

Maths report

by Andrew Cooper

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A brief introduction and evaluation of the
new software application that was
required by UWTSD.

An evaluation and guide for the software application.

UWTSD new maths software
that has been created using
the Math library on C++.

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Maths for Software Engineering.

Contents

Introduction	2
Length of a Vector:.....	3
Implementation of this problem.....	3
Test Schedule:	3
Bibliography	16

Introduction

The students of UWTSD Software Engineering Year 1 was required to make a new software application using the existing maths library and creating and testing additional functions that the company requires on c++.

To achieve this goal the students are required to investigate the mathematical theory to further understand what formulae will be needed to produce the results that are expected.

Please find the program that the student created named, "mFSEAssignment.sln" which contains the code for the additional functions required by the company.

The reader will be able to find a description, examples and implementation of the following operations:

- A function that returns the length of a vector.
- A function that normalizes a vector.
- A function that takes two points and returns the distance between them.
- The cross product of two vectors.
- Multiplication of a (4 x 4) and a (4 x 1) column matrix.
- Mean, Median, Mode and Standard Deviation of a list of integers.
- Union and Intersection of two sets.

A test schedule has also been created to ensure that the programs work as expected and displays the correct results. A series of images throughout the report will also confirm this.

The work that has been submitted is all the workings of student 1704746. Please see "DISCLAIMER.h" within the "mFSEAssignment.sln" to view the student's disclaimer and a list of websites that was used to assist the student for achieving the final product.

Please address any further questions to 1704746@student.uwtsd.ac.uk.

Length of a Vector:

Firstly, the student was required to make a function that would find and return the length of a vector. For this we can take the length of two vectors that the user will define. The program can then square these both separately, add them together which will then provide the program with the squared version of the vector in which they want to find. Using the square root function (sqrt) that has been programmed into the "math.h" library on c++ we will arrive at the length of the vector. This method of finding the length of this vector comes from Pythagoras theorem where the length of a triangle with a right angle can be found by using the formulae $a^2 + b^2 = c^2$ [1].

Implementation of this problem.

For the program to be able to compute the vector, the user will have to provide it with two values because as mentioned above $a^2 + b^2 = c^2$.

```
printf("-----\r\n");
printf("|                               |\r\n");
printf("-----\r\n");
printf("Please enter the length of the first vector... ");
scanf("%lf", &lenOfA);
printf("Please enter the length of the second vector... ");
scanf("%lf", &lenOfB);

lenOfVector = FindLengthOfVector(lenOfA, lenOfB);
printf("Length of vector = %0.3lf\r\n", lenOfVector);
printf("-----\r\n");
break;
```

This is an image that has been taken from the program which the student created and displays that the user must enter the length of "a" and the length of "b" before the program will be able to compute the value as these are needed to be passed through the function.

```
double FindLengthOfVector(double a, double b) {
    double cSquared = (a * a) + (b * b); // a^2 + b^2 = c^2
    double lenOfVector = sqrt(cSquared);

    return lenOfVector;
}
```

When the user enters the length of vectors "a" and "b" the function will then square these two numbers and add them together which will then be stored into a variable named "cSquared". To square root this the student has utilised the "sqrt" function that has been coded into the "math.h" library which has then been stored into the variable "lenOfVector". This variable will then return the length of the vector which the program will then be displayed to the user.

Please see the test schedule for working examples of the program running.

Please acknowledge: The test tables were created for use in Programming II. Creator unknown.

Test Schedule:

