Algorithmics	Student information	Date	Number of session
	UO: 293693	15/02/2024	1.2
	Surname: Castro Álvarez		
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Activity 2. Some iterative models

N	tLoop1 (10000)	tLoop2 (1000)	tLoop3 (100)	tLoop4 (100)
100	0,0099	0,332	1,23	1,22
200	0,0204	1,52	4,99	8,97
400	0,0435	6,03	22,26	70,18
800	0,1061	29,23	94,39	557,89
1600	0,2997	OoT	437,45	OoT
3200	0,5002	OoT	OoT	OoT
6400	1,0283	OoT	OoT	OoT
12800	2,8690	OoT	OoT	OoT
25600	OoT	OoT	OoT	OoT
51200	OoT	OoT	OoT	OoT

As seen in the computing, the difference between the theoretical time and the real time progressively worsens as you go to worse complexities. That is that for Loop1 they are really similar and for Loop4 they are really far apart

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Loop 1 $\Rightarrow O(n \log n)$

$n_2 = 200; n_1 = 100 \Rightarrow t_2 = \frac{n_2 \cdot \log n_2}{n_1 \cdot \log n_1} \cdot t_1 = \frac{200}{100} \cdot \frac{\log 200}{\log 100} \cdot 0.0099 = 0.0227$

Measured = 0.0204

$n_2 = 400; n_1 = 200 \Rightarrow t_2 = \frac{n_2 \cdot \log n_2}{n_1 \cdot \log n_1} \cdot t_1 = \frac{400}{200} \cdot \frac{\log 400}{\log 200} \cdot 0.0204 = 0.0461$

Measured = 0.0435

$n_2 = 800; n_1 = 400 \Rightarrow t_2 = \frac{n_2 \cdot \log n_2}{n_1 \cdot \log n_1} \cdot t_1 = \frac{800}{400} \cdot \frac{\log 800}{\log 400} \cdot 0.0435 = 0.097$

Measured = 0.1061

Loop 2 $\Rightarrow O(n^2 \log n)$

$n_2 = 200; n_1 = 100 \Rightarrow t_2 = \frac{n_2^2 \cdot \log n_2}{n_1^2 \cdot \log n_1} \cdot t_1 = \left(\frac{200}{100}\right)^2 \cdot \log 200 / \log 100 \cdot 0.332 = 1.52$

Measured = 1.52

$n_2 = 400; n_1 = 200 \Rightarrow t_2 = \frac{n_2^2 \cdot \log n_2}{n_1^2 \cdot \log n_1} \cdot t_1 = \left(\frac{400}{200}\right)^2 \cdot \log 400 / \log 200 \cdot 1.52 = 6.88$

Measured = 6.03

$n_2 = 800; n_1 = 400 \Rightarrow t_2 = \frac{n_2^2 \cdot \log n_2}{n_1^2 \cdot \log n_1} \cdot t_1 = \left(\frac{800}{400}\right)^2 \cdot \log 800 / \log 400 \cdot 6.03 = 26.91$

Measured = 29.23

Loop 3 $\Rightarrow O(n^2 \log n)$

$n_2 = 200; n_1 = 100 \Rightarrow t_2 = \frac{n_2^2 \cdot \log n_2}{n_1^2 \cdot \log n_1} \cdot t_1 = \left(\frac{200}{100}\right)^2 \cdot \log 200 / \log 100 \cdot 1.23 = 5.66$

Measured = 4.99

$n_2 = 400; n_1 = 200 \Rightarrow t_2 = \frac{n_2^2 \cdot \log n_2}{n_1^2 \cdot \log n_1} \cdot t_1 = \left(\frac{400}{200}\right)^2 \cdot \log 400 / \log 200 \cdot 4.99 = 22.57$

Measured = 22.26

$n_2 = 800; n_1 = 400 \Rightarrow t_2 = \frac{n_2^2 \cdot \log n_2}{n_1^2 \cdot \log n_1} \cdot t_1 = \left(\frac{800}{400}\right)^2 \cdot \log 800 / \log 400 \cdot 22.26 = 99.34$

