Course Name: *Data Structures and Algorithms*   **Topic:** BST and HEAP TRESS

Assignment *#03*   **Total Marks:** 25

Note:

Do as directed and attempt all the questions. Your answers must be to the point. Give examples where necessary. Paste the screenshots of every program and its output. Copy Paste will be marked zero.

Question # 01.   05 Marks

Mr. Hassan is opening a new restaurant called "Heavenly Hassan's Cuisine." He wants to efficiently manage the menu items using a Binary Search Tree (BST). Each menu item has a unique item ID. Implement a C++ program for the restaurant staff to:

1.   Add a new menu item with a given item ID, ensuring no duplicate IDs.
2.   Search for a menu item by its ID and display its details.
3.   Remove a menu item by its ID.
4.   Display all menu items in sorted order.
   In the BST:
5.   Items with lower item IDs should be placed on the left subtree.
6.   Items with higher item IDs should be placed on the right subtree.
7.   After adding or removing an item, maintain the BST property.
   Demonstrate the usage of your program by adding, searching, and removing menu items, as well as displaying the menu in sorted order.

Question # 02.   05 Marks

Consider a scenario where the menu items for "Heavenly Hassan's Cuisine" have unique identifiers (IDs) and additional attributes such as dietary information and availability status. Extend the AVL tree-based program to efficiently manage these menu items. Your C++ program should:

1.   Handle unique identifiers (IDs) for each menu item.

2.   Implement functions to find a menu item by both its name and ID, displaying the details.

3.   Include attributes like dietary information and availability status for each menu item.

4.   Update the insertion and removal tasks to consider the new attributes while maintaining the AVL tree's balance.

Ensure that the AVL tree remains balanced after these operations and that the program efficiently handles the unique identifiers and additional attributes associated with each menu item.

Question # 03.   05 Marks

In an emergency room setting, patients arrive with varying levels of severity. Design a C++ program that uses a Huffman tree to represent a priority queue for patients based on their medical conditions. Implement functions to add patients to the queue and retrieve the next patient with the highest priority. Test your program with a simulated emergency room scenario

Question # 04.   **05 Marks**

During university exams, students are assigned seats in a hall based on their student ID numbers. Design a C++ program using a Min Heap Tree to organize the seating arrangement. The program should allow the insertion of student IDs and efficient extraction of the smallest ID for seating allocation.

Question # 05.   **05 Marks**

Suppose you are a manager of a hotel and you want to give salaries to waiters . Waiter_id are mentioned below.Write a c++ program For HEAP TREE that will perform the following functions:-

71	67	16	64	14	31	93	40	76

1) Your hotel is getting popular day by day and peoples are coming in large number so you want to more waiters in your hotel.Implement a function to insert new waiter_id**{07,19}** into the max heap tree made with above elements in array.

2) Due to misbehave with the customers you are firing 2 waiters.Waiter_ids are**{64,31}**. Implement a function to delete these elements from a max heap made with above elements in array.