THE HONG KONG POLYTECHNIC UNIVERSITY
Department of Electronic and Information Engineering

Computer Programming (ENG236) Homework 1

(*Note: the format of Programming Test 1 is very similar to this homework.*)

A. Background

Sorting is one of the most common operations in computing. There are many studies on the methods for sorting and many fast algorithms have been devised. Nevertheless, if the number of items to be sorted is not that many, some simple approaches can also be very effective. The following is one of them. Assume that `A`, `B`, `C`, `D`, `E` are 5 variables storing 5 numbers, respectively, and we would like to show the numbers on the screen in descending order. It can be done using the procedure as follows.

1. Initialize a variable `F` that keeps a very large number (must be larger than `A`, `B`, `C`, `D`, `E`)
2. Search among `A`, `B`, `C`, `D`, `E` for the biggest number, which is smaller than `F`
3. Show that number on the screen
4. Save that number to `F`
5. Repeat steps 2, 3, and 4 until all 5 numbers are shown on the screen.

B. The Programming Task

By using C++ and the Visual C++ .NET environment, implement a simple sorting application program with details as follows.

Q1. Start a new project with name "`partQ1`" to do this question. The project should be a console application that shows the following main menu:

```
1. Input data
2. Select operation
3. Quit

Please enter your choice (1, 2, and 3 to quit):
```

Users are expected to enter an integer of value 1, 2 or 3 only. When any other numbers are entered, the program will display "`Invalid input..... Please enter again!`" and the main menu will be shown again.

If the user selects 3, the program will show a message "`Goodbye!`" and then end (return to the command prompt).

If the user selects 1, the program will show a message "`Please enter 10 floating-point numbers`". Your program should then allow the user to enter 10 floating-point numbers and store them into 10 variables. Get back to the main menu when the user finishes entering the numbers.

If the user selects 2, the program will show another message "`Please select the desire operation`" and get back to the main menu.

---------------------------------- PASS line ---------------------------------

Q2. Start a new project namely “`partQ2`” to do the following. Modify the program developed for Q1 to perform the following tasks:

If the user selects 2 in the main menu, rather than showing the message as mentioned in Q1, a sub-menu should be shown as follows.

```
a. Find the maximum
b. Find the minimum
c. Show the numbers in descending order
d. Show the numbers in ascending order
q. Return

Please enter your choice (a, b, c, d, and q to return):
```

a. The user is expected to enter a character of ‘a’, ‘b’, ‘c’, ‘d’ or ‘q’ only. If any other characters are entered, the program will display “`Invalid input..... Please enter again!`” and then show this sub-menu again.
b. If the user chooses ‘a’, the biggest of the 10 entered numbers should be shown on the screen. Get back to this sub-menu when the number is shown.
c. If the user chooses ‘b’, the smallest of the 10 entered numbers should be shown on the screen. Get back to this sub-menu when the number is shown.
d. If the user chooses ‘c’, show a message “`Numbers in descending order: `” and get back to this sub-menu.
e. If the user chooses ‘d’, show a message “`Numbers in ascending order: `” and get back to this sub-menu.
f. If the user chooses ‘q’, do nothing but return to the main menu.

---------------------------------- CREDIT line -------------------------------

Q3. Start a new project namely “`partQ3`” to do the following. Modify the program developed for Q2 such that when user chooses ‘c’ or ‘d’ in the sub-menu of Q2, the numbers entered by user will be shown on the screen in descending or ascending order, respectively. Note that it is <u>mandatory</u> to use the method as described in Section A to do sorting in descending order. For displaying the data in ascending order, the method in Section A should be slightly modified. Get back to the sub-menu in Q2 when the required operation has been performed.

