School of Computer Science, University of Windsor

COMP 2540: Data Structures and Algorithms

Term: Summer 2021

Instructor: Dr. Asish Mukhopadhyay

Lab 3
Posted: 28 May, 2021
Due: 03 June, 2021, 11:59 pm

Instructions:

- You are expected to finish the lab by the end of the posted date. Submissions beyond the due date will earn a penalty of $n * 25\%$, where $n = submissionDay - dueDay$. Thus if the lab is due Tuesday and you submit on Wednesday, this will be considered a day late.
- Whether or not you finish your work during the lab hour you will have to upload your work on BLACKBOARD for record-keeping and grading before the beginning of the next lab. Create a script file as follows:

```
1. script LabName.txt
2. cat LabName.c
3. cat input.txt (ignore this line if no input.txt file has been created)
4. cc labName.c
5. ./a.out < input.txt (./a.out, if there is no input.txt file)
6. ls -l
7. exit (DO NOT FORGET THIS STEP!!)
```

  If you have not created an input.txt file, you can skip step 3 and in Step 5 simply use `./a.out`.

- There will be no make-up for missed labs. If you have missed a lab for truly extenuating circumstances (like illness or family emergency) I will consider allowing you to make a late submission. However, I need to be informed by email about this on the day of the missed lab. The email should include your name and SID.

Problem:

Implement (in C) an algorithm that uses a stack to check if a parentheses sequence is balanced. Note that a parentheses sequence is balanced if it is of the form (S) or of the form (SS), where S is any balanced parentheses sequence. See the courseware for more information on balanced parentheses sequences.

Implement a stack using an array of size n. The leftmost index 0 of the array corresponds to the bottom of the stack and the index of the stacktop lies between 0 and $n-1$ so that stack elements span the index range $[0..stacktop]$. Note that the size of the stacktop bounds the number of elements that the stack can contain.

Test your program on three different kinds of inputs:

1. String is unbalanced in the sense that there are more opening (resp. closing) than closing (resp. opening) parentheses. For example: "(((()".
2. String has an equal number of opening and closing parentheses but not balanced. That is, there exists a closing parenthesis for which there is no nearest opening parenthesis to its left. For example "))((".
3. String is balanced and is of the type (S) or of the type SS. For example, "()", or "(())()"

You must comment your program carefully to enhance its readability and clarity. If your program is not commented you will lose 1 mark.

(10 points)