National University

Of Computer & Emerging Sciences Peshawar Campus

Student Name: _____

Roll No: _____

Program: BS/SE
Semester: Spring-2022
Time Allowed: **2 hour 30 minutes**
Course: CL2001-Data Structures - Lab

Examination: Final Exam
Total Marks: **60**   Weightage: **45**
Date:
Instructor Name: Engr. Khuram Shahzad

Important Instruction:

- Attempt all questions. There will be viva at the end of Lab Exam.
- **Zero** tolerance in case of plagiarism.
- Create a folder on desktop, **name format** be like (Name_RollNo_Section)
- Place all .ccp files in above folder.

Problem: 1 | Recursion and pointer [10 marks]

Ask user to enter the table number and its limit store them into pointer then print the desired table using pointer and recursion.

Sample Execution

```
Select D:\Anjum FAST Labs\DS Manuals\lab 13\test.exe
Enter  table Number: 3
Enter  table Limit: 9
3*1 = 3
3*2 = 6
3*3 = 9
3*4 = 12
3*5 = 15
3*6 = 18
3*7 = 21
3*8 = 24
3*9 = 27
```

Problem: 2 | Implement using pointers and Dynamic Arrays (you cannot use array index). [15 marks]

Implement a function that finds common letter in two arrays. You can assume that the sets are stored using char arrays. So, if

array1 = {'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H'} and
**array2 is {'A', 'C', 'E', 'H'}**, then array3 should be
array3{'A', 'C', 'E'}.

Note array3 should not have any duplicate elements. You have to think of all the functions that are required for this problem. Each function should perform its dedicated task. So, plan them out before implementing them. Main should only have a set of function calls.

Problem: 3 | Binary Search Tree. (Use Problem3.ccp) [10+5]

Write a recursive function to calculate the number of parent nodes at the current time in a Binary Search Tree. You will need to pass the tree root to the function, the function will then traverse through the tree and find the total number of parent nodes at the current time. Your code should be generic. Use the given BST implementation (**Use Problem3.ccp**) to construct the BST.

The function should return 7 if the following tree is passed.

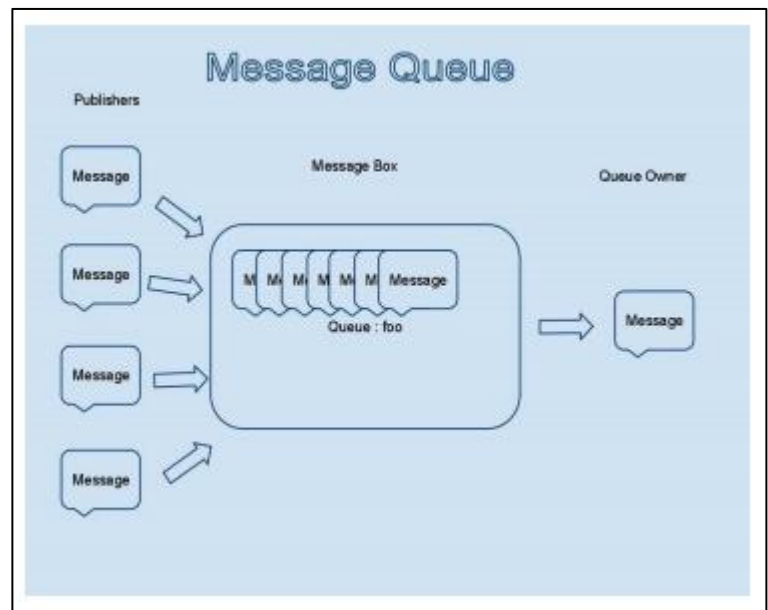**Binary Search Tree Data Strucutre**
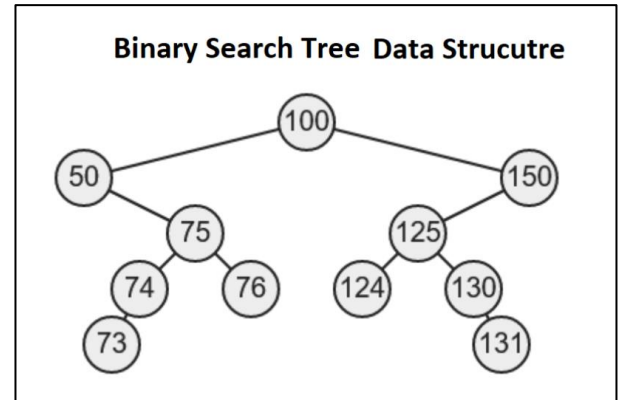
Problem: 4 | Implement using Heap. (Use Problem4.ccp) [15+5 marks]

Messenger is used to send or receive text messages. When someone is offline a messenger maintains a buffer of messages which is delivered to the receiver when he gets online.

The phenomena take place on simple timestamp phenomena, the message delivered earlier will be sent to the receiver first and the message received late will be delivered after it. Sometime a message in the buffer may have higher priority so it should be delivered earlier on the higher priority. Some of the messages are to be delivered on a particular day or a date are also in the same buffer. Your task is to select a suitable data structure (**heap**) and implement the requirements mentioned above.

You need to implement program using (**Problem4.ccp**) which shows a user to be offline, display the messages, with a click or a key stroke make the user online and deliver/display the messages according to the mentioned criteria.

Best of luck 😊