Major Exam II
Term 212

Course Title: Data Structures and Algorithms **Course Code**: CS 210

Exam date: 29/3/2022 **Exam Time: 50** minutes

Student Name:

Student ID:

Serial number:

Check your section:

☐ Dr. Sawsan Alhalawani (322)	☐ Dr. Basit Qureshi
☐ Dr. Sawsan Alhalawani (326)	☐ Dr. Syed Umar Amin (8 AM)
☐ Dr. Sawsan Alhalawani (328)	☐ Dr. Syed Umar Amin (10 AM)
☐ Dr. Najla Althunaiyan	☐ Dr. Skander Turki

Question No.	Points	Student's Score
Question 1 (CLO 1)	10	
Question 2 (CLO 2)	2	
Question 3 (CLO 3)	3	
Total	15	

Instructions:

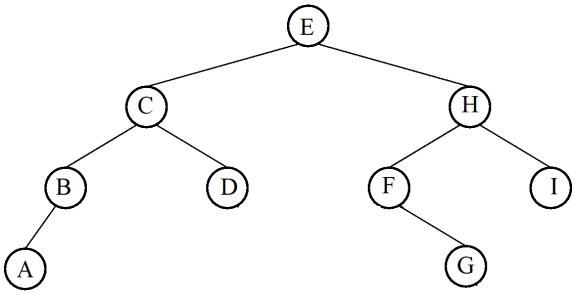
- This exam contains three questions with multiple parts.
- The exam contains 6 pages.
- Time allowed: 50 minutes
- Closed Book, Closed Notes.
- Use of Calculators is ALLOWED. Use of other computing devices / smartphones etc is strictly prohibited.
- Answer the problems on the exam sheets only. No additional attachments would be accepted.
- **DO NOT write on the backside of a page/sheet**; the back of a page will NOT be graded.
- When the "time is over" is called, it is the students' responsibility to submit his exam to the invigilator. Submitting completed exam 3 minutes after the "time is over" will incur a penalty of **5 points**.

Few gentle reminders:

- If you get stuck on some problem for a long time, move on to the next one.
- The ordering of the problems is somewhat related to their relative difficulty. However, the order might be different for you!
- You should be better off by first reading all questions and answering them in the order of what you think is the easiest to the hardest problem.
- Keep the points distribution in mind when deciding how much time to spend on each problem.

Question 1 [/ 10 marks]

Part a: [1 point] Give the pre-order and post-order traversals of the following binary trees.

Binary Tree	Pre-order	Post-order
		

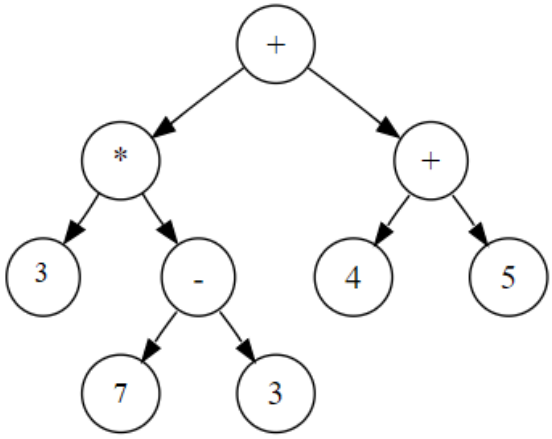
Part b: [2 points] Construct a Binary Tree for the following information. When you traverse this tree using the Pre-order and Post-Order Traversals, you get the following:

- Pre-Order: B L U E P E N
- Post-Order: U E L E N P B

Draw the Binary Tree.

Part b: [3 points] Consider the following binary tree to illustrate:

- [1.0] Print the arithmetic expression using the In-order traversal algorithm (Show brackets)

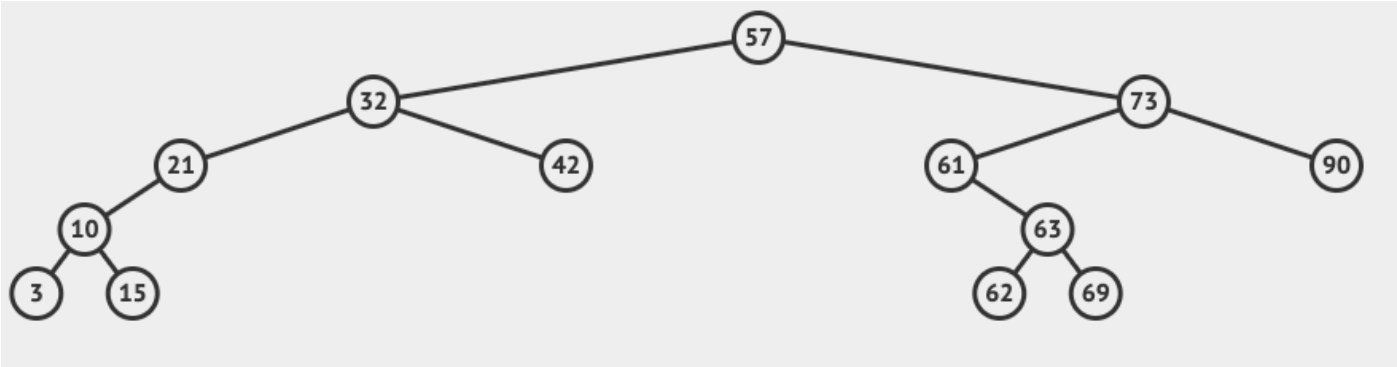


- [1.0] Evaluate the arithmetic expression

- [1.0] Give the array representation of the binary tree.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Part c: [2 points] Given the following Binary Search Tree storing Integer values, remove 57 and then 21 from this tree. Show the tree after each removal and identify the removal case.



Part d: [2 points] Answer the following giving appropriate Big-Oh for each:

Statement	**Big-oh Characterization**
The worst-case run-time for inserting a value in a Binary Search Tree	
Inserting a node in an empty Binary Tree	
Removing the leaf node of a complete Binary Search Tree	
Searching for a value in a Binary Tree using In-order Traversal	

Question 2 [/ 2 marks]

Part a: [2 point] CCIS Students are required to take core CS courses in a particular order: CS101, CS102, CS210, CS330 and then CS492. A Stack storing String contains the course codes is given. The following commands were given:

```
push (CS330), push (CS101), push (CS210), pop (), push (CS102), push
(CS492), pop (), pop (), pop (), pop ().
```

Change the position of the pop () commands in the above sequence so that the items are popped in the following order: CS101, CS102, CS210, CS330, and CS492. You are NOT allowed to change the ordering of the push commands.

Question 3 [/ 3 marks]

Part a: [3 point] Consider the following queue:

Q	23	45	66	77	100	12	40	37	9	82

Write a java method with the header **`public void Split(Queue Q)`** that takes Q as an argument and then creates 2 separate queues: **EvenQ, OddQ**. This method moves all the even valued entries to the EvenQ and the Odd values to the OddQ. Find **T(n)** and the **Big-Oh** for your method.

```
public interface Queue<E> {
  int size();
  boolean isEmpty();
  E first();
  void enqueue(E e);
  E dequeue();
}
```