Algorithmics	Student information	Date	Number of session
	UO: 300829	13/02/2025	2
	Surname: Cid Lazcano		
	Name: Izan		

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Activity 1. Some iterative models

N	tLoop1	tLoop2	tLoop3	tLoop4
100	0.0075	0.28	1.55	1.3
200	0.0196	1.30	7.04	9.48
400	0.0446	5.49	27.45	80.45
800	0.0979	25.07	108.39	967.13
1600	0.1916	94.83	423.92	4242
3200	0.3999	651.39	2032	51689
6400	0.8789	1799	8096	OoT
12800	1.9762	8085	34082	OoT
25600	4.1728	34255	OoT	OoT
51200	9.9209	OoT	OoT	OoT

Conclusion: All the algorithms match their expected complexity.

Loop1 -> O(nlog(n)), **Loop2** -> $O(n^2log(n))$, **Loop3** -> $O(n^2log(n))$, **Loop4** -> $O(n^3)$

Activity 2. Creation of iterative models

N	tLoop5	tLoop6	tLoop7
100	0.39	14.0	34.6
200	1.95	116.8	468.3
400	8.36	1319.4	6806
800	34.90	8884	OoT
1600	152.60	OoT	OoT
3200	719	OoT	OoT
6400	2814	OoT	OoT

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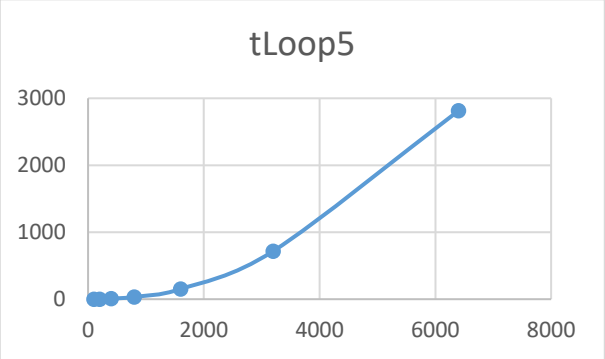
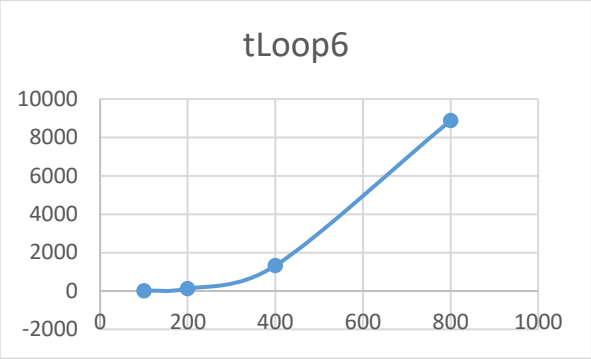
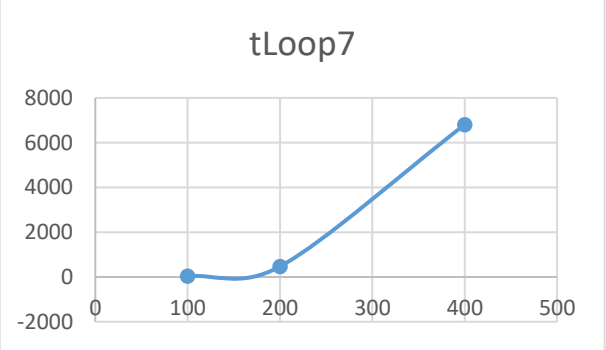




If we plot the times obtained, we can see the different theoretical complexities in the curves.



Activity 3. Comparison of two algorithms

A. Two Algorithms with different complexity

N	tLoop1	tLoop2	t1/t2
100	0.0075	0.28	0,02679
200	0.0196	1.30	0,16333
400	0.0446	5.49	0,00812
800	0.0979	25.07	0,00391
1600	0.1916	94.83	0,00202
3200	0.3999	651.39	0,00094
6400	0.8789	1799	0,00049
12800	1.9762	8085	2,55125
25600	4.1728	34255	1,21816
51200	9.9209	OoT	OoT

Since the quotient is < 1 we can tell that Loop 1 is better than Loop 2. We can also check their complexities in the graph (At the end of the document).

B. Two Algorithms with the same complexity

N	tLoop3	tLoop2	t3/t2
100	1.55	0.28	5.535714286
200	7.04	1.30	5.415384615
400	27.45	5.49	5
800	108.39	25.07	4.323494216
1600	423.92	94.83	4.470315301
3200	2032	651.39	3.119482952
6400	8096	1799	4.500277932
12800	34082	8085	4.21546073
25600	OoT	34255	OoT
51200	OoT	OoT	OoT

Since the quotient is > 1 we can tell that Loop 2 is better than Loop 3. We are getting these results even though both loops have the same complexity because of the way they are implemented, they are logarithms but in this case one has a different base than the other. Therefore, they have the same complexity when we generalize to talk about theoretical complexities but we can observe differences in the execution times.

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C. Two Algorithms with the same complexity

N	tLoop4 (Python) – t41	tLoop4 (Java without optimization) – t42	tLoop4 (Java with optimization) – t43	t42/t41	t43/t42
200	57	9.48	0.31	0.166315789	0.032700422
400	383	80.45	0.81	0.210052219	0.010068365
800	3262	967.13	5.35	0.296483752	0.005531831
1600	52490	4242	38.80	0.080815393	0.009146629
3200	OoT	51689	247.37	OoT	0.004785738
6400	OoT	OoT	OoT	OoT	OoT

If we check the quotients, we can tell that t43(optimized) is better than t42(unoptimized) and t42 is better than t41(Python).
The reason for one instance of the loop being better than the other even though they have the same complexity is due to the Java optimization which, when working with large sizes, could achieve shorter execution times.