

CS2710 - Programming and Data Structures Lab

Lab 1 (ungraded)

Jul. 31, 2024

Instructions

- You are expected to solve ALL the problems in the lab, using the local computer, C++ language, and g++ compiler.
 - The questions are based on your training in programming in CS1111. So no additional inputs are needed, except the changes needed to switch from C to C++.
 - If you need assistance, ask your TA, not your classmate.
 - You should submit your code to the course **moodle** on time, i.e., on/before 4.45pm (so that TAs can subsequently grade your submissions for graded lab assignments).
 - Internet access and mobile devices are prohibited in the lab.
 - For maintaining arrays required for this assignment, you should use the *vector* template (and not C-style arrays).
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Problems to be solved in lab

1. [C++ I/O STRING PRACTICE] In C++, you can read from stdin a single whitespace-separated token of input using cin, and print output to stdout using cout. For example, the code below uses cin to read and save the first token ("High") as string *s*, and the second token ("5") as integer *n*.

```
string s;  
int n;  
cin >> s >> n; //assume user inputs "High 5"  
cout << s << ";" << n << endl; //prints "High;5"
```

Note that you can use the function "getline(cin, s)" to read the entire line (including spaces) into the string variable *s*.

As a practice problem, write a program to print individual welcome message to students enrolled in the PDS Lab course. For each student, the input will contain the following two lines:

Dept Batch Degree RollNo

Name Surname

You need to print the message "Welcome to PDS Lab, Name Surname RollNo".

Input Format: The first line will contain *n*, the number of students enrolled in the course. Subsequently, there will be $2n$ lines, with 2 lines per student of the form:

Dept Batch Degree RollNo

Name Surname

Constraints:

$$1 \leq n \leq 100$$

Output Format: You need to print lines, 1 line per student (in the same order as input) of the form:

Welcome to PDS Lab, Name Surname RollNo

Sample Input 0

2

CS 21 BTech 001

Aadyot Bhardwaj

CS 21 BTech 002

Aashish Choudhary

Sample Output 0

Welcome to PDS Lab, Aadyot Bhardwaj 001

Welcome to PDS Lab, Aashish Choudhary 002

2. [COUNTING ON YOU MAGIC] Given a vector of integers, print the **number of magic** elements in the vector. A *magic* element is an element in the vector which is less than all the elements to its left in the vector. The first element of the vector, that is element indexed at 0 is not magic by definition. The vector may also contain duplicates.

Input format : First line of the input contains a single integer N (≥ 2), denoting the size of the vector. Next line contains N space separated integers like 10 21 34 23 53.

Example :

Input :

5

6 9 12 4 1

Output :

2

Explanation :

For the vector $\{6, 9, 12, 4, 1\}$, the magic elements are 4 and 1, because they are less than every element to their left. Hence there are two numbers which are magic numbers and the output is 2.

Constraints :

$$1 \leq N \leq 200$$

Input	Output
10 30 100 120 -40 87 -30 5 20 -10 -50	2
15 450 348 301 247 232 211 172 95 0 -7 -23 -121 -234 -319 -415	14

3. [ROBOT ON THE LINE] Consider a robot which can only move on a straight line, either left or right from its current position.

Initially, the robot is placed at the integer coordinate $x = X$. Suppose the robot is also given a sequence of commands, which is described by a string S of length N . Each character of this string is either "L" or "R", denoting that the robot should move one step to the left (decreasing its coordinate x by 1) or to the right (increasing x by 1), respectively.

Implement the most efficient solution you can think of. Does your solution run in time proportional to N ?

Input Format: The first line contains two space-separated integers N and X . The second line contains a single string S of length N .

S only contains the characters "L" and "R"

Sample input/output pairs:

The robot followed the path $10 \rightarrow 11 \rightarrow 12 \rightarrow 11 \rightarrow 10 \rightarrow 9 \rightarrow 8$, thus visiting a total of 5 distinct points.

8

[illegible]

100

6

- 3

Input format: First line of the input contains a single integer N , denoting the number of total soldiers. Next line contains N space separated integers like 10 21 34 23 12. The sequence of integers a_0, a_1, \dots, a_{N-1} satisfies the property that there exists an index $0 \leq p \leq N - 1$ such that $a_0 < a_1 < a_2 < \dots < a_p$ and $a_p > a_{p+1} > \dots > a_{N-1}$.

Example :

Input :

7

100 200 340 780 600 550 250

Output :

3

Explanation :

Soldier with maximum height (780) is standing at position 3.

Note:

Indexing starts with index zero i.e. 0.

Your code should consider the possibility of Regiment-A or Regiment-B having no soldiers at all.

Binary search will be faster.