#1	Length of Vector with integers.																				
Description	This test will take two inputs (data type = double) from the user which is then calculated within the "FindLengthOfVector" function.																				
	Test Steps :																				
	<table><tr><td>1</td><td>Program asks for the length of first vector.</td></tr><tr><td>2</td><td>User enters 4.</td></tr><tr><td>3</td><td>Program stores 4 into variable "lenOfA".</td></tr><tr><td>4</td><td>Program asks for the length of second vector.</td></tr><tr><td>5</td><td>User enters 6.</td></tr><tr><td>6</td><td>Program stores 6 into variable "lenOfB".</td></tr><tr><td>7</td><td>Program goes to "FindLengthOfVector" function</td></tr><tr><td>8</td><td>A variable called "cSquared" will stored the value of (lenOfA * lenOfA) + (lenOfB * lenOfB).</td></tr><tr><td>9</td><td>Using "sqrt" which is in the maths library the program will find the square root of "cSquared" and return the value which is stored in variable "lenOfVector".</td></tr><tr><td>10</td><td>"lenOfVector" is then displayed to the user up to three significant figures.</td></tr></table>		1	Program asks for the length of first vector.	2	User enters 4.	3	Program stores 4 into variable "lenOfA".	4	Program asks for the length of second vector.	5	User enters 6.	6	Program stores 6 into variable "lenOfB".	7	Program goes to "FindLengthOfVector" function	8	A variable called "cSquared" will stored the value of (lenOfA * lenOfA) + (lenOfB * lenOfB).	9	Using "sqrt" which is in the maths library the program will find the square root of "cSquared" and return the value which is stored in variable "lenOfVector".	10
1	Program asks for the length of first vector.																				
2	User enters 4.																				
3	Program stores 4 into variable "lenOfA".																				
4	Program asks for the length of second vector.																				
5	User enters 6.																				
6	Program stores 6 into variable "lenOfB".																				
7	Program goes to "FindLengthOfVector" function																				
8	A variable called "cSquared" will stored the value of (lenOfA * lenOfA) + (lenOfB * lenOfB).																				
9	Using "sqrt" which is in the maths library the program will find the square root of "cSquared" and return the value which is stored in variable "lenOfVector".																				
10	"lenOfVector" is then displayed to the user up to three significant figures.																				
Response	Expected: The program will display the value 7.211																				
Status	Date	Description																			
Pass	24/03/2018 14:00	Passed for all values.																			

```

----- Length of Vector -----
Please enter the length of the first vector... 4
Please enter the length of the second vector... 6
Length of vector = 7.211

```

This image is taken from the test that was run and it is confirmed that the program gives the correct answer to three significant figures.

#2Length of Vector with doubles.

Description

This test will take two inputs (data type = double) from the user which is then calculated within the “FindLengthOfVector” function.

The formulae I used for this is Pythagoras theorem... $a^2 + b^2 = c^2$.

Test Steps :

1	Program asks for the length of first vector.
2	User enters 4.2.
3	Program stores 4.2 into variable “lenOfA”.
4	Program asks for the length of second vector.
5	User enters 6.8.
6	Program stores 6.8 into variable “lenOfB”.
7	Program goes to “FindLengthOfVector” function
8	A variable called “cSquared” will stored the value of (lenOfA * lenOfA) + (lenOfB * lenOfB).
9	Using “sqrt” which is in the maths library the program will find the square root of “cSquared” and return the value which is stored in variable “lenOfVector”.
10	“lenOfVector” is then displayed to the user up to three significant figures.

Response

Expected: The program will display the value 7.922

Status	Date	Description
Pass	24/03/2018 14:04	Passed for all values.

```

1
-----
|                               |
|           Length of Vector   |
|                               |
-----
Please enter the length of the first vector... 4.2
Please enter the length of the second vector... 6.8
Length of vector = 7.992
-----

```

The student conducted the test a second time to ensure the program would produce the correct result when the user entered numbers with floating point values. The program displayed the correct result and the user was confident that the function worked as expected.

#3 Distance between two points.**Description**

This test will take two arrays called "pointA" and "pointB" which values will be provided by the user. The program will take the first element of "pointB" and subtract the first element of "pointA" and then multiply it by the same code for the answer to be squared. This will then be added to a distance variable. It will then do the same again but for the second number in the array.

The program will then square root the answer and then return the value.

Please note the formulae is $\sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2}$

Test Steps :

1	Program asks user to enter point 1.
2	User enters 3.
3	Program asks user to enter point 1.
4	User enters 2.
5	Program asks user to enter point 2.
6	User enters 9.
7	Program asks user to enter point 2.
8	User enters 7.
9	The program goes to "distanceBetweenTwoPoints" function and computes the value of distance and square root the outcome. The distance is then returned and displayed to the user.

