# University of Central Punjab Faculty of Information Technology

**Data Structures and Algorithms Spring 2024**

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| **Lab 14** | |  |
| **Topic** | * Hashing * Unordered-map * Heap Sort * Max Heap * Min Heap |
| **Objective** | The basic purpose of this lab is to implement Hashing, Heap Sort and test its Applications |

**Instructions:**

* Indent your code.
* Use meaningful variable names.
* Plan your code carefully on a piece of paper before you implement it.
* Name of the program should be same as the task name. i.e. the first program should be Task\_1.cpp

# void main() is not allowed. Use int main()

* **You have to work in multiple files. i.e separate .h and .cpp files**
* **You are not allowed to use any built-in functions**

# You are required to follow the naming conventions as follow:

* + **Variables:** firstName; (no underscores allowed)
  + **Function:** getName(); (no underscores allowed)
  + **ClassName:** BankAccount (no underscores allowed)

# Students are required to complete the following tasks in lab timings.

**Task 1 Insert Data into Unordered-map**

Write a C++ program that uses an unordered\_map to store employee IDs and their corresponding names. Implement a function to insert a new employee's ID and name into the map.

**Task 2 Search Data in unordered-map**

Write a C++ program to include a function that takes an employee's ID as input and searches for their name in the map. If the ID is found, return the corresponding name; otherwise, return "Employee not found".

**Task 3 Print data from unordered-map**

Write a C++ program that prints all the employee IDs and their corresponding names stored in the unordered\_map.

**Task 4**

Implement a Min Heap using an array and support the insertion operation. Write a function to insert a new element into the Min Heap while maintaining the heap property.

**Requirements:**

1. Define a MinHeap class.

Attributes of MinHeap class are

* **int \*heapArray;**
* **int capacity;**
* **int heapSize;**

Functions for MinHeap class:

* **void Insert(int key)**
* **void display();**
* **void heapifyUp(int index);**

1. Create constructor, destructor for the MinHeap class
2. Implement above methods
3. Write a main function to demonstrate the usage of the MinHeap class with insertion.

**Task 5**

Implement a Max Heap using an array and support the insertion operation. Write a function to insert a new element into the Max Heap while maintaining the heap property.

**Requirements:**

1. Define a MaxHeap class.

Attributes of MaxHeap class are

* **int \*heapArray;**
* **int capacity;**
* **int heapSize;**

Functions for MaxHeap class:

* **void Insert(int key)**
* **void display();**
* **void heapifyUp(int index);**

1. Create constructor, destructor for the MaxHeap class
2. Implement above methods
3. Write a main function to demonstrate the usage of the MaxHeap class with insertion.

**Task 6**

Implement a Min Heap using an array and support the deletion operation. Write a function to remove the minimum element from the Min Heap while maintaining the heap property.

**Requirements:**

1. Define a MinHeap class.

Attributes of MinHeap class are

* **int \*heapArray;**
* **int capacity;**
* **int heapSize;**

Functions for MinHeap class:

* **void Insert(int key)**
* **void display();**
* **void heapifyDown(int index);**
* **int removeMin();**

1. Create constructor, destructor for the MinHeap class
2. Implement above methods
3. Write a main function to demonstrate the usage of the MinHeap class with deletion.

**Task 7**

Implement a Max Heap using an array and support the deletion operation. Write a function to remove the maximum element from the Max Heap while maintaining the heap property.

**Requirements:**

1. Define a MaxHeap class.

Attributes of MaxHeap class are

* **int \*heapArray;**
* **int capacity;**
* **int heapSize;**

Functions for MaxHeap class:

* **void Insert(int key)**
* **void display();**
* **void heapifyDown(int index);**
* **int removeMax();**

1. Create constructor, destructor for the MaxHeap class
2. Implement above methods
3. Write a main function to demonstrate the usage of the MaxHeap class with deletion.