

60-140-1 and 60-140-2 ASSIGNMENT #1 SOLUTION
Handed Out: Thurs. Sept. 17, 2015 for (60-140-01 and 60-140-02)
Due: Thurs Sept. 24, 2015 for (60-140-01 and 60-140-02)
Total: 50 marks

Objective of Assignment: To write a simple C program to solve a problem using no decision or repetition instructions and no function calls.

Scope: Assignment covers materials up until end of chapter 1 and parts of chapters 2 & 3.

Other Things to learn from Assignment : How to use a text editor, compile and run a C program, how to create and print a Unix script file and how to use some Unix commands.

Electronic Assignment Submission:

03-60-140-1 students: email script file to cs140_01@cs.uwindsor.ca with subject including: Name, student id, lecture section, lab [section], assignment #1 (in the subject of the mail submission of script file).

03-60-140-2 students: email script file to cs140_02@cs.uwindsor.ca with subject including: Name, student id, lecture section, lab [section], assignment #1 (in the subject of the mail submission of script file).

*Only the assignments currently due that are submitted to this site within two days before and by the due date, are retrieved for marking. Others are deleted soon after.

CONFIDENTIALITY AGREEMENT & STATEMENT OF HONESTY

I confirm that I will keep the content of this assignment/examination confidential.

I confirm that I have not received any unauthorized assistance in preparing for or doing this assignment/examination. I confirm knowing that a mark of 0 may be assigned for copied work.

Student Signature

Student Name (please print)

Student I.D. Number

Date

Problem:

The variance (SD^2) of a number (N) of scores in a population tells us how spread out the scores (X 's) are around the mean of the scores (M). The variance is the average of the squared deviations from the mean or the standard deviation squared and thus, the reason the symbol SD^2 is used to represent variance. The standard deviation (SD) is the square root of the variance. The variance is the average of each score's squared difference from the mean. The formulas for the variance (SD^2) and the standard deviation (SD) are given below.

$$\text{Variance} = SD^2 = \sum(X - M)^2 / N$$
$$\text{Standard Deviation} = SD = \sqrt{SD^2}$$

Note that the variance formula used in this assignment is the exact number of scores N and not N – 1 that may be used in some variance formulas found elsewhere. Also, in C, you can use the built-in function sqrt(M) to get the square root of M and you can simply multiply a number M by itself to get the square of M or M².

1. Write **an algorithm** and **a program** that reads five given real scores and computes the variance and standard deviation of 5 given scores and displays the following:
 - i. For each input score, a row showing the Score (X), the Mean Score (M), deviation score (X – M) and squared deviation score (X – M)².
 - ii. A row showing the sum of deviation squared $\sum(X - M)^2$.
 - iii. A row showing the Variance (SD²) of the scores.
 - iv. A row showing the standard deviation (SD) of the scores.

Type your algorithm solution in a text file called your userid_asn1.txt. Then, type the C program solution into a source file called your userid_asn1.c. Also, include the <math.h> header file in your source file to be able to use the square root built-in function. Compile your C program with cc userid_asn1.c -lm. Then, run (execute it with ./a.out). When your program is running with no errors, then, create a script file called userid_script1.txt and hand in your script file for marking. Your script file should show your algorithm, your source program, the compilation of the program, the running of the program with the input and output data shown.

Sample Input is:

Please type the 5 test scores: 60 95 73 41 84

Sample Output of the Program is :

Score (X)	Mean Score (M)	=	Deviation Score (X – M)	Squared Deviation (X – M)squared
60.00	70.60		-10.60	112.36
95.00	70.60		24.40	595.36
73.00	70.60		2.40	5.76
41.00	70.60		-29.60	876.16
84.00	70.60		13.40	179.56
			Sum:	1769.20

Variance = 1769.20/5 = 353.84.
 Standard deviation = SD = 18.81.

Marking Scheme :

1. Correct Algorithm solution ----- (10 marks)
2. Program Solution ----- (10marks)
3. Error free Compilation of Program ----- (10 marks)
4. Correct Running of the Program with Correct Input/Output Data ----- (10 marks)
5. Correct creation and handing in of Script File ----- (10 marks)

Hints on Steps to follow to Solve :

Make sure that you type in your full name, student number, lecture and lab section numbers, confidentiality agreement & statement of Honesty (as shown on the front page of the assignment or downloaded from the course web site), and date in both the algorithm and source program files.