Response

Expected: The program will output 7.8102.  2

Status**Date****Description**

Pass

24/03/2018
15:02

Passed for all values.

```

4. Cross product of two vectors
5. Multiply a (4x4) and (4x1) column matrix
6. Mean, Median, Mode and Standard Deviation
7. Union and Intersection of two sets
Please Choose an Option...
3
Distance between two points
Please enter point 1:
3
Please enter point 1:
2
Please enter point 2:
9
Please enter point 2:
7
Distance between points:
7.8102

```

#4	Normalize Vector																				
Description	This test will take two inputs from the user, find the length of the third vector then return to the “normalizeVector” function and divide the two entered numbers by the length of the third vector.																				
	Test Steps :																				
	<table><tr><td>1</td><td>Program asks for the x value.</td></tr><tr><td>2</td><td>User enters 3.</td></tr><tr><td>3</td><td>Program stores 3 into variable “lenOfA”.</td></tr><tr><td>4</td><td>Program asks for the y value.</td></tr><tr><td>5</td><td>User enters 4.</td></tr><tr><td>6</td><td>Program stores 4 into variable “lenOfB”.</td></tr><tr><td>7</td><td>Program goes to “normalizeVector” function.</td></tr><tr><td>8</td><td>Program will go to the “FindLengthOfVector” function and return the value into variable “magnitude”.</td></tr><tr><td>9</td><td>Program will divide both x and y by the magnitude.</td></tr><tr><td>10</td><td>The program will display both X and Y.</td></tr></table>		1	Program asks for the x value.	2	User enters 3.	3	Program stores 3 into variable “lenOfA”.	4	Program asks for the y value.	5	User enters 4.	6	Program stores 4 into variable “lenOfB”.	7	Program goes to “normalizeVector” function.	8	Program will go to the “FindLengthOfVector” function and return the value into variable “magnitude”.	9	Program will divide both x and y by the magnitude.	10
1	Program asks for the x value.																				
2	User enters 3.																				
3	Program stores 3 into variable “lenOfA”.																				
4	Program asks for the y value.																				
5	User enters 4.																				
6	Program stores 4 into variable “lenOfB”.																				
7	Program goes to “normalizeVector” function.																				
8	Program will go to the “FindLengthOfVector” function and return the value into variable “magnitude”.																				
9	Program will divide both x and y by the magnitude.																				
10	The program will display both X and Y.																				
Response	Expected: The program will display the value “Magnitude: 5, X: 0.600, Y: 0.800”																				
Status	Date	Description																			
Pass	24/03/2018 15:17	Passed for all values.																			

```

----- 17047476@student.uwtsd.ac.uk -----
----- Maths for Software Engineering -----
-----
1. Find Length of Vector
2. Normalize
3. Distance between two Points
4. Cross product of two vectors
5. Multiply a (4x4) and (4x1) column matrix
6. Mean, Median, Mode and Standard Deviation
7. Union and Intersection of two sets
Please Choose an Option...
2
Normalize
Enter length of x: 3
Enter length of y: 4
Magnitude: 5.000
Normalized Vector: X: 0.600, Y: 0.800
-----

