Algorithmics	Student information	Date	Number of session
	UO: 301022	06/02/2025	1
	Surname: Canga		
	Name: Martín		

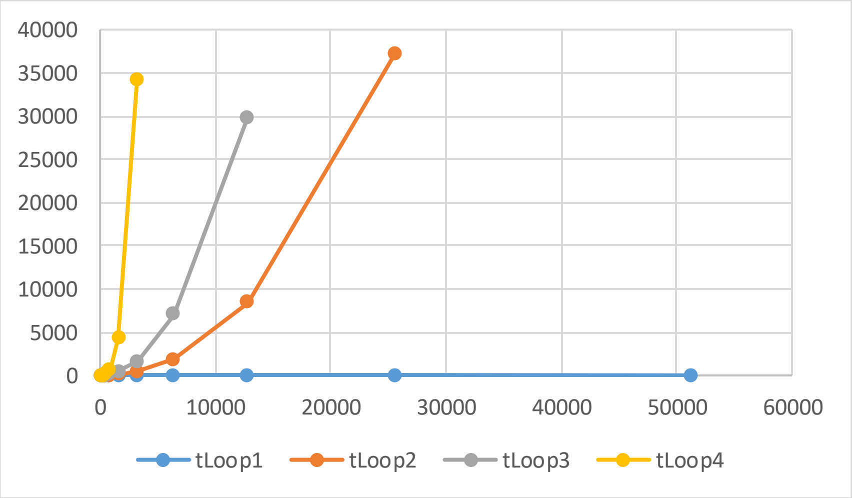
Activity 1. [Iterative models, different complexity]

Java loops with different complexity

N	tLoop1	tLoop2	tLoop3	tLoop4
100	0.0088	0.37	1.28	1.38
200	0.019	1.23	4.88	9.49
400	0.042	5.64	21.65	71.75
800	0.0984	26.38	91.54	546.00
1600	0.2094	100.40	398.00	4284.00
3200	0.439	466.00	1625.00	34075.00
6400	0.9368	1875.00	7022.00	OoT
12800	2.1994	8461.00	29861.00	OoT
25600	4.991	37275.00	OoT	OoT
51200	9.3598	OoT	OoT	OoT

All the loops seem to match their respective complexities:

- Loop1 = $O(n \times log(n))$
- Loop2 = $O(n^2 \times log(n))$
- Loop3 = $O(n^2 \times log(n))$
- Loop4 = $O(n^3)$



Algorithmics	Student information	Date	Number of session
	UO: 301022	06/02/2025	1
	Surname: Canga		
	Name: Martín		

Activity 2. [Developing algorithms]

Java O(n^2 * log^2(n)), O(n^3 * log(n)) and O(n^4) respective loops without optimization:

N	tLoop5	tLoop6	tLoop7
100	2.07	10.50	39.00
200	22.13	83.20	499.00
400	62.40	742.00	7182.00
800	218.44	6991.00	OoT
1600	1663.95	OoT	OoT
3200	5344.00	OoT	OoT
6400	24054.00	OoT	OoT

We can see that the times match their respective growth rate.

Activity 3. [Comparing algorithms]

Comparing algorithms without optimization

N	tLoop1	tLoop2	T1/T2
100	0.0088	0.37	0.023
200	0.019	1.23	0.015
400	0.042	5.64	0.007
800	0.0984	26.38	0.003
1600	0.2094	100.40	0.002
3200	0.439	466.00	0.0009
6400	0.9368	1875.00	0.0004
12800	2.1994	8461.00	0.0002

25600	4.991	37275.00	0.0001
51200	9.3598	OoT	OoT

If we divide the complexities, we'll get the rate at which T1/T2 will differ. In this particular case is 1/n. Since we know that the closer, we are to zero the better T1 is with respect to T2, the efficiency of T1 will follow a linear trend getting better as n tends to infinity.

N	tLoop3	tLoop2	T3/T2
100	1.28	0.37	3.45
200	4.88	1.23	3.96
400	21.65	5.64	3.83
800	91.54	26.38	3.47
1600	398.00	100.40	3.96
3200	1625.00	466.00	3.48
6400	7022.00	1875.00	3.74
12800	29861.00	8461.00	3.52
25600	OoT	37275.00	OoT
51200	OoT	OoT	OoT

In this case we can see that relationships are always the same as we increase n. This is due to the complexity of the two algorithms being the same. Although both have the same complexity, we can argue that Loop2 is more efficient because it completes any N iteration in a lower time.

Algorithmics	Student information	Date	Number of session
	UO: 301022	06/02/2025	1
	Surname: Canga		
	Name: Martín		

Activity 4. [Algorithms in different environments]

N	tLoop4 (t41) python	tLoop4 (t42) Java NonOpt.	tLoop4 (t43) Java Opt.	t42/t41	t43/t42
100	10	1.38	0.14	0.138	0.101
200	64	9.49	0.23	0.148	0.024
400	625	71.75	1.37	0.114	0.019
800	10212	546.00	9.42	0.05	0.017
1600	OoT	4284.00	32.36	OoT	0.007
3200	OoT	34075.00	345.90	OoT	0.010

We can see that the proportion of each execution is the same for all N values. One thing that stands out is that java is consistently faster than python no matter if this one use optimization techniques or not.