1. Use a text editor like gedit or nedit or pico or vi to type your algorithm and save in a file called `userid_asn1.txt` (e.g., `cezeife_asn1.txt`)
2. Use gedit or nedit or pico or vi text editor to type your C source program solution and save in a file called `userid_asn1.c` (e.g., `cezeife_asn1.c`)
3. Now compile this source program to ensure it works using:
`cc userid_asn1.c -lm`
4. Now run this C program with the sample input data suggested above using :
`./a.out`
5. If the program generated correct results, you can now proceed to create your script file as follows:

```
script userid_script1.txt
cat userid_asn1.txt
cat userid_asn1.c
cc userid_asn1.c -lm
./a.out
(when prompted, type in the input data in the correct order)
exit
```

Once you exit, your script file has been created and you can view it on the screen using:

```
cat userid_script.txt
```

You may print this script file at the Computer Center near the CAW center or in your home if you have a computer and printer. Your script file is in `cs.uwindsor.ca` server and will need to be transferred to your home PC or the computer center PC using a file transfer program such as NoMachine or Filezilla since SSH/SFTP program can no longer connect to the new `cs` servers. To download NoMachine to connect to `cs` servers, go the 60-140 course announcement web page (<http://cezeife.myweb.cs.uwindsor.ca/courses/60-140/announce/index.html>), to follow instructions that take you to `cs` server help centre at: <http://www.help.cs.uwindsor.ca/en/servers>. Once NoMachine is downloaded and set up, you can use it to connect to `cs.uwindsor.ca` servers to complete your assignment and transfer your script files for handing in.

For GA/TA Office Hours, check the GA/TA office hour link in the course web site to see when you can go to the JAVA lab to see help with a GA/TA to

seek answers to course materials. You can also come to the professor's office hours also posted on the web site and on the board by her office in LT 5105.

Reminder Notes :

1. Your assignment must be received by the due date and before class begins.
2. You must use the University of Windsor, Computer Science Manila envelope (available in the book store) to submit your work.
3. State your Name, Course Lecture Section and your Course Lab Section as well as your Instructor on the Assignment Envelope so that your assignment does not get sent to the wrong lab and your marks can always be found.



The solution containing the algorithm, the C program, the compilation and the execution of the program showing the input and results of the run as in the script file cezeife_script1.txt is shown below:

SOLUTION

```
Script started on Mon 07 Sep 2015 07:07:40 PM EDT
cezeife@bravo:~/fall15/assignmt$ cat cezeife_asn1.txt
/*
Given that Variance = SD2 = sum of (X - M)squared / N
Standard Deviation = SD = square root of SD2 or variance, write an
algorithm
and a program that reads five given real scores and computes the
variance and standard deviation of 5 given scores and displays the
following:
i. For each input score, a row showing the Score (X), the Mean
Score (M), deviation score (X - M) and squared deviation score (X -
M)2.
ii. A row showing the sum of deviation squared 3(X - M)2.
iii. A row showing the Variance (SD2) of the scores.
iv. A row showing the standard deviation (SD) of the scores.

Written by Dr. Christie Ezeife */
/* Professor for lectures 60-140-01 */
/* Labs 60-140-51, 52, 53 and 54. */

MainAlgorithm
{
Input Data:
    X1, X2, X3, X4, X5 (real);
    N = 5 (real);

Output Data:
    M, D1, D2, D3, D4, D5 (real);
    D1sqr, D2sqr, D3sqr, D4sqr, D5sqr (real);
```

```

        sum_sqr_D, variance, SD  (real);

/* Sequence of steps */
    Read (X1, X2, X3, X4, X5);

/* Now compute the mean, deviations, deviation squares, variance and
standard deviation*/

M = (X1 + X2 + X3 + X4 + X5) /N;
D1 = X1 - M;
D2 = X2 - M;
D3 = X3 - M;
D4 = X4 - M;
D5 = X5 - M;

D1sqr = D1 * D1;
D2sqr = D2 * D2;
D3sqr = D3 * D3;
D4sqr = D4 * D4;
D5sqr = D5 * D5;

sum_sqr_D = D1sqr + D2sqr + D3sqr + D4sqr + D5sqr;

variance = sum_sqr_D/N;

SD = sqrt(variance);

/* Now print the desired output */

Print ("Score    -    Mean Score =    Deviation Score        Squared
Deviation\n");

Print ("%0.2f\t %0.2f \t %0.2f \t %0.2f\n", X1, M, D1, D1sqr);
Print ("%0.2f\t %0.2f \t %0.2f \t %0.2f\n", X2, M, D2, D2sqr);
Print ("%0.2f\t %0.2f \t %0.2f \t %0.2f\n", X3, M, D3, D3sqr);
Print ("%0.2f\t %0.2f \t %0.2f \t %0.2f\n", X4, M, D4, D4sqr);
Print ("%0.2f\t %0.2f \t %0.2f \t %0.2f\n", X5, M, D5, D5sqr);

Print ("\t\t\t\t Sum = %0.2f\n", sum_sqr_D);
Print ("Variance = %0.2f\n", variance);
Print ("Standard Deviation = %0.2f\n", SD);
}

