Algorithmics	Student information	Date	Number of session
	UO: 302165	13/02/2025	1.2
	Surname: Uña Garcia		
	Name: Lucas		

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Activity 1. [Some iterative models]

Loop1: O(nlog(n))

Loop2: O(n^2 log(n))

Loop3: O(n^2log(n))

Loop4: O(n^3)

N	tLoop1	tLoop2	tLoop3	tLoop4
100	0,007	0,166	0,86	0,69
200	0,013	0,592	3,51	4,85
400	0,0302	2,692	14,76	36,51
800	0,0664	12,318	63,19	285
1600	0,1509	49,5	269	2219
3200	0,3187	221,6	1146	16749
6400	0,6935	868,4	4630	Oot
12800	1,5296	3948	19466	Oot
25600	3,16	17337	Oot	Oot
51200	6,342	Oot	Oot	Oot

Taking into account the theoretical complexities, the results obtained after the execution of the programs are the expected ones.

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Activity 2. [Creation of iterative models]

Loop5: $O(n^2 log^2(n))$

Loop6: $O(n^3 log(n))$

Loop7: $O(n^4)$

N	tLoop5	tLoop6	tLoop7
100	4,09	57	394
200	19,5	451	6145
400	92,8	3899	Oot
800	432,5	32641	Oot
1600	2018,6	Oot	Oot
3200	9167	Oot	Oot
6400	41854	Oot	Oot
12800	Oot	Oot	Oot
25600	Oot	Oot	Oot
51200	Oot	Oot	Oot

As expected, the growth tendency of the complexities is reflected in the times obtained.

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Activity 3. [Compare algorithms with different complexities]

N	tLoop1	tLoop2	t1/t2
100	0,007	0,166	0,04216867
200	0,013	0,592	0,02195946
400	0,0302	2,692	0,01121842
800	0,0664	12,318	0,00539049
1600	0,1509	49,5	0,00304848
3200	0,3187	221,6	0,00143818
6400	0,6935	868,4	0,0007986
12800	1,5296	3948	0,00038744
25600	3,16	17337	0,00018227
51200	6,342	Oot	#¡VALOR!

As the complexity of the loop1 program is much better than the complexity of the loop2 program, the division ratio tends to 0 as “n” increases.

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Activity 4. [Compare algorithms with same complexities]

N	tLoop3	tLoop2	t3/t2
100	0,86	0,166	5,18072289
200	3,51	0,592	5,92905405
400	14,76	2,692	5,48291233
800	63,19	12,318	5,12989122
1600	269	49,5	5,43434343
3200	1146	221,6	5,17148014
6400	4630	868,4	5,3316444
12800	19466	3948	4,93059777
25600	Oot	17337	#¡VALOR!
51200	Oot	Oot	#¡VALOR!

Both complexities are not exactly the same because we are omitting the bases of the logarithms, this explains the variations of the division ratio. However, this “error” can be ignored because the division ratio tends to be constant, so this indicates that both complexities have the same growth tendency.

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Activity 5. [Compare algorithms with same complexities, but different environments]

N	tLoop4(python) (t41)	tLoop4(java without op) (t42)	tLoop4(java with op) (t43)	t42/t41	t43/t42
100	4	0,69	0,088	0,1725	0,12753623
200	29	4,85	0,54	0,16724138	0,11134021
400	221	36,51	3,364	0,16520362	0,09213914
800	1692	285	25,096	0,16843972	0,08805614
1600	14907	2219	185,14	0,14885624	0,08343398
3200	Oot	16749	1362,5	#¡VALOR!	0,08134814
6400	Oot	Oot	10753	#¡VALOR!	#¡VALOR!

The division ratio between the program executed in python and the one executed in java has a slightly tendency to 0, we can suppose that the cause of this behavior, even though the program is the same, is the different approaches of the languages python is an interpreted language and java a compiled one and it seems that compiled languages are faster.

Executing the program in java with optimization and without it, reflect a slight improvement when executing with optimization which we can see in the tendency of the division ratio (to 0). This make sense because the optimization of java, improve the performance of the repeated operations and as the size of the problem increases this improvement in the times becomes bigger.