```

#5	Mean of Integers																											
Description	This test will take a set of integers from the user and store them in an array. The program will then add all of the elements within the array and lastly divide the total by the size of the array.																											
	Test Steps :																											
	<table><tr><td>1</td><td>Program asks for the user to enter the size of the array.</td></tr><tr><td>2</td><td>User enters 5.</td></tr><tr><td>3</td><td>The program asks the user to enter the first element.</td></tr><tr><td>4</td><td>User enters 15</td></tr><tr><td>5</td><td>The program asks the user to enter the second element.</td></tr><tr><td>6</td><td>User enters 20</td></tr><tr><td>7</td><td>The program asks the user to enter the third element.</td></tr><tr><td>8</td><td>User enters 8</td></tr><tr><td>9</td><td>The program asks the user to enter the fourth element.</td></tr><tr><td>10</td><td>User enters 9.</td></tr><tr><td>11</td><td>The program asks the user to enter the fifth element.</td></tr><tr><td>12</td><td>User enters 8.</td></tr><tr><td>13</td><td>The program returns the total of the array added together divided by the size of the array.</td></tr></table>		1	Program asks for the user to enter the size of the array.	2	User enters 5.	3	The program asks the user to enter the first element.	4	User enters 15	5	The program asks the user to enter the second element.	6	User enters 20	7	The program asks the user to enter the third element.	8	User enters 8	9	The program asks the user to enter the fourth element.	10	User enters 9.	11	The program asks the user to enter the fifth element.	12	User enters 8.	13	The program returns the total of the array added together divided by the size of the array.
	1	Program asks for the user to enter the size of the array.																										
2	User enters 5.																											
3	The program asks the user to enter the first element.																											
4	User enters 15																											
5	The program asks the user to enter the second element.																											
6	User enters 20																											
7	The program asks the user to enter the third element.																											
8	User enters 8																											
9	The program asks the user to enter the fourth element.																											
10	User enters 9.																											
11	The program asks the user to enter the fifth element.																											
12	User enters 8.																											
13	The program returns the total of the array added together divided by the size of the array.																											
Response	Expected: The program displays 12																											
Status	Date	Description																										
Pass	24/03/2018 15:34	Passed for all values.																										

```

-----
| Mean, Median, Mode and Standard Deviation of a list of integers |
-----
How many elements would you like in your array? 5
Please enter your 1 element into the array...15
Please enter your 2 element into the array...20
Please enter your 3 element into the array...8
Please enter your 4 element into the array...9
Please enter your 5 element into the array...8
Your array of integers are:
15 20 8 9 8
The mean of the set of integers is:
12.000

```

#6a Median of Integers (even array size)**Description**

This test will take a set of integers from the user and store them in an array. The program will then sort them using the "SortArray" function. The program will then run through the array using a "for loop" and then check the size of the array.

In this test the array size will be even, therefore, the program will split the array in half, take the value of the number in which the array is pointing at, add it to the next number in the array and then divide the total of that by 2.

Test Steps :

1	Array size = 8.
2	The program asks the user to enter the first element.
3	User enters 9.
4	The program asks the user to enter the second element.
5	User enters 15.
6	The program asks the user to enter the third element.
7	User enters 2.
8	The program asks the user to enter the forth element.
9	User enters 11.
10	The program asks the user to enter the fifth element.
11	User enters 1.
12	The program asks the user to enter the sixth element.
13	User enters 21.
14	The program asks the user to enter the Seventh element.
15	User enters 4.
16	The program asks the user to enter the eighth element.
17	User enters 7.
18	The program sorts and displays sorted array.
19	The program computes median and returns it.
20	Program displays median.

Response

Expected: The program displays 8

Status	Date	Description
Fail	24/03/2018 15:50	The program did not return expected value. Returned value – 7.5
Pass	24/03/2018 16:23	The program returns 8.

```

| Mean, Median, Mode and Standard Deviation of a list of integers |
-----
How many elements would you like in your array? 8
Please enter your 1 element into the array...9
Please enter your 2 element into the array...15
Please enter your 3 element into the array...2
Please enter your 4 element into the array...11
Please enter your 5 element into the array...1
Please enter your 6 element into the array...21
Please enter your 7 element into the array...4
Please enter your 8 element into the array...7
Your array of integers are:
9 15 2 11 1 21 4 7
Sorted Array:
1 2 4 7 9 11 15 21
Median of Array:
7.50

```

Above is an image of the failed attempt showing that the program does not return the expected value.

```

| Mean, Median, Mode and Standard Deviation of a list of integers |
-----
How many elements would you like in your array? 8
Please enter your 1 element into the array...9
Please enter your 2 element into the array...15
Please enter your 3 element into the array...2
Please enter your 4 element into the array...11
Please enter your 5 element into the array...1
Please enter your 6 element into the array...21
Please enter your 7 element into the array...4
Please enter your 8 element into the array...7
Your array of integers are:
9 15 2 11 1 21 4 7
Sorted Array:
1 2 4 7 9 11 15 21
Median of Array:
8.00

```

This is an image displaying the working program.

