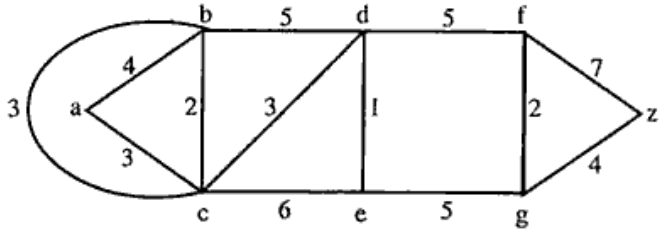
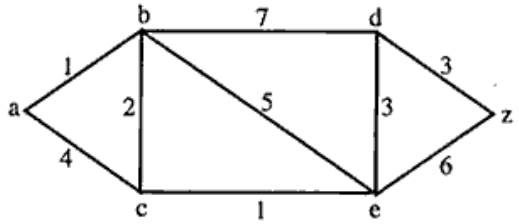
8. a) Draw the minimum spanning tree for the following graph:



b) Apply Dijkstra's algorithm to the given graph and find the shortest path from a to z:



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Total No. of Questions :8] *[Total No. of Printed Pages :4*

Roll No .....

MCTA-101

M.E./M.Tech. I Semester

Examination, June 2016

Mathematical Foundations of Computer Application

Time : Three Hours

Maximum Marks: 70

Note : Attempt any five questions. All questions carry equal marks.

1. a) A survey among the students of a college. 65 study Hindi, 45 study Spanish and 42 study Japanese, further 20 study Hindi and Spanish, 25 study Hindi and Japanese, 15 study Spanish and Japanese and 8 study all the languages.

   i) How many students are studying at least one language?

   ii) How many students are studying only Hindi?

   b) If I be the set of all integers and if the relation R be defined over the set I by xRy if $x-y$ is an even integer, where $x, y \in I$, show that R is an equivalence relation.

2. a) Prove that in a distributed lattice $(L, \wedge, \vee)$, $(a \wedge b) \vee (b \wedge c) \vee (c \wedge a) = (a \vee b) \wedge (b \vee c) \wedge (c \vee a)$ holds for all $a, b, c \in L$.

   b) Express in the principle disjunctive normal form:

   $f(x, y, z) = (x' y)' (x' + xyz')$

3. a) Prove that the following statement is logically equivalent:

   $(p \rightarrow q) \vee r \equiv (p \vee r) \rightarrow (q \vee r)$

b) Show that the following proposition is tautology:

$(p \wedge q) \vee (p \wedge \sim q) \vee (\sim p \wedge q) \vee (\sim p \wedge \sim q)$

4. a) Show that $L = \{a^K b^K \mid K \geq 1\}$ is not a finite state language.

b) Show that the two machines shown below are equivalent:

States	Input 0	Input 1	Output
A	B	C	0
B	B	D	0
C	A	E	0
D	B	E	0
E	F	E	0
F	A	D	1
G	B	C	1

States	Input 0	Input 1	Output
A	H	C	0
B	G	B	0
C	A	B	0
D	D	C	0
E	H	B	0
F	D	E	1
G	H	C	1
H	A	E	0

5. a) Draw finite state machine for

i) Set of string of 0's and 1's each of which ends with 011.

ii) Set of string of 0's and 1's with even 0's.

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

i) $A(Z) = \dfrac{Z^5}{5 - 6Z + Z^2}$

ii) $A(Z) = \dfrac{(1+Z)^2}{(1-Z)^4}$

6. a) The solution of the recurrence relation is

$a_r = A a_{r-1} + B 3^r,\ r \geq 1$

$a_r = C 2^r + D 2^{r+1},\ r \geq 0$

Given $a_0 = 19$, $a_1 = 50$, determine A, B, C, D.

b) Solve the recurrence relation

$a_r - a_{r-1} - 6a_{r-2} = 3^r (r^2 + 2r - 1)$

Given $a_0 = 0$, $a_1 = 1$

7. a) Determine the particular solution for the difference equation:

$a_r - 2a_{r-1} = f(r)$ where $f(r) = 7r$

b) Determine a minimum Hamiltonian circuit for the graph given below: