

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

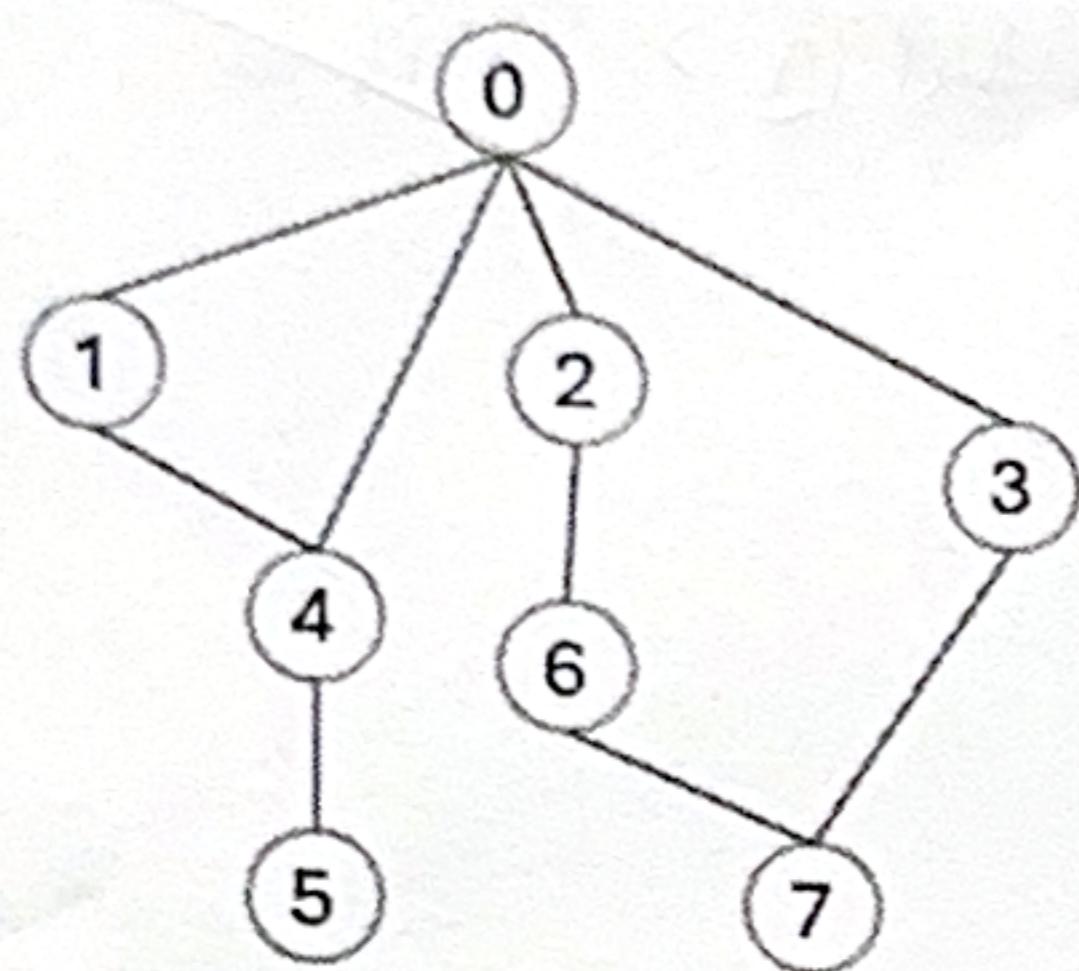
Due: December 16, 2025, 17:00 (Room R1102)

