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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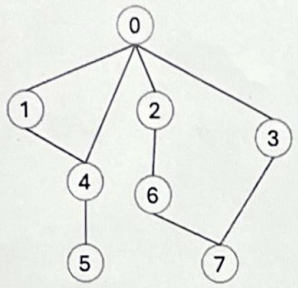
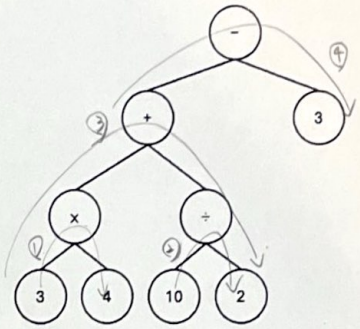
Q1 Figure	Q2 Figure
	

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: BFS 為廣度優先的搜尋方法，從起始節點開始，由近至遠逐層搜尋

① queue : [0] visited : [0]

dequeue (0) ② queue [1, 2, 3, 4] , visited : [0, 1, 2, 3, 4]

dequeue (1) ③ queue [2, 3, 4] , visited 不變

dequeue (2) ④ queue [3, 4, 6] , visited : [0, 1, 2, 3, 4, 6]

dequeue (3) ⑤ queue [4, 6, 7] , visited : [0, 1, 2, 3, 4, 6, 7]

dequeue (4) ⑥ queue [6, 7, 5] , visited : [0, 1, 2, 3, 4, 6, 7, 5]

dequeue (6) ⑦ queue [7, 5] , visited 不變

dequeue (7) ⑧ queue [5] , visited 不變

dequeue (5) ⑨ queue [] , visited 不變

∴ Traversal 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 順序 : left → root → right

expression : 3 × 4 + 10 ÷ 2 − 3 #

final result : 12 + 5 − 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:

① Shape-based : Complete Binary Tree

除了最後一層，每一層的節點都填滿，且最後一層需由左至右連續填入，樹的高度接近 $\log n$

每個節點都有2個子節點

② Criteria-based : Binary Search Tree

依據大小關係來擺放節點：左子樹的所有節點的值均小於 root，而右子樹的所有節點的值均大於 root