

Algorithmics	Student information	Date	Number of session
	UO:300717	13/02/2025	1.2
	Surname: Almoína Iglesias		
	Name: Martín		

## Activity 1.

N	tLoop1	tLoop2	tLoop3	tLoop4
100	63	16	44	635
200	107	62	182	50
400	304	280	740	348
800	640	1266	3124	2669
1600	1527	4998	13449	21492
3200	2996	22926	56080	169426
6400	6856	91201	235641	135511
12800	15112	3896	19246	OoT
25600	31106	17484	80482	OoT
51200	61263	70370	OoT	OoT
Repetitions :	10000	100	50	10

  

N	tLoop1	tLoop2	tLoop3	tLoop4
100	0,0063	0,16	0,88	0,635
200	0,0107	0,62	3,64	5
400	0,0304	2,8	14,8	34,8
800	0,064	12,66	62,48	266,9
1600	0,1527	49,98	268,98	2149,2
3200	0,2996	229,26	1121,6	16942,6
6400	0,6856	912,01	4712,82	13551,1
12800	1,5112	3896	19246	OoT
25600	3,1106	17484	80482	OoT
51200	6,1263	70370	OoT	OoT

Different number of Repetitions used

The complexity of Loop1 is  $O(n \log n^2)$

The complexity of Loop2 is  $O(n^2 \log n)$

The complexity of Loop3 is  $O(n^2 \log n)$

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The complexity of Loop4 is  $O(n^3)$

It was expected that loop one would be the slowest growing one, as it has the lowest complexity, and that loop 4 would grow the fastest, it has cubic complexity, however, it would be expected that 2 and 3 would grow at the same rate as they both have  $n^2 \log n$  complexity but they are in fact very different, this could be because the logarithm inside of loop 2 has base 3 (n is divided by 3 each loop) and the one in loop 3 has base 2, this means that as n increases, loop 2's execution time will grow more slowly.

## Activity 2.

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N	tLoop5	tLoop6	tLoop7
100	94	127	381
200	471	975	5835
400	3079	8030	92203
800	10458	61738	OoT
1600	65657	515977	OoT
3200	196228	4471087	OoT
6400	903941	OoT	OoT
Repetitions :            100                    1                    1			

N	tLoop5	tLoop6	tLoop7
100	0,94	127	381
200	4,71	975	5835
400	30,79	8030	92203
800	104,58	61738	OoT
1600	656,57	515977	OoT
3200	1962,28	4471087	OoT
6400	9039,41	OoT	OoT

The times are in line with what was expected due to the time complexity of the given loops

## Activity 3.

A. Two algorithms with different complexity

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N	tLoop1	tLoop2	t1/t2
100	0,0063	0,16	0,039375
200	0,0107	0,62	0,01725806
400	0,0304	2,8	0,01085714
800	0,064	12,66	0,00505529
1600	0,1527	49,98	0,00305522
3200	0,2996	229,26	0,00130681
6400	0,6856	912,01	0,00075175
12800	1,5112	3896	0,00038789
25600	3,1106	17484	0,00017791
51200	6,1263	70370	8,7058E-05

B. Two algorithms with different complexity

N	tLoop2	tLoop3	t2/t3
100	0,16	0,88	0,18181818
200	0,62	3,64	0,17032967
400	2,8	14,8	0,18918919
800	12,66	62,48	0,20262484
1600	49,98	268,98	0,18581307
3200	229,26	1121,6	0,20440442
6400	912,01	4712,82	0,19351683
12800	3896	19246	0,20243167
25600	17484	80482	0,21724112
51200	70370	OoT	

C. Same algorithm in different development environments

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N	t41 (Python)	t42(Java-no optimization)	t43(Java-optimization)	t42/t41	t43/t42
100	11	0,635	0,34	0,05772727	0,53543307
200	58	5	1,88	0,0862069	0,376
400	498	34,8	3,32	0,06987952	0,0954023
800	3060	266,9	14,84	0,08722222	0,05560135
1600	24122	2149,2	61,93	0,08909709	0,02881537
3200	224435	16942,6	249,42	0,07549001	0,01472147
6400		13551,1	1524,28		0,11248386

A-

T1/t2 tends to 0 as t1 has the lower complexity.

B-

T2/t3 stays at roughly 0.2 meaning t2 is better this lines up with activity 1 where it was observed that despite these two loops having the same complexity t2 grew at a slower rate.

C-

T42/t41 and t43/t42 both tend towards 0 meaning that t42 is better than t41 and, in turn t43 is better than t42, making java with optimization enabled the most efficient of the three enviroments.