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Miscellaneous - Part IV

Complete Course on Algorithms - GATE

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Goto hell

Matrix chain multiplication

C++

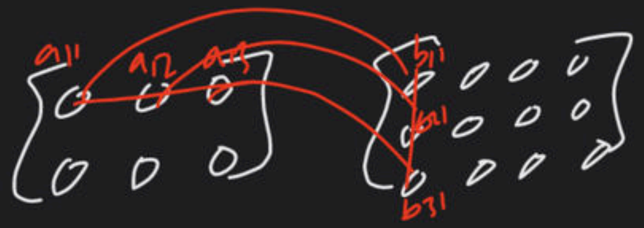
$A_{2\times3}$ $B_{3\times4}$

$C = A * B$

2×4

⇓

8-ele



$a_{11} * b_{11} + a_{12} * b_{21} + a_{13} * b_{31}$

2×4

||

8-ele

||

8 * 3 = 24 mul

24 add

$A_{3\times1}$ $B_{1\times10}$

$C = A * B$

3×10 - ele

30 elements

ex

$A_{1\times4}$ $B_{4\times2}$ $C_{2\times3}$

$D = A * B * C$

((AB)C)

$(AB) = 1\times2 * 4$

$1\times2 = 8$

$(AB)_{1\times2} * C_{2\times3} = 1*3*2$

$1\times3 = 6$

14

$(A(BC))$

$B_{4\times2}\ C_{2\times3} = 4*3*2$

