MCA SEM-I CBGS
Discrete Mathematics
27/11/15

Q.P. Code : 25318

(3 Hours) **[Total Marks : 80**

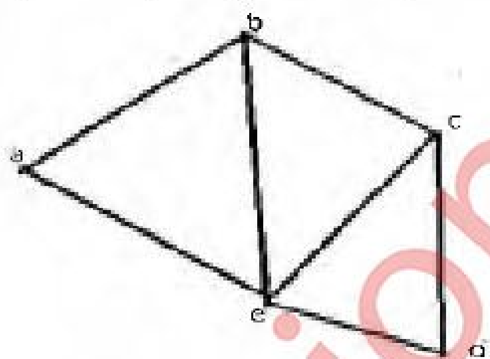
N.B.: (1) Q1. is compulsory, attempt any 4 questions out of remaining six questions
(2) Assume any necessary data to justify the same
(3) Figures to the right indicate full marks
(4) Use of scientific calculator is allowed

Q1 a) Determine whether the relation on the set A is reflective, irreflective, symmetric, asymmetric, antisymmetric or transitive. Give the necessary explanation to your answer. (10)
A=Set of all positive integers, aRb, iff GCD(a,b)=1

Q1 b) State the Tower of Hanoi problem and obtain the corresponding recurrence relation indicating the suitable initial conditions(s). Solve the recurrence relation obtained. (10)

Q2 a) Find the transitive closure of R of the following using by Warshall's algorithm
A={1,2,3,4,5} R={ (1,1) (1,4) (2,2) (3,4) (3,5) (4,1) (5,2) (5,5) } (10)

Q2 b) Find the adjacency list and adjacency matrix for the following graph (05)



Q3 a) Consider (3,6) encoding function e as follows: (10)
e(000) = 000000, e(001) = 000110, e(010) = 010010, e(011) = 010100
e(100) = 100101, e(101) = 100011, e(110) = 110111, e(111) = 110001
Show that the encoding function e is a group code.
Decode the code word 101101 with maximum likelihood technique.

Q3 b) Establish the following result without using truth tables. (use the laws of logic to show the following equivalence) (05)
$(P\to Q)\wedge(R\to Q)\equiv(P\vee R)\to Q$.

Q4 a) Let V = {vo, w, a, b, c} S={a, b, c} (10)
Let → be the relation on V^* given by the relation
1. $V_0 \to aw$ 2. $w\to bbw$ 3. $w\to c$
Consider a phase structure grammar $G=(V, S, v_0, \to)$
(i) Derive the sentence ab^4c. Also draw the derivation tree.
(ii) Derive the sentence ab^6c. Also draw the derivation tree.
(iii) Derive the sentence ab^8c. Also draw the derivation tree.

Q4 b) Find the solution of the recurrence relation defined by $a_n=3a_{n-1}-2a_{n-2}$ with $a_1=5$ (05)

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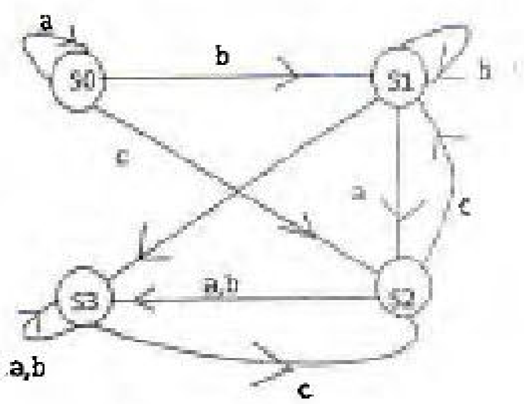
and $a_2=3$

Q5 a) Let A={1,2,3,4,12}. Consider the relation R as aRb iff 'a divides b' Show that R is a partial order relation. Draw the Hasse diagram of the Poset (A,R). (10)

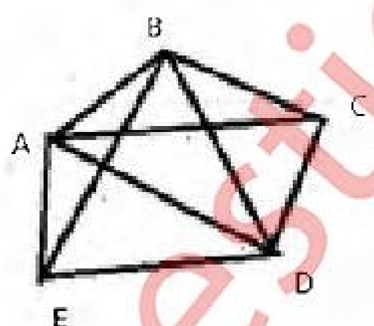
Q5 b) Construct a transition table for a finite state machine whose diagraph is shown below. (05)



Q6 a) Let S=Set of integers. Define the relation R on A=SxS as aRb if and only if $a \equiv b \pmod 2$. (10)
i) Show that R is an equivalence relation
ii) Determine A/R.

Q6 b) If G is a group with identity e. Show that if $a^2 = e$ for all a in G, then every element is its own inverse. (05)

Q7 a) Consider the graph. Find and Euler path or Euler circuit, if exists. If it does not exists, why not? (10)



Q7 b) Let T be the set of even integers. Show that (Z, +) and (T,+) are isomorphic, where Z is the set of integers. (05)

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