CS 251
Fall 2007
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Assignment 3
Due Monday September 17, 11:59PM

Recursion & Stacks

1. Write a recursive function that reads a positive integer n from the standard input and prints to the standard output the permutations of the numbers $\{1, 2, …, n\}$. What is the running time of the function?

2. Implement a C++ class that models the stack ADT. The elements are integers and are stored in an array. The array should increase in length by 10 when a push does not have room to store the new element.
   a. Show that the amortized cost of a push is $O(n)$ using the accounting method.
   b. Use the stack class in a program that checks whether a string of characters is parenthetically correct, meaning that the parenthetic symbols (), {}, and [] are balanced and properly nested. The string, which ends with the character 'z', is read from the standard input, and the program must print the answer as *yes* or *no*.

3. Extra-credit: Solve the *Towers of Hanoi* puzzle (see problem C-4.6 in textbook at page 198) for $n = 5$ using the stack class and display the solution visually as a collection of images saved in a text file, using your 2D graphics application from A1. (3%)

4. Turn in instructions:
   a. Assignment specific
      i. use lab3 for labX and all your files should be in a directory named lab3 and in no other subdirectory.
      ii. the command will be /turnin -c cs251 -p lab3 lab3 where all your files are in the lab3 directory and you are in the directory above lab3
      iii. for question 1, the file will be named perm.cc and will be written in C++
      iv. for question 2, the files will be named stack.h, stack.cc, main.cc (your application code goes in main.cc) and will be written in C++
      v. for question 3, the file will be named hanoi.cc and will be written in C++. the textfile with the image solution will be named hanoi.txt
      vi. include a Makefile for perm, stack, and hanoi and have it build the programs as follows by having separate rules:
          make perm creates the executable perm
          make stack creates the executable stack
          make hanoi creates the executable hanoi
      vii. turn in a pdf document for written part in question 1 and 2.a.

   b. General:
      See instruction at http://www.cs.purdue.edu/cgvlab/courses/251/As/turnin.html
      Make sure to check it EVERY TIME before submitting a new assignment. It is kept updating.