

# CS 240: Data Structure

## Problem Set 2

Due: 03/13/2020

### **Instructions:**

Please follow the instruction given at each problem for submission. The deadline of each assignment is 11:59 pm on the due date, unless otherwise specified. It is important that your code/solution is straight forward, not cumbersome. At the beginning of each cpp file, you must include the following:

- 1. Description:** description of the program (later we will elaborate this more, but for now, just describe what the program does)
- 2. Author:** the person who writes this program
- 3. Date:** the very last date/time the program is modified

**First Name:**

**Last Name:**

**Score:**        /120

**Problem 1 OOP and ADTs:: Classes 30 pts**

The point-slopes equation of a line with slope  $m$  and passing through point  $P$  with coordinates  $x_1, y_1$  is

$$y - y_1 = m(x - x_1)$$

The slope-intercept equation with slope  $m$  and  $y$ -intercept  $b$  is

$$y = mx + b$$

Write and test a class **Line** describe its slope and a point on the line (that is to say in your class you have two attributes: *slope* and *point*) along with functions that

- (a) A constructor that sets the value of the above two attributes.
- (b) A function (PointSlope) finds the point-slope equations of the line
- (c) A function SlopeIntercept finds the slope-intercept( equation of the line

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**Problem 2    Standard Input/Output and String 30 pts**

Write a simple text-formatting program (TextFormat.cpp) that reads a text file (input.txt) and produces another text file (output.txt) [you can choose to be fixed as given here or you can be creative asking the user to give the file names for input file and output file] in which blank lines are removed, multiple blanks are replaced with a single blank and no lines are longer than some given length (in your code, it would prompt up asking the users for this value). Put as many words as possible on the same line. You will have to break some lines of the given file, but do not break any words or put punctuations marks at the beginnign of a new line.

**Problem 3 Linked List in C++ 30 pts**

The shuffle merge of two lists  $X = x_1, x_2 \cdots x_n$  and  $Y = y_1 y_2 \cdots y_m$  is

$$z = x_1 y_1 x_2 y_2 \cdots x_n y_n y_{n+1} \cdots y_m \quad \text{if } n \leq m$$

$$z = x_1 y_1 x_2 y_2 \cdots x_m y_m x_{m+1} \cdots x_n \quad \text{if } m \leq n$$

Write an algorithm to do the shuffle-merge two linked lists (struct LL with attributes char value, LL \* next). Just change links in the two lists (thus destroying the original lists) to produce the merged list

**Problem 4 Stacks:: 30 pts**

A prime factorization of a number  $n$  is  $n = p_1 * p_2 * \dots * p_k$  where  $p_i$  is a prime number where  $1 \leq i \leq k$ . For instance:

$$3960 = 11 * 5 * 3 * 3 * 2 * 2 * 2$$

We want the factors to be presented in a descending order. [Hint: 1. Find factors by iterations and modulo 2. Once found, put into stack 3. Then just pop]

## Problem 5 Practice

1. Trace on functions that pass parameters via (a) reference (b) pointer (c) variables
2. Create a simple linkedlist by inserting the inputs one after one to the head of the list (no sorting required); What elements inside struct??
3. Given an array of numbers, how would you sort them? It does not have to be efficient. Just your ideas.
4. The post man problem from PS 1 but now you ask for input from the user to determine the size of the array (i.e. using dynamic array now)
5. Please make sure you can follow the the uploaded cpp files in the in class exercise section, also questions asked in the section.