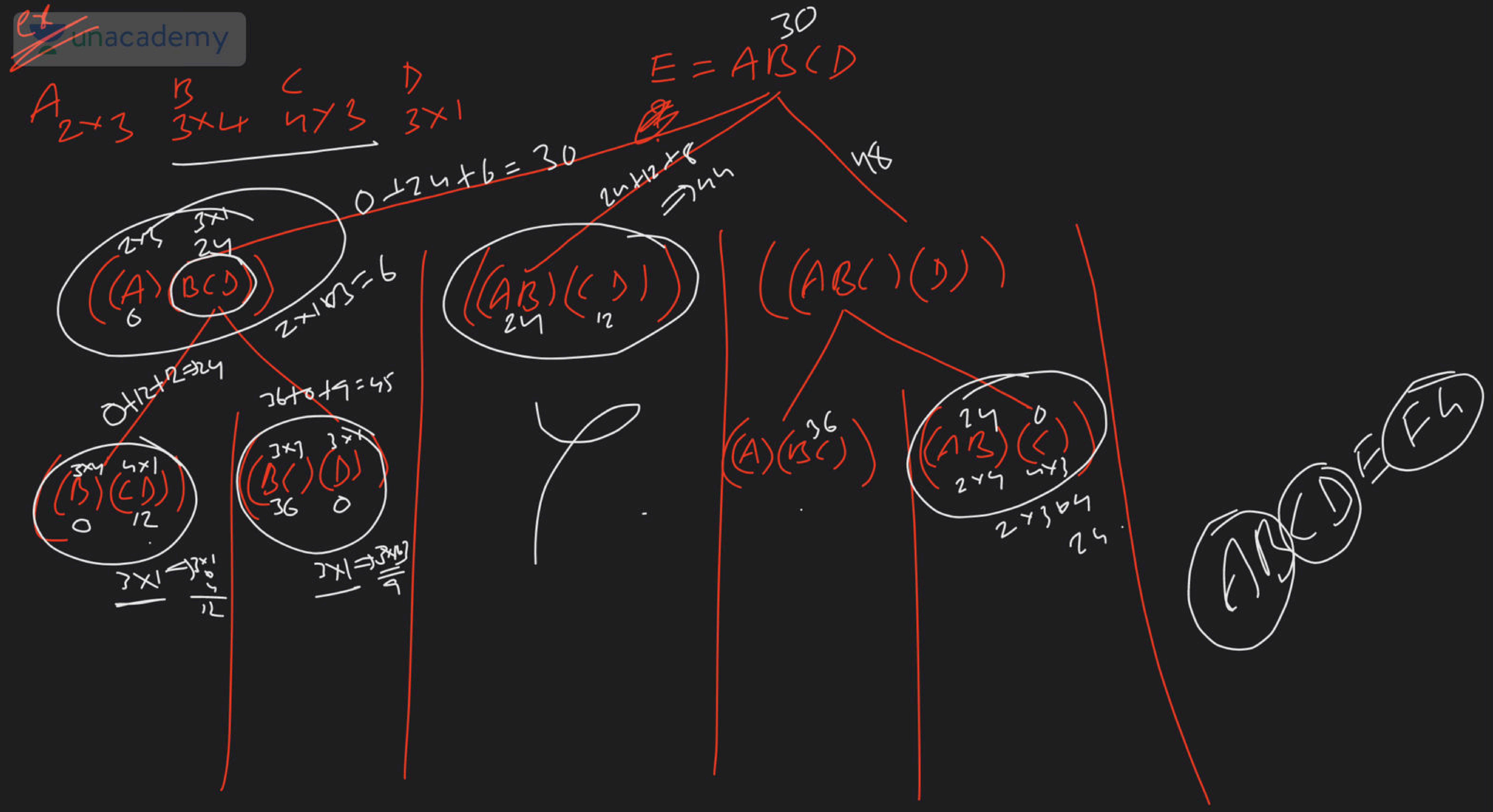
$4\times3 = 24$

$A_{1\times4} * (BC)_{4\times3} = 1\times3*4$

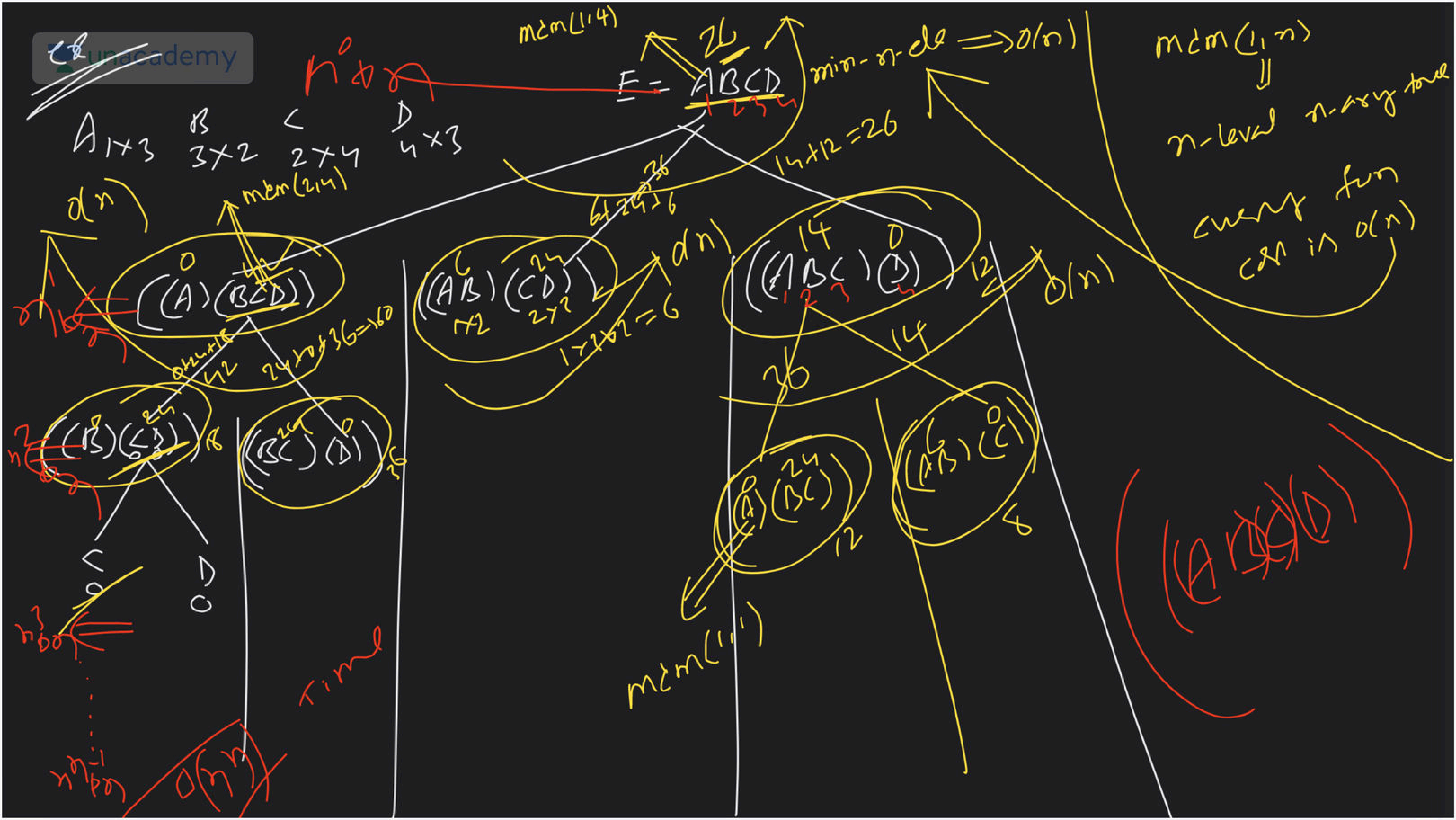
$1\times3 = 12$

36

14



A 2×3
B 3×4
C 4×3
D 3×1
E = ABCD
30
0+24+6 = 30
24+12+8
⇒44
48
((A)(BCD))
2×1×3 = 6
((AB)(CD))
((ABC)(D))
0+12+12 ⇒24
36+0+9 = 45
((B)(CD))
((BC)(D))
(A)(BC)
((AB)(C))
2×3×4
24



mcm(1,4)
26
E = ABCD
min-n-ele ⟹ O(n)
mcm(1,n)
n-level n-ary tree
every fun call is O(n)
A 1×3
B 3×2
C 2×4
D 4×3
14+12=26
mcm(2,4)
O(n)
((A)(BCD))
((AB)(CD))
((ABC)(D))
1×2
2×3
1×3×2=6
6+24+6=36
0+24+18=42
24+0+36=60
((B)(CD))
((BC)(D))
((A)(BC))
((AB)(C))
12
8
36
14
mcm(1,1)
Time
O(n^n)

mcm(1, 4)

2	3
3	2
	1
4	
4	4

$\Rightarrow$ 16 - DIC

mcm(1, n)

2	n-1
3	n-2
⋮	⋮
n	n

n^2 - DFC

