SUMMARY

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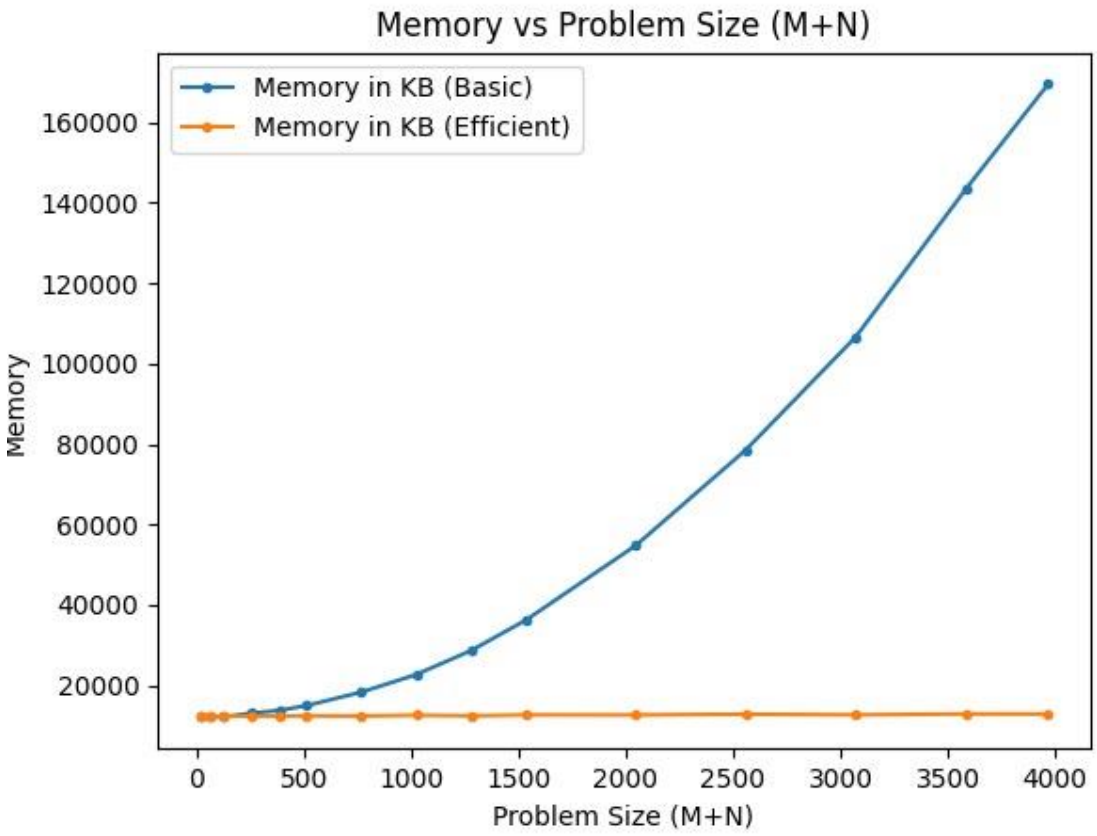
Datapoints

M+N	Time in MS (Basic)	Time in MS (Efficient)	Memory in KB (Basic)	Memory in KB (Efficient)
16	0.13375282287597	0.221252441406	12224	12240
64	0.8058547973632812	1.786947250366211	12256	12368
128	2.86102294921875	5.967855453491211	12192	12384
256	10.042190551757812	21.680116653442383	13120	12384
384	22.097110748291016	46.30398750305176	13792	12400
512	36.905765533447266	76.76196098327637	14992	12464
768	80.25908470153809	169.74282264709473	18336	12416
1024	141.22486114501953	303.2402992248535	22720	12624
1280	217.58699417114258	452.6171684265137	28688	12464
1536	302.9210567474365	625.3712177276611	36288	12704
2048	541.7859554290771	1129.2188167572021	54848	12672
2560	849.452018737793	1795.1438426971436	78576	12880
3072	1185.1067543029785	2497.9968070983887	106640	12704
3584	1637.3350620269775	3439.3057823181152	143344	12944
3968	2065.9170150756836	4432.064056396484	169440	12912

Insights

The data shows that the memory consumed by the basic algorithm increases as the problem size increases. However, the memory consumed by the efficient algorithm stays around 12 MB. It can be attributed to the fact that for efficient implementation, we need to build only part of the matrix for memoization. However, one must also notice the time taken by both algorithms. The efficient algorithm takes twice as much time as the basic algorithm. It is a trade-off. While taking twice the time, we can get the sequence alignments within just 7% of the space (when m+n = 3968) consumed by the basic version.

