SUMMARY

USC ID/s:

Shardul Datar - 5735709975, Rahul Nair - 7054425373, Darshan Rao - 6129709292

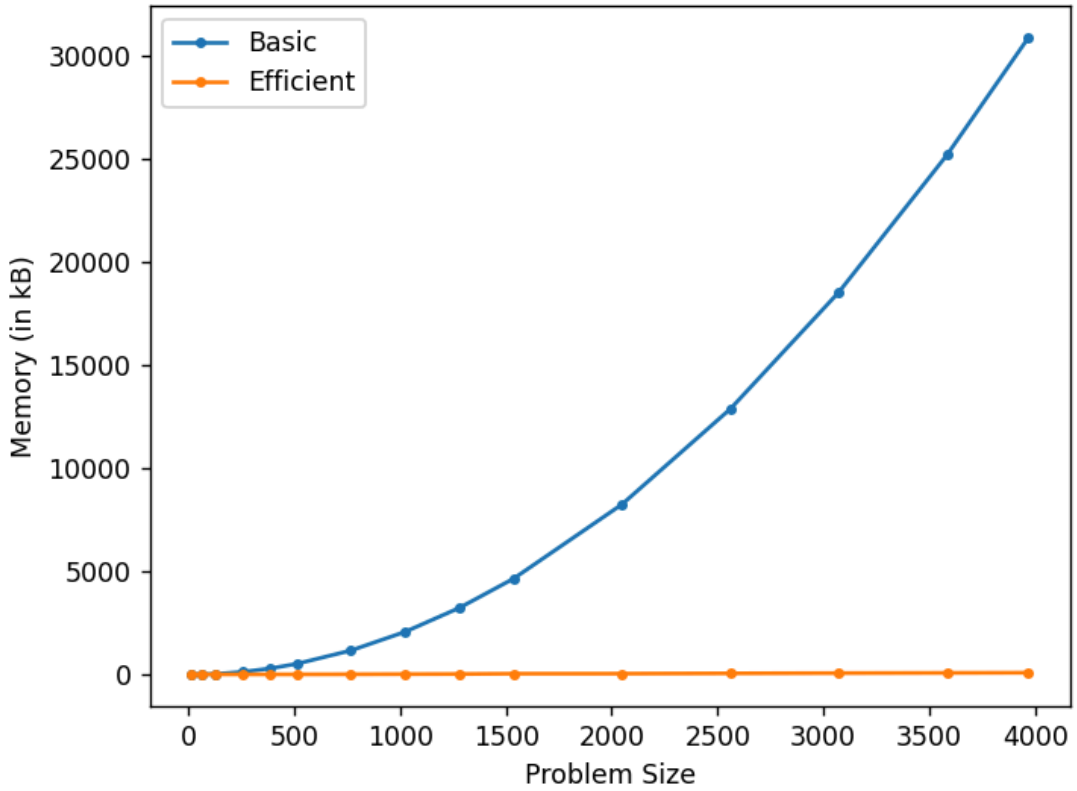
Datapoints

M+N	Time in MS (Basic)	Time in MS (Efficient)	Memory in KB (Basic)	Memory in KB (Efficient)
16	1.9917	2.9928	17.8554	17.8554
64	20.4722	41.1949	17.8554	17.8554
128	66.9963	136.2144	36.4482	17.8535
256	294.1093	528.5196	136.913	17.9628
384	738.291	1239.834	300.9755	17.956
512	1122.083	2039.1011	528.266	17.9472
768	2824.916	4991.622	1175.959	22.747
1024	5884.917	9156.144	2080.006	29.999
1280	8527.095	14815.571	3240.805	36.382
1536	12402.992	22191.799	4656.178	50.6142
2048	22681.674	39872.271	8254.915	53.0449
2560	35958.51	63913.173	12880.874	66.8652
3072	55550.40	94613.673	18532.67	79.4648
3584	72637.85	128958.690	25197.16	90.333
3968	89288.85	160381.361	30874.20	99.0947

Insights

The data shows that the memory consumed by the basic algorithm increases as the problem size increases. The memory consumed by the efficient algorithm also increases, but not as much as the increase seen in the basic algorithm. This can be due to the fact that in the efficient algorithm, we need only a part of the matrix for memoization. We must also note the time taken by both the algorithms. The efficient algorithm takes about twice as much time as the basic algorithm. Therefore, there is a space-time tradeoff in this case, where the efficient algorithm takes more time but takes up way less space than the basic algorithm.

