

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

- a. Show using truth table that the statements $(p \rightarrow q)$ and $(\sim p \vee q)$ are logically equivalent and Construct the truth table of $(P \wedge Q) \rightarrow P$. 5
- b. Design a DFA with $\Sigma = \{0, 1\}$ accepts the only input 1010. 5
- c. Give the Principle of Inclusion and Exclusion formula.. 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.

- 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 with proper diagram of each. 5

- b. Prove that Statement $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a tautology. 5
- c. 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

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

98162

X822Y71F5B3X822Y71F5B3X822Y71F5B3X822Y71F5B3