The reason why the program did not work as expected is a small issue in the code.

```

...
double medianOfIntegers(int arrayOfInt[], int arraySize) {
    double median = 0.00;
    SortArray(arrayOfInt, arraySize);

    for (int i = 0; i < arraySize; i++) {
        //If the array size is even, divide the array in half, add the next number in the
        if (arraySize % 2 == 0) {
            median = (arrayOfInt[i / 2] + arrayOfInt[i / 2] + 1) / 2.0;
        }
    }
}

```

In the given example of the program running, instead of it adding the half way element and the number after, it was added the middle number by itself and adding one to it. It was then dividing that total by two. $15 / 2 = 7.5$.

```
double medianOfIntegers(int arrayOfInt[], int arraySize) {
    double median = 0.00;
    SortArray(arrayOfInt, arraySize);

    for (int i = 0; i < arraySize; i++) {
        //If the array size is even, divide the array in half, add the next number in the array
        if (arraySize % 2 == 0) {
            median = (arrayOfInt[i / 2] + arrayOfInt[i / 2 + 1]) / 2.0;
        }
    }
}
```

By ensuring that the one is in the correct place, it will read the next element in the array.

#6b Median of Integers (odd array size)

Description

This test will take a set of integers from the user and store them in an array. The program will then sort them using the "SortArray" function. The program will then run through the array using a "for loop" and then check the size of the array.

In this test the array size will be odd, therefore, the program will split the array in half and return the value as that will be the median.

Test Steps :

1	Array size = 7.
2	The program asks the user to enter the first element.
3	User enters 9.
4	The program asks the user to enter the second element.
5	User enters 15.
6	The program asks the user to enter the third element.
7	User enters 2.
8	The program asks the user to enter the forth element.
9	User enters 11.
10	The program asks the user to enter the fifth element.
11	User enters 1.
12	The program asks the user to enter the sixth element.
13	User enters 21.
14	The program asks the user to enter the Seventh element.
15	User enters 4.
16	The program asks the user to enter the eighth element.
17	The program sorts and displays sorted array.
18	The program computes median and returns it.
19	Program displays median.

Response

Expected: The program displays 9

Status

Date

Description

Pass

24/03/2018
16:37

The program returns 9.

```

-----
| Mean, Median, Mode and Standard Deviation of a list of integers |
-----
How many elements would you like in your array? 7
Please enter your 1 element into the array...9
Please enter your 2 element into the array...15
Please enter your 3 element into the array...2
Please enter your 4 element into the array...11
Please enter your 5 element into the array...1
Please enter your 6 element into the array...21
Please enter your 7 element into the array...4
Your array of integers are:
9 15 2 11 1 21 4
Sorted Array:
1 2 4 9 11 15 21
Median of Array:
9.00
-----

```

#7 Mode of integers

Description

This test will take a set of integers from the user and store them in an array. The array will be sorted from previous functions therefore the program won't have to re-sort the numbers.

The program will start from the first number in the array and check it against the next element. If the number is the same it will add one to a counter. If not it will make that number the number to compare to other numbers in the array.

Numbers that will be checked is: 1, 3, 7, 7, 9, 9, 9.

A total will handle the largest amount of matched numbers in the array.

Mode will be the number in the array with the most amount of matches.

Test Steps :

1	Check element = 1 (check element is the variable used in the program).
2	Program compares 1 with 3.
3	No match, the check element becomes 3.
4	Program compares 3 with 7.
5	No match, the check element becomes 7.
6	Program compares 7 with 7.
7	This is a match, 1 will be added to the running total. (runningTotal) is the variable used in program.
8	Total will be 1.
9	Because this is the largest total so far, the mode will become 7.
10	The program will check the next number in the array and compare it to 7.
11	No match, running total will return to 0.
12	Check element will become 9.
13	The program will check 9 with 9.

