letters of the word 'MISSISSIPPI'?
  - (i) Define bounded lattice with example.
  - (j) In how many ways can 4 prizes be distributed in 3 students?
- 2
- (a) How many positive integers not exceeding 500 are divisible by 7 or 11?

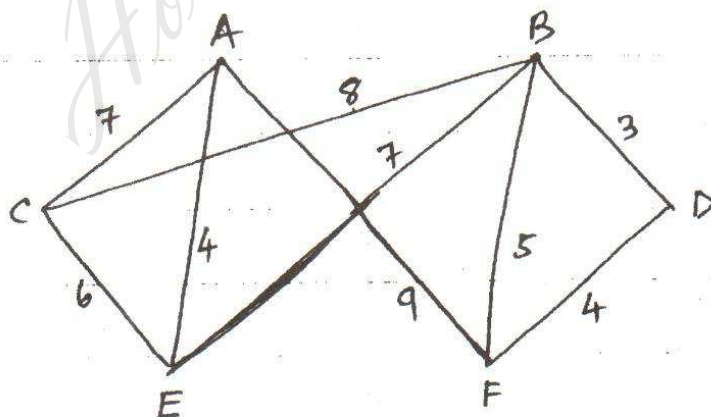


- (b) Give any three topological sorting for the poset whose Hasse diagram is given below.



- (c) Give suitable examples of the graphs which are  
 (i) Both Eulerian and Hamiltonian  
 (ii) Eulerian-Non Hamiltonian.  
 (d) Let  $R$  be a relation in  $N$  defined by  $(x,y) \in R \Leftrightarrow x+2y=8$ . Express  $R$  and  $R^{-1}$  as a sets of ordered pairs.  
 (e) Prove that  $(A \cup B)' = A' \cap B'$ , for any two sets  $A$  and  $B$ .

- 3 (a) Show that  $Z_5 = \{0,1,2,3,4\}$  is an abelian group for the operation  $'+_5'$ .  
 (b) There are 6 white, 4 blue and 5 green balls in a bag. In how many ways the balls are drawn?  
 (i) three white balls  
 (ii) one ball of each colour  
 (c) Find the shortest path between vertices  $C$  and  $D$  in the following weighted graph.



- (d) State Pigeonhole principle and show that among 13 people, there are atleast two people who were born in the same month.



- (e) A grammar  $G$  is specified below. Describe precisely the language,  $L(G)$ , produced by this grammar.

$$G = (V, S, v_0, \rightarrow )$$

$$V = \{v_0, v_1, a, b\}, S = \{a, b\}$$

$$\mapsto : v_0 \mapsto av_1$$

$$v_1 \mapsto bv_0$$

$$v_1 \mapsto a$$

**5×4=20**

- 4 (a) Obtain the principal conjunctive normal form of the formula  $S$  given by  $(\sim P \rightarrow R) \wedge (Q \iff P)$ . By using this obtained PCNF, find out the principal disjunctive normal form of the same formulas.
- (b) Show that the order of a cycle of length  $r$  is  $r$ .
- (c) Write short note on Finite State Machine.

**3x5=15**

- 5 (a) Prove by the principle of mathematical induction that  $n(n+1)(2n+1)$  is divisible by 6 for all  $n \in \mathbb{N}$ .
- (b) If  $R$  and  $S$  are two equivalence relations on a set  $A$ , then prove that  $(R \cap S)$  is also an equivalence relation on  $A$ .

**2x10=20**

