

# EECE 230 Introduction to Programming, Sections 3, 4, and 12

## Quiz I

Oct 30, 2012

- The duration of this exam is 2 hours and 40 minutes.
- It consists of 4 problems.
- The exam is open book. You can use also all the material on Moodle: lecture notes, programming assignments, and solutions, etc. You are **NOT** allowed to use the **web** (**imail** included). You are not allowed to use **USB's** or files previously stored in your **account**.
- If you violate the above rules or if you communicate with a person other than the exam proctors during the exam, you will immediately get zero and you will be referred to the appropriate disciplinary committee.
- Active cell phones and any other unauthorized electronic devices are absolutely not allowed in the exam rooms. They should be turned off and put away.
- Plan your time wisely. Do not spend too much time on any one problem. Read through all of them first and attack them in the order that allows you to make the most progress.
- Submit your solutions each part in a separate file as indicated in the booklet. Include your name and ID number in each file. Submit the files online in a single zip file called *yourLastName.yourFirstName.zip*.
- Good luck!

**Problem 1 (20 points). Consecutive Integers**

Write a program which prompts the user to enter three integers, and checks whether or not they are consecutive in increasing order or in decreasing order.

*Examples:*

Please enter three integers: 3 4 5  
YES consecutive in increasing order

Please enter three integers: 5 4 3  
YES consecutive in decreasing order

Please enter three integers: 4 3 5  
NO

Please enter three integers: 3 4 9  
NO

Submit your solution in a file called Prob1.cpp including your name and ID number.

**Problem 2 (25 points). Largest divisor**

Write a computer program which prompts the user to enter a positive integer  $n$ . Your program is supposed to find the largest integer strictly less than  $n$  which divides  $n$ .

For example if you enter 20, your program should print 10 since the divisors of 20 are : 1, 2, 4, 5, 10, and 20. If you enter 7, your program should print 1 since the divisors of 7 are 1 and 7.

If the user enters zero or a negative number, your program should print the error message "input not positive".

Submit your program in a file called Prob2.cpp including your name and ID number.

**Problem 3 (25 points). Repeated list**

Write a program which prompts the user to enter a positive even integer  $n$  followed by a list of  $n$  integers. Your program is supposed to check whether or not the first half of the list is the same as its second half. Your program is supposed to give a YES/NO answer only if  $n$  is positive and even. If  $n$  is not positive and even, your program is supposed to display an error message.

*Examples:* The answer is YES for each of the following lists

- 2, 10, 3, 2, 10, 3
- -10, 3, 20, 20, -10, 3, 20, 20
- 3, 3

The answer is NO for each of the following lists

- 2, 11, 3, 2, 10, 3
- 10, 4, 20, 20, -10, 3, 20, 20
- 3, 1

Submit your solution in a file called Prob3.cpp including your name and ID number.

**Problem 4 (30 points+5 bonus points). Max sum**

- a) **(25 points)** Write a program which prompts the user to enter a list of integers and finds the **subsequence** (of contiguous elements) of the input list **whose sum is maximum**.

Assume that the list end is indicated by the sentinel  $-999$ ,

For example, consider the sequence

-1 2 -1 3 -5 -999

The following table shows all its subsequences (of contiguous elements) underlined and the corresponding sums.

subsequence	sum	subsequence	sum
<u>-1 2 -1 3 -5</u>	-1	-1 <u>2 -1 3 -5</u>	-1
-1 <u>2 -1 3 -5</u>	1	-1 2 <u>-1 3 -5</u>	-1
-1 2 <u>-1 3 -5</u>	0	-1 2 <u>-1 3</u> -5	2
-1 2 -1 <u>3 -5</u>	3	-1 2 <u>-1 3 -5</u>	-3
<u>-1 2 -1 3 -5</u>	-2	-1 2 -1 <u>3 -5</u>	3
-1 <u>2 -1 3 -5</u>	2	-1 2 -1 <u>3 -5</u>	-2
-1 <u>2 -1 3</u> -5	1	-1 2 -1 <u>3 -5</u>	-5
-1 <u>2 -1 3</u> -5	4		

Thus the maximum sum of a subsequence is 4 (second column, last row).

Note that what makes this problem nontrivial is that the integers in the list are allowed to be negative (if all the integers are nonnegative, then the maximum sum subsequences is the the whole sequence).

Below are other examples of integer sequences and their corresponding maximum sum subsequences (underlined).

maximum sum subsequence	maximum sum
-1 <u>2 -1 3</u> -5	4
-10 -1 <u>3 4 -3 5 -2 7</u> -11 2 4	14
<u>1 4 0 2</u>	7
-10 <u>2 2</u> -10 1 3	4
<u>1 2 -3 4 5</u> -9 2 6 -10 5	9
-1 <u>0</u> -5 -2	0
-1 -2 -5 -2	0

Note that in the last sequence all the integers in the list are negative, hence the maximum sum subsequence is the empty subsequence and the max sum is by convention zero.

You are only asked to find the maximum sum. That is, your program is NOT supposed to display a subsequence whose sum is equal to the max sum (i.e., the above underlined subsequences).

Submit your solution in a file called Prob4a.cpp including your name and ID number.

- b) **(5 point + 5 bonus points)** In this part you are asked to solve part (a) without using arrays.

This part is difficult but it has a simple solution.

Submit your solution in a file called Prob4b.cpp including your name and ID number.