```

```

cezeife@bravo:~/fall115/assignmt$ cat cezeife_asn1.c
#include <stdio.h>
#include <math.h>

```

```

/*
Given that Variance = SD2 = sum of (X - M)squared / N
Standard Deviation = SD = square root of SD2 or variance, write an
algorithm

```

and a program that reads five given real scores and computes the variance and standard deviation of 5 given scores and displays the following:

- i. For each input score, a row showing the Score (X), the Mean Score (M), deviation score (X - M) and squared deviation score (X - M)².
- ii. A row showing the sum of deviation squared $\sum (X - M)^2$.
- iii. A row showing the Variance (SD²) of the scores.
- iv. A row showing the standard deviation (SD) of the scores.

```
Written by Dr. Christie Ezeife          */
/* Professor for lectures 60-140-01      */
/* Labs 60-140-51, 52, 53 and 54.       */

int main(void)
{
    // Input Data:
    float X1, X2, X3, X4, X5;
    float N = 5;

    // Output Data:
    float M, D1, D2, D3, D4, D5;
    float D1sqr, D2sqr, D3sqr, D4sqr, D5sqr;
    float sum_sqr_D, variance, SD;

    /* Sequence of steps */
    printf("Please type the 5 test scores:\t");
    scanf("%f %f %f %f %f", &X1, &X2, &X3, &X4, &X5);

    /* Now compute the mean, deviations, deviation squares, variance and
    standard deviation*/

    M = (X1 + X2 + X3 + X4 + X5) /N;
    D1 = X1 - M;
    D2 = X2 - M;
    D3 = X3 - M;
    D4 = X4 - M;
    D5 = X5 - M;

    D1sqr = D1 * D1;
    D2sqr = D2 * D2;
    D3sqr = D3 * D3;
    D4sqr = D4 * D4;
    D5sqr = D5 * D5;

    sum_sqr_D = D1sqr + D2sqr + D3sqr + D4sqr + D5sqr;

    variance = sum_sqr_D/N;

    SD = sqrt(variance);

    /* Now print the desired output */
```

```

printf("Score    -    Mean Score =    Deviation Score        Squared
Deviation\n");

printf("%.2f\t\t %.2f \t\t %.2f \t %.2f\n", X1, M, D1, D1sqr);
printf("%.2f\t\t %.2f \t\t %.2f \t\t %.2f\n", X2, M, D2,
D2sqr);
printf("%.2f\t\t %.2f \t\t %.2f \t\t %.2f\n", X3, M, D3,
D3sqr);
printf("%.2f\t\t %.2f \t\t %.2f \t %.2f\n", X4, M, D4, D4sqr);
printf("%.2f\t\t %.2f \t\t %.2f \t\t %.2f\n", X5, M, D5,
D5sqr);

printf("\t\t\t\t\t Sum = %.2f\n", sum_sqr_D);
printf("Variance = %.2f\n", variance);
printf("Standard Deviation = %.2f\n", SD);

return 0;
}

```

```

cezeife@bravo:~/fall15/assignmt$ cc cezeife_asn1.c -lm
cezeife@bravo:~/fall15/assignmt$ ./a.out
Please type the 5 test scores:    60 95 73 41 84
Score    -    Mean Score =    Deviation Score        Squared Deviation
60.00    70.60    -10.60    112.36
95.00    70.60    24.40    595.36
73.00    70.60    2.40    5.76
41.00    70.60    -29.60    876.16
84.00    70.60    13.40    179.56
Sum = 1769.20

Variance = 353.84
Standard Deviation = 18.81
cezeife@bravo:~/fall15/assignmt$ exit
exit

```

Script done on Mon 07 Sep 2015 07:09:24 PM EDT