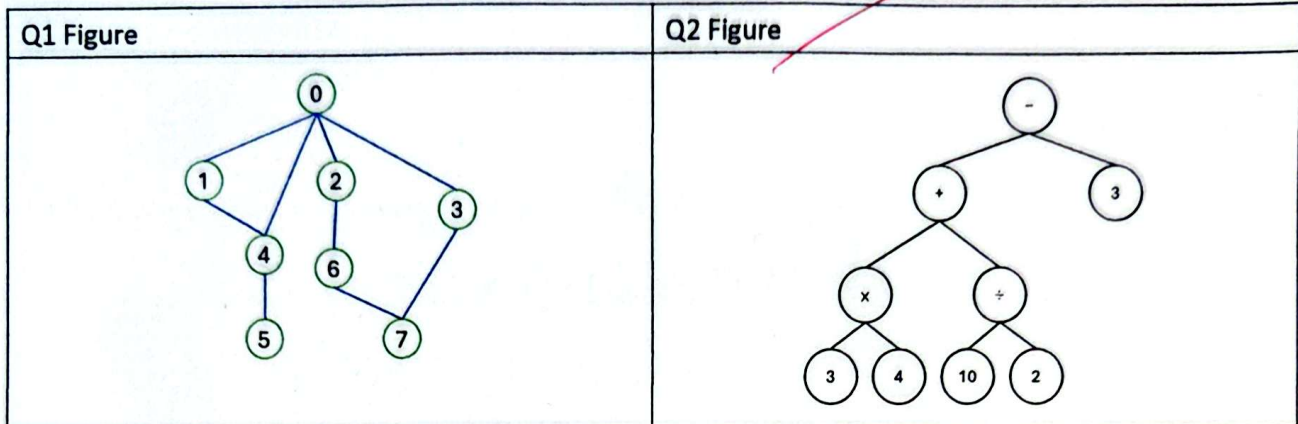


Due: December 16, 2025, 17:00 (Room R1102)

Important Notice: You must print this take-home quiz and write your answers by hand with a pen.

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Q1. (30 pts) Explain Breadth-First Search (BFS) on the graph and provide the BFS traversal order for the graph shown in Q1 Figure.

A1: BFS 是從起始節點開始，距離由近至遠搜尋，先搜尋與起始結點距離為 1 的結點，再搜尋距離為 2 的結點，以此類推。

Q1 Figure BFS traversal order: 0 . 1 . 4 . 2 . 3 . 5 . 6 . 7

queue visited

Q2. (30 pts) In tree traversal, one common method is inorder traversal. Please use inorder traversal to print the arithmetic expression represented by the expression tree in Q2 Figure, and then evaluate it to compute the final result.

A2:

$$[(3 \times 4) + (10 \div 2)] - 3 = 14$$

Q3. (40 pts) A binary tree is a fascinating data structure with many variations, including binary search trees, AVL trees, red-black trees, complete binary trees, and max/min heaps. These variations can be classified as shape-based (structural constraints) or criteria-based (rules such as ordering). Choose one shape-based tree and one criteria-based tree, and provide a brief description of each.

A3:

Shape-based: Complete Binary Tree

除了最底層之外，樹的每一層都要被填滿，  
底層結點要靠左排列

Criteria-based: Binary Search Tree

對於數中的任意結點 $N$ ，都必須滿足其左子樹中的所有鍵值都小於 $N$ 的鍵值，右子樹中的所有鍵值都大於 $N$ 的鍵值。