Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/BCA/SEM-3/BM-301/2011-12

2011

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 *ten* of the following : $10 \times 1 = 10$

   i) The mathematical model of a Mealy Machine is a

   a) 5-tuple b) 4-tuple

   c) 6-tuple d) none of these.

   ii) A regular language is accepted by

   a) every DFA b) every NFA

   c) no DFA d) at least one DFA.

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

   a) 120 b) 720

   c) 210 d) 386.

iv) If a graph has 5 vertices and 7 edges then the size of its adjacency matrix is

a) 5×5 b) 7×7

c) 5×7 d) 7×5.

v) Number of elements contained in an incidence matrix of a digraph is

a) 1 b) 2

c) 3 d) none of these.

vi) 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) $2^n - 1$.

vii) If δ is transition function of a mealy machine then for any state q and input $a, \delta(q, a) =$

a) an input b) a state

c) an output d) none of these.

viii) The generating function of the sequence < 0, 1, 0, 0, 1, 0, 0, 1 ... > is

a) $\frac{x}{1-x}$ b) $\frac{x}{1-x^3}$

c) $\frac{1}{1-x}$ d) $\frac{1}{1-x^2}$.

ix) A spanning tree has

a) only one circuit b) two circuits

c) no circuit d) none of these.

x) The type-3 grammar in relation to the automata theory is known as

a) context sensitive grammar

b) regular grammar

c) context free grammar

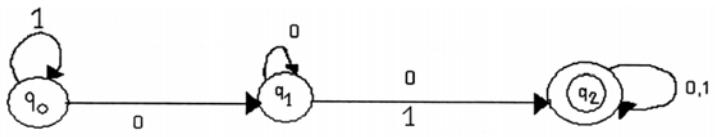
d) none of these.

xi) If $n! = x(n-2)!$ then x =

a) n b) $n-1$

c) $n(n-2)$ d) $n(n-1)$.

xii) The automata



accepts the string

a) 111 b) 01

c) 111 d) none of these.

xiii) The generation function for the sequence 1, 2, 3, 4 ... is

a) $(1+2x)^{-1}$ b) $(1-2x)^{-1}$

c) $(1-x)^{-2}$ d) $(1+x)^{-2}$.

xiv) $2n < n!$ is true for

a) $n < 4$ b) $n > 4$

c) $n \geq 4$ d) $n = 4$.

xv) No. of four digit numbers formed by digits 3, 1, 3, 1 is

a) 5 b) 10

c) 20 d) 6.

xvi) The proposition $p \wedge (q \wedge \sim q)$ is a

a) contradiction b) tautology

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

GROUP – B

(Short Answer Type Questions)

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

2. Prove that a tree with n vertices has $(n - 1)$ edges.
3. Write short notes on Euler path and Hamilton path.
4. 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 juniors in the committee ?
5. Find the generating function corresponding to the sequence $\{1, -1, 1, -1, 1, -1 \ldots.\}$.
6. Prove that ${}^{n+1}C_r = {}^{n}C_{r-1} + {}^{n}C_r$.

7. Construct the graph or digraph corresponding to the following incidence matrix :

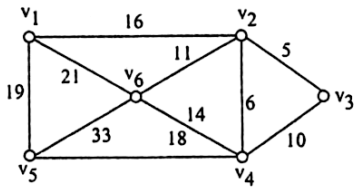
$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

GROUP – C
(Long Answer Type Questions)

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

8. a) Write Kruskal's Algorithm for minimal spanning tree.

   b) Find the minimal spanning tree of the following labelled connected graph by Kruskal's Algorithm.



   c) How many permutations can be made out of the letters of the word 'Basic' that

      i) begin with B ?

      ii) end with C ? $5 + 5 + 5$

9. a) Write CNF & DNF of the following statement :

   $p \rightarrow (p \wedge (q \rightarrow p))$

   b) Verify whether the argument given below is valid or not :

   If I like Mathematics then I will study.

   Either I do not study or I pass the examination.

   If I do not graduate then I did not pass Mathematics.

   ... If I like Mathematics, then I will graduate.

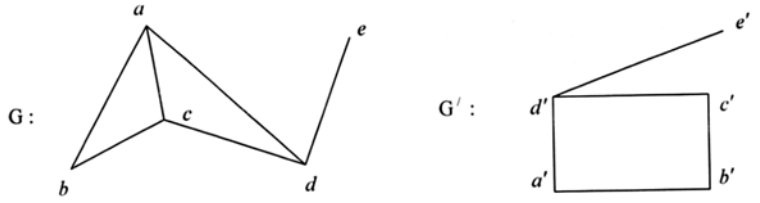
c) Prove the following equivalence :

$p \Leftrightarrow (p \wedge q) \vee (p \wedge \sim q)$ 5 + 5 + 5

10. a) Draw the graph represented by the given adjacency matrix :

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

b) Examine if the following two graphs are isomorphic :



8 + 7

11. a) Prove that the number of vertices of odd degree in a graph is always even.

b) Show that $(2n) ! = 2^n . n ! \{ 1, 3, 5, ..., (2n\text{-}1) \}$.

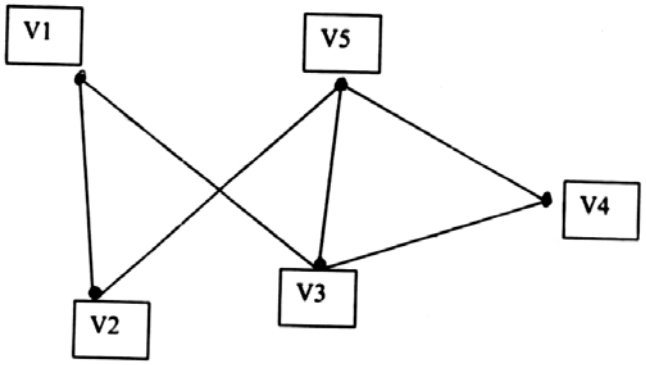
c) In how many ways can three prizes be distributed among 4 boys when,

i) no one gets more than one prize ?

ii) a boy can get any number of prizes ? 5 + 5 + 5

12. a) Solve $a_n - 5a_{n-1} + 6a_{n-2} = 0$, where $a_0 = 2$, $a_1 = 5$.

b) Find the incidence matrix of the following graph :



7 + 8

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