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BSCS_F19_M_63
Analysis of Algorithm
Question #1 - Part #3
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Final Parenthesization

Given:

- **$A1_{12*35}$, $A2_{35*42}$, $A3_{42*60}$, $A4_{60*89}$ and $A5_{89*110}$**

To Find:

- Optimal Parenthesization for Minimal Calculations

Solution:

- ➔ For the Calculations of Matrices, according to the laws of Dynamic Programming, we'll use the methods of **Memoization** and **Tabulation.**
- ➔ For that, we'll use **M** and **S** Tables to keep track of the calculations (Memoization) and will utilize them as needed.
- ➔ Below are the tables of **M** and **S**, with the table of Calculations we have to perform to get the Optimal Results.
  - ◆ **D1, D2, D3, D4, D5** and **D6** are the dimensions of the Matrices, which are getting multiplied. If they aren't listed, then Memoized Results are used

M	1	2	3	4	5	S	1	2	3	4	5
1	0	17,640	47,880	111,960	229,440	1		1	2	3	4
2		0	88,200	275,100	617,760	2			1	2	3
3			0	224,280	635,460	3				1	2
4				0	557,400	4					1
5					0	5					

Multiplications	D1	D2	D3	Memoized Value	Total Calculations
1 : 2	12	35	42		17,640
2 : 3	35	42	60		88,200
3 : 4	42	60	89		224,280
4 : 5	60	89	110		587,400
1 : (2 : 3)	12	42	60	17,640	47,880
(1 : 2) : 3	12	35	60	88,200	113,400
2 : (3 : 4)	35	42	89	224,280	355,110
(2 : 3) : 4	35	60	89	88,200	275,100
(3 : 4) : 5	42	89	110	224,280	635,460
3 : (4 : 5)	42	60	110	587,400	864,600
1 : (2 : 3 : 4)	12	35	89	275,100	312,480
(1 : 2) : (3 : 4)				17,640 + 224,280	241,920
(1 : 2 : 3) : 4	12	60	89	47,880	111,960
2 : (3 : 4 : 5)	35	42	110	635,460	797,160
(2 : 3) : (4 : 5)				88,200 + 587,400	675,600
(2 : 3 : 4) : 5	35	89	110	275,100	617,750

Multiplications	D1	D2	D3	D4	D5	D6	Memoized Value	Total Calculations
1 : (2 : 3 : 4 : 5)	12	35	110				617,750	663,950
(1 : 2) : (3 : 4 : 5)							17,640 + 635,460	653,100
1 : 2 : (3 : 4 : 5)	12	35	110	35	42	110	635,460	843,360
(1 : 2 : 3) : (4 : 5)							47,880 + 587,400	635,280
(1 : 2 : 3) : 4 : 5	12	60	89	12	89	110	47,880	229,440

- Hence, Minimal Parenthesization will be: **(((A1 x A2) x A3) x A4) x A5**