Instruction: 1) All questions are compulsory.

2) Each question carry equal marks.

Q 1) Solve the following (any 4) [20]

a) Arrange the numbers 6, 7,4,5,3 in ascending order using Bubble sorting algorithm.

b) Define the terms

i) Relation　　ii) Cycle　　iii)Boolean product of two matrices

iv) Symmetric closure　　v) simple path

c) Solve the recurrence relation $a_n = 8a_{n-1} + 10^{n-1}$, with $a_1 = 9$, using generating function.

d) Write a note on Tower of Hanoi.

e) Let A={1,2,3,4,5}. Using Warshall's algorithm find the transitive closure of R whose matrix is given by

$$M_R = \begin{pmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

f) Let a relation R defined on Z^+ as aRb iff a/b then prove that $(Z^+,/)$ is also poset.

g) Define the Composite relation.

Let A={1,2,3}, B={a,b,c}, C={x,y,z}. Let R={(1,b),(2,a),(2,c)} from A to B and S={(a,y),(b,x),(c,y),(c,z)} from B to C. Find SoR, M_{SoR}. Also verify $M_{SoR} = M_R O M_S$.

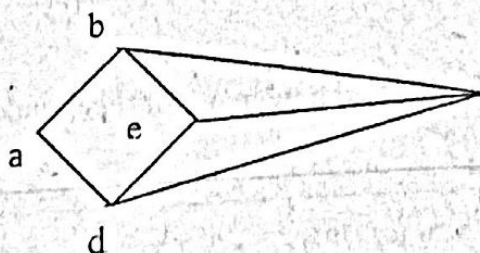h) Solve the recurrence relation $a_n = 7a_{n-1} - 10a_{n-2}$, with $a_0 = 5$, $a_1 = 16$.

Q 2) Solve the following (any 4) [20]

a) Perform a postorder search on the following tree using postorder search algorithm.
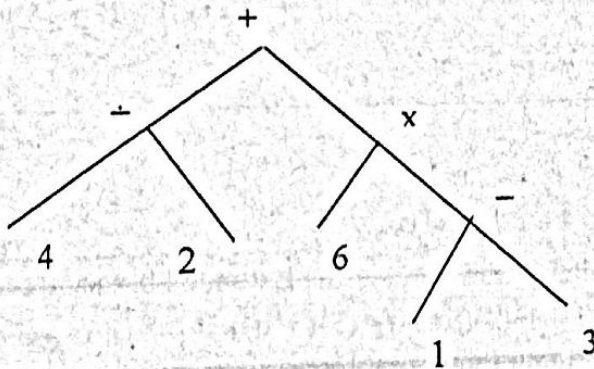
b) Define i) ordered rooted tree

ii) linked list representation using vertex and edge file.

c) Write the Breadth First Search algorithm. Apply it on the following graph starting with vertex 'a'
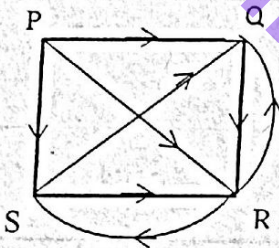
d) Write an algorithm on deleting the value in binary search tree. Use it to delete V=22.
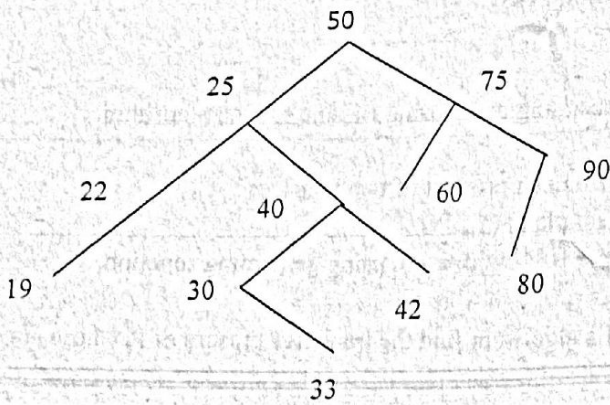
e) i) Build a binary tree for a list- begin, break, else, end, goto, if, then.
   ii) Give adjacency structure and linked representation for the graph,
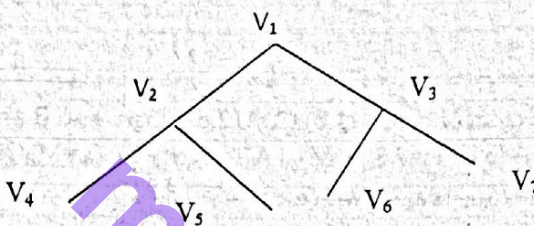
f) Find the Path matrix for the following graph using Warshall's algorithm

