Raheel Khoja

UT EID: rrk549

**CS 314 Assignment 1: Timing and Big O**

1.

|  |  |
| --- | --- |
| Data Type | Max number for factorial |
| int | 12 |
| Integer | 12 |
| long | 20 |
| float | 34 |
| double | 170 |

There was no indication given by Java that the value of the factorial was incorrect.

2.

Daffy

|  |  |  |
| --- | --- | --- |
| n | Estimated Time (seconds) | Ratio [ETN/ETN-2] |
| 30 | 0.010072632 | - |
| 31 | 0.007413151 | 0.735969606 |
| 32 | 0.010005128 | 1.349645785 |
| 33 | 0.016863249 | 1.685460596 |
| 34 | 0.028049097 | 1.663326978 |
| 35 | 0.046532826 | 1.658977685 |
| 36 | 0.081080419 | 1.742434878 |
| 37 | 0.121206332 | 1.494890301 |
| 38 | 0.194652141 | 1.605956865 |
| 39 | 0.300995855 | 1.546326968 |
| 40 | 0.497599283 | 1.65317653 |
| 41 | 0.744929044 | 1.497046056 |
| 42 | 1.2904657 1 | 0.732333717 |
| 43 | 2.107120595 | 1.632837351 |
| 44 | 4.135118769 | 1.96244998 |

The times for Daffy are graphed on graph A, which is attached.

Donald

|  |  |  |
| --- | --- | --- |
| n | Estimated Time (seconds) | Ratio [ETN/ETN-2] |
| 30 | 1.46E-05 | - |
| 31 | 1.46E-05 | 1.0 |
| 32 | 4.74E-06 | 0.324318773 |
| 33 | 1.46E-05 | 3.083386109 |
| 34 | 5.13E-06 | 0.351362454 |
| 35 | 5.13E-06 | 1.0 |
| 36 | 1.46E-05 | 2.846063913 |
| 37 | 4.74E-06 | 0.324318773 |
| 38 | 5.13E-06 | 1.083386109 |
| 39 | 5.53E-06 | 1.076968044 |
| 40 | 6.71E-06 | 1.214221096 |
| 41 | 5.53E-06 | 0.823424229 |
| 42 | 5.53E-06 | 1.0 |
| 43 | 5.53E-06 | 1.000180963 |
| 44 | 1.89E-05 | 3.428442193 |

The times in Donald are too fast to measure and can’t be plotted.

Mickey

|  |  |  |
| --- | --- | --- |
| n | Estimated Time (seconds) | Ratio [ETN/ETN-2] |
| 1000 | 0.000026 | - |
| 2000 | 0.000060 | 2.253696 |
| 4000 | 0.000126 | 2.112602 |
| 8000 | 0.000227 | 1.805635 |
| 16000 | 0.000217 | 0.953127 |
| 32000 | 0.000071 | 0.327867 |
| 64000 | 0.000093 | 1.305562 |
| 128000 | 0.000084 | 0.910637 |

The times in Mickey are too fast to measure and can’t be plotted.

Minnie

|  |  |  |
| --- | --- | --- |
| n | Estimated Time (seconds) | Ratio [ETN/ETN-2] |
| 1000 | 0.002768434 | - |
| 2000 | 0.001593242 | 0.575503 |
| 4000 | 0.00305187 | 1.915509 |
| 8000 | 0.015858987 | 5.196482 |
| 16000 | 0.054768256 | 3.453452 |
| 32000 | 0.198311543 | 3.620921 |
| 64000 | 0.637593306 | 3.215109 |
| 128000 | 2.56509136 | 4.023084 |

The times for Minnie are graphed on graph B, which is attached.

Goofy

|  |  |  |
| --- | --- | --- |
| n | Estimated Time (seconds) | Ratio [ETN/ETN-2] |
| 1000 | 0.003722563 | - |
| 2000 | 5.67E-04 | 0.152280029 |
| 4000 | 0.001809963 | 3.192895398 |
| 8000 | 0.009016656 | 4.981679736 |
| 16000 | 0.033407929 | 3.705135141 |
| 32000 | 0.131491342 | 3.935932156 |
| 64000 | 0.526951079 | 4.007496395 |
| 128000 | 2.128263806 | 4.038826166 |

The times for Goofy are graphed on graph B, which is attached.

Pluto

|  |  |  |
| --- | --- | --- |
| n | Estimated Time (seconds) | Ratio [ETN/ETN-2] |
| 1000 | 4.45E-04 | - |
| 2000 | 4.51E-04 | 1.014196704 |
| 4000 | 4.91E-04 | 1.087489584 |
| 8000 | 9.81E-04 | 1.999192963 |
| 16000 | 0.00204129 | 2.080885081 |
| 32000 | 0.002740406 | 1.342487349 |
| 64000 | 0.005065133 | 1.848314812 |
| 128000 | 0.01058029 | 2.08884742 |

The times for Pluto are graphed on graph B, which is attached.

Gyro

|  |  |  |
| --- | --- | --- |
| n | Estimated Time (seconds) | Ratio [ETN/ETN-2] |
| 1000 | 2.29E-05 | - |
| 2000 | 1.38E-05 | 0.603424179 |
| 4000 | 3.55E-06 | 0.257165605 |
| 8000 | 3.55E-06 | 1.0 |
| 16000 | 1.26E-05 | 3.555586828 |
| 32000 | 5.92E-06 | 0.468693105 |
| 64000 | 1.38E-05 | 2.333558521 |
| 128000 | 4.74E-06 | 0.342838532 |

The times in Gyro are too fast and can’t be plotted.

Big Integer N

|  |  |  |
| --- | --- | --- |
| n | Estimated Time (seconds) | Ratio [ETN/ETN-2] |
| 1000 | 0.004577 | - |
| 2000 | 0.0044 | 0.961359 |
| 4000 | 0.01677 | 3.811413 |
| 8000 | 0.057845 | 3.449273 |
| 16000 | 0.227661 | 3.935741 |
| 32000 | 0.978846 | 4.299569 |
| 64000 | 4.230895 | 4.322331 |
| 128000 | 18.24884 | 4.313235 |

The times for BigInteger are graphed on graph B, which is attached.

Big O Estimate from Ratio

|  |  |  |  |
| --- | --- | --- | --- |
| Function | Ratio | Power of 2 | Big-O |
| mickey | 1 | 20 | 1 |
| minnie | 4 | 22 | n2 |
| goofy | 4 | 22 | n2 |
| pluto | 2 | 21 | n |