# University of Central Punjab Faculty of Information Technology

**Data Structures and Algorithms Spring 2024**

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| **Lab 08** | |  |
| **Topic** | * Abstract Classes * Templates * Linked List * Application of Linked List using head and tail pointer * Application of Linked List using head pointer only |
| **Objective** | The basic purpose of this lab is to implement Linked List 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**

* Create Struct **Node** which is having

***Attributes:***

* **Type data;**
* **Node\* next;**
* Create abstract class named as **LinkedList**

***Attributes of LinkedList:***

* **Node\* head;**
* **Node\* tail;**

***Functions:***

* **virtual void insertAtTail(Type data) = 0;**
* **virtual Type deleteFromTail() = 0;**
* **virtual void insertAtHead(Type data) = 0;**
* **virtual Type deleteFromHead() = 0;**
* **virtual int countAllNodes() = 0;**

Create **constructor** and **Destructor** for this class

Now you have to make a derived class named as **myLinkedList** andimplement the above functions

**Task Explanation:**

* + - 1. You have to count all the nodes in the Linked List

**Input:** 5 3 1 10

**Output:** count of All nodes = 4

After Implementation of the functions in **myLinkedList** create menu based program to perform the following operations .:

1. **Insert data at end**
2. **Delete data from end**
3. **Insert data at head**
4. **Delete dada from head**
5. **Display count of all nodes**
6. **Exit**

**Task 2**

* Create Struct **Node** which is having

***Attributes:***

* **Type data;**
* **Node\* next;**
* Create abstract class named as **LinkedList**

***Attributes of LinkedList:***

* **Node\* head;**

***Functions:***

* **virtual void insertAtEnd(Type data) = 0;**
* **virtual Type deleteFromEnd() = 0;**
* **virtual void insertAtHead(Type data) = 0;**
* **virtual Type deleteFromHead() = 0;**
* **virtual int countAllNodes() = 0;**
* **virtual int addnodes()=0; add values of first 3 nodes**
* **virtual updateMiddleNode(Type data)=0;**

Create **constructor** and **Destructor** for this class

Now you have to make a derived class named as **myLinkedList** andimplement the above functions

After Implementation of the functions in **myLinkedList** create menu based program to perform the following operations .:

1. **Insert data at end**
2. **Delete data from end**
3. **Insert data at head**
4. **Delete dada from head**
5. **Display count of all nodes**
6. **Add nodes**
7. **Update middle value**
8. **Exit**