Measured = 94.39

Loop 4 $\Rightarrow O(n^3)$ 1.22

$n_2 = 200; n_1 = 100 \Rightarrow t_2 = n_2^3 / n_1^3 \cdot t_1 = \left(\frac{200}{100}\right)^3 \cdot 1.22 = 9.76$

Measured = 8.97

$n_2 = 400; n_1 = 200 \Rightarrow t_2 = n_2^3 / n_1^3 \cdot t_1 = \left(\frac{400}{200}\right)^3 \cdot 8.97 = 71.76$

Measured = 70.18

$n_2 = 800; n_1 = 400 \Rightarrow t_2 = n_2^3 / n_1^3 \cdot t_1 = \left(\frac{800}{400}\right)^3 \cdot 70.18 = 561.44$

Measured = 557.89

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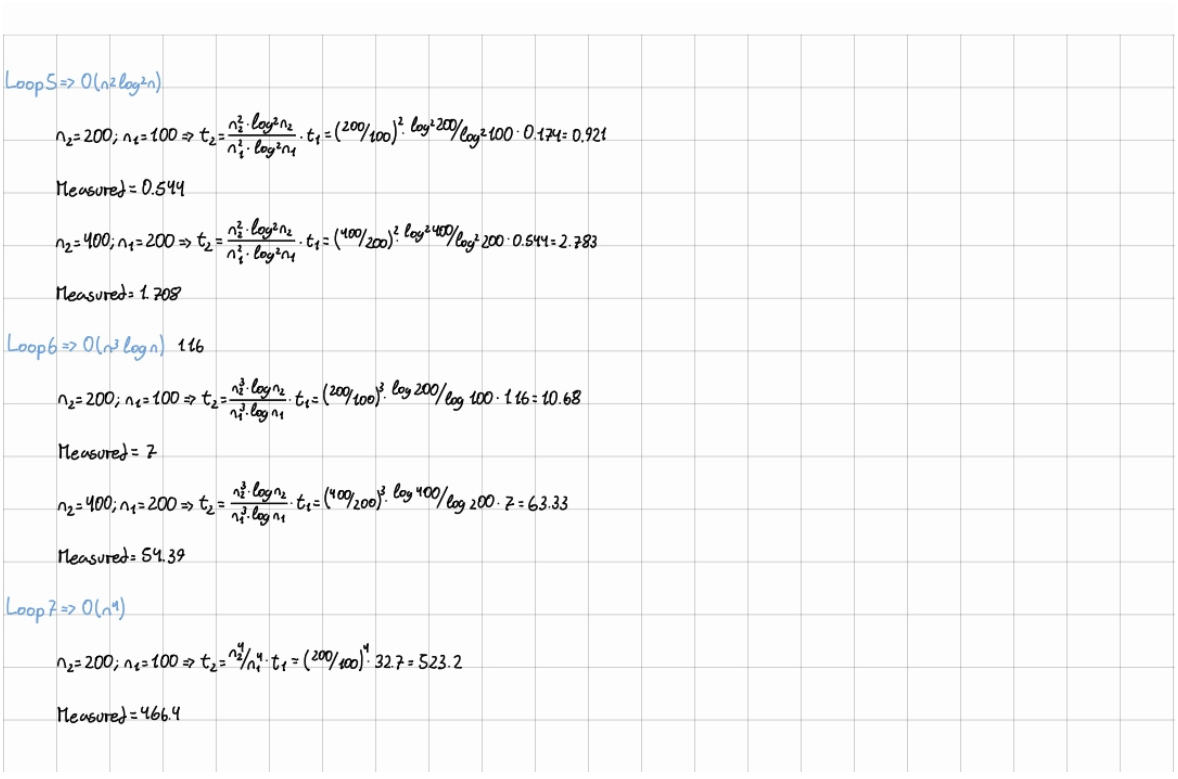
Activity 3. Creation of iterative models of a given time complexity

