Activity 1. Divide and conquer by subtraction

The subtraction1 has a complexity of O (n) (a = 1, b = 1, k = 0).

The subtraction2 has a complexity of O (n^2) (a = 1, b = 1, k = 1).

The subtraction3 has a complexity of O (2^n) (a = 2, b = 1, k = 0).

The subtraction1 and 2 stop measuring with n = 8192 due to a stack overflow.

The subtraction3 with n = 80: we know that for n = 25 it takes 1180ms, now we compute (2^25) / (2^80) = 3.6028797e+16. Therefore the time for would be 1180 \* 3.6028797e+16, that is 1348109462201928 years.

Table with times of Subtraction4 and 5 without optimization in milliseconds.

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **S1** | **N** | **S2** |
| **100** | 1 | **30** | 363 |
| **200** | 11 | **32** | 1084 |
| **400** | 80 | **34** | 3356 |
| **800** | 619 | **36** | 10072 |
| **1600** | 4870 | **38** | 29624 |
| **3200** | 38698 | **40** | OoT(90K+) |

Using the same method used in calculating S3 and taking in account that 3^(40/2) = 89743ms, the time in years would be, 3.1291449e+14.

Activity 2. Divide and conquer by division

Division1 has a complexity of O (n) (a = 1, b = 3, k = 1).

Division2 has a complexity of O (n \* logn) (a = 2, b = 2, k = 1).

Division3 has a complexity of O (n) (a = 2, b = 2, k = 0).

With the timings we can see that D1’s are the fastest, D2’s are in the slowest and D3’s are in the middle.

Table with times of Division4 and 5 without optimization in milliseconds.

|  |  |  |
| --- | --- | --- |
| **N** | **S1** | **S2** |
| **1000** | 4 | 25 |
| **2000** | 17 | 94 |
| **4000** | 65 | 372 |
| **8000** | 255 | 1508 |
| **16000** | 1020 | 6116 |
| **32000** | 4067 | 24081 |
| **64000** | 16404 | OoT |
| **128000** | OoT | OoT |

Activity 3. Two basic examples (VectorSum and Fibonacci)

From the VectorSum1 class we can obtain that the complexities are:

-sum1: O(n) just a simple loop.

-sum2: O(n) (a = 1, b = 1, k = 0) (subtraction).

-sum3: O(n) (a = 2, b = 2, k = 0) (division).

Table with times VectorSum1, 2 and 3 without optimization in milliseconds.

|  |  |  |  |
| --- | --- | --- | --- |
| **Size** | **VS1** | **VS2** | **VS3** |
| **3** | 392 / 10^7 = | 25 |  |
| **6** | 618/ 10^7 = | 94 |  |
| **12** | 849 / 10^7 = | 372 |  |
| **24** | 1305/ 10^7 = | 1508 |  |
| **48** | 2218 / 10^7 = | 6116 |  |
| **96** | 4029 / 10^7 = | 24081 |  |
| **192** | 7703 / 10^7 = | OoT |  |
| **384** | 14975 / 10^7 = | OoT |  |
| **768** | 29592 / 10^7 = |  |  |
| **1536** | 58652 / 10^7 = |  |  |
| **3072** | 116528 / 10^7 = |  |  |