

**LAB # 10 Solution**  
**(Relevant Lecture: #18, 20, 21)**

1. Modify your program or the program in the Lab#4 solution file for **Lab#4-Exercise#3** so that the program can perform the following tasks:
  - read Tom's grades for four courses from last semester (for example, 3.7 4.0 3.3 3.7) from the keyboard using `scanf_s()`,
  - compute his average GPA,
  - display the computed average GPA on the screen using `printf()`, and
  - write all the input grades and the computed average GPA to a report file named [TomGrade1.txt](#) using `fprintf()`.Check the file [TomGrade1.txt](#) in your folder after you run the program to confirm the content.

**Solution:**

The statements highlighted in yellow are the extra lines added to the program for Lab#4-Exercise#3.

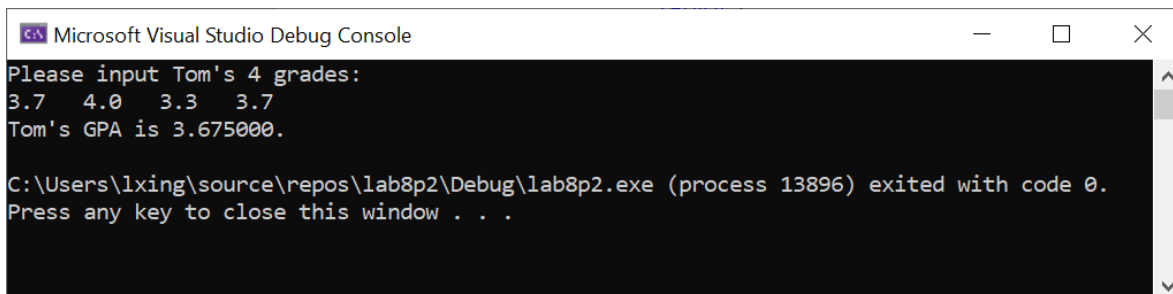
```
#include <stdio.h>

void main(void)
{
    float grade1 = 0;
    float grade2 = 0;
    float grade3 = 0;
    float grade4 = 0;
    float GPA = 0;
    FILE *reportptr;

    printf("Please input Tom's 4 grades:\n");
    scanf_s("%f%f%f%f", &grade1, &grade2, &grade3, &grade4);
    GPA = (grade1 + grade2 + grade3 + grade4)/4;
    printf("Tom's GPA is %f.\n", GPA);

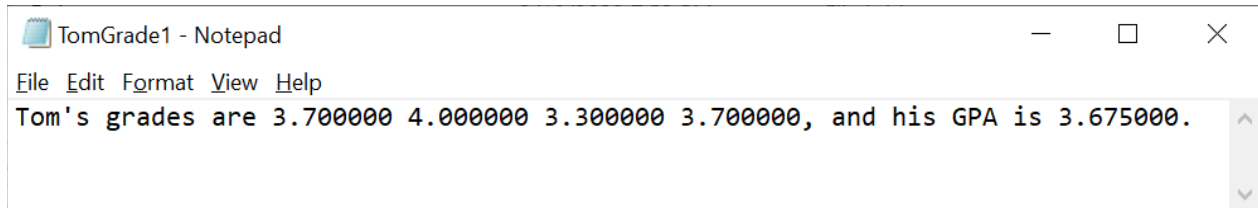
    fopen_s(&reportptr, "TomGrade1.txt", "w");
    fprintf(reportptr, "Tom's grades are %f %f %f %f, and his GPA is %f.",
    grade1, grade2, grade3, grade4, GPA);
    fclose(reportptr);
}
```

**Testing:**



```
Microsoft Visual Studio Debug Console
Please input Tom's 4 grades:
3.7 4.0 3.3 3.7
Tom's GPA is 3.675000.

C:\Users\lxing\source\repos\lab8p2\Debug\lab8p2.exe (process 13896) exited with code 0.
Press any key to close this window . . .
```



```
TomGrade1 - Notepad
File Edit Format View Help
Tom's grades are 3.700000 4.000000 3.300000 3.700000, and his GPA is 3.675000.
```

2. The program in Exercise#1 can handle one student's grades. Modify your program in Exercise#1 so that the program can **handle three students'** grades and GPA calculation and reporting **using a loop**. **For each student**, the following tasks must be performed:

- read the student's grades for four courses from last semester from the keyboard,
- compute this student's semester GPA,
- display the computed GPA on the screen using printf(), and
- write all the input grades and the computed GPA to a report file named [StudentGrade.txt](#) using fprintf().

After you run the program, the file [StudentGrade.txt](#) in your folder should contain grades and GPA for all the three students on three different lines.

