CMIS 102 Hands-On Lab

// Week 5

Overview:
This hands-on lab allows you to follow and experiment with the critical steps of developing a program including the program description, Analysis, , Design(program design, pseudocode), Test Plan, 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 student name and the average exam score for each student will be calculated and printed.

Analysis:

The program will consist of two loops. An outer loop for each student and an inner loop for the exams of each student.

I will define one String to store student name: StudentName.
I will define three Float variables: 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 data is used for calculations each time.

Program Design (flowchart next page):

```
Main

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

// Declare variables
// Loop through 5 Students

     // reset Sum to 0
     //Prompt for student name


    // Nested Loop for Exams (3)
        //Prompt for exam grade
```

```
      //Accumulate sum
   //End loop  For exams

   //Calculate average

   //Print the results studentname and average

  // End loop For students

End
```

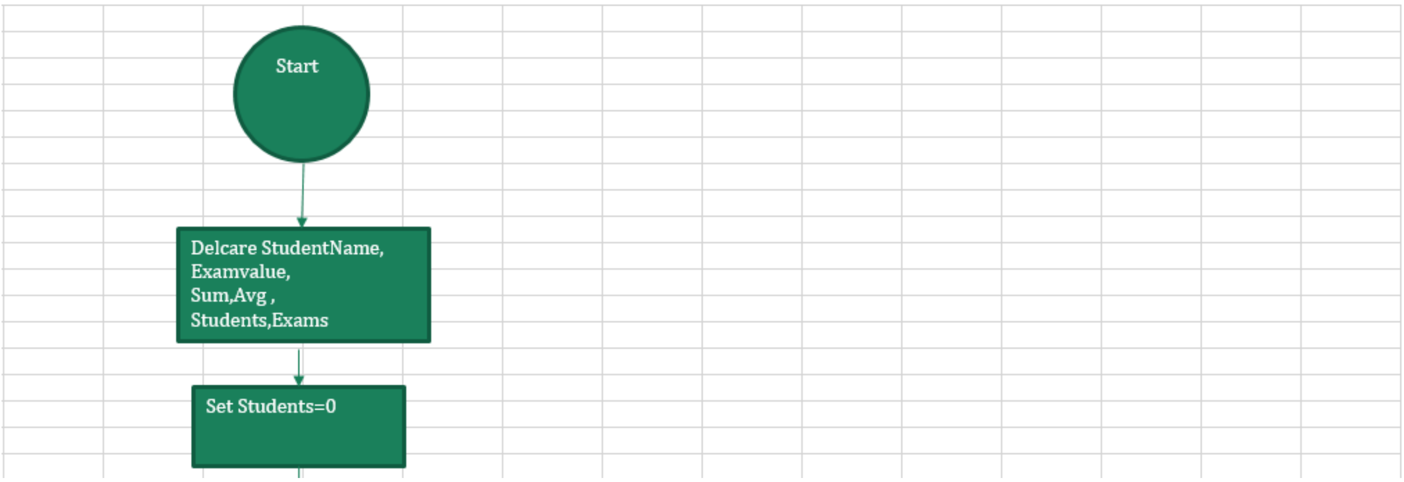
Test Plan:

