Unit - V

5. a) Let a and b be the two numeric functions, where

$$a_r = \begin{cases} 0 & ,0 \le r \le 2 \\ 2^{-r}+7 & ,r \ge 3 \end{cases}$$

and $b_r = \begin{cases} 5-2^r & ,0 \le r \le 1 \\ r+3 & ,r \ge 2 \end{cases}$

find $a+b$.

b) Find $a * b$, where $a_r = \begin{cases} 1 & ,0 \le r \le 2 \\ 0 & ,r \ge 3 \end{cases}$, $b_r = \begin{cases} 1 & ,0 \le r \le 2 \\ 0 & ,r \ge 3 \end{cases}$

c) Determine the generating function of the numeric function a_r, where

$$a_r = \begin{cases} 2^r & , \text{ if } r \text{ is even} \\ -2^r & , \text{ if } r \text{ is odd} \end{cases}$$

d) Solve the recurrence relation $a_r - 7a_{r-2} - 6a_{r-3} = 0$ with initial conditions $a_0 = 9$, $a_1 = 10$, $a_2 = 32$.

OR

Solve the recurrence relation

$a_r - 5a_{r-1} + 6a_{r-2} = 2 + r$, $r \ge 2$

with boundary conditions $a_0 = 1$ and $a_1 = 1$.

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4

Roll No ....

MCA - 102

M.C.A. I Semester

Examination, December 2014

Mathematical Foundation of Computer Science

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each question are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a) Consider the relation $R = \{(i, j) / |i-j| = 2\}$ on $\{1, 2, 3, 4, 5, 6\}$. Is R is transitive?

b) Prove the De Morgan's Law of sets.

c) Show that the mapping $f : R \to R$ be defined by $f(x) = ax+b$, where $a, b, x \in R$, $a \ne 0$ is invertible. Define its inverse.

d) Show that $n^2 > 2n+1$ for $n \ge 3$ by mathematical induction.

OR

If R be a relation in the set of integers Z defined by $R = \{(x, y) : x \in z, y \in z, (x-y)$ is divisible by $6\}$. Then prove that R is an equivalence relation.

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Unit - II

2\. a) Write an equivalent expression for $(p \rightarrow q \wedge r) \vee (r \leftrightarrow s)$ which contains neither the biconditional nor the conditional.

b) Show that $(p \vee q) \wedge (\sim p \wedge \sim q)$ is a contradiction.

c) Let $X = \{1, 2, 3, 4, 5, 6\}$ and/ is a partial order relation on X. Draw the, Harse diagram of $(X, 1)$

d) Show that every chain is a distributive lattice.

OR

If $(L, \vee, \wedge)$ is a complemented distributive lattice, then De Morgan's laws

$(a \vee b)' = a' \wedge b'$ and $(a \wedge b)' = a' \vee b'$ hold for all $a, b \in L$.

Unit - III

3\. a) Show that the binary operation $*$ defined on $(R, *)$ where $x * y = x^y$ is not associative.

b) Prove that the identity element of a subgroup is the same as that of the group.

c) Define :

i) Subgroup

ii) Cosets

iii) Normal subgroup

d) Prove that the fourth roots of unity $1, -1, i, -i$ form an abelian multiplicative group.

OR

Show that every field is an integral domain.

Unit - IV

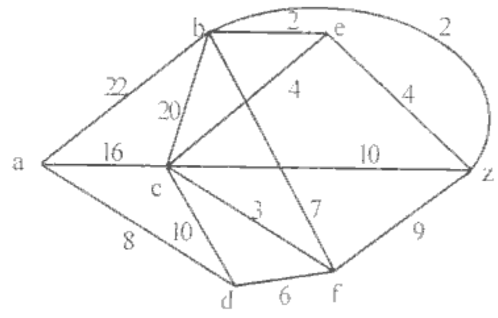
4\. a) Define with example:

i) Complete graph ii) Regular graph

b) Give an example of a graph which is Hamiltonian but non-Eulerian.

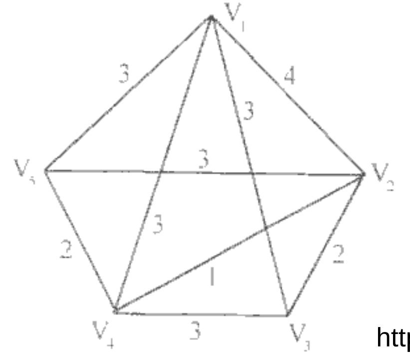
c) Show that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$.

d) Determine a shortest path between the vertices a to z as given below:



OR

Find the minimal spanning tree of the weighted graph.



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