 Activity 1. Some iterative models

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| N | tLoop1 (mS) | tLoop2 (mS) | tLoop3 (mS) | tLoop4 (mS) |
| 100 | 0.00678 | 0.167 | 0.797 | 0.641 |
| 200 | 0.01204 | 0.604 | 3.544 | 4.574 |
| 400 | 0.03165 | 2.790 | 14.667 | 34.8 |
| 800 | 0.06850 | 13.127 | 62.9 | 268.1 |
| 1600 | 0.17307 | 49.6 | 263.4 | 2120 |
| 3200 | 0.35820 | 224.7 | 1120.2 | 16724 |
| 6400 | 0.726 | 894.5 | 4681.9 | OoT |
| 12800 | 1.544 | 4098 | 19612 | OoT |
| 25600 | 3.143 | 18001 | OoT | OoT |
| 51200 | 6.303 | OoT | OoT | OoT |

tLoop1: O(n\*log(n))

tLoop2: O(n2\*log(n))

tLoop3: O(n2\*log(n))

tLoop4: O(n3)

There is a slight difference in the theoretical and actual complexities of the loops because theoretical complexity is an approximation that does not take into account the constants of the iterations but overall the deviation is very small.

Activity 2. Iterative models of a given time complexity

|  |  |  |  |
| --- | --- | --- | --- |
| N | tLoop5 (mS) | tLoop6 (mS) | tLoop7 (mS) |
| 100 | 4.04 | 51.21 | 386.8 |
| 200 | 19.23 | 427 | 6159 |
| 400 | 92.55 | 3663 | OoT |
| 800 | 434 | 32152 | OoT |
| 1600 | 2017 | OoT | OoT |
| 3200 | 9292 | OoT | OoT |
| 6400 | 41805 | OoT | OoT |

Loop5: O(n2 log2n)

Loop6: O(n3 log n)

Loop7: O(n4)

As said earlier the theoretical and actual values differ slightly because of the constants that are not considered theoretically.

Activity 3. Compare two algorithms with different complexities.

|  |  |  |  |
| --- | --- | --- | --- |
| N | tLoop1 (mS) | tLoop2 (mS) | t1 / t2 |
| 100 | 0.00685 | 0.166 | 0.0413 |
| 200 | 0.01131 | 0.6 | 0.0189 |
| 400 | 0.03099 | 2.752 | 0.0113 |
| 800 | 0.06773 | 13.012 | 0.00521 |
| 1600 | 0.17197 | 49.5 | 0.00347 |
| 3200 | 0.358 | 224.7 | 0.0016 |
| 6400 | 0.726 | 894.5 | 0.0008 |
| 12800 | 1.544 | 4098 | 0.0004 |
| 25600 | 3.143 | 18001 | 0.0002 |
| 51200 | 6.303 | OoT | OoT |

Loop1 is faster than Loop2 as proved by the quotient tending to 0.

Activity 4. Compare two algorithms with the same complexity

|  |  |  |  |
| --- | --- | --- | --- |
| N | tLoop2 (mS) | tLoop3 (mS) | t2 / t3 |
| 100 | 0.167 | 0.797 | 0.2095 |
| 200 | 0.604 | 3.544 | 0.1704 |
| 400 | 2.790 | 14.667 | 0.1902 |
| 800 | 13.127 | 62.9 | 0.2087 |
| 1600 | 49.6 | 263.4 | 0.1883 |
| 3200 | 224.7 | 1120.2 | 0.2006 |
| 6400 | 894.5 | 4681.9 | 0.1911 |
| 12800 | 4098 | 19612 | 0.2090 |
| 25600 | 18001 | 82583 | 0.2180 |
| 51200 | OoT | OoT | OoT |

As we can see although the Loop2 is faster, the complexity is the same because the quotient stays around the same values.

Activity 5. Different development environments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| N | L4Python (mS) | L4JaWith (mS) | L4JaWithout (mS) | JaWith/Python | JaWithout/JaWith |
| 200 | 24 | 4.574 | 0.84 | 0.1906 | 0.1836 |
| 400 | 100 | 34.8 | 4.97 | 0.3480 | 0.1428 |
| 800 | 1600 | 268.1 | 30.65 | 0.1676 | 0.1143 |
| 1600 | 13000 | 2120 | 205.98 | 0.1631 | 0.0972 |
| 3200 | 123000 | 16724 | 1396.8 | 0.1360 | 0.0835 |
| 6400 | OoT | OoT | 11116 | OoT | OoT |

The quotient of each comparison doesn’t vary that much because the complexity of the algorithm is the same in every environment even if in one is faster than others.