Algorithmics	Student information	Date	Number of session
	UO: UO283428		1.2
	Surname: Triana Fernández		
	Name: Carlos		

Activity 1. Two algorithms with the same complexity

N	loop2(t)	loop3(t)	loop2(t)/loop3(t)
8	0	0	0
16	0	0	0
32	0	0,1	0
64	0,2	0	0
128	0,4	0,2	2
256	1	0,5	2
512	3,7	1,9	1,947368421
1024	14,5	7,5	1,933333333
2048	54,6	27,7	1,971119134
4096	218,1	109,2	1,997252747
8192	870,2	434	2,005069124
16384	3649,8	1795,7	2,032522136
32768	14756	7803,6	1,890922139
65536	60864,7	30032,1	2,026654813

Algorithms loop 2 and loop 3 have the same complexity O(n^3). However, the algorithm loop 3 has a different implementation and reduce the amount of iterations on the loop. In loop 3, n number of times a loop is run inside which there is a second loop that will be executed the number of times the first one has been ran, making the complexity O(n)*O(n times already executed)*O(n). This explains the difference between the runtimes. Loop 2/ Loop 3 compare is always greater than 1 because the execution of loop 2 is slower.

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Activity 2. Two algorithms with different complexity

N	loop1(t)	loop2(t)	loop1(t)/loop2(t)
8	0	0	
16	0	0	
32	0,1	0	
64	0	0,2	0
128	0	0,4	0
256	0	1	0
512	0,1	3,7	0,027027
1024	0,2	14,5	0,013793
2048	0,4	54,6	0,007326
4096	0,7	218,1	0,00321
8192	1,7	870,2	0,001954
16384	3,5	3649,8	0,000959
32768	8	14756	0,000542
65536	14,8	60864,7	0,000243
131072	31,9		
262144	64,6		
524288	134,1		
1048576	285,8		

Algorithm loop 1 has a complexity O(n^2 logn). Its progression compared with the one of loop 2 (O(n^3)) is significantly slower. Loop 1/ Loop 2 compare is lower than 1 because the execution of loop 1 is faster.

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Activity 3. Complexity of other algorithms

N	loop4	loop5	loop4(t)/ loop5(t)
8	0	0	
16	0,2	0,1	2
32	0,6	0,2	3
64	3,6	0,4	9
128	28,7	1,9	15,10526316
256	219,6	8,5	25,83529412
512	1959	34,9	56,13180516
1024	15305,7	150,7	101,5640345
2048	111232,5	654,7	169,8984268
4096		2828,3	
8192		13836,3	

Although the results of the algorithms loop 4 and loop 5 have different complexities than loop 1 and loop 2, we expect that the logarithmic complexity will affect the differences in the same way. Therefore, loop 5 progression is slowed down by its logarithmic complexity when compared with the loop 4 version. The loop 4 7/ loop 5 column clearly shows that difference.

Activity 4. Study of Unknown.java

This unknown algorithm has a temporal complexity of O(n^4) as it is formed by three nested for loops and the execution a method with complexity O(n). Each nested loop depend on the value of the count of the previous one, no loop is executed more times than the previous one.

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Times: 9.1, 55.3, 360.3, 2776.4 and 22222.1.

Complexity is n^4, so t2 = t1 * k^4, where k = n2/n1

When n1 = 1024 t1 is 9.1, so when n2 = 2048 and k = 2, t2 should be 145.6

When n1 = 2048 t1 is 55.3, so when n2 = 4096 and k = 2, t2 should be 884.8

This estimations doesn't match the real values of the execution, even though the complexity of the unknown program follows the progression.

Measurements taken on: Intel(R) Core(TM) i7-1065G7 CPU @ 1.30GHz   1.50 GHz

16,0 GB (15,6 GB usable)