National University of Sciences & Technology
School of Electrical Engineering and Computer Science
Department of Computing

CS-250 Data Structures & Algorithms (3+1)

| Assignment 1 | |
|---|---|
| Maximum Marks: 10 | Instructor: Dr. Muhammad Shahzad |
| Due Date:  19 November, 2020 | Linked List & Stack Data Structures |

**Objectives:**
To develop understanding of the concepts of the linked list and stack data structures.

**Tools/Software Requirements:**
C/C++

## Task 1

Decode the given sequence to number as follows:

| Sequence | Output |
|---|---|
| SSGGSGSG | 12543768 |
| SGSGSS | 132546 |
| GGGG | 4321 |
| SSSS | 1234 |

Where **S** represents 'Shrink' and **G** represents 'Grow'.

The idea is that for each element in the input sequence, we insert its position into a stack (assuming the position starts from 1). After inserting it to stack, if the current element is 'S' (shrink) or the whole input sequence has been processed, we empty the stack, appending the positions from stack in output. Otherwise, for 'G' (grow), the stack keeps growing.

**Your task is to implement this decoder algorithm using stack, that supports characters 'S' and 'G' as input.**

## Task 2

Modern computers can support many programs running at the same time. Under the hood, it is the job of the Operating System to schedule these different processes. Only of the basic scheduling algorithms used by Operating Systems is Round-robin Scheduling.

Round-robin Scheduling is a simple algorithm in which a process is only allowed to run for a fixed amount of time (**quantum**). If a process does not finish within the specified quantum, it is moved to the end of the line and the CPU moves to the next process. If the process is completed within a quantum, it is removed from the line. All the incoming (new) processes are inserted at the end of the line.

Your task is to implement this Round-robin Scheduling algorithm for a CPU, from scratch, with **QUANTUM = 5**. One of the best ways to implement it is through the use of a circular linked list as follows:
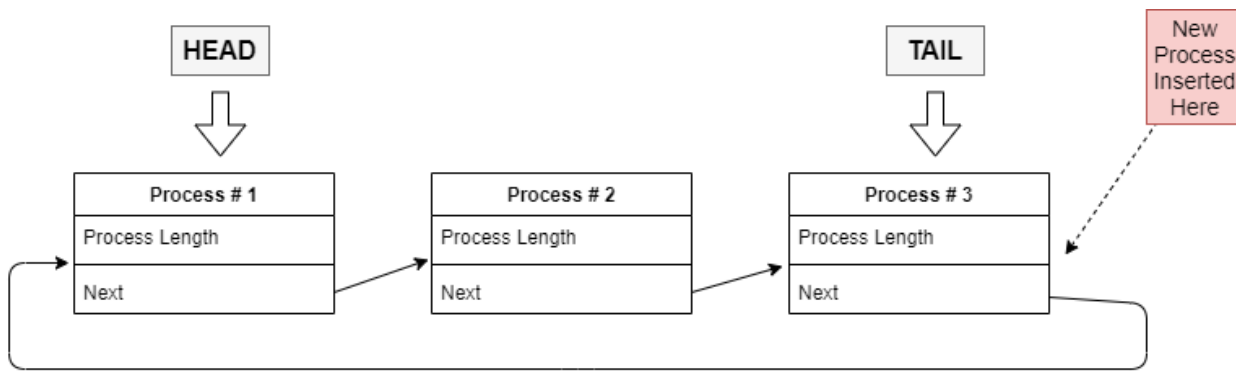


**Note**: Process Length is the amount of time the process would take to complete. It can be greater than the defined quantum.

**Deliverables**

Upload source files along with the output snapshots in a single word file on LMS.

**Note:**

There may be a random quiz/viva from the assignment.

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