University of Central Punjab
(Incorporated by Ordinance No. XXIV of 2002 promulgated by Government of the Punjab)
FACULTY OF INFORMATION TECHNOLOGY

Data Structures and Algorithms, Spring 2022

Deadline: Monday, July 03, 2022
Weightage : 10% Theory + 10% Lab

Submissions are to be done on Portal (all group members should submit the project, in this way, at least one of you would be submitting on time)

Group Policy:

1. **2 to 3 member groups allowed.**
2. **If a group member is absent during an evaluation, everyone would get a ZERO.**
3. **Minimum marks of a member in the group would be awarded to all group members.**

PROBLEM STATEMENET:

Implement the following tree:

- Red-Black Tree

Your project should have the following main menu:

```
Press 1 to insert values in the tree (one by one)
Press 2 for searching a value from the tree
Press 3 for pre-order traversal NLR
Press 4 for in-order traversal LNR
Press 5 for post-order traversal LRN
Press 6 for pre-order traversal 2 NRL
Press 7 for in-order traversal 2 RNL
Press 8 for post-order traversal 2 RLN
Press 9 for displaying parent of a node present in Tree
Press 10 to read integer values from the file "input.txt"
         to create a red-black tree
Press 11 to delete all duplicate values from the tree
Press 12 to destroy the complete tree
Press 13 to EXIT
```

The program should exit when option 13 from the main menu is selected. There shouldn't be memory leakages or dangling pointers in your program.

Please note that in case of red-black tree, the colour of a particular node should also be displayed along with its value for options 2, 3, 4, 5, 6, 7, 8 and 9

The non-empty "input.txt" will have the data in such a way that a new value will be placed on every new line. For example, the following file (containing 7 values) is valid for creating the red-black tree (there may be less or more than 7 values):

```
10
16
2
-5
0
22
1024
```