Algorithmics	Student information	Date	Number of session
	UO:300084	24-2-2025	2
	Surname: Seijo Martinez		
	Name: Sergio		

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Activity 1. Direct exchange or bubble algorithm

Table 1, Bubble algorithm (WITHOUT OPTIMIZATION)

N	T ordered	T reverse	T random
10000	335 ms	1776 ms	1024 ms
2*10000	1278 ms	6986 ms	4121 ms
2**2*10000	5129 ms	28005 ms	16709 ms
2**3*10000	20841 ms	OoT(80K+)	OoT(66k)
2**4*10000	OoT	OoT	OoT

This algorithm has a best complexity of O(n) therefore the ordered one is the fastest.The worst complexity of it is O(n^2) that is why we can see that the reverse is the slowest and the random is in between the values.

Activity 2. Selection algorithm

Table 2, Selection algorithm (WITHOUT OPTIMIZATION)

N	T ordered	T reverse	T random
10000	315	288	323
2*10000	1253	1128	1275
2**2*10000	5012	4479	5101
2**3*10000	20115	18272	20272
2**4*10000	OoT(70k+)	OoT(74k)	OoT(79k)

This algorithm has always the same complexity O(n^2) that is why in the three cases the timings are the same.

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Activity 3. Insertion algorithm

Table 3, Insertion algorithm (WITHOU OPTIMIZATION)

N	T ordered	T reverse	T random
10000	LoR	304	157
2*10000	LoR	1173	606
2**2*10000	LoR	4816	2433
2**3*10000	LoR	19402	9675
2**4*10000	LoR	OoT(76k)	38466
2**5*10000	LoR	OoT	OoT
2**6*10000	LoR	OoT	OoT
2**7*10000	LoR	OoT	OoT
2**8*10000	49	OoT	OoT
2**9*10000	91	OoT	OoT
2**10*10000	185	OoT	OoT
2**11*10000	376	OoT	OoT
2**12*10000	752	OoT	OoT
2**13*10000	1502	OoT	OoT

The best case complexity of this algorithm is O (n) that is why the ordered trimmings are way smaller than the other two. The worst time complexity is O (n^2).

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Activity 4. Quicksort algorithm

Table 4, Quicksort algorithm (WITHOU OPTIMIZATION)

Measured in a different PC than the previous ones.

N	T ordered	T reverse	T random
250000	54	60	134
2*250000	110	122	282
2**2*250000	225	252	608
2**3*250000	457	515	1323
2**4*250000	955	1064	2980
2**5*250000	1927	2168	6958
2**6*250000	3990	4491	17786

For our implementation of the quicksort algorithm we have similar complexities for the ordered and the reverse one due to the way we select our pivot, because it does not matter the order of the numbers the one in the middle is always the same. For the random one this is not the case so that is why the measurements are way bigger.

The quicksort algorithm has a complexity of O (n * log n), and it takes almost 18 seconds, Therefore, knowing that the complexity of the other algorithms is O(n^2) these algorithms will be 666666 times slower than quicksort. That translates to 18 * 666666 which is 140 days(approx.).

Activity 5. Quicksort + Insertion algorithm

Table 5, Quicksort + Insertion (WITHOUT OPTIMIZATION)

n	T random
Quicksort	2283
Quicksort + Insertion(K=5)	

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Quicksort + Insertion(K=10)	
Quicksort + Insertion(K=20)	
Quicksort + Insertion(K=30)	
Quicksort + Insertion(K=50)	
Quicksort + Insertion(K=100)	
Quicksort + Insertion(K=200)	
Quicksort + Insertion(K=500)	
Quicksort + Insertion(K=1000)	