Assignment 12 Francis Meng

1. In the factorial procedure that I have, there are several functions that get called, including multiply procedure and the predecessor. In the multiply procedure, the plus is called. And in the plus will call the pred procedure for n times. For n!, there are n numbers multiply together, so the runtime is approximately n^3. To be more accurate, n! = n \* (n-1)! and it will take n operations to multiply n \* O((n-1)!), and for calculating (n-1)! = (n-1)\*(n-2)! It will take (n-1)\*O((n-2)!), so the total runtime will be O(n!). The time runtime that I predicted is n!/1250.

The fitting equation is displayed as a n^3 equation.

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| --- | --- | --- |
|  | Real time(ms) | (n!)/1250 |
| 1 | 0 | 0.0008 |
| 2 | 0 | 0.0016 |
| 3 | 0 | 0.0048 |
| 4 | 0 | 0.0192 |
| 5 | 0 | 0.096 |
| 6 | 1 | 0.576 |
| 7 | 6 | 4.032 |
| 8 | 35 | 32.256 |
| 9 | 288 | 290.304 |
| 10 | 3058 | 2903.04 |
| 11 | 31622 | 31933.44 |
| 12 | 355286 | 383201.28 |

2. The number of base won't significantly affect the time the predecessor get called, but predecessor run time will change, because small base number will make the list very long for large numbers. so the runtime I predicted is O(logBASE(n!)).

I used factorial 10 for my calculation

In the graph below, the red line is the calculated data which use the 100\*logBASE(10!)+ 1200 the blue curve is the real run time. And the doted line is the fit line.

|  |  |  |
| --- | --- | --- |
| BASE | factorial 10 (ms) | 100\*log\_BASE(10!)+ 1200 |
| 2 | 3058 | 3279 |
| 3 | 2495 | 2574.863 |
| 4 | 2072 | 2289.55 |
| 5 | 2134 | 2138.48 |
| 6 | 2025 | 2042.99 |
| 20 | 1762 | 1704.1977 |
| 50 | 1732 | 1586.1023 |
| 100 | 1652 | 1527.9882 |
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