MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : BM-301

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 alternative for *any ten* of the following: 1×10=10

(i) A grammar is said to be regular if it is of

(a) Type–0 (b) Type–1

(c) Type–2 (d) Type–3

(ii) How many non-isomorphic trees are there with the number of vertices equal to 4?

(a) 1 (b) 2

(c) 3 (d) 4

(iii) Choose the correct statement:

(a) Euler line is a open path. (b) Euler line is a open trial.

(c) Euler line is a open walk. (d) Euler line is a closed path.

(iv) The solution of recurrence relation $a_n - a_{n-1} = 2^n, a_0 = 2$ is

(a) $a_n = 2n$ (b) $a_n = 2^n$

(c) $a_n = 2(n+1)$ (d) $a_n = 2^{n+1}$

(v) Out of the following statements the formula for tautology is

(a) $(p \vee q) \rightarrow q$ (b) $p \vee (q \rightarrow p)$

(c) $p \vee (p \rightarrow q)$ (d) $p \rightarrow (p \rightarrow q)$

(vi) The type of the grammar, which consists of the following productions:

$s \to aA, A \to aAB, B \to bb, A \to Aa$

(a) Type–0 (b) Type–1

(c) Type–2 (d) Type–3

(vii) The generating function of the sequence $\{2, 0, 2, 0, 2, 0, \ldots \ldots \ldots\}$ is

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

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

(viii) If a tree has 10 vertices, then number of its edges is

(a) 8 (b) 11

(c) 10 (d) None of these

(ix) Number of edges in a cubic graph on 4 vertices is

(a) 3 (b) 4

(c) 5 (d) 6

(x) Which one is true?

(a) Type–0 grammar is also Type–1 grammar. (b) Type–1 grammar is also Type–0 grammar.

(c) Type–2 grammar is also Type–3 grammar. (d) Type–1 grammar is also Type–3 grammar.

(xi) What is the minimum number of vertices necessary for a graph with 6 edges?

(a) 2 (b) 3

(c) 4 (d) 5

(xii) If a binary tree has 14 pendant vertices, then find the number of internal vertices.

(a) 2 (b) 3

(c) 4 (d) 5

Group – B

(Short Answer Type Questions)

Answer *any three* of the following. 5×3=15

2. Draw the graphs for the following incidence matrix I:

$$I = \begin{bmatrix} 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

3. Prove by mathematical induction $3^{2n} - 8n - 1$ is divisible by 64.

4. If you arrange all the letters of the word "*SENJUTI*". How many possible ways are there such that no two vowels come together?

5. Prove whether $[(P \rightarrow Q) \rightarrow R] \rightarrow [P \rightarrow (Q \vee R)]$ is a tautology or not.

6. 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.

Group – C

(Long Answer Type Questions)

Answer *any three* of the following. 15×3=45

7. (a) Define bi-partite and complete bi-partite graph with example.

   (b) Show that the number of vertices in a binary tree is always odd number.

   (c) Draw the three distinct connected graphs from the degree sequence {1, 3, 3, 4, 5} which are not isomorphic. 5+5+5=15

8. (a) Define Deterministic Finite Automata and Non-deterministic Finite Automata.

   (b) Draw the DFA for the following transition function (δ):

Present state	Input 0	Input 1
	Next state	Next state
A	B	C
B	A	C
C	B	A

   (c) Convert the NFA, $M = \langle \{q_0, q_1, q_2\}, \{0, 1\}, \delta, q_0, q_2 \rangle$ to DFA, δ is given below:

Present state	Input 0	Input 1
	Next state	Next state
$\rightarrow a$	a	b
b	c	a, c
(c)	b	a

5+5+5=15

9. (a) Use mathematical induction to prove that $n^3 + 2n$ is divisible by 3.

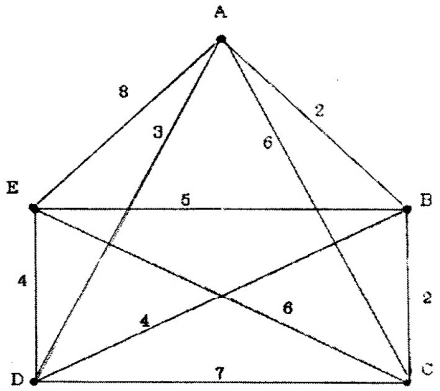
(b) Solve the recurrence relation $a_n - 6a_{n-1} + 5a_{n-2} = 0, n \geq 2, a_0 = 2, a_1 = 5.$

(c) Draw the transition diagram of a automation M that accepts all odd numbers. 5+5+5=15

10. (a) Prove that the number of odd vertices in a graph is always even.

(b) Define grammar.

(c) Find the minimal spanning tree of the following graph by Kruskal's algorithm (show intermediate steps): 5+3+7=15



11. (a) Let $\sum = (a, b)$. Write the grammar for the language $L = \{a^n b^{n+1}; n \geq 0\}$.

(b) There are 15 shades of colour pencils in a shop. In how many ways can 5 pencils be purchased such that—

(i) all are of different shades, and

(ii) all are of the same shades

(c) Test whether the following two graphs are isomorphic to each other or not. 5+5+5=15