United International University
B.Sc. in Data Science (BSDS)

CSE 2215: Data Structure and Algorithms-I

Final Exam: Fall 2024 Time: 2 Hours Marks: 40

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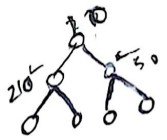
Answer all of the following questions.

1. Convert the following infix expression to postfix and evaluate. Show detailed calculation using STACK. [4]

   5*(3+6/(7-4*1)-3)-1

2. a. You are given the root of a binary tree. Write a pseudocode/code to determine whether the given binary tree is a binary search tree. [4]

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

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

   i. Now your task is to reconstruct the BST from the given preorder traversal. [4]

   ii. A balanced binary tree has the following properties [4]

   - The heights of the left and right subtrees do not differ by more than one.
   - The left subtree is balanced.
   - The right subtree is balanced.

   Using this definition determine whether the tree constructed in question 2.b.i is balanced.

3. a. Draw a binary tree from the following Inorder and Preorder sequences [3]

   Inorder: c d e i g b a h f

   Preorder: b d c i e g a f h

b. 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. [3]

c. Determine the height of the following tree T(Figure 1:Left) where height is expressed as : [3]

$$H = max(H(T^{left}), H(T^{right})) + 1$$

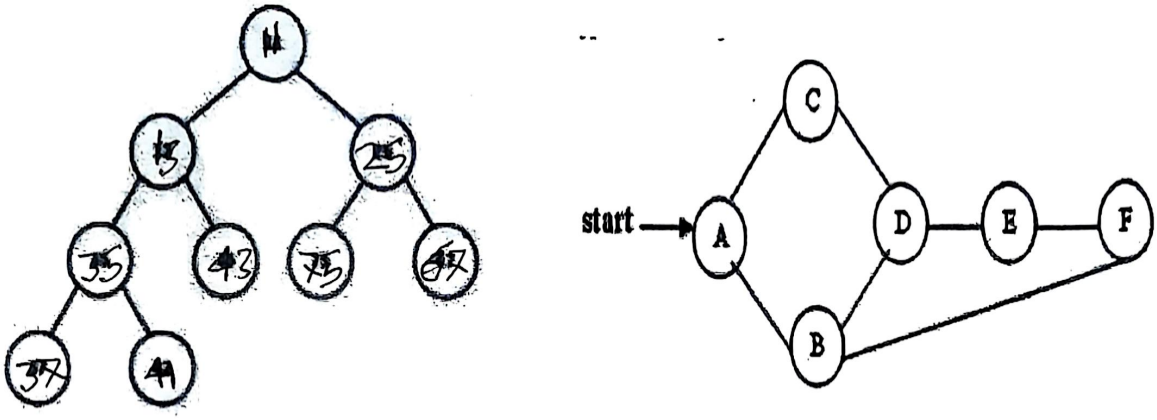
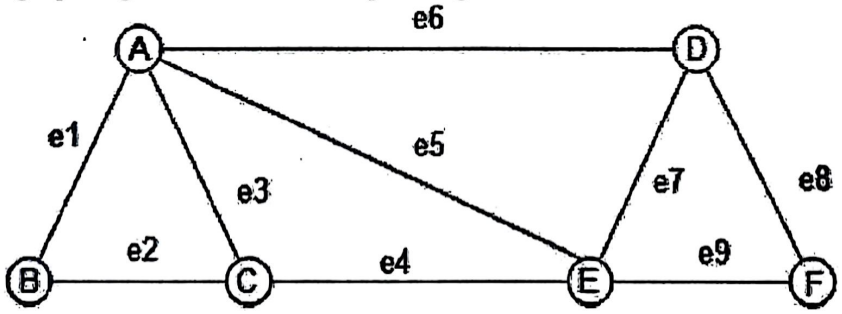


Figure 1: Left : for Question 3(c) & Right : for Question 4(a)

4. a. You are given the undirected graph shown above(Figure 1:Right). Considering Node A as the start node, show the simulation of Depth First Search. [4]

b. Consider the graph G given below, find a spanning tree of G [3]



c. Is the spanning tree you derived in question 4.b. the only possible spanning tree for G? Provide your reasoning clearly. [2]

5. a. You are given a task to make custom "Priority queue" of Students using "Max Heap" where priority is based on summation each student's marks of English, Math and Science. Show the mechanism and the final heap considering the following data: [5]

Marks	English	Maths	Science
Student 1	2	5	9
Student 2	15	4	17
Student 3	16	10	14
Student 4	20	15	12
Student 5	23	10	25
Student 6	24	26	28
Student 7	30	26	28
Student 8	26	21	27

b. What is the time complexity of heapsort? [1]