g) Define the term i) Binary tree   ii) Complete binary tree   iii) Extended binary tree.

h) i) Construct a tree of the algebraic expression $((7*3)+(4-(5*3)))+(3-(3*6))$.

   ii) Give the adjacency list and adjacency matrix of complete graph of 5 vertices.

Q 3) Solve the following (any 4)   [20]

a) State the Inclusion – exclusion principle.

   How many positive integers not exceeding 100 are divisible by 2,3 or 5?

b) State the Extended pigeonhole principle

   Show that if seven colours are used to paint 60 bicycles, atleast 9 bicycles will be of the same colour.

c) State the sum and product rule.

   How many bit string are there of length 8? Also find how many of them ends with two bits 00?

d) A family of 4 brothers and 3 sisters are to be seated for photograph in one row. In how many ways can they selected i) if all sisters are seat together.

   ii) if no two sisters sit together

e) State the Binomial theorem. Use it to prove
i) $\sum_{k=0}^{n} \binom{n}{k} = 2^n$ for non-negative integer n.
ii) $\sum_{k=0}^{n} \binom{n}{k}(-1)^k = 0$, for positive integer n.
f) State and prove Vandermonde's identity.
g) State and prove Pascal's identity.
h) Consider following FSA. Find states, input letters, initial state, accepting state, $f(s_1, b)$, write it's state table
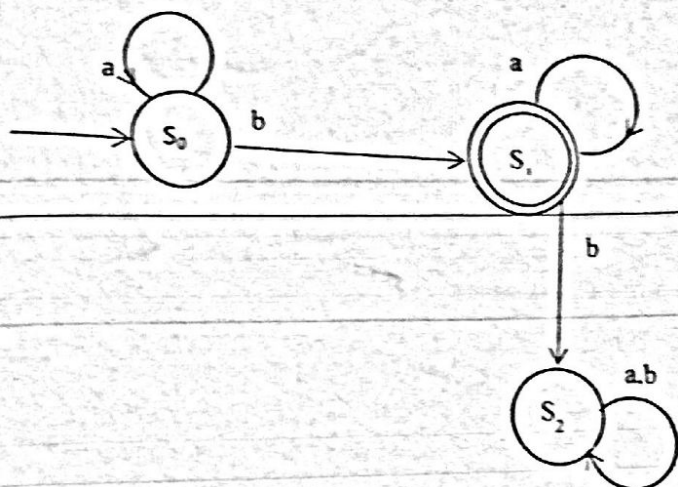
Q 4) Solve the following (any 3)   [15]
a) Solve the non-homogenous recurrence relation $a_n = 5a_{n-1} - 6a_{n-2} + 7^n$.
b) Write a note on Binary operations on the graph.
c) Use Shortest-Path algorithm to find shortest path between the vertices of the following graph.
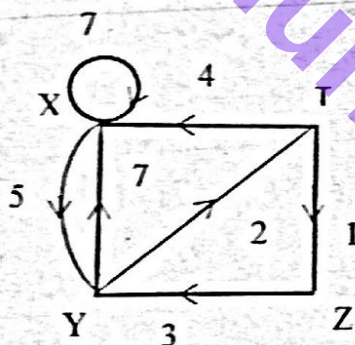
d) Define the term Grammar. Write a note on the types of Grammar.
e) Define a) Turning Machine   b) finite state automata   c) types of languages.
f) Determine whether the relation R whose diagraph is given is reflexive, irreflexive, symmetric, asymmetric.