

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 $P = \{ S \rightarrow bAB, A \rightarrow aB, abAbb \rightarrow abbb \}$ 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 :

$$\text{For all } (a, b), (c, d) \in R \times R \quad (a, b) (c, d) \Leftrightarrow a = c$$

Then ρ is

- a) symmetric only
 - b) symmetric but not reflective
 - c) equivalence relation
 - d) none of these.
- iv) Let $A = R - \{3\}$ and $B = R - \{1\}$.

$$\text{If } f : A \rightarrow B : f(x) = \frac{x-2}{x-3} \text{ then}$$

- 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) $\frac{n-1}{2}$
 - b) $\frac{n+1}{2}$
 - c) $\lfloor \log_2^{(n+1)} - 1 \rfloor$
 - d) $\lceil \log_2^{(n+1)} - 1 \rceil$.

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 *ABCDEFGH* 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
$$\frac{3+7x}{(1-x)(1+4x)}.$$

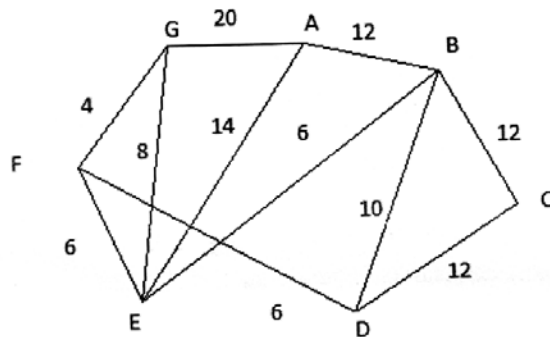
5. Suppose G is a non-directed graph with 12 edges. If G has 6 vertices each of degree 3 and rest have degree less than 3, find the minimum number of vertices in G .
6. What is Deterministic finite Automata (DFA) ? Explain with suitable example.
7. Write a short note on Moore Machine.

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 $4 \times {}^nP_3 = {}^{n+1}P_3$. $6 + 6 + 3$
9. a) Find the grammar on the set of terminals $\{ a, b \}$ that generates the language $L = \{ a, ab, ab^2, ab^3, \dots \}$.

- 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 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

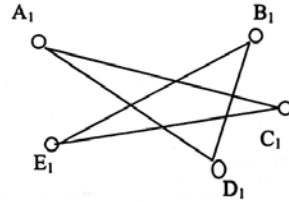
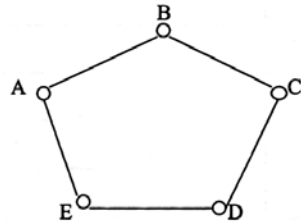
11. a) What is Grammar ?

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

State	Input		Output	
	0	1	0	1
$\rightarrow S_0$	S_1	S_1	1	0
S_1	S_3	S_0	1	0
S_2	S_1	S_0	1	0
S_3	S_2	S_1	0	0

5 + 10

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



- b) Solve the following recurrence relation using generating function :

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

- 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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