# University of Central Punjab Faculty of Information Technology

**Data Structures and Algorithms Spring 2024**

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| **Lab 05** | | Q |
| **Topic** | * Abstract Classes * Templates * Queues * Applications of Queues |
| **Objective** | The basic purpose of this lab is to implement Queue, and test its Applications |

**Instructions:**

* Indent your code.
* Comment 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 system("pause")

* **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.

# Queue Explanation

The Queue class has the following attributes:

1. T \*arr - This is a pointer to the array that holds the elements in the queue.
2. int maxSize - This is the maximum size of the queue.
3. int currentSize - This is the current size of the queue.

There are several pure virtual functions inside the Queue class:

1. void enqueue(T data) - This function is used to add data to the back of the queue.
2. T dequeue() - This function is used to remove and return the data at the front of the queue.
3. T front() - This function is used to get the data at the front of the queue without removing it.
4. T rear() - This function is used to get the data at the back of the queue without removing it.
5. bool isFull() - This function is used to check if the queue is full.
6. bool isEmpty() - This function is used to check if the queue is empty.

The Queue class also has a constructor:

1. Queue(int maxQueueSize) - This constructor takes the maximum size of the queue as a parameter and initializes the queue.

# To use the Queue<T> class, you need to create your own class, MyQueue<T>, which inherits from the Queue<T> class. MyQueue<T> should be a template class that takes a type T as a parameter.

## **Task 1**

Write a C++ program to implement a queue using an array with enqueue and dequeue operations. Find the top element of the stack and check if the stack is empty, full or not.

## **Task 2**

Repeat task 1 using a Circular Queue to solve the problem.