### Solution:

```
#include <stdio.h>

void main(void)
{
    float grade1 = 0;
    float grade2 = 0;
    float grade3 = 0;
    float grade4 = 0;
    float GPA = 0;
    int k = 1; //counter
    FILE* reportptr;

    fopen_s(&reportptr, "StudentGrade.txt", "a");
    while (k <= 3)
    {
        printf("Please input student %d's 4 grades:\n", k);
        scanf_s("%f%f%f%f", &grade1, &grade2, &grade3, &grade4);
        GPA = (grade1 + grade2 + grade3 + grade4) / 4;
        printf("Student %d's GPA is %f.\n", k, GPA);
        fprintf(reportptr, "Student %d's grades are %f %f %f %f, and GPA is
%f.\n", k, grade1, grade2, grade3, grade4, GPA);
        k++;
    }
    fclose(reportptr);
}
```

## Testing:

```
Microsoft Visual Studio Debug Console
Please input student 1's 4 grades:
3.0 4.0 3.7 3.3
Student 1's GPA is 3.500000.
Please input student 2's 4 grades:
4.0 4.0 3.7 4.0
Student 2's GPA is 3.925000.
Please input student 3's 4 grades:
3.0 2.7 3.3 3.7
Student 3's GPA is 3.175000.

C:\Users\lxing\source\repos\lab8p2\Debug\lab8p2.exe (process 11020) exited with code 0.
Press any key to close this window . . .
```

```
StudentGrade - Notepad
File Edit Format View Help
Student 1's grades are 3.000000 4.000000 3.700000 3.300000, and GPA is 3.500000.
Student 2's grades are 4.000000 4.000000 3.700000 4.000000, and GPA is 3.925000.
Student 3's grades are 3.000000 2.700000 3.300000 3.700000, and GPA is 3.175000.
```

3. Modify your program in Exercise#1 so that the program can perform the following tasks:

- write Tom's grades for four courses from last semester in the displayed format (one per line) to a file named `TomGrade2.txt` using `fprintf()`,

```
3.3
3.0
4.0
3.7
```
- read the data from the file `TomGrade2.txt` using `fscanf_s()`,
- compute the semester GPA,
- display the four course grades and computed GPA on the screen.

## Solution:

```
#include <stdio.h>

void main(void)
{
    float grade1 = 3.3;
    float grade2 = 3.0;
    float grade3 = 4.0;
    float grade4 = 3.7;
```

```

float g1, g2, g3, g4;
float GPA = 0;

FILE* reportptr;

//write grades to the file
fopen_s(&reportptr, "TomGrade2.txt", "w");
fprintf(reportptr, "%3.1f\n%3.1f\n%3.1f\n%3.1f\n", grade1, grade2,
grade3, grade4);
fclose(reportptr);

//read grades from the file
fopen_s(&reportptr, "TomGrade2.txt", "r");
fscanf_s(reportptr, "%f%f%f%f", &g1, &g2, &g3, &g4);
fclose(reportptr);

//computer GPA
GPA = (g1 + g2 + g3 + g4) / 4;

//dispaly grades and GPA
printf("Tom's grades are %3.1f %3.1f %3.1f %3.1f, and GPA is %3.1f.\n",
g1, g2, g3, g4, GPA);
}

```

### Testing:

Microsoft Visual Studio Debug Console

```

Tom's grades are 3.3 3.0 4.0 3.7, and GPA is 3.5.

C:\Users\lxing\source\repos\lab8p2\Debug\lab8p2.exe (process 24816) exited with code 0.
Press any key to close this window . . .

```

TomGrade2 - Notepad

```

File Edit Format View Help
3.3
3.0
4.0
3.7

```

4. The program below assigns values to a 1-D array and then outputs each array element.
  - a) Using **defined constant** as the size of the array provides flexibility: change the array size to 7, and then run the program, and record and understand your output.
  - b) Change `< array_size` to `<=array_size` in the test expression part of the `for` loop, then see and record what happens.

While you are only required to submit the program files for a) to the M drive, please understand the program and why `<=array_size` would cause a run time error.

```
#include "stdio.h"

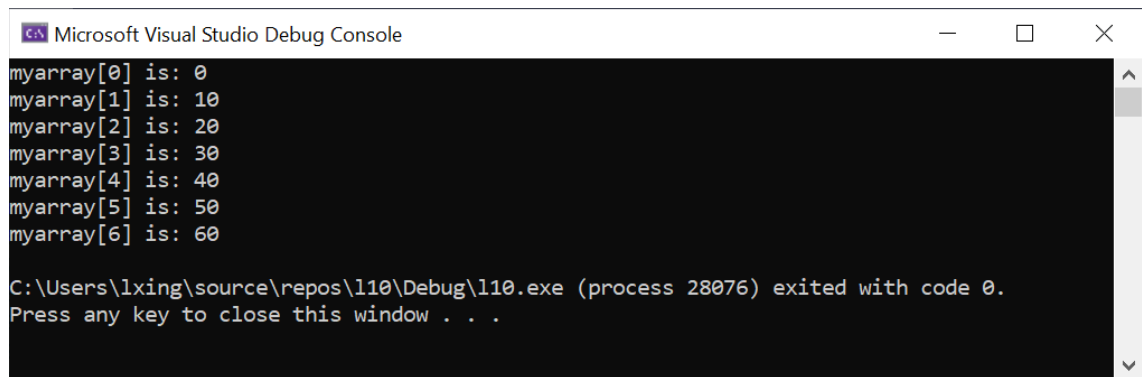
#define array_size 5
#define my_const 10

void main(void)
{
    int myarray[array_size];
    int i;

    for (i = 0; i < array_size; i++)
    {
        myarray[i] = i * my_const;
        printf("myarray[%d] is: %d\n", i, myarray[i]);
    }
}
```

