For a chain of matrix $A_1 A_2 A_3 A_4$ with their dimensions in the following table, parenthesize the product $A_1 A_2 A_3 A_4$ to minimize the number of scalar multiplication. What is the minimum number of scalar multiplications?

Matrix	Dimension
A_1	2x3
A_2	3x5
A_3	5x4
A_4	4x2

(A) 82 (B) 72 (C) 112 (D) 99 (E) 70 【104 年交大資工所】

解 (A)

Ans.

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$P_0 = 2$

$P_1 = 3$

$P_2 = 5$

$P_3 = 4$

$P_4 = 2$

m	1	2	3	4
1	0	30	170	(82)
2		0	60	170
3			0	40
4				0

$m[1,3] = 170$

$k=1$

$m[1,1] + m[2,3] + 2\times4\times3 = 84$

$k=2$

$m[1,2] + m[3,3] + 2\times4\times5 = 170$

$m[2,4] = 70$

$k=2$

$m[2,2] + m[3,4] + 3\times2\times5 = 70$

$k=3$

$m[2,3] + m[4,4] + 3\times2\times4 = 84$

$m[1,4]$

$k=1$

$m[1,1] + m[2,4] + 2\times2\times3 = 82$

$k=2$

$m[1,2] + m[3,4] + 2\times2\times5 = 90$

$k=3$

$m[1,3] + m[4,4] + 2\times2\times4 = 86$