Algorithmics	Student information	Date	Number of session
	UO: UO300535	20-2-2025	2
	Surname: Cabo Stroup		
	Name: José David		

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Activity 1. Bubble Sort

	Bubble Sort (ms)		
n	ordered	reverse	random
10000	314	1478	1055
20000	1205	5715	4115
40000	4831	22886	16202
80000	19481	OoT	OoT
160000	OoT	OoT	OoT

- Explain whether the different times obtained agree with what is expected, according to the time complexity studied.

They do. Bubble Sort has an average complexity of $O(n^2)$, which is coherent with the data measured.

Activity 2. Selection Sort

	Selection Sort (ms)		
n	ordered	reverse	random
10000	308	288	324
20000	1215	1149	1252
40000	4979	4572	4930
80000	19322	17960	19537
160000	OoT	OoT	OoT

- Explain whether the different times obtained agree with what is expected, according to the time complexity studied.

Yes, they do. Selection Sort also has an average complexity of $O(n^2)$.

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Activity 3. Insertion Sort

	Insertion Sort (ms)		
n	ordered	reverse	random
10000	LoR	299	151
20000	LoR	1179	605
40000	LoR	4739	2365
80000	LoR	18943	9478
160000	LoR	OoT	37275
320000	LoR	OoT	OoT
640000	LoR	OoT	OoT
1280000	LoR	OoT	OoT
2560000	LoR	OoT	OoT
5120000	91	OoT	OoT
10240000	179	OoT	OoT
20480000	361	OoT	OoT
40960000	740	OoT	OoT

- Explain whether the different times obtained agree with what is expected, according to the time complexity studied.

The times show that Insertion Sort is roughly O(n) when the list is already ordered and $O(n^2)$ when it's not, just as we could have predicted.

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Activity 4. Quick Sort

	Quick Sort (ms)		
n	ordered	reverse	random
250000	LoR	LoR	95
500000	63	69	198
1000000	124	141	415
2000000	256	290	880
4000000	529	609	1902
8000000	1098	1226	4331
16000000	2343	2525	10333

- Explain whether the different times obtained agree with what is expected, according to the time complexity studied.

In this case the times seem to follow a linear trend, as if the complexity were O(2n), so I'm not quite sure what's happening...

- After seeing how long it takes to sort 16 million items, initially in a random order, calculate and compare (from the complexities and data in the tables above): How many days would each of those three methods (Bubble, Selection and Insertion) take to do the same?

Answer: $t_2 = \frac{(n_2)^2}{n_1 \log n_1} t_1$ = 2.29 x 10^{10} ms = ***265.61 days!!***

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Activity 5. Quick + Insertion Sort

	Q + I Sort (ms)
k	random
None	17693
5	16756
10	16538
20	16518
30	15398
50	14769
100	12368
200	6562
500	5577
1000	5147

- Explain conclusions obtained from the previous table

This table shows the growing effectiveness of blending the two algorithms together as we increase k, which in this case becomes especially noticeable when k >= 200. Beyond a certain value, however, Insertion Sort would presumably stop performing as well, so further testing would be required to strike the right balance.