------------------------------- DISTINCTION line ----------------------------

C. Instructions

1. Your program should be well commented. Try to explain your program as clear as possible using comments.
2. The program structure will be an important part of your work. Never try to write your program using a single `main()` function.
3. Though this homework is NOT assessed, you are strongly encouraged to finish it <u>yourself</u> and test your results using Visual Studio .NET. It offers a good chance for you to prepare your Programming Test 1. Please post any of your difficulties in the Forum, and we’ll help you. Suggested solution will be released to you before Programming Test 1.

```
// partQ1
/*-------------------------------------------------------------------------------*/
/*Objective: Create a main menu to let users choose to enter 10 floating-        */
/*    point numbers or display a message, or quit.                               */
/*Usage: partQ1                                                                  */
/*Version: 1                                                                     */
/*Date: Oct. 17, 2005                                                            */
/*-------------------------------------------------------------------------------*/

#include<iostream>
using namespace std;
void menu();  // function prototype
void input();  // function prototype
float f1, f2, f3, f4, f5, f6, f7, f8, f9, f10; // 10 global variables

int main()                                     // main function
{
       menu();                                 // calling function "menu"
       return 0;
}


void menu()
{
       int choice;                      // variable choice
       do
       {
       //==== menu ====
              cout << "\n";
              cout << "1.\tInput Data\n";
              cout << "2.\tSelect Operation\n";
              cout << "3.\tQuit \n\n";

              cout <<"Please enter your choice (1, 2, and 3 to quit):";
              cin >> choice;
              cout << "\n";

              switch (choice)     // choice's options
              {
                     case 1:      // Goto function input(), let user enter 10 numbers
                            input(); break;
                     case 2:      // Goto operation menu
                            cout << "Please select the desired operation.\n"; break;
                     case 3:      // Quit
                            cout << "Goodbye!\n"; break;
                     default:     // other choices, return to main menu
                            cout << "Invalid input..... Please enter again!\n"; break;
              }
       } while(choice!=3); // repeat menu until user enter '3' to quit
}


void input()        // function to read in 10 floating-point numbers.
{
       cout << "Please enter 10 floating-point numbers. \n";
       cin >> f1;
       cin >> f2;
       cin >> f3;
       cin >> f4;
       cin >> f5;
       cin >> f6;
       cin >> f7;
       cin >> f8;
       cin >> f9;
       cin >> f10;
}
```

```
// partQ2
/*------------------------------------------------------------------------------*/
/*Objective: Create a main menu to let users choose to enter 10 floating-       */
/*    point numbers or perform some operations on these numbers.               */
/*    For the operations, another menu is created to let user check maximum,    */
/*    minimum of the 10 numbers.                                                */
/*Usage: partQ2                                                                 */
/*Version: 1                                                                    */
/*Date: Oct. 17, 2005                                                           */
/*------------------------------------------------------------------------------*/

#include<iostream>
using namespace std;
void menu();
void input();
void operations();  //function prototype
float max();  //function prototype
float min();  //function prototype
float f1, f2, f3, f4, f5, f6, f7, f8, f9, f10; // 10 global variables

int main()                                              // main function
{
        menu();                                         // calling function "menu"
        return 0;
}


void menu()
{
        int choice;                             // variable choice
        do
        {
        //==== menu ====
                cout << "\n";
                cout << "1.\tInput Data\n";
                cout << "2.\tSelect Operation\n";
                cout << "3.\tQuit \n\n";

                cout <<"Please enter your choice (1, 2, and 3 to quit):";
                cin >> choice;
                cout << "\n";

                switch (choice)         // choice's options
                {
                        case 1:         // Goto function input(), let user enter 10 numbers
                                input(); break;
                        case 2:         // Goto operation menu
                                operations(); break;
                        case 3:         // Quit
                                cout << "Goodbye!\n"; break;
                        default:        // other choices, return to main menu
                                cout << "Invalid input..... Please enter again!\n"; break;
                }
        } while(choice!=3); // repeat menu until user enter '3' to quit
}


void input()            // function to read in 10 floating-point numbers.
{
        cout << "Please enter 10 floating-point numbers. \n";
        cin >> f1;
        cin >> f2;
        cin >> f3;
        cin >> f4;
        cin >> f5;
        cin >> f6;
