Activity 1. Direct exchange or Bubble algorithm

Using **Vector.java** class, we can create an ordered vector, a vector in reverse order, and a randomize vector. The **Bubble.java** class implements the bubble sort algorithm needed for sort this vector. Finally with the **BubbleTimes.java** we can increase the size of the problem and the times that it's executed.

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **t ordered** | **t reverse** | **t random** |
| 10000 | 627 ms | 1942 ms | 1422 ms |
| 20000 | 2544 ms | 7986 ms | 5827 ms |
| 40000 | 9827 ms | 31729 ms | 23609 ms |
| 80000 | 41002 ms | Oot | Oot |
| 160000 | Oot | Oot | Oot |

The times obtained matches with what was expected because the Bubble sort algorithm has a time complexity of O(n2)

Activity 2. Selection algorithm

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **t ordered** | **t reverse** | **t random** |
| 10000 | 475 ms | 538 ms | 663 ms |
| 20000 | 1994 ms | 3146 ms | 2102 ms |
| 40000 | 8403 ms | 9302 ms | 9675 ms |
| 80000 | 35484 ms | 38448 ms | 36442 ms |
| 160000 | Oot | Oot | Oot |

It can be seen that, although the complexity is the same as in the Bubble algorithm, the Selection algorithm works better for unordered vectors than the bubble one

Activity 3. Insertion algorithm

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **t ordered** | **t reverse** | **t random** |
| 10000 | LoR | 1167 ms | 382 ms |
| 20000 | LoR | 3862 ms | 1584 ms |
| 40000 | LoR | 13083 ms | 6008 ms |
| 80000 | LoR | 54204 ms | 25926 ms |
| 160000 | LoR | Oot | Oot |
| 320000 | LoR | Oot | Oot |
| 640000 | LoR | Oot | Oot |
| 1280000 | LoR | Oot | Oot |
| 2560000 | 80 ms | Oot | Oot |
| 5120000 | 120 ms | Oot | Oot |
| 10240000 | 236 ms | Oot | Oot |
| 20480000 | 468 ms | Oot | Oot |
| 40960000 | 936 ms | Oot | Oot |
| 81920000 | 1883 ms | Oot | Oot |

Activity 4. Quicksort algorithm

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **t ordered** | **t reverse** | **t random** |
| 10000 | LoR | LoR | LoR |
| 20000 | LoR | LoR | LoR |
| 40000 | LoR | LoR | LoR |
| 80000 | LoR | LoR | LoR |
| 160000 | LoR | 59 ms | 88 ms |
| 320000 | 74 ms | 92 ms | 155 ms |
| 640000 | 389 ms | 162 ms | 332 ms |
| 1280000 | 317 ms | 332 ms | 727 ms |
| 2560000 | 665 ms | 703 ms | 1604 ms |
| 5120000 | 1441 ms | 1441 ms | 3607 ms |
| 10240000 | 2789 ms | 3478 ms | 9890 ms |
| 20480000 | 6498 ms | 6145 ms | 26708 ms |
| 40960000 | 13294 ms | 15441 ms | Oot |
| 81920000 | 26242 ms | 28809 ms | Oot |