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Daffodil International University

Faculty of Science & Information Technology

Department of Software Engineering

Final Examination, Spring 2026

Course Code: SE 123; Course Title: Discrete Mathematics

Sections & Teachers: 44(A-D), 44(E-F), 44(G-I), 44(J) (DSM, AR, FC & MKS)

Time: 2 Hours **Marks: 40**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

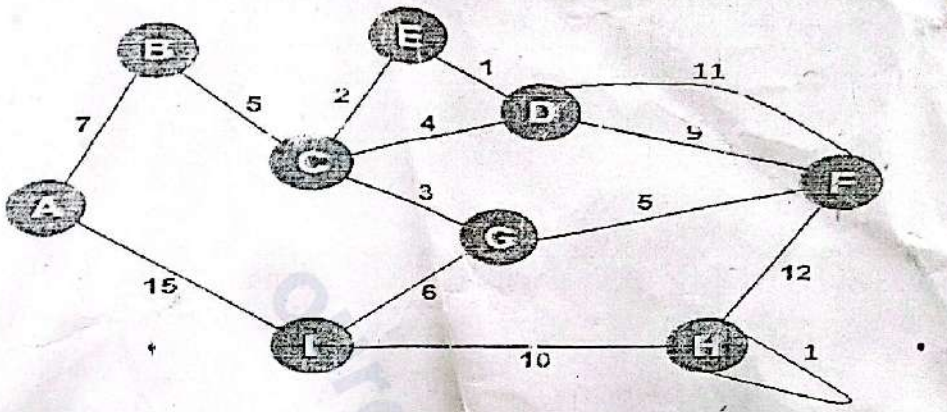
1.	a)	i) Suppose f: $Z \times Z \rightarrow Z$, $f(m, n) = m^2 + n^2$. Analyze the function and identify it with justification (the idetificaton may come under multiple types at the same time).	[Marks-4]	CLO-3 *Level-4*
		ii) Identify the term of the Arithmetic Sequence 4, 1, -2, ……, is -77	[Marks-3]	
		iii) Let f and g be the functions from the set of integers to the set of integers defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$. Figure out the composition of f and g?	[Marks-3]	
	b)	i) Analyze the following set X and relation R provided below: $X = \{1, 2, 3, 4\}$ and $R = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 3), (3, 2), (3, 4), (4, 1), (4, 3)\}$. Identify the properties of the relation and express the relation using a tabular array	[Marks-5]	
		ii) Analyze the following set X and relation R_1 provided below: $X = \{1, 2, 3\}$ and $R_1 = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 1)\}$. Is the relation R_1 a Partial order relation? If yes, explain why. If not, explain which properties are not satisfied.	[Marks-5]	
2.	a.	i) Evaluate the following hierarchy of Transport Management System. In a transport: • **Main system:** Transportation Network ➢ Two main modes: Road Transport (R) and Rail Transport (RL) ➢ Road Transport has two sub-services: Public Buses (PB) and Private Cars (PC) ➢ Rail Transport has one sub-service: Metro Service (MS) ➢ Public Buses have two operational features: City	[Marks-3+2]	CLO-04 *Level-5*

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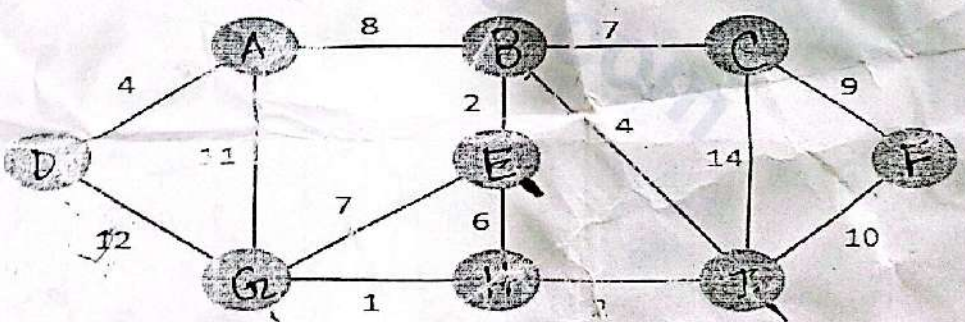
Routes (CR) and Intercity Routes (IR)

a) Sketch the tree structure of transport dependencies.
b) Justify the tree as a Full Binary tree

ii) **Determine** how Prim's algorithm would derive a minimum spanning tree from the graph shown below. [Marks-5]



b. **Evaluate** the path considering following Graph



i) Suppose you are an emergency medical supply coordinator responsible for delivering critical medicines to multiple clinics during a health crisis. You have 9 delivery locations, and all supplies must reach their destinations within 30 minutes to ensure patient safety. You are provided with a city map showing various possible routes between the supply center and each clinic. However, due to traffic conditions and time constraints, not all routes are equally efficient. [Marks-5]

As a responsible coordinator, determine the shortest and fastest paths from D to F to deliver all supplies within the given time frame, ensuring that no clinic experiences a delay.

ii) Construct the adjacent List. [Marks-5]