	14	This is a match, 1 will be added to the running total.
	16	Mode will stay as 7 as the runningTotal has not exceeded the previous total.
	17	The program will check 9 with 9.
	18	This is a match, 1 will be added to the running total.
	19	runningTotal is now greater than total. Mode will now become 9.
	20	The program will return the mode.
Response Status	Expected: The program displays 9	
	Date	Description
	24/03/2018 17:02	An error that was found when testing this is if there was a number earlier on in the sequence that was the largest mode but there were common numbers later in the array it would make the later numbers the mode.
	25/03/2018 09:13	The program returns 9.

```

|-----|
| Mean, Median, Mode and Standard Deviation of a list of integers |
|-----|
How many elements would you like in your array? 7
Please enter your 1 element into the array...1
Please enter your 2 element into the array...3
Please enter your 3 element into the array...7
Please enter your 4 element into the array...7
Please enter your 5 element into the array...7
Please enter your 6 element into the array...9
Please enter your 7 element into the array...9
Your array of integers are:
1 3 7 7 7 9 9
Mode of Integers:
9

```

Above is an image taken showing that the program had failed to return the number that the user was expecting.

The issue was due to a logical error within the code. The code can be seen in the image below.

```

for (int i = 1; i < arraySize; i++) {
    if (arrayOfInt[i] == checkElement) { //is element[i] the
        runningTotal = runningTotal + 1;
    }
    else {
        total = runningTotal;
        mode = arrayOfInt[i];
        runningTotal = 0;
        checkElement = arrayOfInt[i];
    }
}

```

The problem is that when the number isn't a match to the next number in the array it will make total equal to running total and then total to 0. This would work if the total was no in this loop as when the loop runs again it will reset total to 0.

```

for (int i = 1; i < arraySize; i++) {
    if (arrayOfInt[i] == checkElement) { //is element[i] the sam
        runningTotal = runningTotal + 1;
    }
    else {
        runningTotal = 0;
        checkElement = arrayOfInt[i];
    }

    if (runningTotal > total) {
        total = runningTotal;
        mode = arrayOfInt[i];
    }
}

```

To ensure this worked properly an extra “if” statement had to be added to the function outside of the loop to check whether “runningTotal” was greater than “total”. This got rid of the problems and the program returned what was expected.

```

| Mean, Median, Mode and Standard Deviation of a list of integers |
-----
How many elements would you like in your array? 7
Please enter your 1 element into the array...1
Please enter your 2 element into the array...3
Please enter your 3 element into the array...7
Please enter your 4 element into the array...7
Please enter your 5 element into the array...9
Please enter your 6 element into the array...9
Please enter your 7 element into the array...9
Your array of integers are:
1 3 7 7 9 9 9
Mode of Integers:
9

```

```

| Mean, Median, Mode and Standard Deviation of a list of integers |
-----
How many elements would you like in your array? 7
Please enter your 1 element into the array...1
Please enter your 2 element into the array...3
Please enter your 3 element into the array...7
Please enter your 4 element into the array...7
Please enter your 5 element into the array...7
Please enter your 6 element into the array...9
Please enter your 7 element into the array...9
Your array of integers are:
1 3 7 7 7 9 9
Mode of Integers:
7

```

These images shows that the program will run as expected regardless of where the most common number occurs.

