



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

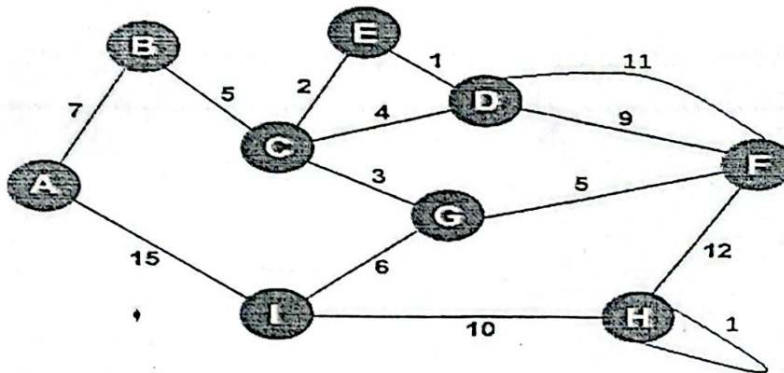
[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	a)	i) Suppose $f: \mathbb{Z} \times \mathbb{Z} \rightarrow \mathbb{Z}$, $f(m, n) = m^2 + n^2$. Analyze the function and identify it with justification (the identification 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]	
1-4 = 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]	(2)
		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

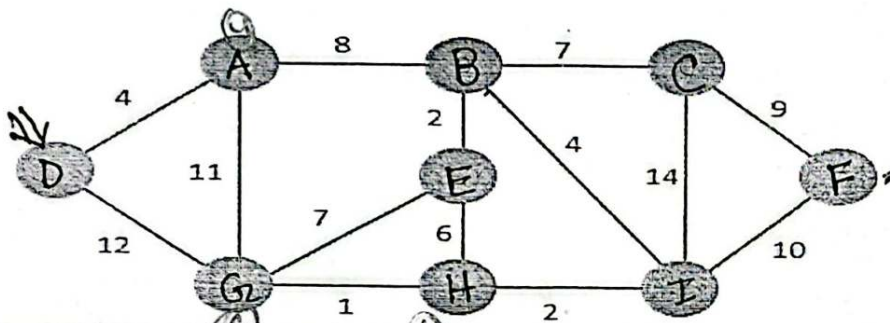
Routes (CR) and Intercity Routes (IR)

- 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]



iii) Evaluate the path considering following Graph



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.

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.

iv) Construct the adjacent List.