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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.]***

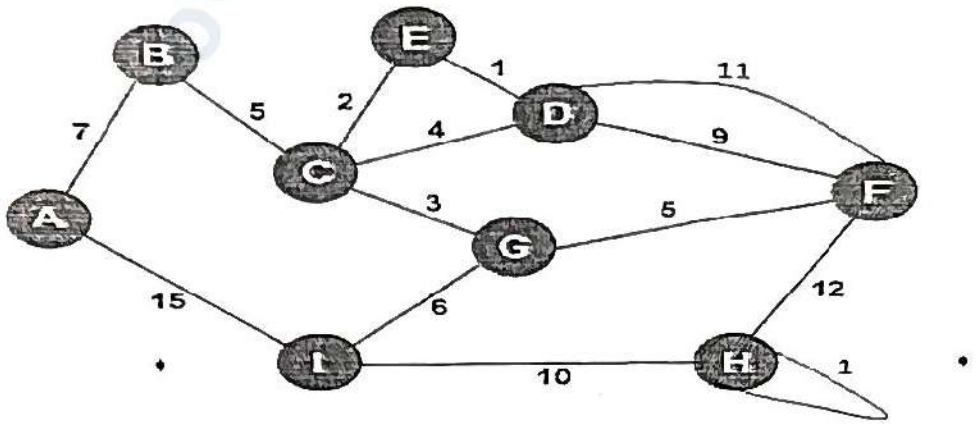
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|---|---|---|---|---|
| 1. | a) | i) Suppose f: $Z \times Z \rightarrow Z$, f (m, n)=$m^2 + n^2$. **Analyze** the function and identify it with justification (the idetificaton may come under multiple types at the same time). | [Marks-4] | CLO-3 Level-4 |
| | | **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:<br>X = {1, 2, 3, 4} and<br>R = {(1, 1), (1, 2), (1, 4), (2, 1), (2, 3), (3, 2), (3, 4), (4, 1), (4, 3)}.<br><br>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:<br>X = {1, 2, 3} and<br>$R_1$ = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 1)}.<br><br>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.<br>In a transport:<br>• **Main system:** Transportation Network<br>➢ Two main modes: Road Transport (R) and Rail Transport (RL)<br>➢ Road Transport has two sub-services: Public Buses (PB) and Private Cars (PC)<br>➢ Rail Transport has one sub-service: Metro Service (MS)<br>➢ Public Buses have two operational features: City | [Marks-3+2] | CLO-04 Level-5 |

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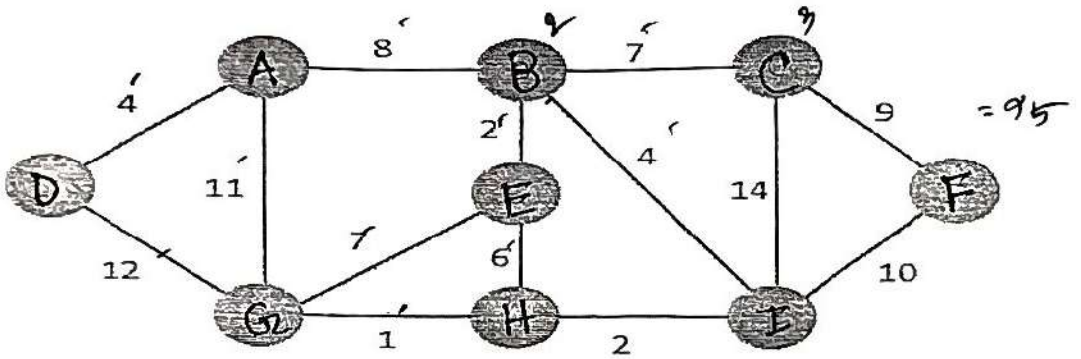
Routes (CR) and Intercity Routes (IR)

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]**