CS325 Project 1

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Group 32

1. Theoretical Run Time Analysis
2. Testing
3. Experimental Analysis
4. Brute Force

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | Brute Force | |  |  |  |  |
| n=100 | n=200 | n=500 | n = 1000 | n=2000 | n=5000 | n=10000 | n=20000 | n=50000 | n=1000000 |
| 2.00E-05 | 5.30E-05 | 0.000314 | 0.001489 | 0.005105 | 0.032017 | 0.133363 | 0.531272 | 3.3681 | 13.2832 |
| 1.80E-05 | 6.20E-05 | 0.000388 | 0.001518 | 0.005294 | 0.03276 | 0.132925 | 0.541575 | 3.32885 | 13.2687 |
| 1.70E-05 | 6.30E-05 | 0.000395 | 0.001452 | 0.004989 | 0.032542 | 0.130558 | 0.534111 | 3.31621 | 13.3264 |
| 1.60E-05 | 6.20E-05 | 0.000352 | 0.001343 | 0.00491 | 0.034062 | 0.131184 | 0.519187 | 3.29927 | 13.3021 |
| 1.60E-05 | 6.90E-05 | 0.000412 | 0.00137 | 0.005179 | 0.035344 | 0.134863 | 0.52589 | 3.33833 | 13.5319 |
| 1.70E-05 | 6.70E-05 | 0.00035 | 0.001399 | 0.005358 | 0.033945 | 0.140684 | 0.526301 | 3.34994 | 13.3201 |
| 1.80E-05 | 6.40E-05 | 0.000423 | 0.001486 | 0.005322 | 0.032465 | 0.141604 | 0.529129 | 3.30668 | 13.3379 |
| 1.80E-05 | 6.20E-05 | 0.00039 | 0.001374 | 0.005287 | 0.032296 | 0.138743 | 0.529723 | 3.30983 | 13.3526 |
| 1.60E-05 | 6.70E-05 | 0.000382 | 0.001407 | 0.005694 | 0.034539 | 0.132262 | 0.522947 | 3.36832 | 13.3437 |
| 2.60E-05 | 6.20E-05 | 0.000373 | 0.001487 | 0.004973 | 0.035327 | 0.133398 | 0.53646 | 3.33432 | 13.51 |
| Avg | Avg | Avg | Avg | Avg | Avg | Avg | Avg | Avg | Avg |
| **1.82E-05** | **6.31E-05** | **0.000378** | **0.001433** | **0.005211** | **0.03353** | **0.134958** | **0.52966** | **3.331985** | **13.35766** |

Table 1: Brute Force Timing Data

Figure 1: Brute Force Run Time vs Number of Elements

1. Improved Brute Force

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | Improved Brute Force | | |  |  |  |
| n=100 | n=200 | n=500 | n = 1000 | n=2000 | n=5000 | n=10000 | n=20000 | n=50000 | n=1000000 |
| 8.00E-06 | 4.00E-05 | 0.000137 | 0.000618 | 0.005182 | 0.009162 | 0.080605 | 0.295142 | 1.42131 | 9.95867 |
| 1.40E-05 | 2.70E-05 | 0.000151 | 0.001058 | 0.004064 | 0.024849 | 0.076248 | 0.223009 | 0.965965 | 6.85034 |
| 8.00E-06 | 2.20E-05 | 0.000205 | 0.000781 | 0.002704 | 0.021468 | 0.044611 | 0.279406 | 1.25897 | 4.72566 |
| 8.00E-06 | 4.20E-05 | 0.000187 | 0.000828 | 0.002633 | 0.022205 | 0.066709 | 0.322016 | 2.03356 | 10.2935 |
| 1.20E-05 | 4.10E-05 | 0.000148 | 0.000642 | 0.00163 | 0.012647 | 0.118127 | 0.253288 | 2.08973 | 6.83575 |
| 1.10E-05 | 4.30E-05 | 0.000235 | 0.000802 | 0.002878 | 0.013625 | 0.075705 | 0.280478 | 1.26384 | 8.04637 |
| 1.30E-05 | 3.30E-05 | 0.00019 | 0.000637 | 0.002046 | 0.01635 | 0.038793 | 0.173169 | 2.56585 | 6.93253 |
| 1.20E-05 | 4.20E-05 | 0.000226 | 0.001159 | 0.002563 | 0.011407 | 0.101194 | 0.304477 | 1.95178 | 4.94376 |
| 6.00E-06 | 4.50E-05 | 0.000282 | 0.000927 | 0.003061 | 0.014643 | 0.072252 | 0.134293 | 1.58763 | 5.38412 |
| 7.00E-06 | 4.20E-05 | 0.000225 | 0.000864 | 0.003305 | 0.01084 | 0.066611 | 0.183326 | 1.2177 | 13.6168 |
| Avg | Avg | Avg | Avg | Avg | Avg | Avg | Avg | Avg | Avg |
| **9.90E-06** | **3.77E-05** | **0.000199** | **0.000832** | **0.003007** | **0.01572** | **0.074086** | **0.24486** | **1.635634** | **7.75875** |

Table 2: Improved Brute Force Timing Data

Figure 2: Improved Brute Force Run Time vs Number of Elements

1. Divide and Conquer
2. Dynamic Programming