

Time: 3 Hours

Max. Marks: 80

NB:

1. Question No. 1 is compulsory and solve any THREE questions from remaining questions
2. Assume suitable data if necessary
3. Draw clean and neat diagrams

Q.1 Attempt any four

Marks

- a. Show using truth table that the statements $(p \rightarrow q)$ and $(\sim p \vee q)$ are logically equivalent. 5
- b. Design a DFA with $\Sigma = \{0, 1\}$ accepts the only input 101. 5
- c. Explain mealy and Moore machine, the O/P depends upon and explain with proper diagram. 5
- d. Calculate union of two Regular Expression. With proper steps
 $RE1 = a(aa)^*$ and $RE2 = (aa)^*$ 5
- e. Prove using Mathematical Induction that $1 + 3 + 5 + \dots + (2n - 1) = n^2$ 5

Q.2.a. Define with example Euler path, Euler circuit, Hamiltonian path, and Hamiltonian circuit. 10

b. Define and give the Example of Injective, Surjective & Bijective function. Check the Injectivity and Surjectivity for the following function: $f: \mathbb{N} \rightarrow \mathbb{N}$ given by $f(x) = x^2$ 10

Q.3.a Differentiate between DFA and NFA. 5

b. Prove that Statement $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a tautology. 5c. Consider the set $A = \{4, 5, 6, 7\}$. Let R be the relation \leq on A. Draw the directed graph and the Hasse diagram of R. 10

Q.4.a. What is Dijkstra's Algorithm? Working Example of Dijkstra's Algorithm 10

b. Explain Warshall's algorithm. Consider the set $A = \{1, 4, 7, 8\}$ and $R = \{(1, 4), (4, 7), (7, 4), (1, 8)\}$. Find out the transitive closure of R using Warshall's algorithm 10

Q.5. a Explain isomorphism in graph. Is it possible to draw a graph with 5 vertices of degree 1, 1, 2, 2, 4? 10

b. Write a short notes on Types of Grammar with examples of each. 10

Q.6 Write notes on following

- a) Write a short note on Myhill- Nerode theorem. 5
- b) What are Graph Isomorphism Conditions? 5
- c) State fundamental theorem of graph theory 5
- d) Explain Types of Functions with Example and Diagram. 5