### Solution/Testing:

- a) Output after changing array\_size to 7:

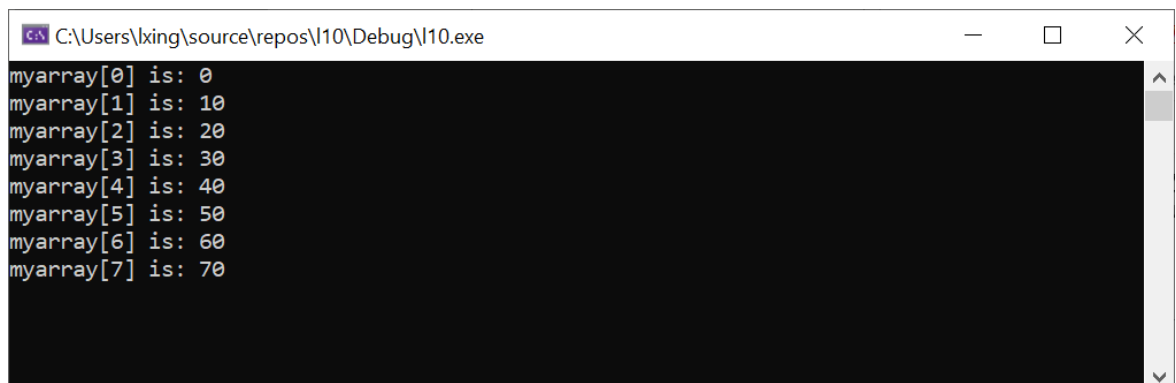


```
Microsoft Visual Studio Debug Console

myarray[0] is: 0
myarray[1] is: 10
myarray[2] is: 20
myarray[3] is: 30
myarray[4] is: 40
myarray[5] is: 50
myarray[6] is: 60

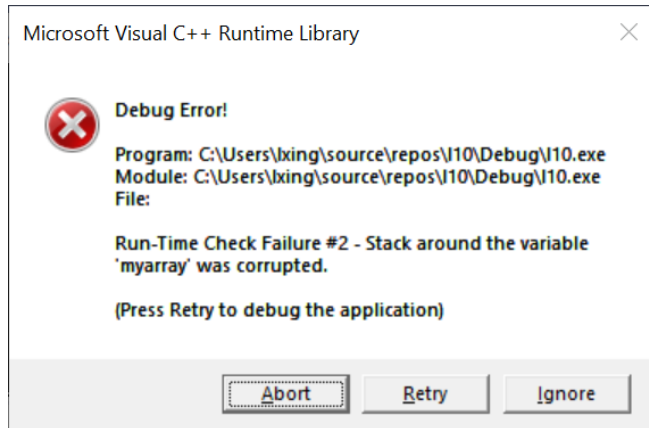
C:\Users\lxing\source\repos\l10\Debug\l10.exe (process 28076) exited with code 0.
Press any key to close this window . . .
```

- b) No compilation error. The program executed. However, you will get a run time error saying that the array variable is corrupted. The output for myarray[7] was also printed.



```
C:\Users\lxing\source\repos\l10\Debug\l10.exe

myarray[0] is: 0
myarray[1] is: 10
myarray[2] is: 20
myarray[3] is: 30
myarray[4] is: 40
myarray[5] is: 50
myarray[6] is: 60
myarray[7] is: 70
```



5. Modify the program in Exercise (4) of Lecture #21 (Slide #7 in the solution file) so that the program reads 10 integer numbers into a 1-D array from the keyboard, finds and prints out the maximum (int), minimum (int) and average (float) of the 10 array elements.

