

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS / BCA / SEM-3 / BM (BCA)-301 / 2010-11**

**2010-11**

**MATHEMATICS FOR COMPUTING**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP - A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *one* of the following :

$$10 \times 1 = 10$$

- i) Maximum number of edges with  $n$  vertices in a completely connected graph is

a)  $(n - 1)$

b)  $\frac{n}{2}$

c)  $\frac{(n - 1)}{2}$

d)  $\frac{n(n - 1)}{2}$

ii) A square matrix is said to be symmetric iff

a)  $A = -(A)$                       b)  $A^T = A$

c)  $A^T = -A$                       d)  $A = A.$

iii) If  $R_1$  and  $R_2$  are two Regular expressions (R.E.) then

$R_1 + R_2$  is

a) R.E.                      b) CFG

c) CSG                      d) Regular Grammar.

iv) Prim's Algorithm is used to find the minimal spanning tree of a

a) Dense graph                      b) Sparse graph

c) Null graph                      d) Normal graph.

v) A simple graph has

a) no self loop                      b) no parallel edges

c) both (a) and (b)                      d) none of these.

vi) The generating function of  $\{ 1, 1, 1, 1, \dots \}$  is

a)  $\frac{1}{1-x}$

b)  $\frac{1}{1+x}$

c)  $\frac{1}{(1+x)(1-x)}$

d) none of these.

vii) A grammar is said to be regular if it is of

a) Type-0

b) Type-I

c) Type-2

d) Type-3.

viii) How many bit strings of length 10 contain exactly four 1's ?

a) 120

b) 720

c) 386

d) 210.

ix) Solution of the recurrence relation  $a_n = 2a_{n-1} + 1$  with  $a_0 = 0$  is

a)  $1 - 2^n$

b)  $2^n - 2$

c)  $2^{n-1} - 1$

d)  $2^n - 1.$

- x) Number of four-digit number formed by the digits  
3, 1, 3, 1 is
- a) 5                                      b) 10
- c) 20                                      d) 6.
- xi) How many permutations of the letters ' $A B C D E F G$ '  
contain the string ' $B C D$ ' ?
- a) 24                                      b)  $\lfloor 6$
- c) 120                                     d) 0.
- xii) If a binary tree has 20 pendant vertices, then the  
number of internal vertices of the tree is
- a) 20                                      b) 21
- c) 23                                      d) 19.

**GROUP - B**

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

2. Let  $A = \{1, 2, 3, 4\}$  and  $R = \{(1, 1), (2, 2), (3, 3), (4, 4), (1, 2), (1, 3), (3, 2)\}$ . Is  $R$  is equivalence relation ? Explain.
3. Prove that  $((P \wedge \rightarrow Q) \rightarrow R) \rightarrow (P \rightarrow (Q \vee R))$  is a tautology.

4. Find out the characteristic roots for  $a_n + 4a_{n-1} + 3a_{n-2} = 0$  and hence solve it.
5. Prove that for a graph  $G = (V, E)$ , there can be even number of odd vertices.
6. Show that there exists no simple graph with five vertices having degrees 4, 4, 4, 2, 2.

**GROUP - C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Solve the following recurrence relation using generating function  $a_n - 2a_{n-1} + a_{n-2} = 2^{n-2}$  for  $n \geq 2$  &  $a_0 = 1, a_1 = 5$ .
- b) Show that a simple graph with  $n$  vertices and  $k$  components has at most  $\frac{(n-k)(n-k+1)}{2}$  edges.  $7 + 8$
8. a) Find the Grammar on the set of terminals  $\{a, b\}$  that generates the language  $L = \{a, ab, ab^2, ab^3, \dots\}$ .
- b) Draw the transition diagram for the FSA with  $I = \{a, b\}$ ,  $Q = \{q_0, q_1, q_2\}$ ,  $F = \{q_0, q_1\}$  and  $\delta$  is given by

$\delta$	$a$	$b$
$q_0$	$q_0$	$q_1$
$q_1$	$q_0$	$q_2$
$q_2$	$q_2$	$q_2$

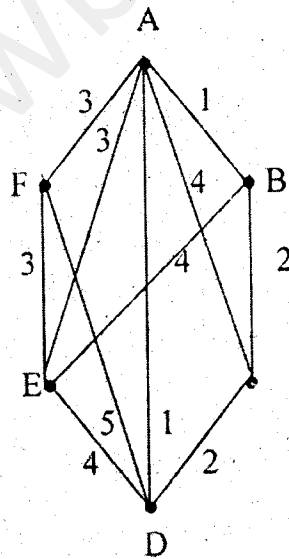
$7 + 8$

9. a) Find the CNF of the following statement :

$$\neg (p \vee q) \leftrightarrow (p \wedge q)$$

- b) There are 50 students in each of the senior or junior classes. Each class has 25 male and 25 female students. In how many ways can an eight-student committee be formed so that there are four females and three seniors in the committee ?

10. a) Find by Kruskal's Algorithm a minimal spanning tree from the following graph G.



- b) Draw the graph having the following matrices as their adjacency matrices.

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

8 + 7

11. a) How many selections any number at a time, may be made from 3 white balls, 4 green balls, 1 red ball and 1 black ball, if at least one must be chosen ?

- b) How many integral solutions are there of  $x_1 + x_2 + x_3 + x_4 + x_5 = 30$

where  $x_1 \geq 2, x_2 \geq 3, x_3 \geq 4, x_4 \geq 2, x_5 \geq 0$ .

- c) Solve the following recurrence relation :

$$a_r - 6a_{r-1} + 8a_{r-2} = r \cdot 4^r \text{ where } a_0 = 8 \text{ and } a_1 = 22.$$

- d) Find the characteristic roots of the following recurrence relation :

$$a_n - 3a_{n-1} - 4a_{n-2} = 0.$$

3 + 4 + 5 + 3

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