        cin >> f7;
        cin >> f8;
        cin >> f9;
        cin >> f10;
```

```
}


void operations()          // menu for option 2: operations
{
       char choice;                     // local variable choice
       do
       {
       //==== operation menu ====
              cout << "\n";
              cout << "a.\tFind the maximum\n";
              cout << "b.\tFind the minimum\n";
              cout << "c.\tShow the numbers in descending order\n";
              cout << "d.\tShow the numbers in ascending order\n";
              cout << "q.\tReturn\n\n";

              cout <<"Please enter your choice (a, b, c, d, and q to return): ";
              cin >> choice;
              cout << "\n";

              switch (choice)            // choice's options
              {
                     case 'a':           // Calculate maximum of the 10 numbers.
                            cout << "The biggest number is:\t "<< max() << endl; break;

                     case 'b':           // Calculate minimum of the 10 numbers.
                            cout << "The smallest number is:\t " << min() << endl; break;

                     case 'c':           // Sort numbers in descending order
                            cout << "Numbers in descending order: \n"; break;

                     case 'd':           // Sort numbers in ascending order
                            cout << "Numbers in ascending order:\n"; break;

                     case 'q':           // Go back to main menu
                            break;

                     default:            // Return to the operation menu
                            cout << "Invalid input..... Please enter again!\n"; break;
              }
       } while (choice!='q');     // repeat operation menu until user enter 'q' to quit
}


float max()                // function to find the maximum
{
       float max=f1;       // set max= 1st floating-point number

       if (f2 > max) max = f2;      //  |
       if (f3 > max) max = f3;      //  |
       if (f4 > max) max = f4;      //  |
       if (f5 > max) max = f5;      //  |-- check if the number > max, if true
       if (f6 > max) max = f6;      //  |-- replace max with that number
       if (f7 > max) max = f7;      //  |
       if (f8 > max) max = f8;      //  |
       if (f9 > max) max = f9;      //  |
       if (f10 > max) max = f10;    //--|

       return max;
}


float min()                // function to calculate minimum
{
       float min=f1;       // set min=1st floating point number

       if (f2 < min) min = f2;      //--|
       if (f3 < min) min = f3;      //  |
       if (f4 < min) min = f4;      //  |
       if (f5 < min) min = f5;      //  |-- check if the number < min, if true,
       if (f6 < min) min = f6;      //  |-- replace min with that number
       if (f7 < min) min = f7;      //  |
       if (f8 < min) min = f8;      //  |
       if (f9 < min) min = f9;      //  |
       if (f10 < min) min = f10;    //--|

       return min;
}
```

```
//partQ3
/*-------------------------------------------------------------------------------*/
/*Objective: Create a main menu to let users choose to enter 10 floating-        */
/*    point numbers or perform operations on these numbers.                      */
/*    For the operations, another menu is created to let user check maximum,     */
/*    minimum, or display in descending or ascending order of the 10 numbers.    */
/*Usage: partQ3                                                                  */
/*Version: 1                                                                     */
/*Date: Oct. 17, 2005                                                            */
/*-------------------------------------------------------------------------------*/

#include<iostream>
using namespace std;
void menu();
void input();
void operations();
float max();
float min();
void descending();  //function prototype
void ascending();  //function prototype
float f1, f2, f3, f4, f5, f6, f7, f8, f9, f10; // 10 global variables


int main()                                     // main function
{
       menu();                                 // calling function "menu"
       return 0;

}


void menu()
{
       int choice;                             // local variable choice
       do
       {
              //==== menu ====
              cout << "\n";
              cout << "1.\tInput data\n";
              cout << "2.\tSelect operation\n";
              cout << "3.\tQuit \n\n";

              cout <<"Please enter your choice (1, 2, and 3 to quit):";
              cin >> choice;
              cout << "\n";

              switch (choice)                  // choice's options
              {
                     case 1:            // Goto function input(), user enter 10 numbers
                            input(); break;
                     case 2:            // Goto operation menu
                            operations(); break;
                     case 3:            // Quit
                            cout << "Goodbye!\n\n";    break;
                     default:           // other choice, return to main menu
                            cout << "Invalid input..... Please enter again!\n";   break;
              }
       } while (choice!=3);// repeat menu until user enter '3' to quit
```

```
}


void input()            // function to read in 10 floating-point numbers.
{
        cout << "Please enter 10 floating-point numbers. \n";
        cin >> f1;
        cin >> f2;
        cin >> f3;
        cin >> f4;
        cin >> f5;
        cin >> f6;
        cin >> f7;
        cin >> f8;
        cin >> f9;
