Algorithmics	Student information	Date	Number of session
	UO:300809	20/02/2025	2
	Surname: González Bajo		
	Name: Javier		

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Activity 1. Direct exchange or Bubble algorithm

n	t ordered	t reverse	t random
10000	315	1480	1044
20000	1247	5876	4184
40000	5086	23449	16637
80000	20585	OoT	OoT
160000	OoT	OoT	OoT

- The complexity of the Bubble algorithm is $O(n^2)$, each time the size is duplicated, the time is multiplied by $4(2^2)$.

Activity 2. Selection algorithm

n	t ordered	t reverse	t random
10000	325	296	310
20000	1274	1163	1223
40000	5102	4735	4904
80000	20435	18903	19435
160000	OoT	OoT	OoT

- The complexity of the Selection algorithm is $O(n^2)$, each time the size is duplicated, the time is multiplied by $4(2^2)$.

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Activity 3. Insertion algorithm

n	t ordered	t reverse	t random
10000	LoR	290	152
20000	LoR	1147	575
40000	LoR	4600	2302
80000	LoR	18361	9142
160000	LoR	OoT	36838
320000	LoR	OoT	OoT
640000	LoR	OoT	OoT
1280000	LoR	OoT	OoT
2560000	LoR	OoT	OoT
5120000	97	OoT	OoT
10240000	186	OoT	OoT
20480000	371	OoT	OoT
40960000	744	OoT	OoT
81920000	1503	OoT	OoT

- The complexity of the Insertion algorithm can be O(n) or O(n^2) depending if it is ordered or not. If it is ordered, each time the size is duplicated, the time is multiplied by 2. If it is not, each time the size is duplicated, the time is multiplied by 4(2^2).

Activity 4. Quicksort algorithm

n	t ordered	t reverse	t random
250000	LoR	LoR	93
500000	60	70	210
1000000	127	148	436
2000000	257	303	914
4000000	533	622	1937
8000000	1106	1238	4374
16000000	2246	2550	10528

- The complexity of the Quicksort algorithm is O(nlog(n)).

n	Bubble	Selection	Insertion
40000	16637	4904	2302
16000000	2661920000	784640000	368320000
days	30,81	9,08	4,26

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Activity 5. Quicksort + Insertion algorithm

k	t random
1	11939
5	11961
10	11986
20	11865
30	11826
50	11801
100	11810
200	11740
500	11763
1000	11792

- As we can see in the table, the optimal k for the quicksort + insertion algorithm is around 200.