

Project #5 – Dr. Doolittle



Professor Dolittle has asked some computer science students to write a program that will help him calculate his final grades. Professor Dolittle gives two midterms and a final exam. Each of these is worth 100 points. In addition, he gives a number of homework assignments during the semester. Each homework assignment is worth 100 points.

At the end of the semester, Professor Dolittle wants to calculate the median score on the homework assignments for the semester. He believes that the median score is a good measure of the student's overall performance on the homework assignments. The median is found by putting the homework scores in order, and then taking the score that is at the midpoint of this list. If there are an odd number of assignments, the median is the score exactly in the middle of the list. If there are an even number of assignments, the median is the average of the two scores closest to the middle.

Once the median score is known, professor Dolittle takes the sum of the exam scores and the median homework score and uses this value to compute a letter grade. Letter grades are assigned based on the following table:

Total Score	Letter Grade
381 - 400	A
361 - 380	A-
341 - 360	B+
321 - 340	B
301 - 320	B-
281 - 300	C+
261 - 280	C
241 - 260	C-
221 - 240	D+
201 - 220	D
181 - 200	D-
180 and below	fail

Program

Your program should work as follows:

1. All user input should be tested to be sure that it is a valid integer value.
2. It should ask the user to enter in the score for the first midterm.
3. This value is read in and saved.
4. It should ask the user to enter in the score for the second midterm.
5. This value is read in and saved.
6. It should ask the user to enter in the score for the final exam.
7. This value is read in and saved.
8. The program then asks the user to enter in the scores for the homework assignments. Any number of scores can be entered in. When done, the user signals the completion by pressing a key.
9. Store the homework scores in a vector.
10. Once all of the data has been entered, the program calls a function to find the median homework score.
11. The program then calls a function that you have written to calculate and return the letter grade.
12. Finally, display the median homework score, the total point count, and the letter grade.
13. There are a couple of neat things about vectors that will save you tons of work on this project. First of all, you can find out how many elements are in a vector by calling the `size` function.

Median Value: The Median is the "*middle*" of a sorted list of numbers.

How to Find the Median Value

To find the Median, place the numbers in **value order** and find the **middle**.
(It doesn't matter if some numbers are the same in the list.)

Example: Find the Median of 12, 3, and 5
Put them in order: 3, **5**, 12
The middle is 5, so the median is 5.

Two Numbers in the Middle

BUT, with an **even amount of numbers** things are slightly different.
In that case we find the **middle pair** of numbers, and then find the value that is **half way** between them.
This is easily done by adding them together and dividing by two.

Example: Find the Median 13, 7, 5, and 21
Put them in order: 5, **7, 13**, 21
There are now **four** numbers, so there is no middle number. There are a **pair**.
In this example the middle numbers are **7 and 13**.
To find the value halfway between them, add them together and divide by 2:
 $7 + 13 = 20$, then $20 \div 2 = 10$
So the **Median** in this example is **10**.

(Note that 10 was not in the list of numbers ... but that is OK because half the numbers in the list are less, and half the numbers are greater.)

Where is the Middle?

A quick way to find the middle: **count how many numbers, add 1 then divide by 2**

Example: There are 45 numbers
45 plus 1 is 46, then divide by 2 and we get 23
So the median is the **23rd number** in the sorted list.

Example: There are 66 numbers
66 plus 1 is 67, then divide by 2 and we get **33.5**
33 and a half? That means that the **33rd and 34th** numbers are the two middle numbers.
So to find the median: add the **33rd and 34th** numbers together and divide by 2.

Standard Template Library: Algorithms

The header `<algorithm>` defines a collection of functions especially designed to be used on ranges of elements.

A range is any sequence of objects that can be accessed through iterators or pointers, such as an array or an instance of some of the [STL containers](#) such as vectors. Algorithms operate through iterators directly on the values, not affecting in any way the structure of any possible container (it never affects the size or storage allocation of the container).

Code: `#include <algorithm>`

`sort(variable.begin(), variable.end());`