INSTRUCTIONS:

a. This assignment must be conducted in a group. Please clearly write the group members' names & matric numbers on the front page of the submission.

b. Solutions for each question must be readable and neatly written on plain A4 paper. Every step or calculation should be properly shown. Failure to do so will result in the rejection of the submission of the assignment.

c. This assignment has 4 questions (60 marks), contributing 5% of overall course marks.
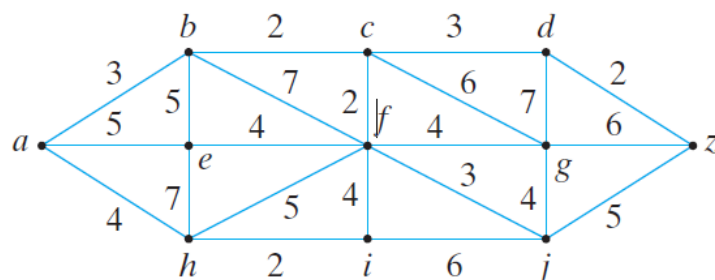
STRUCTURES:

1. Chapter 4.7 : Dijkstra's Shortest Path Algorithm   [12 Marks]
2. Chapter 4.8 : Trees   [18 Marks]
3. Chapter 5.1 : Deterministic Finite Automata   [8 Marks]
4. Chapter 5.2 : Finite State Machines   [22 Marks]

Q1. Dijkstra's Shortest Path Algorithm

1.   [3 Marks]

Describe Dijkstra's shortest-path algorithm.

2.   [9 Marks]

Based on the graph above, find the length of a shortest path and a shortest path between each pair of vertices in the weighted graph as stated below:
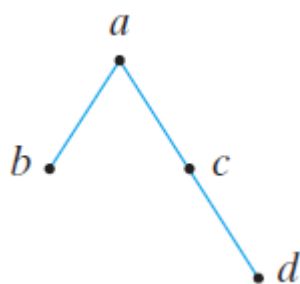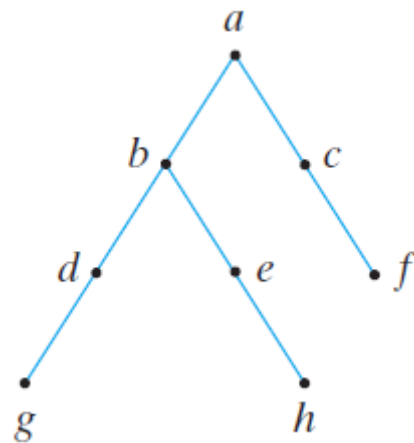
    a) a,f

b) b,j

c) a,g

Q2. Trees

1. [4 Marks]

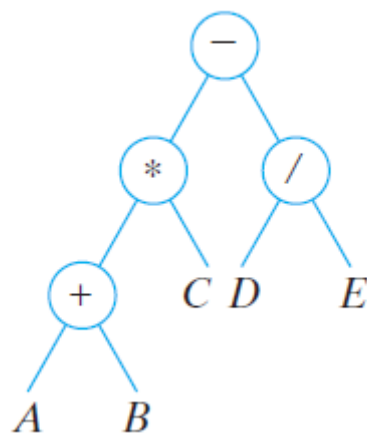Determine either each of the following binary tree is balance.

a

b

2. [3 Marks]

From the above tree, form the expression using inorder traversal.

3. [7 Marks]

Represent the expression below as a binary tree and write the prefix and postfix forms of the expression.

$$(((A + B) * C + D) * E) - ((A + B) * C - D)$$

4.   [4 Marks]

Find a minimal spanning tree for the above graph.

Q3. Deterministic Finite Automata

1.   [8 Marks]

Design deterministic finite-state automata that accept the strings over {a, b} having the properties specified in:

   a) Starting either abb or ba

Q4. Finite State Machines

1.   [3 Marks]

Define *finite-state machine*.

2.   [13 Marks]

Draw each of the transition diagram of the finite-state machine (I,O, S, f , g, σ_0) based on the following tables.

$\mathcal{I} = \{a, b\}, \mathcal{O} = \{0, 1\}, \mathcal{S} = \{\sigma_0, \sigma_1\}$

$\mathcal{I}$ $\mathcal{S}$	f		g	
	a	b	a	b
σ_0	σ_1	σ_1	1	1
σ_1	σ_0	σ_1	0	1

a)

$\mathcal{I} = \{a, b, c\}, \mathcal{O} = \{0, 1\}, \mathcal{S} = \{\sigma_0, \sigma_1, \sigma_2\}$

$\mathcal{I}$ $\mathcal{S}$	f			g		
	a	b	c	a	b	c
σ_0	σ_0	σ_1	σ_2	0	1	0
σ_1	σ_1	σ_1	σ_0	1	1	1
σ_2	σ_2	σ_1	σ_0	1	0	0

b)

3. [6 Marks]

Find the sets I, O, and S, the initial state, and the table defining the next-state and output functions for the finite-state machine below.