**Testing:** if you input 1 3 5 7 9 2 4 6 8 10 from the keyboard, then the output on the screen should be:

The largest array member is: 10

The smallest array member is: 1

The average is: 5.500000

### **Solution:**

The part highlighted in yellow shows the extra lines added to the program for Exercise (4) of Lecture #21 (Slide 7 in the "Solution to Exercises in L#21")

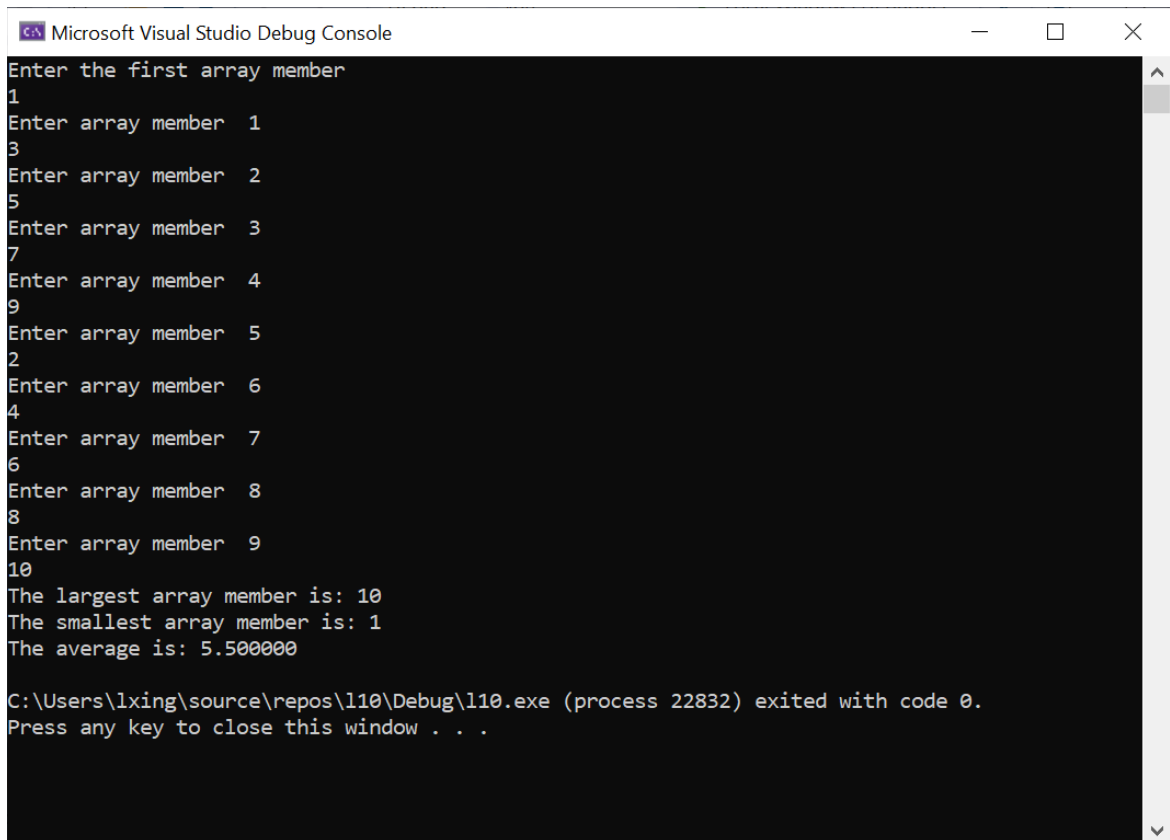
```
#include "stdio.h"
#define array_size 10
void main(void)
{
    int myarray[array_size];
    int max, min, sum=0;
    float avg;

    int i = 0;

    printf("Enter the first array member\n");
    scanf_s("%d", &myarray[0]);
    max = myarray[0];
    min = myarray[0];
    sum = sum + myarray[0];

    for (i = 1; i < array_size; i++)
    {
        printf("Enter array member %d\n", i);
        scanf_s("%d", &myarray[i]);
        if (myarray[i] > max)
            max = myarray[i];
        if (myarray[i] < min)
            min = myarray[i];
        sum=sum + myarray[i];
    }
}
```

```
    }  
    avg = (float) sum / array_size;  
  
    printf("The largest array member is: %d\n", max);  
    printf("The smallest array member is: %d\n", min);  
    printf("The average is: %f\n", avg);  
}
```



The screenshot shows a window titled "Microsoft Visual Studio Debug Console". The console output is as follows:

```
Enter the first array member  
1  
Enter array member 1  
3  
Enter array member 2  
5  
Enter array member 3  
7  
Enter array member 4  
9  
Enter array member 5  
2  
Enter array member 6  
4  
Enter array member 7  
6  
Enter array member 8  
8  
Enter array member 9  
10  
The largest array member is: 10  
The smallest array member is: 1  
The average is: 5.500000  
  
C:\Users\lxing\source\repos\l10\Debug\l10.exe (process 22832) exited with code 0.  
Press any key to close this window . . .
```