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, ... } 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 $((P \wedge \to Q) \to R) \to (P \to (Q \vee R))$ 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 $L = \{ a, ab, ab^2, ab^3, \ldots \}$.

   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 δ is given by

δ	a	b
q_0	q_0	q_1
q_1	q_0	q_2
q_2	q_2	q_2

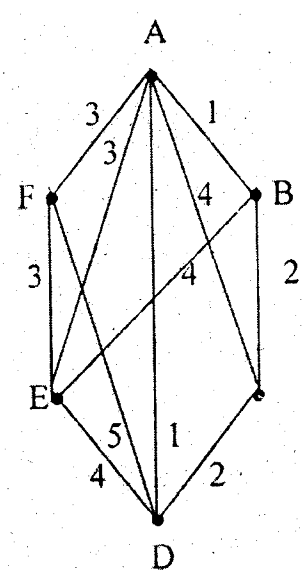
7 + 8

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

c) Solve the following recurrence relation :

$a_r - 6a_{r-1} + 8a_{r-2} = r.4^r$ where $a_0 = 8$ 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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