Course: Data Structures (CSE CS203A, 114-1)
Take-Home Quiz IV: Tree/Heap/Graph

Due: December 16, 2025, 17:00 (Room R1102)
Important Notice: You must print this take-home quiz sand **write your answers by hand with a pen.**

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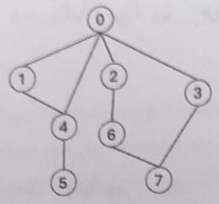
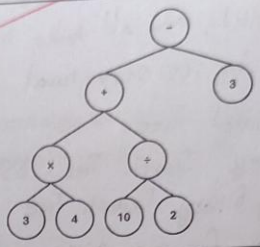
Q1 Figure	Q2 Figure
	

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: Breadth-First Search (BFS 廣度優先搜尋) is a graph traversal algorithm that explores th graph layer by layer. It starts at a selected node (the root) and visits all its immediate neighbor first, before moving to the neighbors of those neighbors (the next depth level). It typically uses a Queue data structure to keep track of the nodes to visit.

BFS Traversal Order: Based on the structure provided in the figure (Root 0 connects to 1,2,3; Node 1 connects to 4 ; Node 2 connects to 6; Node 3 connects to 7; Node 4 connects to 5; Node 6 connects to 7)

Order: 0→1→2→3→4→6→7→5

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:

Inorder Traversal Expression:
In an expression tree, Inorder Traversal follows the Left Subtree → Root → Right Subtree order.

Expression: (3×4)+(10/2)−3

1. 3×4=12
2. 10/2=5
3. 12+5=17
4. 17−3=14

Final Result: 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:

1. shape-based Tree:

Selection: Complete Binary Tree (完全二元樹)

Description: Binary Tree is a binary tree in which every level, except possibly the last, is completely filled, and all nodes in the last level are as far left as possible, it is defined strictly by its structural shape constraints.

2. Criteria-based Tree

Selection: Binary Search Tree (BST, 二元搜尋樹)

Description: A Binary Search Tree is a tree where the nodes are ordered based on specific criteria: for any given node, all values in its left subtree are smaller than the node's value, and all values in its right subtree are larger than the node's value.