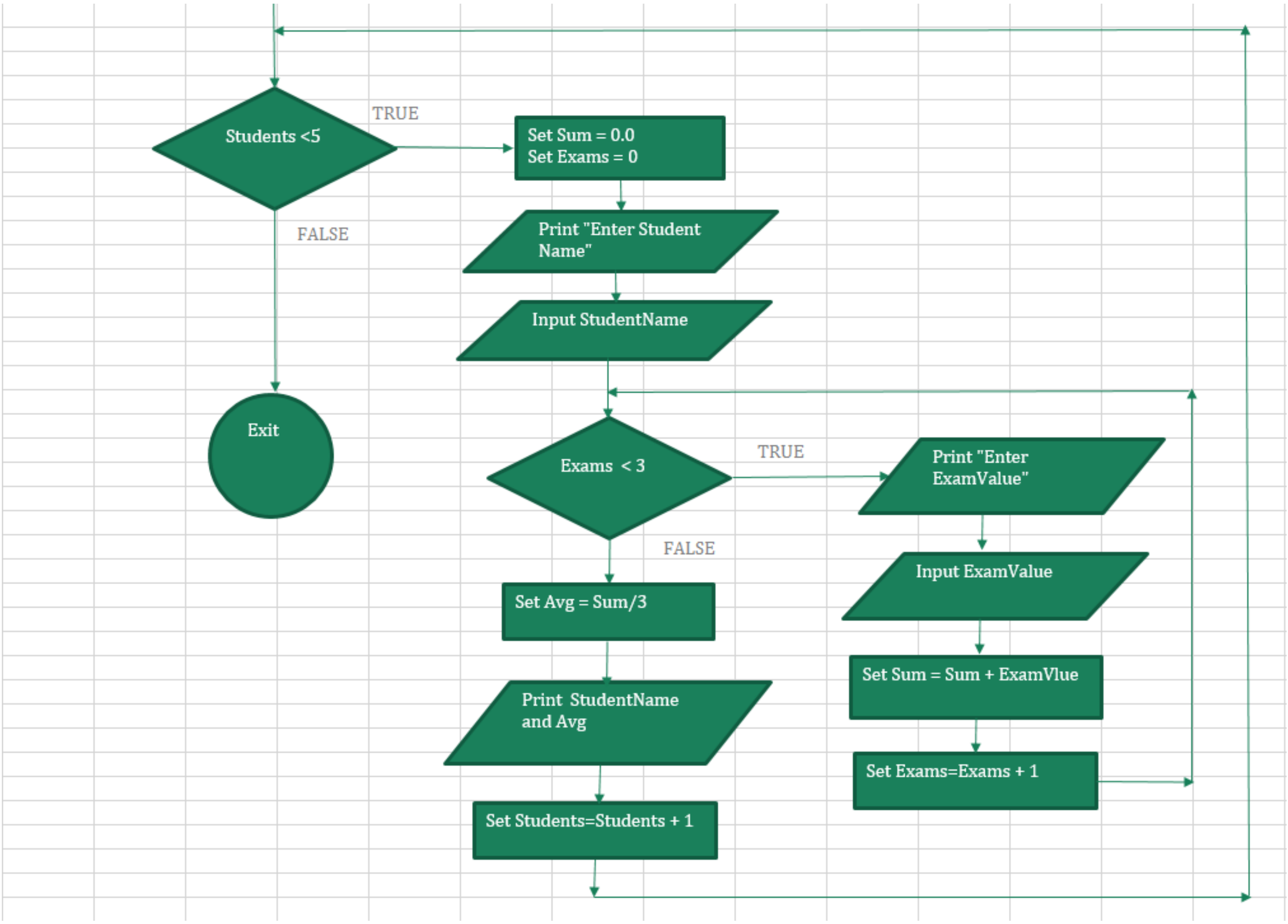
To verify this program is working properly the input values could be used for testing:

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

Flowchart:


Start
Delcare StudentName, Examvalue, Sum,Avg , Students,Exams
Set Students=0


Students <5
TRUE
FALSE
Set Sum = 0.0
Set Exams = 0
Print "Enter Student Name"
Input StudentName
Exit
Exams < 3
TRUE
FALSE
Print "Enter ExamValue"
Input ExamValue
Set Sum = Sum + ExamVlue
Set Exams=Exams + 1
Set Avg = Sum/3
Print StudentName and Avg
Set Students=Students + 1

Pseudocode:

```
Main

// 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

    //Prompt for student name
    Print “Enter Student Name”
    Input StudentName


    // Nested Loop for Exams
    For (exams=0; exams < 3; exams++)

        //Prompt for exam grade
        Print “Enter exam grade: \n”
        Input ExamValue

        //Accumulate sum
        Set Sum = Sum + ExamValue
    End For  //End of For exams

    //Calculate average
    Set Avg = Sum/3.0

    //Display the results
    Print “Average for “ + StudentName + “ is “ + Avg
End For  //End of For students

End  //End of Main
```

