King Fahd University of Petroleum & Minerals
College of Computer Science and Engineering
Information and Computer Science Department
ICS 202 – Data Structures

Stacks and Queues

Objectives
The objective of this lab is to design, implement and use Stacks and Queues.

Outcomes
After completing this Lab, students are expected to:
- Design classes for Stacks and Queues.
- Implement Stack and Queue classes using array and Linked Lists.
- Developing applications that use stacks and Queues.

Notes
For the purpose of this lab, you may download the attached programs.

Lab Exercises
1. Download and run the files **`Stack.java, LLStack.java`**, **`Queue.java`**, **`StackTest.java`**.

2. Write a method (in the class **`StackTest`**)

```
public static boolean isPalindrome(String input)
```

that checks if a given string is a palindrome using a stack. Test your method using the following strings: **`civic, madam, apple`**.

2. Write a method **`public static Stack reverse(Stack s)`** that reverses the order of elements on stack ***s*** using a **`Queue`**. Test your method using some example stacks.

2. Write a method **`public static boolean isBalanced(String expression)`**, that checks if a given mathematical expression is balanced or not. The algorithm for evaluating parentheses is as follows:

(a) Remove all non-parentheses from a mathematical expression.
(b) Given an opening parenthesis, i.e., a '[', a '(' or a '{', push it onto the stack.
(c) Given a closing parenthesis, pop an opening parenthesis from the stack:
  (i) if the closing parenthesis and the opening parenthesis match, it is a successful match
  (ii) if the parentheses do not match, the expression is not balanced
  (iii) if the stack is empty, the expression is not balanced
(d) if, at the end of the program, the stack is empty, then the expression is balanced.

For example: **[3 + (2 – 4) + {(a – b)}]** is balanced, while **[3 + 2(** and **{ 7 + [a – b}]** are not balanced.

The method takes as input a mathematical expression and outputs whether the input is balanced or not. Use stacks to find your answer. Test your method on ((3), [(3 + 4)] and {{( )( )}}.