#7	Standard Deviation																											
Description	This function will take the array of integers, the size of the array and the mean of the integers (that will be computed in a separate function). Using a “for loop” the program will take the number in which the array is pointing to and subtract the mean of the integer and square it. This will then be added to a total. Once this is complete the square root of the total will be returned. Numbers that will be entered: 10, 20, 30, 40, 50																											
	Test Steps :																											
	<table><tr><td>1</td><td>Numbers are entered.</td></tr><tr><td>2</td><td>Median is computed (30.00).</td></tr><tr><td>3</td><td>(i = 0), this points to 10. Program computes $\sqrt{(10 - 30.00)^2}$</td></tr><tr><td>4</td><td>Value gets added to total.</td></tr><tr><td>5</td><td>(i = 1), this points to 20. Program computes $\sqrt{(20 - 30.00)^2}$</td></tr><tr><td>6</td><td>Value gets added to total on top of previous total.</td></tr><tr><td>7</td><td>(i = 2), this points to 30. Program computes $\sqrt{(30 - 30.00)^2}$</td></tr><tr><td>8</td><td>Value gets added to total on top of previous total.</td></tr><tr><td>9</td><td>(i = 3), this points to 40. Program computes $\sqrt{(40 - 30.00)^2}$</td></tr><tr><td>10</td><td>Value gets added to total on top of previous total.</td></tr><tr><td>11</td><td>(i = 4), this points to 40. Program computes $\sqrt{(50 - 30.00)^2}$</td></tr><tr><td>12</td><td>Value gets added to total on top of previous total.</td></tr><tr><td>13</td><td>The program square roots the total to return the standard deviation.</td></tr></table>		1	Numbers are entered.	2	Median is computed (30.00).	3	(i = 0), this points to 10. Program computes $\sqrt{(10 - 30.00)^2}$	4	Value gets added to total.	5	(i = 1), this points to 20. Program computes $\sqrt{(20 - 30.00)^2}$	6	Value gets added to total on top of previous total.	7	(i = 2), this points to 30. Program computes $\sqrt{(30 - 30.00)^2}$	8	Value gets added to total on top of previous total.	9	(i = 3), this points to 40. Program computes $\sqrt{(40 - 30.00)^2}$	10	Value gets added to total on top of previous total.	11	(i = 4), this points to 40. Program computes $\sqrt{(50 - 30.00)^2}$	12	Value gets added to total on top of previous total.	13	The program square roots the total to return the standard deviation.
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13	The program square roots the total to return the standard deviation.																											
Response	Expected: The program displays 14.142																											
Status	Date	Description																										
Pass	24/03/2018 17:31	Passed for all values.																										

```

Please enter your 1 element into the array...10
Please enter your 2 element into the array...20
Please enter your 3 element into the array...30
Please enter your 4 element into the array...40
Please enter your 5 element into the array...50
Your array of integers are:
10 20 30 40 50
The mean of the set of integers is:
30.000
Sorted Array:
10 20 30 40 50
Median of Array:
30.00
Mode of Integers:
0
Standard Deviation:
14.142

```

Bibliography

- [1] Unknown, "<https://www.mathsisfun.com/pythagoras.html>," [Online]. Available: <https://www.mathsisfun.com/pythagoras.html>. [Accessed 13 April 2018].

Maths report

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

56/100

PAGE 1

PAGE 2

PAGE 3

PAGE 4



Comment 1

We require the length of ONE vector not two.

a should represent the x co-ordinate, b the y. The calc will be correct then but please do this for a 3d vector ie $v=(x,y,z)$

PAGE 5

PAGE 6

PAGE 7



Comment 2

show the detailed function too please.

Code ok here.

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

GRADING FORM: SMU GENERIC_GJ

ANDREW COOPER**56****RESEARCH-INFORMED LITERATURE**

You've clearly investigate the majority of mathematical concepts and have included a reference. You have also investigated the appropriate SE principles and coding practices for many of the required operations - good- so also please include a reference to a std C/C+= text.

3**KNOWLEDGE AND UNDERSTANDING**

No cross product? No matrix calc? What about union and intersection? A fair understanding of C and underlying mathematical principles demonstrated here. Further work required for some tasks. Otherwise you have made a good attempt at the majority of functions required. Well done. See comments on finding the length of a vector - understanding confused here.

7**ANALYSIS**

Tasks that were completed show good analysis and



testing. No need to show failed tests here, just the success.

8

PRACTICAL APPLICATION AND DEP.



A fair attempt- The majority of tasks have been completed and tested. Cross product, matrix mult. not done, union and intersection incomplete. Some distance tests in 2D only. SE principles demonstrated in coding.

35

SKILLS FOR PROFESSIONAL PRAC.



Test documentation very good. Ref used (see earlier comment). Some aspects of the assignment not completed.

3