C Code

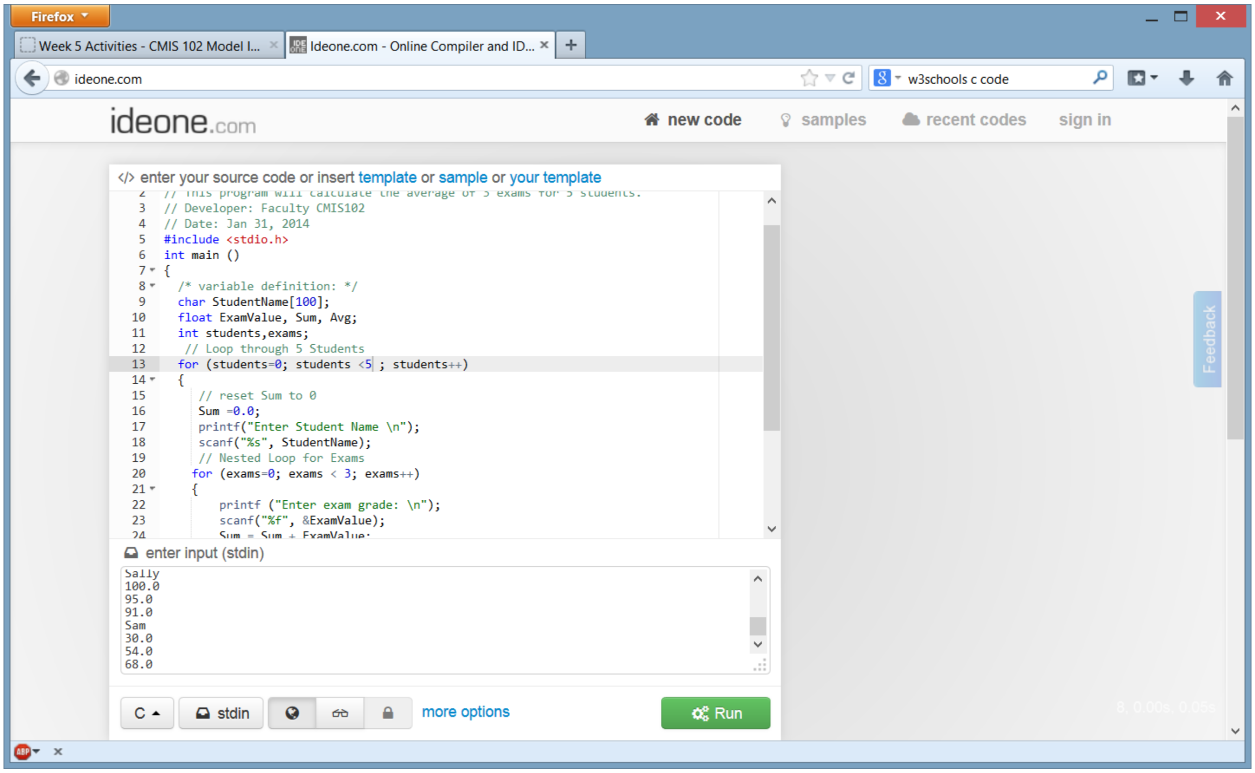
The following is the C Code that will compile in execute in the online compilers.

```
// C code
// This program will calculate the average of 3 exams for 5 students.
// Developer: Faculty CMIS102
// Date: Jan 31, 2014
#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 = 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

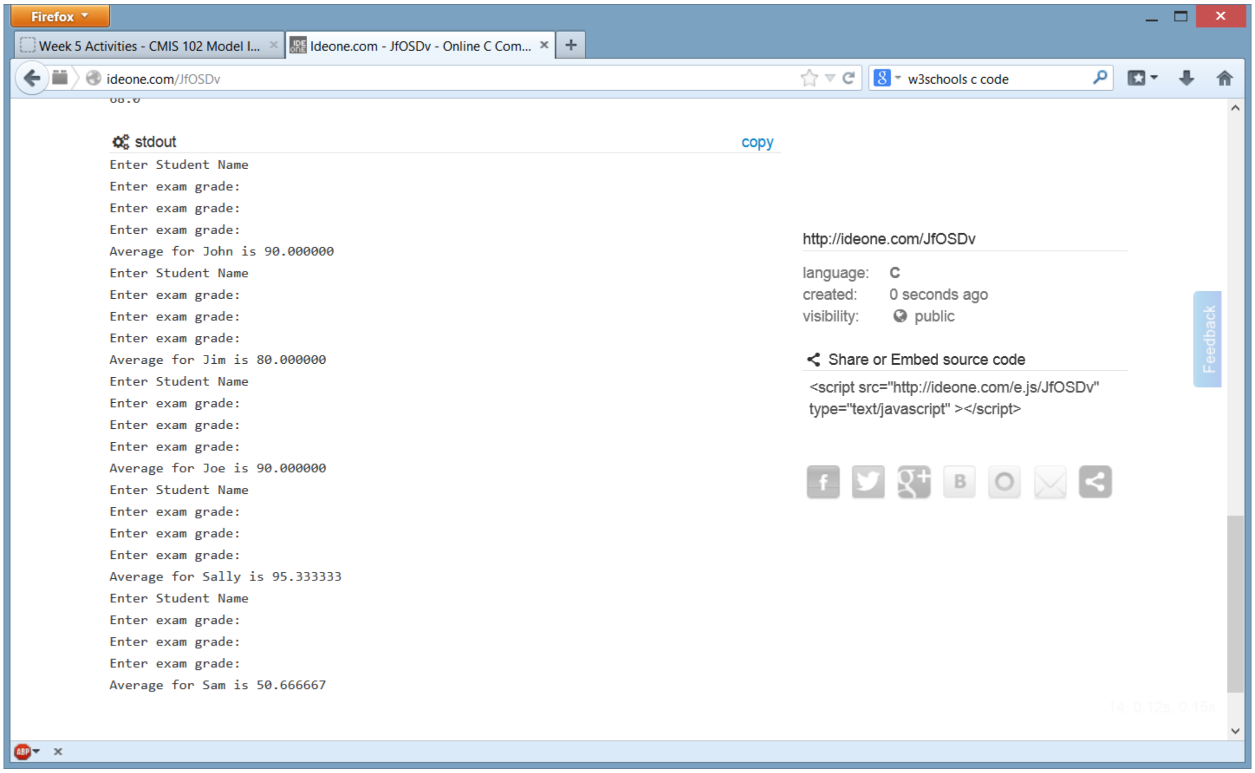
Note: in IDEone, the input data must be put into the stdin window in the same order as the program is expecting it. The data must be separated by a space or new line.
You can change these values to any valid integer values to match your test cases.


Firefox
Week 5 Activities - CMIS 102 Model I...
Ideone.com - Online Compiler and ID...
ideone.com
w3schools c code
ideone.com
new code
samples
recent codes
sign in
enter your source code or insert template or sample or your template
Feedback
enter input (stdin)
C
stdin
more options
Run

