

Northeastern University
College of Engineering
Department of Electrical & Computer Engineering

EECE7205: Fundamentals of Computer Engineering

Homework 1

Instructions

- For programming problems:
 1. Your code must be well commented by explaining what the lines of your program do. Have at least one comment for every 4 lines of code.
 2. You are **not** allowed to use any advanced C++ library unless it is clearly allowed by the problem. For example, you cannot use a library function to sort a list of data if the problem is asking you to implement an algorithm to sort the list.
 3. At the beginning of your source code files write your full name, students ID, and any special compiling/running instruction (if any).
 4. Your code must compile and tested with a standard GCC compiler (available in the CoE Linux server), before submitting the source code file(s) (do not submit any compiled/executable files):
 - a. If your program does not compile with a GCC compiler due to incompatible text encoding format, then make sure the program is saved with Encoding Unicode (UTF-8). In visual studio, Save As -> Click on the arrow next to Save -> Save with Encoding -> Yes -> Unicode (UTF-8) -> Ok
 - b. Compile using `g++ -std=c++11 <filename>`
- For non-programming problems, include explanation of all steps of your answers/calculations not only the final results.
- Submit the following to the homework assignment page on Canvas:
 1. Your homework report developed by a word processor (e.g., Microsoft Word) and submitted as one PDF file. For answers that require drawing and if it is difficult on you to use a drawing application, which is preferred, you can neatly hand draw “only” these diagrams, scan them, and insert the scanned images in your report document. The report includes the following (depending on the assignment contents):
 - a. Answers to the non-programming problems that show all the details of the steps you follow to reach these answers.
 - b. A summary of your approach to solve the programming problems.
 - c. The screen shots of the sample run(s) of your program(s).
 2. Your well-commented programs source code files (i.e., the .cc or .cpp files).

Do NOT submit any files (e.g., the PDF report file and the source code files) as a compressed (zipped) package. Rather, upload each file individually.

Note: You can submit multiple attempts for this homework, however, only what you submit in the last attempt will be graded. This means all required files must be included in this last submission attempt.

Reading requirement:

You need to go over the “C++ Programming Overview” slides posted on the course Canvas and practice with the C++ programs examples included in the slides before attempting this homework assignment.

Problem 1 (30 Points)

Write a C++ program to implement and test two functions: SwapP and SwapR.

1. SwapP swaps the values of two integer variables using pass-by-pointer.
2. SwapR swaps the values of two integer variables using pass-by-reference.

Write a main function in your program to test these two functions.

Problem 2 (30 Points)

The following *main* function of a C++ program calls the function MinFirst that moves the minimum value in a pre-initialized array *v* of integers to the beginning of the array. The contents of the array are displayed on the screen after that change.

```
int main()
{
    // Declare array
    int v[] = {6, 2, 7, 8, 1, 5};
    // Bring Min value to beginning
    MinFirst(v, 6);
    // Print array
    for (int i = 0; i < 6; i++)
        cout << v[i] << ' ';
    return 0;
}
```

Implement the function MinFirst in C++. The function brings the **minimum** value in the array to the first index of the array (i.e., *v*[0]) and moves the other contents as needed. Your algorithm must work on the given array without defining any other temporary arrays and for **any array size**. For the above example, the program will display “1 x x x x x” on the screen where the x’s represent the other numbers (6, 2, 7, 8, 5) in any order as needed by your algorithm. **Do not use** the swap function provided by the language library.

Problem 3 (40 Points)

Write a C++ program that takes as inputs from a teacher, the names and ages of her/his students along with the grade of each student in an exam. Define a **struct** with three fields: **LastName**, **Age**, and **Grade**. In your program, the main function creates an array of this struct to store the students' data. Assume the following:

- LastName is a one word with only letters from the English alphabet with no spaces.
- All ages are integers that have to be in the range from 16 to 40 (inclusive) and no two ages have the same value.
- All grades are integers that have to be in the range from 0 to 100 (inclusive) and no two grades have the same value.

At the beginning, you will need to ask the teacher for the size of the class (the number of students) and use **dynamic memory allocation** to create the needed array.

The program will display (as its outputs) the following:

1. The median of the students' ages.
2. The average of the students' grades.
3. The name and grade of the two students with the highest two grades.
4. The name and grade of the two students with the lowest two grades.

Each one of the above four outputs must be implemented in a separate function where the array is passed to these functions as a parameter. Do not use any global variables in your program.