Mark Meade Algorithms Project 2

3.

A) Theta notation for Brute Force Method:

Theta(n^2)

B) Recurrence for the divide and conquer method / solve using masters:

T(n) = 2\* T(n/2) + n

Compare n to n^1 (log base2 of 2)

n = n Case 2

Therefore, T(n) = theta(nlgn)

C)

In theory, it should be faster to use the divide and conquer method, since it’s big theta runtime is nlgn as opposed to n^2. The difference between theory and reality is the overhead of all of the constants that must be run for each iteration through the divide and conquer method. Therefore, at lower input size n, brute force may be shorter than divide and conquer.

//for the purpose of this chart, I’ll make the values of the day random ints between 0 and 1000.

4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Input size (n) | Brute Force runtime (nanosecs) | D and C runtime (nanoseconds) | Buy Day: | Sell Day: | Profit: |
| 10 | 283900 | 562300 | 1 | 10 | $868 |
| 15 | 448200 | 606900 | 10 | 11 | $786 |
| 25 | 323700 | 799500 | 8 | 11 | $743 |
| 50 | 570100 | 908700 | 6 | 16 | $957 |
| 75 | 1000800 | 1308700 | 15 | 27 | $942 |
| 100 | 1582700 | 1182500 | 42 | 95 | $991 |
| 150 | 1828700 | 1372700 | 127 | 131 | $971 |
| 200 | 2902300 | 1623400 | 102 | 162 | $981 |
| 300 | 4913100 | 2050600 | 199 | 261 | $985 |
| 500 | 9686900 | 3041000 | 377 | 386 | $996 |
| 750 | 12137800 | 4393900 | 55 | 160 | $998 |
| 1000 | 17915700 | 4791300 | 334 | 632 | $998 |
| 1500 | 18601600 | 8917100 | 115 | 487 | $998 |
| 2000 | 33241600 | 9275200 | 317 | 1726 | $997 |
| 3000 | 49069600 | 13017400 | 125 | 831 | $999 |
| 5000 | 90453000 | 20159400 | 709 | 1709 | $999 |
| 7500 | 168711500 | 19445400 | 992 | 1200 | $999 |
| 10000 | 201538200 | 23183900 | 191 | 2196 | $999 |
| 15000 | 434789100 | 16999200 | 1856 | 2461 | $999 |
| 20000 | 768487200 | 29287300 | 1320 | 2336 | $999 |
| 30000 | 1040310200 | 25389000 | 3393 | 4525 | $999 |
| 50000 | 1988203400 | 37466700 | 1349 | 1939 | $999 |
| 100000 | 7160206100 | 79650900 | 2733 | 2845 | $999 |
| 200000 | 28552132700 | 136599200 | 771 | 2158 | $999 |
| 500000 | Gave | Up | After | 20 | Minutes |

It seems that divide and conquer begins to beat brute force around n = 80. I assume this is because of the constant overhead of the divide and conquer. It appears that the overhead uses less resources than the double loop around 80. Therefore, if n < 80, I’d say use the brute force method. Otherwise, use the divide and conquer method past the 80 threshold.