Activity 1. Two algorithms with the same complexity

They do make sense as the growth in time is (k^2\*t2) being k^2 = 4 in both cases and the better performance f the second is due to the way the data is treated.

Specs of the computer: Intel i7-10750H RAM: ddr4 32gb

|  |  |  |  |
| --- | --- | --- | --- |
| N | loop2(t) (ms) | loop3(t) (ms) | loop2(t)/loop3(t) |
| 8 | 1 | 1 | 1 |
| 16 | 3 | 1 | 3 |
| 32 | 9 | 5 | 1,8 |
| 64 | 36 | 21 | 1,714285714 |
| 128 | 139 | 74 | 1,878378378 |
| 256 | 560 | 275 | 2,036363636 |
| 512 | 2215 | 1105 | 2,004524887 |
| 1024 | 8730 | 4604 | 1,896177237 |
| 2048 | 34796 | 18385 | 1,892629861 |

Activity 2. Two algorithms with different complexity

It does seem correct as loop 2 has a complexity of O(n^2) and loop 1 has the complexity of O(n\*log(n)) which is way faster than O(n^2), that’s why the ratio is less than 0 and the bigger the n the bigger the difference between both algorithms.

Specs of the computer: Intel i7-10750H RAM: ddr4 32gb

|  |  |  |  |
| --- | --- | --- | --- |
| N | loop1(t) (ms) | loop2(t) (ms) | loop1(t)/loop2(t) |
| 8 | 0 | 1 | 0 |
| 16 | 1 | 3 | 0,333333333 |
| 32 | 3 | 9 | 0,333333333 |
| 64 | 4 | 36 | 0,111111111 |
| 128 | 9 | 139 | 0,064748201 |
| 256 | 23 | 560 | 0,041071429 |
| 512 | 51 | 2215 | 0,023024831 |
| 1024 | 106 | 8730 | 0,012142039 |
| 2048 | 230 | 34796 | 0,006609955 |

Activity 3. Complexity of other algorithms

As the loop4 has O(n^4) and loop5 has O(n^3\*log(n)) it can be seen in the proportion column how the proportion grows quadratically and it meets the results.

Specs of the computer: Intel i7-10750H RAM: ddr4 32gb

|  |  |  |  |
| --- | --- | --- | --- |
| N | Loop4 (ms) | Loop5 (ms) | Loop4/Loop5 (ms) |
| 8 | 0 | 0 | 1 |
| 16 | 2 | 1 | 2 |
| 32 | 12 | 3 | 4 |
| 64 | 145 | 18 | 8,055555556 |
| 128 | 2183 | 159 | 13,72955975 |
| 256 | 34798 | 1303 | 26,70606293 |

Activity 4. Study of Unknown.java

Yes, it does meet its theoretical complexity as it is expected to be cubic. If you use the formula:

You obtain that t2 = 2^3\*t1 for example with t1 = 181 it means that t2 should be 1448 and the real value is 1602 they are more or less close to each other so it could be seen as the theoretical and the real are plausible.

Specs of the computer: Intel i7-10750H RAM: ddr4 32gb

|  |  |
| --- | --- |
| N | Unknown.java (ms) |
| 8 | 3 |
| 16 | 21 |
| 32 | 181 |
| 64 | 1602 |
| 128 | 14416 |
| 256 | 130569 |