# Data Structures

# Fall 2021

# Lab 06

**Learning outcomes:**

In this lab you are expected to learn the following:

- Node based Doubly and Circular Linked List
- Google testing

## Task 1:

Each node of a linked list will have a data item which will represent the record of an employee. Following Table shows the list of Employee;



| Data Member | Format | Data Type |
|---|---|---|
| EmpID | XXi-XXXX | String |
| CNIC | XXXXX-XXXXXXX-X | String |
| Joining Date | DD/MM/YYYY | String |
| Salary | - | Int |
| Bonus | - | Int |

Each emp is list contain 5 attributes of Employee.

The data items form a linear structure in which list data items follow one after the other, from the beginning of the list to its end. The ordering of the data items is determined by when and where each data item is inserted into the list and is *not* a function of the data contained in the list data items. At any point in time, one data item in any nonempty list is marked using the list's cursor. You travel through the list using operations that change the position of the cursor.

Your class must provide implementation for the following

- **Constructor** to create empty list
- **Copy Constructor** to copy all elements of linked list
- **IsEmpty** to check if there is no data element in the list. It returns **true** if a list is empty. Otherwise, returns **false**
- **Insert** function to insert employee. If the list is not empty, then inserts **emp** at the end
- **Search** function to search employee
- **Remove** function to remove the data item whose employee id matched the parameter id
- **UpdateSalary** function which locate the data item whose employee id matches the parameter id, then update the respective data item salary member with the parameter salary
- **MaximumSalary** function which searches for the employee having maximum salary
- A function to **print** the data of linked list

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## Task 2:

The Josephus problem is the following game: N people, numbered 1 to N, are sitting in a circle.

Starting at person 1, a hot potato is passed. After M passes, the person holding the hot potato is

eliminated, the circle closes ranks, and the game continues with the person who was sitting after

the eliminated person picking up the hot potato. The last remaining person wins. Thus, if M = 0

and N = 5, players are eliminated in order, and player 5 wins. If M = 1 and N = 5, the order of

elimination is 2, 4, 1, 5.

Write a program to solve the Josephus problem for general values of M and N. Try to make your
program as efficient as possible. Make sure you dispose of cells.

| Input | Output |
|-------|--------|
| M=2, N=6 | 1 |
| M=1, N=5 | 3 |
| M=3, N=9 | 1 |