Introduction to Programming

MTech CS, First Year, Indian Statistical Institute

Assignment 3 : Basic Data Structure

Posted on 1 October 2014 | Due on 20 October 2014

Problem 1

Write a C code to construct a singly linked list, and to perform basic operations on the same. The program should allow the user to create a new linked list, add a node to the linked list at a location desired by the user (beginning, end, or after a specific node), delete a node from a location desired by the user (beginning, end, or specified otherwise), and print the linked list.

Problem 2

Given an existing singly linked list (by address of the first node), write a function `findLoop` to determine if there exists any loop in the list. Write another function `removeLoop` to break/remove loop(s) in the list, if there exists any. For this problem, provide a theoretical write-up explaining the algorithm you use, and discuss its runtime.

Problem 3

Implement a stack and a queue, independently, using singly linked lists. The structures should have basic operational functions – `stackPush`, `stackPop`, `queuePush`, `queuePop` – and independent functions `stackPrint` and `queuePrint` to print the elements in the respective structures.

Problem 4

Implement a queue using only stack(s) as components; the standard queue functions `queuePush` and `queuePop` should be simulated by calling native stack functions like `stackPush` and `stackPop` on the component stack(s). Similarly, implement a stack using only queue(s) as components.

Problem 5

Write a C code to implement a single-line command-line scientific calculator. The command-line input from the user will be a completely parenthesized *infix* mathematical expression (without gaps) comprising of basic binary arithmetic operations like `+,-,*,/,%` and `^` (power), and basic mathematical functions like `sin,cos,tan,log,exp` etc. You may use the `math.h` library.

Bonus: In addition to evaluating the expression, print the *prefix* and *postfix* forms, and allow the user to input rational numbers in decimal format within the aforesaid mathematical expression.

Good Luck! ☺