        cin >> f10;
}


void operations()               // menu for option 2: operations
{
        char choice;                            // local variable choice
        do
        {
        //==== operation menu ====
                cout << "\n";
                cout << "a.\tFind the maximum\n";
                cout << "b.\tFind the minimum\n";
                cout << "c.\tShow the numbers in descending order\n";
                cout << "d.\tShow the numbers in ascending order\n";
                cout << "q.\tReturn\n\n";

                cout <<"Please enter your choice (a, b, c, d, and q to return): ";
                cin >> choice;
                cout << "\n";

                switch (choice)                 // choice's options
                {
                        case 'a':               // Calculate maximum of the 10 numbers.
                                cout << "The biggest number is:\t "<< max() << endl; break;
                        case 'b':               // Calculate minimum of the 10 numbers.
                                cout << "The smallest number is:\t " << min() << endl; break;
                        case 'c':               // Sort numbers in descending order
                                cout << "Numbers in descending order: \n";
                                descending(); break;
                        case 'd':               // Sort numbers in ascending order
                                cout << "Numbers in ascending order:\n";
                                ascending(); break;
                        case 'q':               // Go back to main menu
                                break;
                        default:                // Return to the operation menu
                                cout << "Invalid input..... Please enter again!\n";
                                break;
                }
        }while (choice!='q');           // repeat operation menu until user enter 'q' to quit
}


float max()                     // function to find the maximum
{
        float max=f1;           // set max= 1st floating-point number

        if (f2 > max) max = f2;         //  |
        if (f3 > max) max = f3;         //  |
        if (f4 > max) max = f4;         //  |
        if (f5 > max) max = f5;         //  |-- check if the number > max, if true
        if (f6 > max) max = f6;         //  |-- replace max with that number
        if (f7 > max) max = f7;         //  |
        if (f8 > max) max = f8;         //  |
        if (f9 > max) max = f9;         //  |
        if (f10 > max) max = f10;    //--|

        return max;
}


float min()                 // function to calculate minimum
{
        float min=f1;        // set min=1st floating point number

        if (f2 < min) min = f2;      //--|
        if (f3 < min) min = f3;      //  |
        if (f4 < min) min = f4;      //  |
        if (f5 < min) min = f5;      //  |-- check if the number < min, if true,
        if (f6 < min) min = f6;      //  |-- replace min with that number
        if (f7 < min) min = f7;      //  |
        if (f8 < min) min = f8;      //  |
        if (f9 < min) min = f9;      //  |
        if (f10 < min) min = f10;    //--|

        return min;
}


void descending()    // function to sort numbers in descending order
{
        float temp=-3.4e38;        // Preset temp to be smaller than the smallest number
        float maxn=3.4e38;         // Initialize maxn to be very big

        for (int i=0; i<10; i++)
        {
                // Check if number is smaller than maxn but bigger than the current
                // temp, if true, replace it.
                // After checking with all numbers, temp will become new maxn.
                // Only number smaller than maxn will be considered in each iteration
                // Display maxn.
                if (f1>temp && f1<maxn) temp =f1;
                if (f2>temp && f2<maxn) temp =f2;
                if (f3>temp && f3<maxn) temp =f3;
                if (f4>temp && f4<maxn) temp =f4;
                if (f5>temp && f5<maxn) temp =f5;
                if (f6>temp && f6<maxn) temp =f6;
                if (f7>temp && f7<maxn) temp =f7;
                if (f8>temp && f8<maxn) temp =f8;
                if (f9>temp && f9<maxn) temp =f9;
                if (f10>temp && f10<maxn) temp =f10;

                maxn=temp;          //reset the 2 checking values
                temp=-3.4e38;
                cout << maxn << endl;
        }
}


void ascending()                  // function to sort numbers in ascending order
{
        float temp=3.4e38;         // Preset temp to be bigger than the biggest number
        float minn=-3.4e38;        // Initialize minn to be very small

for (int i=0; i<10; i++)
{
                // Check if number is bigger than minn but smaller than current temp,
                // if true, replace it.
                // After checking with all numbers, temp will become new minn.
                // Only number bigger than minn will be considered in each iteration
                if (f1<temp && f1>minn) temp =f1;
                if (f2<temp && f2>minn) temp =f2;
                if (f3<temp && f3>minn) temp =f3;
                if (f4<temp && f4>minn) temp =f4;
                if (f5<temp && f5>minn) temp =f5;
```

```
        if (f6<temp && f6>minn) temp =f6;
        if (f7<temp && f7>minn) temp =f7;
        if (f8<temp && f8>minn) temp =f8;
        if (f9<temp && f9>minn) temp =f9;
        if (f10<temp && f10>minn) temp =f10;

        minn=temp;                 // reset the 2 checking value
        temp=3.4e38;
        cout << minn << endl;
    }
}
```