N	tLoop5 (1000)	tLoop6 (100)	tLoop7 (10)
100	0,174	1,16	32,7
200	0,544	7,00	466,4
400	1,708	54,39	OoT
800	6,504	413,30	OoT
1600	25,360	OoT	OoT
3200	OoT	OoT	OoT
6400	OoT	OoT	OoT

As can be seen in this, that they all have worse complexities than in the previous activity, the difference in the theoretical and measured times are really obvious



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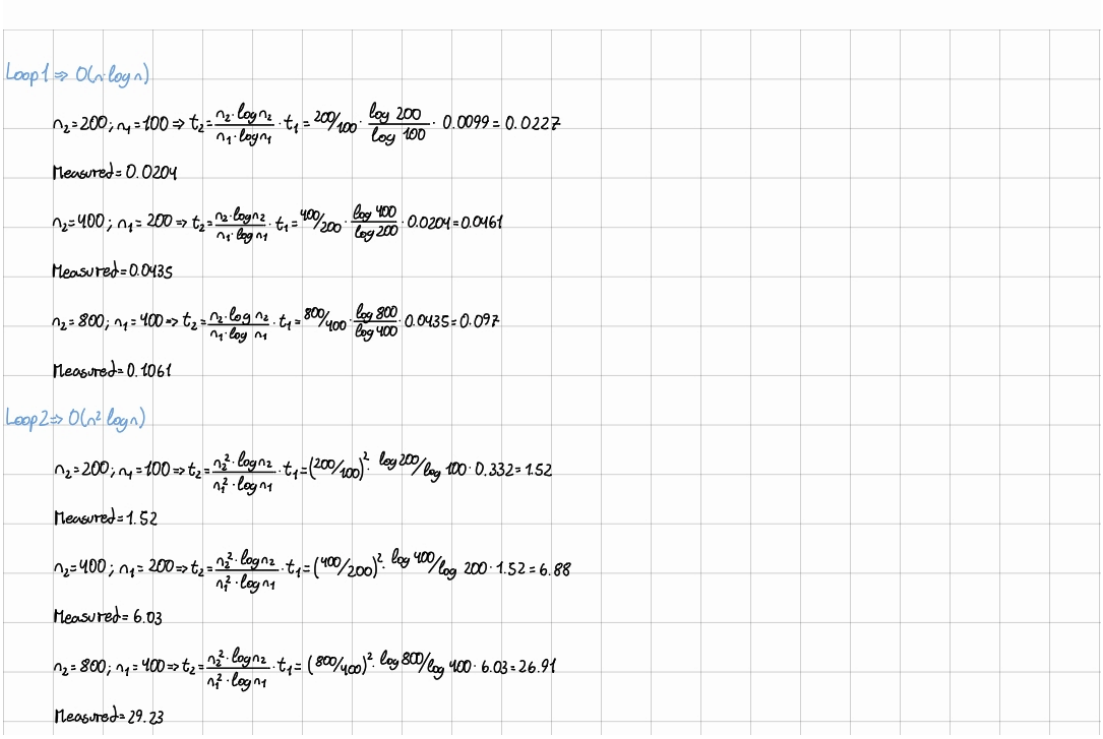
Activity 4. Comparison of two algorithms

N	tLoop1 (10000)	tLoop2 (1000)	t1/t2
100	0,0099	0,332	0,0298
200	0,0204	1,520	0,0134
400	0,0435	6,030	0,0072
800	0,1061	29,230	0,0036
1600	0,2997	OoT	OoT
3200	0,5002	OoT	OoT
6400	1,0283	OoT	OoT
12800	2,8690	OoT	OoT
25600	OoT	OoT	OoT
51200	OoT	OoT	OoT

