**SUMMARY**

## USC ID/s: 3981517964, 6912823101, 9828379882

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| M+N | Time in MS (Basic) | Time in MS (Efficient) | Memory in KB (Basic) | Memory in KB (Efficient) |
| 16 | 1.512289047 | 1.760959625 | 98868 | 93900 |
| 64 | 3.676891327 | 6.030797958 | 98988 | 93900 |
| 128 | 9.581804276 | 18.5239315 | 99560 | 93900 |
| 256 | 24.20401573 | 46.99897766 | 101640 | 93900 |
| 384 | 40.04812241 | 74.46599007 | 105060 | 93932 |
| 512 | 70.80602646 | 132.7960491 | 109984 | 93940 |
| 768 | 170.7267761 | 310.598135 | 121288 | 93740 |
| 1024 | 350.2628803 | 548.5229492 | 142080 | 93804 |
| 1280 | 575.3951073 | 837.8648758 | 174900 | 93808 |
| 1536 | 898.1750011 | 1220.183849 | 207676 | 93704 |
| 2048 | 1705.517769 | 2285.941124 | 284076 | 93720 |
| 2560 | 2795.774937 | 3581.687212 | 419252 | 93736 |
| 3072 | 4037.746191 | 4803.231001 | 549520 | 93796 |
| 3584 | 5863.472223 | 6999.869108 | 731184 | 93820 |
| 3968 | 7273.264885 | 8530.380964 | 740016 | 93864 |

## Datapoints

## Insights

### Graph1 – Memory vs Problem Size (M+N)

#### Nature of the Graph (Logarithmic/ Linear/ Exponential)

Basic: Exponential

Efficient: Linear

#### Explanation:

The basic algorithm takes exponential O(MN) space.

The efficient algorithm takes O(M + N) space. Instead of having an M\*N array, the efficient algorithm reuses the working space from one call to the next.

### Graph2 – Time vs Problem Size (M+N)

#### Nature of the Graph (Logarithmic/ Linear/ Exponential)

Basic: Exponential

Efficient: Exponential

#### Explanation:

The basic algorithm takes O(MN) time because there are MN entries in the optimal value array and, in the worst case, we spend a constant amount of time on each (Tardos).

The memory efficient algorithm still takes O(MN) time. At the root level, it takes C\*MN time, then ½C\*MN time, then ¼C\*MN time and so on. The summation adds up to 2C\*MN which is O(MN) time. The running time of the algorithm is increased but only by a constant factor.

## Contribution

(Please mention what each member did if you think everyone in the group does not have an equal contribution, otherwise, write “Equal Contribution”)

3981517964: Equal Contribution

6912823101: Equal Contribution

9828379882: Equal Contribution