Data Structures and Algorithms
CS-F22
LAB-02

Issue Date: July 05,2024

Start Time: 8:15 AM
Completion Time: 11:15 M

Total Marks : 50

Objective:

In this lab, students will understand about circular linked lists and stack working. The objective is to reinforce understanding of different functionalities performed by stack.

Instructions:

1) Follow the question instructions very carefully, no changes in function prototypes are allowed.
2) Your laptops must be on airplane mode.
3) Anyone caught in an act of plagiarism would be awarded an "F" grade in this Lab.

TASK 01: Josephus Problem using Circular Linked List [20 Marks]

The Josephus problem is a theoretical problem related to a certain elimination game. The problem is as follows:

N people are standing in a circle, numbered from 1 to N. Starting from a given person, you count around the circle, removing every M-th person until only one person remains.

⇨ Write a function which receives a circular doubly linked list in which nodes have positions from 1 to N, return the position of last remaining node after removing every m-th node starting from head.

Function prototype:

int removeMthNodes(CDLL & list, int m);

Sample run:

m = 3

Input: 1↔ 2 ↔ 3 ↔ 4 ↔ 5 ↔ 6 ↔ 7 ➔ start with 1, remove 3
1 ↔ 2 ↔ 4 ↔ 5 ↔ 6 ↔ 7 ➔ start with 4, remove 6
1 ↔ 2 ↔ 4 ↔ 5 ↔ 7 ➔ start with 7, remove 2

Final Output: 4

TASK 02: Sorting a stack [20 Marks]

Given a stack of integers, sort it in ascending order.
Function prototype:

Stack sortStack(Stack & s);

Sample run:
Input: [34, 3, 31, 98, 92, 23]
Output: [3, 23, 31, 34, 92, 98]

TASK 03: Palindrome Linked List [10 Marks]

Given the head of a singly linked list, return true if it is a palindrome or false otherwise.
Function prototype:

bool isPalindrom(Node * head);

Sample run:
Input: head = 1 -> 2 -> 2 -> 1
Output: true

Input: head = 1 -> 2
Output: false