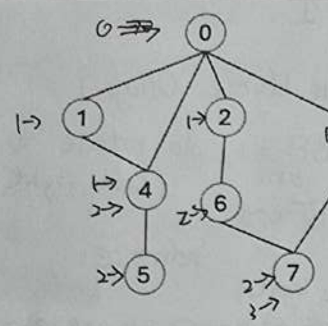
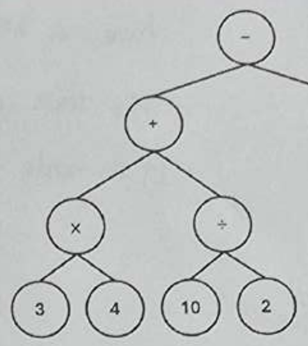
Course: Data Structures (CSE CS203A, 114-1)

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.**

Student ID: 1131428 Student Name: [illegible]

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 start from root, and go thrugh the vertices that have higher level first. (closer to root)

order: 0 → 1 → 4 → 2 → 3 → 5 → 6 → 7

queue, revisiting

-6

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 × 4 + 10 ÷ 2 − 3

= 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:

shape-based: AVL tree:

- a kind of binary search tree (left node & right node)
- A left subtree and right subtree from same node can't have a height difference more than 1.
- this tree make binary search tree more blance. O(logn)
- Each node has a BF value, when BF > 1 or BF < -1, do rotate to avoid illegal. (left, right .....
  1. Max(left tree hight, right tree hight) + 1
  2. (left tree hight - right tree hight)

p.s 我在網路上找到這兩種算法，兩種的寫法不太一樣但好像都可以用)

criteria-based: red-black tree:

- also a binary search tree
- rule:
  - every nodes can only be red or black tree.
  - root must be black
  - leaf must be black and NULL
  - red node's child must be black
  - each node to every child leaf, number of black nodes must be same.
    from
- more blance then other binary tree, O(logn)
  May be

⇒ blance: no blance lead to , close to linked list, worse case become O(n).