Graph1 – Memory vs Problem Size (M+N)



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

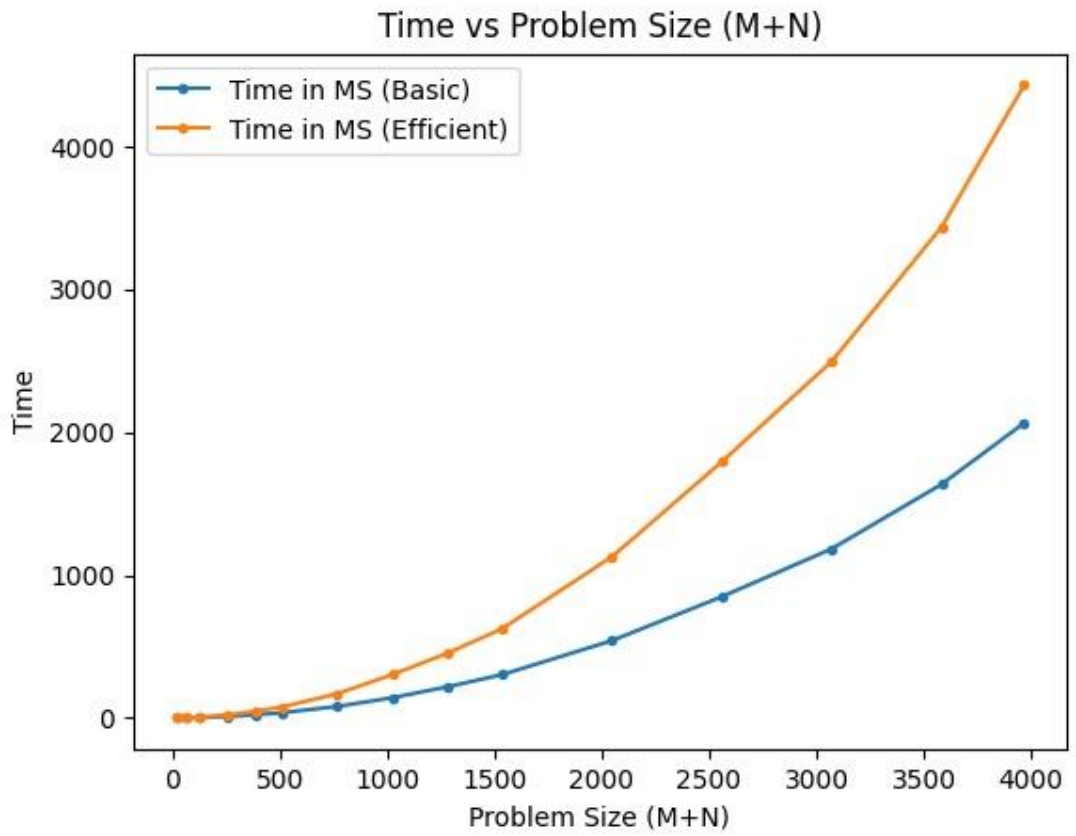
Basic: Polynomial (Quadratic)

Efficient: Linear

Explanation:

The efficient algorithm uses only |m|*2 sized matrix while the basic algorithm uses |m|*|n| sized matrix. Theoretically, memory consumed by the efficient algorithm is linearly dependent on the input size while the memory consumed by the basic algorithm is polynomial (quadratic) dependent on the input size. The above fact is in agreement with our results obtained.

Graph2 – Time vs Problem Size (M+N)



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

Basic: Polynomial (Quadratic)
Efficient: Polynomial (Quadratic)

Explanation:

Asymptotically the time consumed by both algorithms is |m|*|n|. However, we can see there is a clear separation between the times consumed by both algorithms. Theoretically, the efficient algorithm consumes twice the time that the basic algorithm consumes. Hence, although they are separated, they vary by a constant factor. Since we do not consider constants for asymptotic analysis, they have the same time complexity. Hence our results are in agreement with the theory.

Contribution

<8768634447>: <Equal Contribution>
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