CMIS 102 Hands-On Lab

Week 6

Overview

This hands-on lab allows you to follow and experiment with the critical steps of developing a program including the program description, analysis, test plan, design and implementation with C code. The example provided uses sequential, repetition statements and nested repetition statements.

Program Description

This program will calculate the average of 3 exams for 5 students. The program will ask the user to enter 5 student names. For each of the students, the program will ask for 3 exam scores. The average exam score for each student will be calculated and printed.

Analysis

I will use sequential and repetition programming statements.
I will define one String to store the student name: StudentName.
I will define three Float variabless: Examvalue, Sum, Avg to store exam values, the sum of the exams, and the average of the exams.
The sum will be calculated by this formula:

Sum = Sum + Examvalue

For example, if the first value entered was 80.0 and second was 90.0 and the third exam was 100.0:
sum = sum + Examvalue = 0.0 + 80.0
sum = 80.0 + 90.0 = 170.0
sum = 170.0 + 100.0 = 270.0
Avg is then calculated as:
Avg = sum/3.0
For example 270.0/3.0 = 90.0
A nested repetition loop can be used to loop through each of the 5 students and each of the 3 exams:

```
For (students=0; students <5; students++)
  For (exams=0;exams<3;exams++)
  End For
End For
```

Sum values will need to be reset for each student to ensure only one student's data is used for calculations each time.

Test Plan

To verify this program is working properly the input values could be used for testing:

Test Case	Input	Expected Output
1	Studentname=Chris Examvalue1=80.0 Examvalue2=90.0 Examvalue3=100.0 Studentname=John Examvalue1=70.0 Examvalue2=90.0 Examvalue3=80.0 Studentname=Sally Examvalue1=100.0 Examvalue2=100.0 Examvalue3=100.0 Studentname=Pat Examvalue1=50.0 Eexamvalue2=70.0 Examvalue3=60.0 Studentname=Sam Examvalue1=90.0 Examvalue2=95.0 Examvalue3=100.0	Average for Chris is 90.0 Average for John is 80.0 Average for Sally is 100.0 Average for Pat is 60.0 Average for Sam is 95.0

Pseudocode

```
// This program will calculate the average of 3 exams for 5 students

// Declare variables
Declare StudentName as String
Declare ExamValue, Sum, Avg as Float

// Loop through 5 Students
For (students=0; students <5; students++)
    // reset Sum to 0
    Set Sum =0.0
    Print “Enter Student Name” Input StudentName
    // Nested Loop for Exams
    For (exams=0; exams < 3; exams++)
      Print “Enter exam grade: \n”
      Input ExamValue
      Set Sum = Sum + ExamValue
    End For
    Set Avg = Sum/3.0
    Print “Average for “ + StudentName + “ is “ + Avg
End For
```

