Algorithmics	Student information	Date	Number of session
	UO: UO294786	07/02/24	2
	Surname: Alvarez Iglesias		
	Name: Rafael		

Escuela de Ingeniería Informática
Universidad de Oviedo

Universidad de Oviedo
Universidá d'Uviéu
University of Oviedo

Activity 1. [MEASURING EXECUTION TIMES]

YOU ARE REQUESTED TO: Calculate how many more years we can continue using this way of counting:

Given that the currentTimeMillis() method returns a long integer of 64 bits, the max number that can be stored is 9,223,372,036,854,775,807 (in ms). If we convert that into years, that means that the max amount of years that we can use this method is 292,277,024.62693. If we add those years to the year 1970, we have that we can keep using this method until 292279003.

Activity 2. [MEASURING EXECUTION TIMES]

YOU ARE REQUESTED TO: What does it mean that the time measured is 0?

A time of 0ms means that the time that it takes to execute the program is so small (less than 1ms) that it can't be measured.

YOU ARE REQUESTED TO: From what size of problem (n) do we start to get reliable times? We consider a time as reliable if it is over 50ms. I found that for problem sizes greater than 5000000 we start to get times over 50ms, which can be considered as reliable. (SIZE=5000000 TIME=62 milliseconds SUM=-114720).

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Activity 3. [TAKING SMALL EXECUTION TIMES]

YOU ARE REQUESTED TO: What happens with the time if the problem size is multiplied by 2?

Depending on the problem complexity, the execution time should increase accordingly. In the case of the Vector4 problem, that has a linear O(n) complexity, the time tends to double for each multiplication.

However, the proportion for the increase will vary with the complexity of the given problem.

YOU ARE REQUESTED TO: What happens with the time if the problem size is multiplied by a value k other than 2? (try it, for example, for k=3 and k=4 and check the times obtained). Explain whether the times obtained are those expected from the linear complexity O(n):

In both cases, as expected, the increase in time follows a linear trend. Trying a value of 3 will lead to the time tripling for each iteration, and a value of 4 quadruples the time.

YOU ARE REQUESTED TO: From what we saw in Vector4.java measuring the times for sum, create the following three java classes:

- **Vector5.java to measure times for maximum.**
- **Vector6.java to measure times for matches1.**
- **Vector7.java to measure times for matches2.**

With the times obtained from the previous classes (in milliseconds), fill in the following table:

CPU	RAM
AMD Ryzen 5 2600 Six-Core Processor	16 GB

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n	Time(ms)			
	sum()	maximum()	matches1()	matches2()
10000	0,098	0,124	668	0,102
20000	0,178	0,26	2669	0,204
40000	0,388	0,506	20668	0,408
80000	0,748	0,992	42670	0,822
160000	1,39	1,886	171042	1,642
320000	2,782	3,726	687961	3,264
640000	5,79	7,186	2747570	6,61
1280000	11,548	14,206	OoT	13,034
2560000	22,682	28,304	OoT	25,998
5120000	45,958	56,432	OoT	52,062
10240000	91,23	112,968	OoT	104,49
20480000	182,2	226,556	OoT	208,21
40960000	364,072	452,782	OoT	416,766
81920000	725,894	906,954	OoT	838,194

Once both tables are filled in, conclude whether the times obtained meet what was expected, given the computational time complexity of the different operations:

By calculating the complexity of each algorithm, the following results were obtained:

Sum, maximum and matches2 all have O(n) as complexity. Matches1 is the worst performing, with a complexity of $O(n^2)$.

With the obtained complexities, and analyzing the obtained data, we see that on the ones with linear complexity, the execution times are pretty similar, all following the linear trend as supposed. That means that the execution time doubles as n doubles.

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For the worst performing of them all, the matches1, the trend is in fact exponential, even though it wasn't possible to measure the time past the n = 640000 mark, given the large amount of time required to complete the execution.