```
// This program will calculate the average of 3 exams for 5 students.
// Developer: Faculty CMIS102
// Date: Jan 31, 2014
#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 = Sum + ExamValue;
```

```
Sally
100.0
95.0
91.0
Sam
30.0
54.0
68.0
```

Results from running the programming at ideone.com:


Firefox
Week 5 Activities - CMIS 102 Model I...
Ideone.com - JfOSDv - Online C Com...
ideone.com/JfOSDv
w3schools c code
stdout
copy
Feedback

```
Enter Student Name
Enter exam grade:
Enter exam grade:
Enter exam grade:
Average for John is 90.000000
Enter Student Name
Enter exam grade:
Enter exam grade:
Enter exam grade:
Average for Jim is 80.000000
Enter Student Name
Enter exam grade:
Enter exam grade:
Enter exam grade:
Average for Joe is 90.000000
Enter Student Name
Enter exam grade:
Enter exam grade:
Enter exam grade:
Average for Sally is 95.333333
Enter Student Name
Enter exam grade:
Enter exam grade:
Enter exam grade:
Average for Sam is 50.666667
```

http://ideone.com/JfOSDv

language: C
created: 0 seconds ago
visibility: public

Share or Embed source code

<script src="http://ideone.com/e.js/JfOSDv" type="text/javascript" ></script>

Learning Exercises for you to try:

1. Modify the output printf statement so that the **average grade is displayed** with just **<u>three decimals places</u>** and so that there is **<u>two tabs</u> between the student name and his average grade**. Support your experimentation with screen captures of executing the new code.

2. Describes what happens if you don't have the following code <u>Sum = 0.0</u> inside the for loop. Remove or comment out the line Sum = 0.0

   // Sum = 0.0;

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

3. Replace Sum = 0.0 back to where it was before (inside the loop). Modify the code to be able to input an <u>undetermined number of students</u>. Hint: you can prompt the user for the number of students and use that value Or you can use a sentinel loop approach OR you can prompt the user to continue. You will still only have 3 exams for each student. Support your experimentation with screen captures of executing the new code. Submit this code in a separate .txt (or .c) file.

4. Prepare a new test table with at least 3 distinct test cases listing input and expected output for the code you created after step 4.

Grading guidelines

Submission	**Points**
No 1. Modify the output printf statement so that the average grade is displayed with just three decimals places and so that there is two tabs between the student name and his average grade. Support your experimentation with screen captures of executing the new code.	**2**
No 2. Described what would happen if you moved the Set Sum = 0.0 from inside the for loop to right after the declaration. Be sure to provide screen captures to document your analysis and results.	**2**
No 3. Modifies the original code to be able to input an undetermined number of students. Support your experimentation with screen captures of executing the new code. Submits code as a separate .txt (or .c) file.	**3**
No 4. Provides a new test table with at least 3 distinct test cases listing input and expected output for the code you created after step 4.	**2**
Document is well organized, and contains minimal spelling and grammatical errors.	**1**
Total	**10**