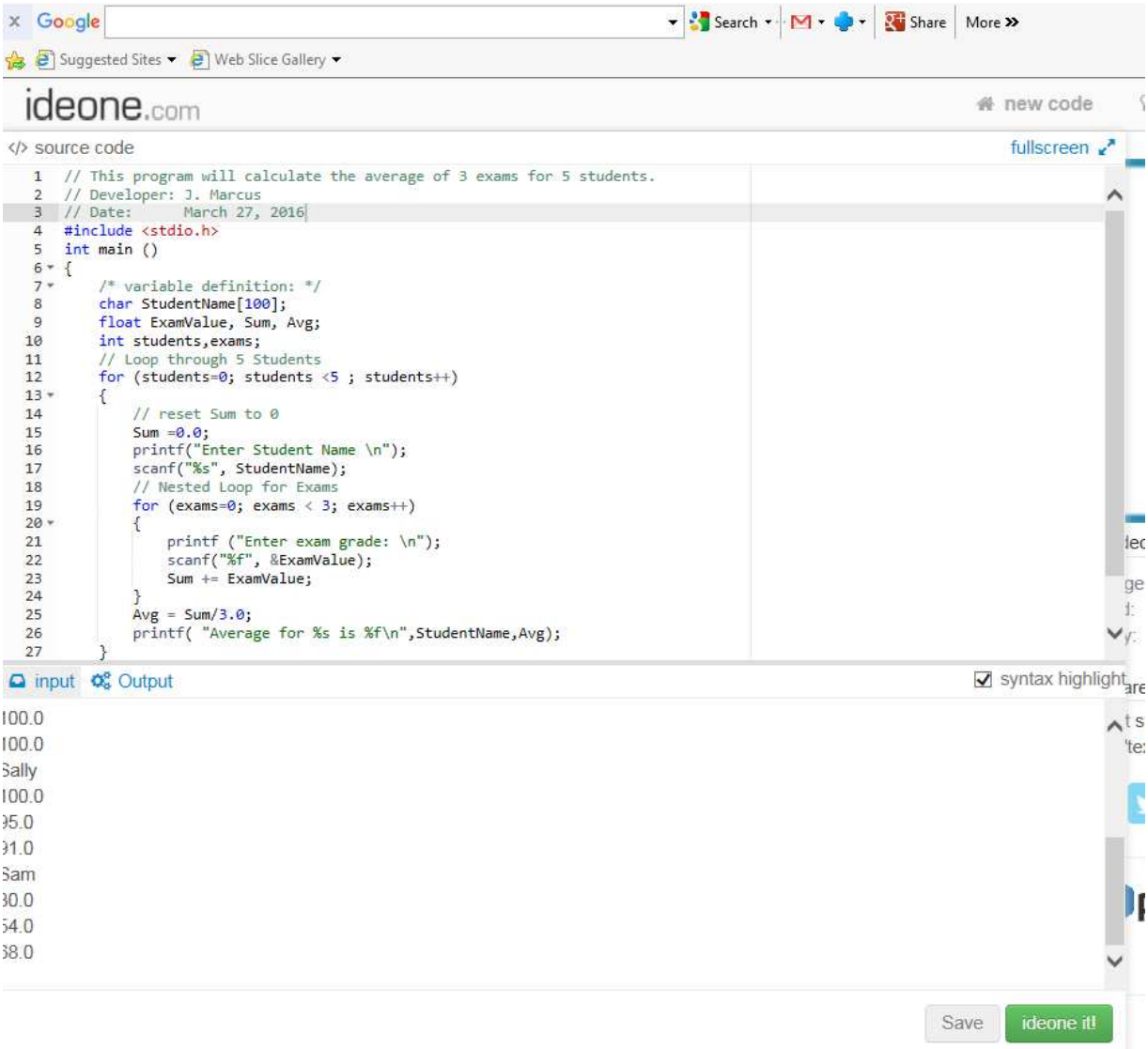
C Code

The following is the C Code that will compile in execute in the online compilers.

