



S1\_01 Data Structures And Algorithms : Subject Content

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Reading Material



Example:

Consider the four matrices M1, M2, M3 and M4 having the dimensions as shown in Figure-4.

> M1: (10,20) M3: (50,1) M2: (20,50) M4: (1,100) FIGURE 4: MATRIX SIZES

Now the desired result is product of the four matrices - M1  $\times$  M2  $\times$  M3  $\times$  M4. The simplest way of doing this would be to apply the normal matrix multiplication  $% \left( 1\right) =\left( 1\right) \left( 1\right) \left($ procedure recursively in the order

## M1 x (M2 x (M3 x M4))

Figure-5 shows the number of operations that are involved in performing this multiplication in the above order.

Operation	Multiplications	Total
M3 X M4	50 X 100	5000
M2 X (M3 X M4)	20 X 50 X 100	100000
(M1 X M2 X (M3 X M4))	10 X 20 X 100	20000
	1	125000

## FIGURE 5: NORMAL MATRIX MULTIPLICATION

Here we see that the number of multiplication operations = 125000

Now we know that matrix multiplication is Associative. So,  $A \times B \times C = (A \times B) \times C =$ 

This means that the same multiplication of the four matrices can also be performed in a different order to get the same result. Figure-6 shows an optimized solution to the same problem.

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