**QP CODE : 514103**

(3 Hours) [Total marks: 80]

Note (1) Q1. is compulsory, attempt any four questions out of remaining six questions.
   (2) Assume any necessary data but justify the same.
   (3) Figures to the right indicate full marks.
   (4) Answer to sub-questions should be grouped together.

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

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

Q2. (a) Determine whether the following set together with the binary operation is a 8
      semigroup, a monoid or neither. If it is a monoid, specify the identity. If it is a
      semigroup of a monoid determine whether it is commutative.
      Set S = {1,2,3,6,9,18} where a*b=LCM. (a,b).

   (b) Use generating function method to solve recurrence relation 7
      $a_n = 3a_{n-1} + 2$, $a_0 = 2$

Q3. (a) Obtain the PDNF and PCNF of the following: 8
      $(P \wedge Q) \vee (\sim P \wedge Q \wedge R)$

   (b) Determine the validity of the following argument:- 7
      If I go to my class tomorrow then I must get up early, and if I go to dance
      tonight I will stay up late. If I stay up late and get up early, then I will be
      forced to exist on only five hours of sleep. I simply cannot exist on only five
      hours of sleep. So I must either miss my class tomorrow or not go to the
      dance.

Q4. (a) Let A= {1,2,3,4,12} Consider the partial order relation R of divisibility on A. 8
      i.e. if a, b ∈ A , aRb if and only if a|b. Draw the hasse diagram

   (b) Show that a group G is abelian if and only if $(ab)^2 = a^2 b^2$ the elements a & b 7
      are in G

Q5. (a) Find particular solution of the recurrence relation $a_n = 7a_{n-1} - 10a_{n-2}$, with 8
      initial condition $a_0 = 1$, $a_1 = 8$

   (b) Construct a transition table for a finite state machine whose diagraph is shown 7
      below.
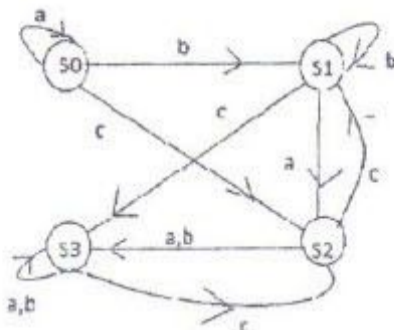
[TURN OVER]

Q6. (a) Find the adjacency list and adjacency matrix for the following graph   8
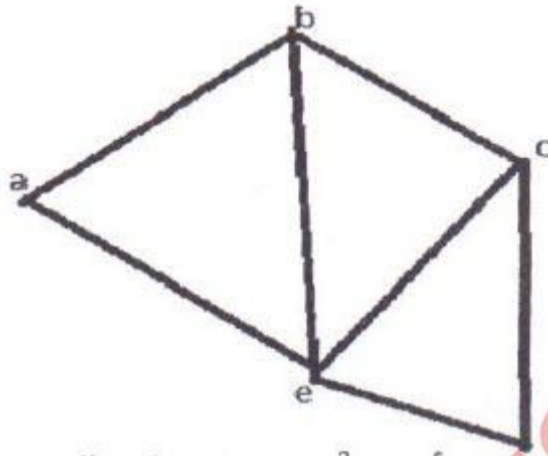
(b) Show that the (2,5) encoding function e: $B^2 \rightarrow B^5$ defined by   7
    e(00)=00000   e(10)=10101
    e(01)=01110   e(11)=11011
is a group code

Q7. (a) Consider the group code defined by e: $B^2 \rightarrow B^5$ such that   8
    e(00)=00000   e(10)=10101
    e(01)=01110   e(11)=11011
Decode the following words relative to maximum likelihood decoding
function (i) 11001   (ii) 10001

(b) Let R be an equivalence relation on the set A={1,2,3,4,5} defined by   7
R={(1,1),(2,2),(3,3),(4,4),(5,5),(1,4),(4,1), (2,4),(4,2),(1,2),(2,1)}. Determine
its equivalence classes of R & find A/R.

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