Activity 1. Basic recursive models

*Subtraction 4*

This class was supposed to be a recursive method by subtraction with complexity O(3^(n/2)) and as such, we need specific number and size of subproblems, complexity of the method without recursive calls. The wording doesn’t state any of these, but the complexity that must be achieved. To obtain it, we must find the case where the number of problems is greater than 1 (in this case, it will be 3 because of the desired complexity). Then we need a specific value for the size of the subproblem and looking at both the formula and expression we want, we get that such value is 3. Since the complexity of the problem without the calls isn’t present in the formula, we will give it the value 1, making such problem with a linear complexity. Then, we have that a = 3, b = 2, k = 1 and the wanted subtraction is achieved.

*Division 4*

This class was supposed to be a recursive method by subtraction with complexity O(n^2) and as such, we need specific number and size of subproblems, complexity of the method without recursive calls. The wording states that the number of subproblems must be 4. Taking this into account, we will try to find values which will make the formula O(n^k), this being achieved by having number of problems (a) smaller than the size of the problem (b) ^ complexity of the problem without calls (k). Since we need the k to be 2 to satisfy the wording, we will need a b which satisfies that b^2 > 4; so, we will get the smaller value possible, b = 3.

Activity 2. Uncle Scrooge

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| nTimes = 10 | Gilito1 | | Gilito2 | | Comparison | |
| Number of coins | Energy | Time | Energy | Time | Energy | Time |
| 10 | 2 |  | 4 |  | -2 |  |
| 20 | 6 |  | 6 |  | 0 |  |
| 40 | 19 |  | 5 |  | 14 |  |
| 80 | 18 |  | 6 |  | 12 |  |
| 160 | 23 |  | 7 |  | 16 |  |
| 320 | 159 |  | 10 |  | 149 |  |
| 640 | 142 |  | 10 |  | 132 |  |
| 1280 | 223 |  | 10 |  | 213 |  |
| 2560 | 182 |  | 11 |  | 171 |  |
| 5120 | 403 |  | 12 |  | 391 |  |
| 10240 | 344 |  | 12 |  | 332 |  |
| 20480 | 10219 |  | 14 |  | 10205 |  |
| 40960 | 10364 |  | 14 |  | 10350 |  |
| 81920 | 498 |  | 16 |  | 482 |  |
| 163840 | 36662 | 2 | 17 | 1 | 36645 | 1 |
| 327680 | 47659 | 2 | 18 | 3 | 47641 | -1 |
| 655360 | 327538 | 20 | 19 | 5 | 327519 | 15 |
| 1310720 | 360928 | 18 | 20 | 11 | 360908 | 7 |
| 2621440 | 546395 | 29 | 21 | 23 | 546374 | 6 |
| 5242880 | 461114 | 24 | 21 | 44 | 461093 | -20 |
| 10485760 | 4735005 | 243 | 23 | 176 | 4734982 | 67 |
| 20971520 | 2268465 | 131 | 25 | 174 | 2268440 | -43 |
| 41943040 | 16282517 | 760 | 27 | 341 | 16282490 | 419 |
| 83886080 | 34718016 | 1636 | 28 | 694 | 34717988 | 942 |
| 167772160 | 45313189 | 2159 | 29 | 1336 | 45313160 | 823 |