Data Structures, 2016
Lab Assignment #4

1. In Lab assignment 1, you had created the ADT *EMP_DATABASE* using singly linked list. Now implement this ADT and its specified operations using "doubly linked list" with an exclusive header node. Use this header node to store the global information about the total number of employees in the organization.
    Do this assignment before you come to the lab.

    In the lab perform the following:

2. An ordinary **Doubly Linked List** of integers requires space for two address fields to store the addresses of previous and next nodes i.e. *prev* and *next* pointer fields. A memory efficient version of Doubly Linked List can be created using only one space for address field with every node. This memory efficient Doubly Linked List is called **XOR Linked List** or Memory Efficient as the list uses bitwise XOR operation to save space for one address. In the XOR linked list, instead of storing actual memory addresses, every node stores the XOR of addresses of previous and next nodes. Now each node contains two field, one is *data* and other is *link*. For a given node *x*, if the address of its left node is *l* and the address of its right node is *r*, then the *link* field of node *x* is given by: *l* XOR *r*. If *x* is the leftmost node of this non circular list, then *l* = NULL and if *x* is the rightmost node then *r* is NULL. For this XOR linked list, perform the following operation in a menu driven program:
    a. Create the list.
    b. Traverse the list from left to right direction and display the items in the list.
    c. Traverse the list from right to left direction and display the items in the list.
    d. Insert an item at the nth position in the list.
    e. Delete a specified item from the list.

3. 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, the 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. Use circular linked list.