Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/BCA/SEM-3/BM-301/2012-13

2012

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

a) contradiction b) tautology

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

ii) The type of the grammar G which consists of productions $P = \{S \to bAB, A \to aB, abAbb \to abbb\}$ is

a) Type-0 b) Type-1

c) Type-2 d) Type-3.

iii) ρ is a relation on the set $R \times R$ of ordered pairs of real numbers as follows :

F or all (a, b), (c, d) ε $R \times R$ (a, b) (c, d) $\Leftrightarrow$ $a = c$

Then ρ is

a) symmetric only

b) symmetric but not reflective

c) equivalence relation

d) none of these.

iv) Let $A = R - \{3\}$ and $B = R - \{1\}$.

If $f : A \to B : f(x) = \dfrac{x-2}{x-3}$ then

a) f is into b) f is surjective

c) f is bijective d) none of these.

v) A pseudo graph

a) must has loops

b) does not have loop

c) must have parallel edges

d) none of these.

vi) Minimum height of a n vertex binary tree is

a) $\dfrac{n-1}{2}$ b) $\dfrac{n+1}{2}$

c) $\lfloor \log_2^{(n+1)} - 1 \rfloor$ d) $\left| \log_2^{(n+1)} - 1 \right|$.

vii) If the general term of the sequence $\{a^k\}$ be a^k which will be the generating function ?

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

c) $\frac{k}{1-x}$ d) $\frac{1}{1-ax}$.

viii) A simple graph with n vertices has maximum

a) $\frac{n(n-1)}{2}$ edges b) $(n-1)$ edges

c) $\frac{n(n+1)}{2}$ edges d) n^2 edges.

ix) If a language L is accepted by a automata M then

a) every string in L is accepted by M

b) at least one string in L is accepted by M

c) no string of L is accepted by M

d) only one string is accepted by M.

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

a) 1 b) 2

c) 3 d) none of these.

xi) The degree of the origin of the longest path in a tree is

a) 1 b) 2

c) 3 d) none of these.

xii) Choose the correct statement :

a) Path is an open walk

b) Every walk is trail

c) Every trail is a path

d) A vertex cannot appear twice in a walk.

xiii) How many permutations of the letters *ABCDEFG* contain in the string *BCF* ?

a) 24 b) 6!

c) 120 d) 252.

xiv) A spanning tree has

a) one circuit b) no circuit

c) two circuits d) none of these.

xv) You have five friends. In how many ways can you invite them ?

a) 51 b) 36

c) 25 d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Prove that $((P \wedge \sim Q) \rightarrow R) \rightarrow (P \rightarrow (Q \vee R))$ is a tautology.

3. In an examination a minimum is to be secured in each of the 5 subjects for a pass. In how many ways can a candidate fail ?

4. Find the sequence corresponding to the generating function $\frac{3+7x}{(1-x)(1+4x)}$.

5. Suppose G is a non-directed graph with 12 edges. If G has 6 vertices each of degree 3 and rest have degree less than 3, find the minimum number of vertices in G.

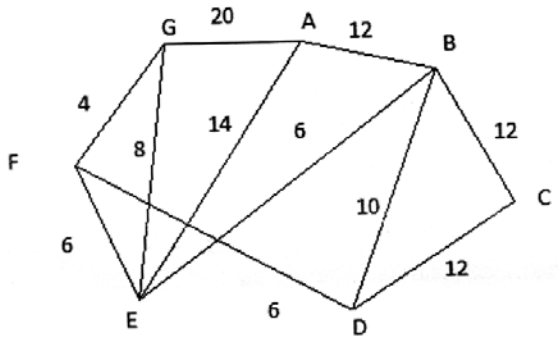
6. What is Deterministic finite Automata (DFA) ? Explain with suitable example.

7. Write a short note on Moore Machine.

GROUP – C
(Long Answer Type Questions)

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

8. a) Find by Prim's algorithm a spanning tree with minimum weight from the graph given below. Also calculate total weight of spanning tree.



b) Prove that a connected graph n with $n - 1$ vertices and edges is a tree.

c) Determine the value of n if $4 \times {}^{n}P_3 = {}^{n+1}P_3$. 6 + 6 + 3

9. 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

10. a) Write DNF of the following statement :

$\neg\{\neg(p \leftrightarrow q) \wedge r\}$

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

All mammals are animals. Some mammals are two-legged. Therefore, some animals are two-legged.

c) Prove the following equivalence :

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

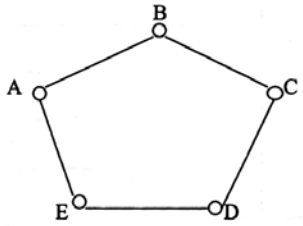
11. a) What is Grammar ?

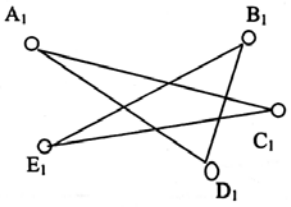
b) Construct the sate diagram for finite state machine with state table as under :

State	Input		Output	
	0	1	0	1
$\rightarrow S0$	$S1$	$S1$	1	0
$S1$	$S3$	$S0$	1	0
$S2$	$S1$	$S0$	1	0
$S3$	$S2$	$S1$	0	0

5 + 10

12. a) Examine if the following two graphs are isomorphic :





b) Solve the following recurrence relation using generating function :

$a_n - 2a_{n-1} + a_{n-2} = 2^{n-2}$ for $n \geq 2$ and $a_0 = 1, a_1 = 5$.

c) Write short notes on any *two* of the following :

i) Spanning Graph

ii) Hamiltonian Graph

iii) Digraph. 5 + 5 + 5

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