Activity 1. Two algorithms with the same complexity

|  |  |  |  |
| --- | --- | --- | --- |
| N | loop2(μs) | loop3(μs) | loop2(μs)/loop3(μs) |
| 8 | 141 | 47 | 3 |
| 16 | 297 | 234 | 1,269230769 |
| 32 | 1234 | 703 | 1,755334282 |
| 64 | 5182 | 2807 | 1,846099038 |
| 128 | 20357 | 11574 | 1,758856057 |
| 256 | 81702 | 45218 | 1,806846831 |

The CPU has 4 cores and 4 logic processors. The memory consisted of a 4GB RAM.

In order to see if the obtained times are consistent, we should calculate the theorical values. We know both loop2 and loop3 are quadratic and as such, t2 = n2^2/n1^2 \* t1.

Let’s look at the theorical t2 obtained from n1 = 16 and n2 = 32. In loop2 we got that tht2 = 1188, close to the real t2 which is 1234. In loop 3, such value is 936, compared to the real 703.

Taking another n1, 128, and another n2, 256; we calculate other couple of t2. In loop2, the value calculated is 81428, close to the obtained 81702. In loop3, such number is 46296, close to the experimental time 45218.

We can discuss further the data looking at the table. The column loop2/loop3 displays the information about one time divided by the other. Thus, we can see that even though the two method have the same complexity, the values of the table tend to go to 2, since the content of the for loops differ.

Activity 2. Two algorithms with different complexity

|  |  |  |  |
| --- | --- | --- | --- |
| N | loop1(μs) | loop2(μs) | loop1(ms)/loop2(μs) |
| 8 | 78 | 141 | 0,553191489 |
| 16 | 140 | 297 | 0,471380471 |
| 32 | 250 | 1234 | 0,202593193 |
| 64 | 594 | 5182 | 0,114627557 |
| 128 | 1356 | 20357 | 0,066610994 |
| 256 | 3278 | 81702 | 0,040121416 |

The CPU has 4 cores and 4 logic processors. The memory consisted of a 4GB RAM.

In order to see if the obtained times are consistent, we should calculate the theorical values. We know loop1 has a n log n complexity (so then t2 = n2logn2/n1logn1 \* t1), while loop3 is quadratic (and as such t2 = n2^2/n1^2 \* t1).

Let’s look at the theorical t2 obtained from n1 = 16 and n2 = 32. In loop1 we got that tht2 = 350, close to the real t2 which is 250. In loop 2, such value is 1188, compared to the real 1234.

Taking another n1, 128, and another n2, 256; we calculate other couple of t2. In loop1, the value calculated is 3099, close to the obtained 3278 In loop2, such number is 81428, close to the experimental time 81702.

We can discuss further the data looking at the table. The column loop1/loop2 displays the information about one time divided by the other. As we know, both methods have different complexities, and even though at first the division is only 0.5; we can see how the loop2 has a larger complexity and as such, makes the value go to 0.

Activity 3. Complexity of other algorithms

|  |  |  |  |
| --- | --- | --- | --- |
| N | loop4(ms) | loop5(ms) | loop4(ms)/loop5(ms) |
| 8 | 47 | 22 | 1,51612903 |
| 16 | 761 | 243 | 2,85670732 |
| 32 | 11837 | 2230 | 5,39279147 |
| 64 | 191494 | 20756 | 9,01386718 |

The CPU has 4 cores and 4 logic processors. The memory consisted of a 4GB RAM.

In order to see if the obtained times are consistent, we should calculate the theorical values. We know loop4 has a n ^4 complexity (so then t2 = n2^4/n1^4 \* t1), while loop3 is n^3 log n (and as such t2 = n2^2/n1^2 \* t1).

Let’s look at the theorical t2 obtained from n1 = 16 and n2 = 32. In loop4 we got that tht2 = 14992, close to the real t2 which is 14663. In loop5, such value is 2430, compared to the real 2230.

Taking another n1, 32, and another n2, 64; we calculate other couple of t2. In loop4, the value calculated is 234608, close to the obtained 224905. In loop5, such number is 21408, close to the experimental time 20756.

We can discuss further the data looking at the table. The column loop4/loop5 displays the information about one time divided by the other. As we know, both methods have different complexities, having the dividend the larger complexity. As its growth is much higher than the one of the divisor, we can see that the values keep getting higher, tending to infinity.

Activity 4. Study of Unknown.java

|  |  |  |
| --- | --- | --- |
| N | unknown(μs) | unknown(ns) |
| 64 | 125 | 125000000 |
| 128 | 656 | 656000000 |
| 256 | 4390 | 4390000000 |
| 512 | 34420 | 34420000000 |
| 1024 | 245142 | 2,45142E+11 |
| 2048 | 1603392 | 1,60339E+12 |

The CPU has 4 cores and 4 logic processors. The memory consisted of a 4GB RAM.

As we know, the complexity of the method unknown is n^3. Let’s check if the obtained values are similar to the theorical values we should have obtained.

We will calculate t2, having n2 = 1024, n1 = 512. In order to calculate the theorical t2, we use the formula t2 = n2^3/n1^3 \* t1. Using this formula, we obtain tht2 = 275360, close to the obtained 245360.

Using other n2 = 2048, n1 = 1024, we will calculate another tht2, with the value obtained being 1961136, close to the one measured being 1603392.