$n^2 \cdot n$

‖

$O(n^3)$ Time

Space complexity

‖

Stacked Table

n $\quad$ n^2

$O(n^2)$

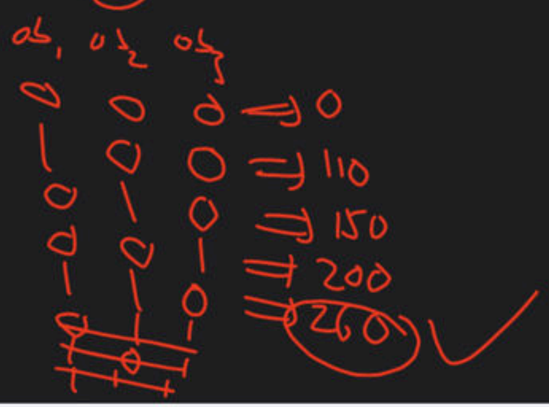
0/1 Knapsack

ex $n=3$ $m=10$

objects	ob_1	ob_2	ob_3
profit	110	150	200
weight	4	6	7
	27.5 ②	25 ③	28.5 ①

manually

(1)



Greedy tech

$\left(\frac{1}{x_1} \quad \frac{1}{x_2} \quad \frac{1}{x_3}\right)$

$10-7=3$

200

Using - DP

DKP(m,n) =

$n = 6 \quad m = 35$

Objects :	ob_1	ob_2	ob_3	ob_4	ob_5	ob_6
profit :	30	80	90	65	150	120
weight :	7	3	4	4	10	8

$$OKS(m, n) = \begin{cases} OKS(m - w_n, n-1) + P_n \\ OKS(m, n-1) \end{cases} \max$$

3

$OKS(35, 6) = OKS(35, 5)$ if $w[6] > m$

$35, 5$
$35, 4$
$35, 3$
$35, 2$
$35, 1$
$35, 0 = 0$

2

$$OKS(m, n) = 0$$

if $m = 0$
or
$n = 0$

1