Graph1 – Memory vs Problem Size (M+N)



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

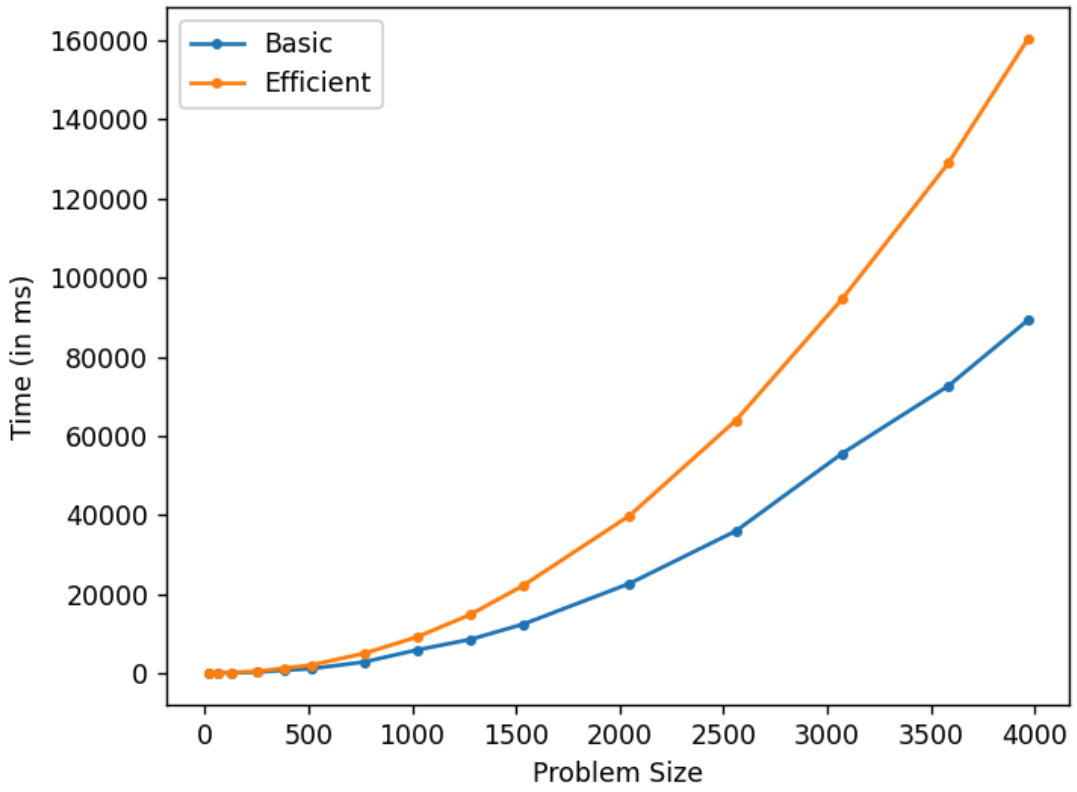
Basic: Polynomial (Quadratic)

Efficient: Linear

Explanation:

The efficient algorithm uses |m| *2 while the basic algorithm uses a |m|*|n| matrix. The memory consumed by the efficient algorithm should be linearly dependent on the input size while the memory consumed by the basic algorithm is polynomially (quadratic) dependent on the input size. The above result confirms this statement.

Graph2 – Time vs Problem Size (M+N)



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

Basic: Polynomial (Quadratic)

Efficient: Polynomial (Quadratic)

Explanation:

The asymptotic time complexity of both the algorithms is 0(|m|*|n|). However, there is a clear difference in the time taken by both the algorithms. This is because the efficient algorithm takes about twice the amount of time taken by the basic algorithm. Even though they are different, they vary by a constant factor. Since we do not consider constants in asymptotic time complexity, they have the same time complexity. Our results confirm this statement.

Contribution

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

<USC ID/s>: <Equal Contribution>

<5735709975>:<Equal Contribution>

<7054425373>:<Equal Contribution>

<6129709292>:<Equal Contribution>