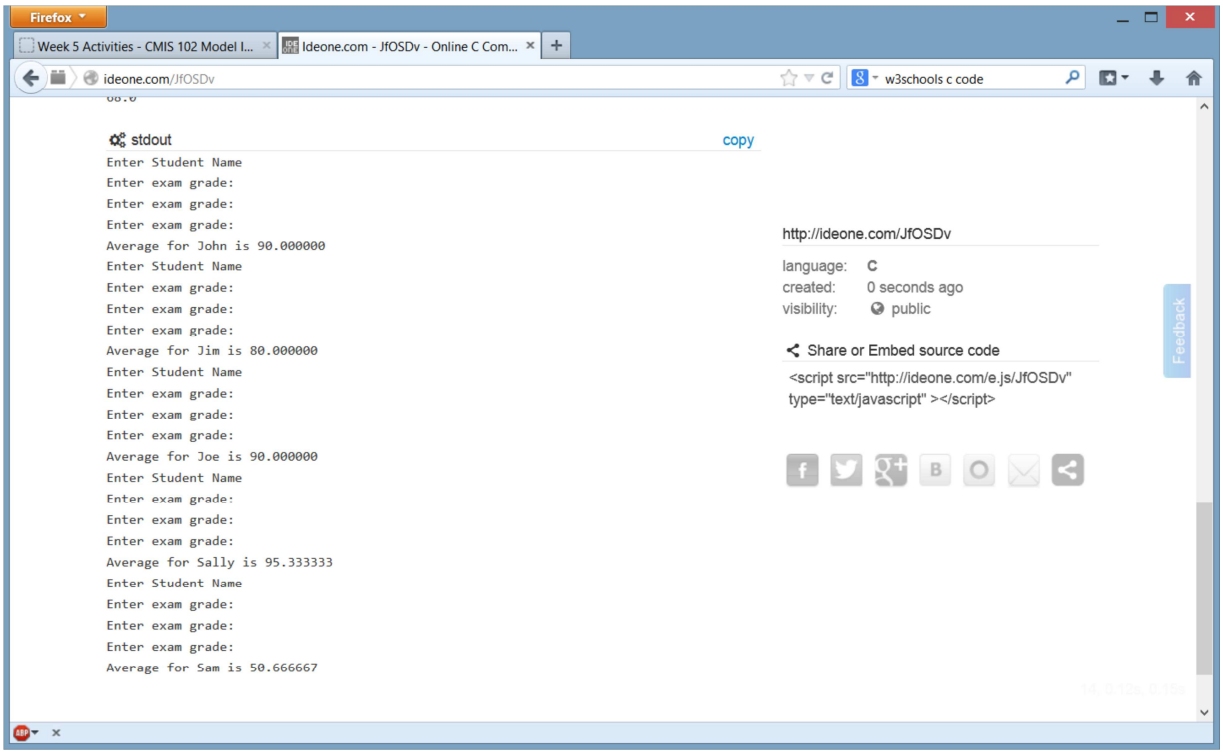
```
// C code
// This program will calculate the average of 3 exams for 5 students.
// Developer: ENTE YOUR NAME
// Date:      ENTER DATE PROGRAM FINISHED

#include <stdio.h>

int main ()
{
    /* variable definition: */
    char StudentName[100];
    float ExamValue, Sum, Avg;
    int students,exams;

    // Loop through 5 Students
    for (students=0; students <5 ; students++)
    {
      // reset Sum to 0
      Sum =0.0;
      printf("Enter Student Name \n");
      scanf("%s", StudentName);
      // Nested Loop for Exams
      for (exams=0; exams < 3; exams++)
      {
          printf ("Enter exam grade: \n");
          scanf("%f", &ExamValue);
          Sum += ExamValue;
      }
      Avg = Sum/3.0;
      printf( "Average for %s is %f\n",StudentName,Avg);
    }
    return 0;
}
```

Setting up the code and the input parameters in ideone.com:

Note the Student and ExamValues for this run were:
John: 90.0 80.0 100.0
Jim: 80.0 70.0 90.0
Joe: 70.0 100.0 100.0
Sally: 100.0 95.0 91.0
Sam: 30.0 54.0 68.0
You can change these values to any valid values to match your test cases.



Results from running the programming at ideone.com



Learning Exercises for you to complete

1. Load the baseline program into a compiler and run it. Provide a listing of the program, and a screen capture showing the program executing.

2. Modify the code to be able to input an undetermined number of students. There will continue to be only 3 exams for each student, but the program will need to use an EOF loop. You cannot ask how many students there are. Provide a full listing of your program (including needed comments), and screen captures showing the input data and the program executing.

3. Prepare a new test table with at least 3 distinct test cases listing input and expected output for the code you created in step 2.

4. What is the line of code doing?

   ```
   char StudentName[100];
   ```

   (Hint: We haven't covered arrays, but a String can be thought of as an array of characters)

5. What would happen if you moved the Set Sum = 0.0 from inside the for loop to right after the declaration. For example:

   ```
   // Declare variables
   Declare StudentName as String
   Declare ExamValue, Sum, Avg as Float

   // Initialize Sum
   Set Sum = 0.0;
   ```

   Support your experimentation with screen captures of executing the new code.

Grading guidelines

Submission	**Points**
Successfully demonstrates execution of this lab with online compiler. Includes a program listing (including comments) and a screen capture showing the program executing.	3
Modifies the code to be able to input an undetermined number of students. Provides a full program listing and screen captures showing the program executing and the data used.	2
Provides a new test table with at least 3 distinct test cases listing input and expected output for the code you created after step 2.	1
Describes what the char array line is doing.	1
Described what would happen if you moved the Set Sum = 0.0 from inside the for loop to right after the declaration. Provided screen captures to document your analysis and results.	2
Document is well-organized, and contains minimal spelling and grammatical errors.	1
Total	**10**