United International University

B.Sc. in Computer Science & Engineering (CSE)

CSE 2215: Data Structure and Algorithms-I

Term Final Exam: Fall 2024   Time: 2 Hour   Marks: 40

Answer all of the following questions.

1. The preorder traversal of a binary search tree(BST) is given by:

$$13, 10, 8, 7, 12, 11, 16, 14, 15, 18$$

(a) Now your task is to reconstruct the BST from the given preorder traversal.   [5]

(b) A balanced binary tree has the following properties   [5]

   i. The heights of the left and right subtrees do not differ by more than one

   ii. The left subtree is balanced.

   iii. The right subtree is balanced.

   Using this definition determine whether the tree constructed in question (a) is balanced.

(c) Draw a binary tree from the following Preorder and Inorder sequences   [3]

   i. Inorder: c d e i g b a h f

   ii. Preorder: b d c i e g a f h

2. (a) Determine the height of the following tree where height is expressed as :   [3]

$$H = max(H(T^l), H(T^r)) + 1$$

(b) You are given an undirected graph below. Show the visited sequence to find node C in the graph[follow alphabetic order]. Choose the appropriate technique where the STACK data structure is applied. Starting Node:A   [3]
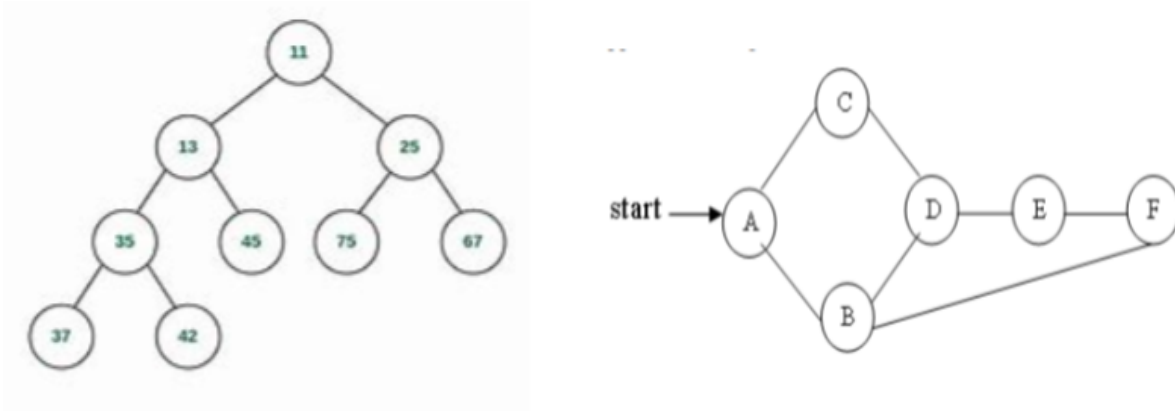
Figure 1: Left : 2(a) & Right : 2(b)

3. (a) Consider three sets A = {1,3,5,7}, B = {0,2,4,6} and C = {1,1,2,3,5,8}. What do you understand by Disjoint set and if $(A \cap C)$ and $(B \cap C)$ are disjoint set or not. [3]

   (b) Write the differences between a full binary tree and a complete binary tree. [2]

4. You are given a task to make a custom "Priority queue" of Students using "Max Heap" where priority is based on summation each student's marks of English, Math and Science. Write the pseudocode/code of the heapify function for this task. [5]

5. Consider a tree T with n nodes. Each node contains a value(int). Write a pseudocode/code to find the second highest valued node of T. [5]

6. (a) Consider a tree T with n nodes, where every internal node have only one child. Find the height of the tree in terms of n and what will be time complexity of BFS. [3]

   (b) Consider a Heap H with n nodes and an Array A with n elements. If we want to sort these two collection using Heap sort for H and Bubble sort for A which would be better in which case. Explain based on space complexity and time complexity. [3]