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

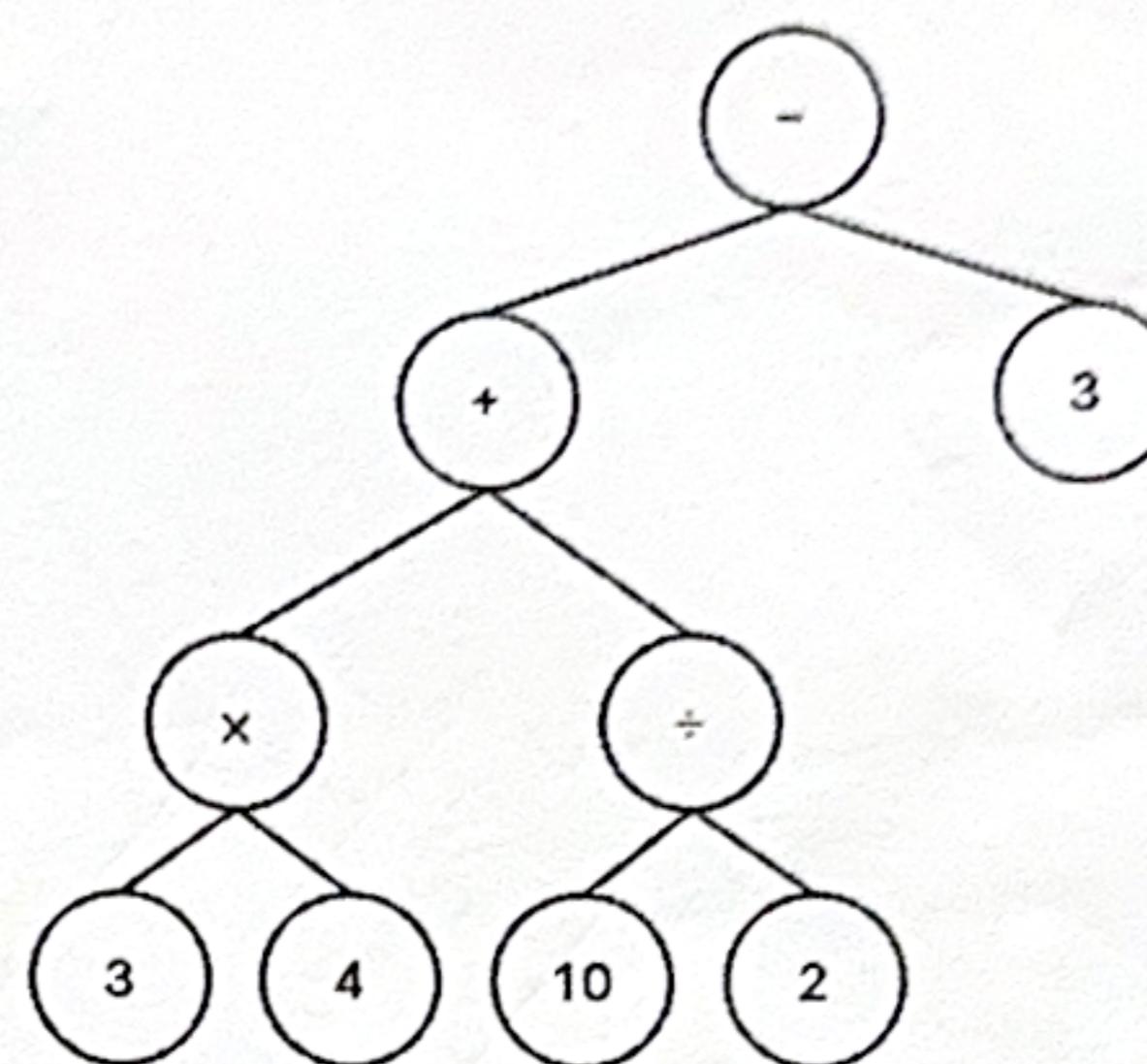
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Q1 Figure



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: 先拜訪所有距離為一條邊的，再往外擴，BFS 使用 Queue

1. 將起始節點加入 Queue 並標記為已拜訪
2. 從 Queue 取出一個節點
3. 從該節點所有未被拜訪的鄰居加入 Queue
4. 重複直到 Queue 為空

$0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 6 \rightarrow 7 \rightarrow 5$

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 \rightarrow left \rightarrow root \rightarrow right

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

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 \Rightarrow complete Binary Tree = 除了最後一層，每一層都要填滿，且最後一層的節點要靠左連續排列

Criteria - based \Rightarrow Binary Search Tree : 左子樹所有鍵值 $<$ 該節點
右子樹所有鍵值 $>$ 該節點