# SUMMARY

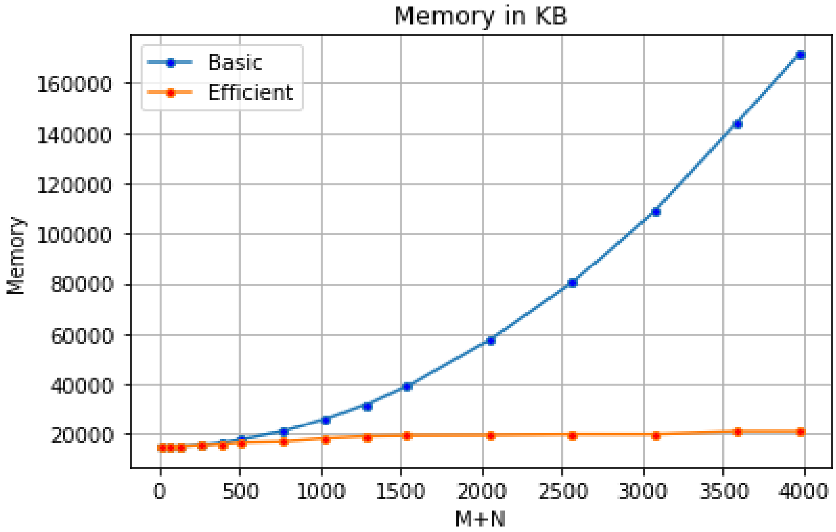
## CSCI570 - Algorithm

### Datapoints :

| M+N | Time in MS (Basic) | Time in MS (Efficient) | Memory in KB (Basic) | Memory in KB (Efficient) |
|---|---|---|---|---|
| 16 | 0.0 | 0.0 | 14776 | 14880 |
| 64 | 1.6655921936035156 | 6.744384765625 | 14852 | 14932 |
| 128 | 2.902984619140625 | 3.1816959381103516 | 14976 | 14988 |
| 256 | 10.470867156982422 | 17.392635345458984 | 15488 | 15316 |
| 384 | 16.231060028076172 | 32.98830986022949 | 16416 | 15784 |
| 512 | 27.696847915649414 | 101.36103630065918 | 17816 | 16524 |
| 768 | 75.57296752929688 | 146.44169807434082 | 21068 | 16892 |
| 1024 | 116.4557933807373 | 294.4614887237549 | 25880 | 18212 |
| 1280 | 164.57080841064453 | 364.3190860748291 | 31708 | 19036 |
| 1536 | 263.80038261413574 | 560.8949661254883 | 39036 | 19340 |
| 2048 | 454.88762855529785 | 954.3516635894775 | 57356 | 19436 |
| 2560 | 723.3548164367676 | 1899.2176055908203 | 80104 | 19748 |
| 3072 | 1045.4788208007812 | 3207.106113433838 | 108720 | 19732 |
| 3584 | 1601.8283367156982 | 6367.202043533325 | 143952 | 20968 |
| 3968 | 2021.9225883483887 | 12326.189756393433 | 171256 | 20960 |

### Insights

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




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

Basic: Polynomial

Efficient: Linear

*Explanation:*

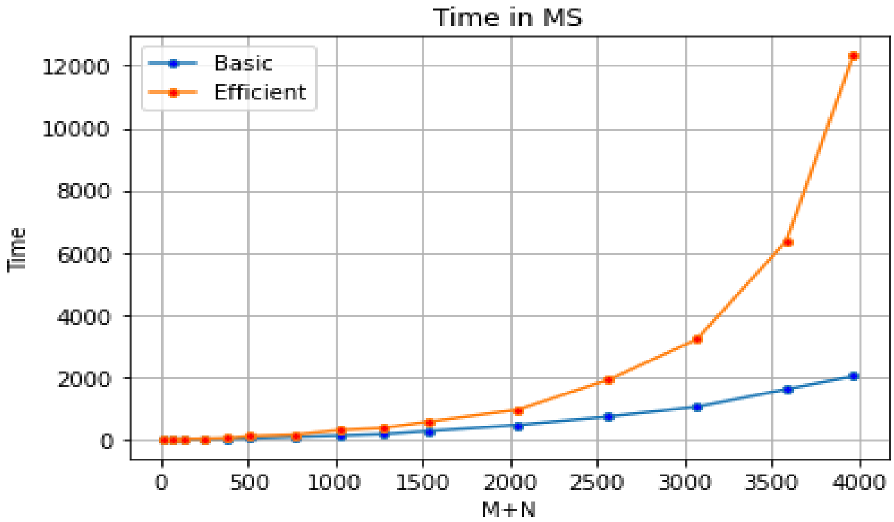
1. The space complexity of Basic algorithm: O(mn)

For the basic algorithm, as problem size goes up, the used memory grows rapidly. We used a whole two-dimensional array to store values of the solution. Thus, as the problem size grows up, the used memory for the two-dimensional array grows up as well.

2. The space complexity of Efficient algorithm: O(m+n)

On the other hand, we can bring the space requirement down to linear O(m+n). We applied recursive calls sequentially and reused the working space from one call to the next. Thus, since we only worked on one recursive call at a time, the total space is O(m+n). As a result, the above line of efficient algorithm graph increases linearly closer to the x-axis than the basic one.

Graph2 – Time vs Problem Size (M+N)




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

Basic: Polynomial

Efficient: Polynomial

*Explanation:*

1. The time complexity of Basic algorithm: O(mn)

We iterated through the whole characters of two generated strings, so it takes O(m*n) time. Thus, as you can see, the above graph has the shape of y = k*m*n which is polynomial. As the problem size (M+N) is increased, the total time is increased as well.

2. The time complexity of Efficient algorithm: O(mn)

Likewise, we iterated through the whole characters of two generated strings, so it also takes O(m*n) time. However, we need more workload to use the Divide and conquer algorithm. For example, we should split the problem into subproblems and combine them again. Therefore, the graph of the memory-efficient algorithm increases more steeply than the basic one.