All the ratios tend to 0 which means the complexity of Loop1 is better



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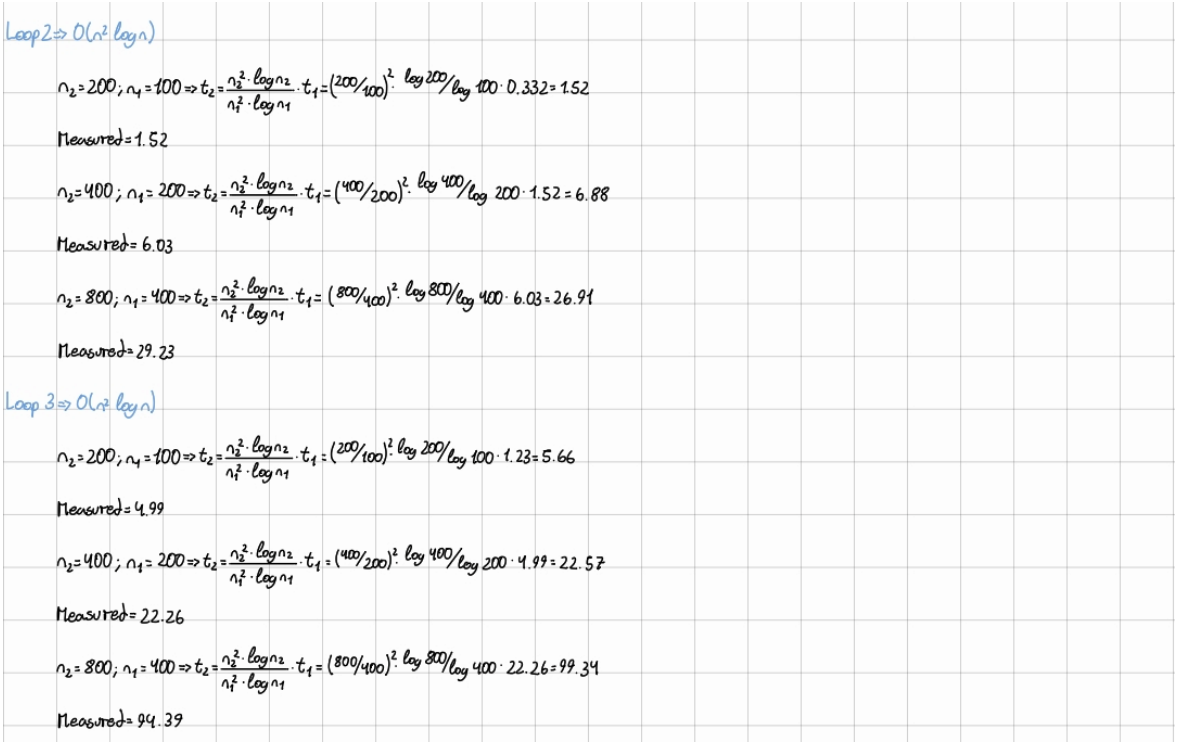
N	tLoop3 (100)	tLoop2 (1000)	t3/t2
100	1,23	0,332	3,7048
200	4,99	1,520	3,2829
400	22,26	6,030	3,6915
800	94,39	29,230	3,2292
1600	437,45	OoT	OoT
3200	OoT	OoT	OoT
6400	OoT	OoT	OoT
12800	OoT	OoT	OoT
25600	OoT	OoT	OoT
51200	OoT	OoT	OoT

As their complexity is equal we have to compute its implementation constant which is greater than 1 which means that Loop2 is better



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N	tloop4 python	tloop4 java no	tloop4 java yes	no/python	yes/no
200	6,148	8,97	0,1038	1,459	0,1157
400	53,473	70,18	0,6453	1,3124	0,0092
800	458,983	557,89	4,4478	1,2136	0,0080
1600	OoT	OoT	26,0689	OoT	OoT
3200	OoT	OoT	OoT	OoT	OoT
6400	OoT	OoT	OoT	OoT	OoT

As the implementation constant of no optimizations by python is greater than 1, we know that python is better

As the implementation constant of optimizations by no optimizations is smaller than 1, we know that java with optimizations is better