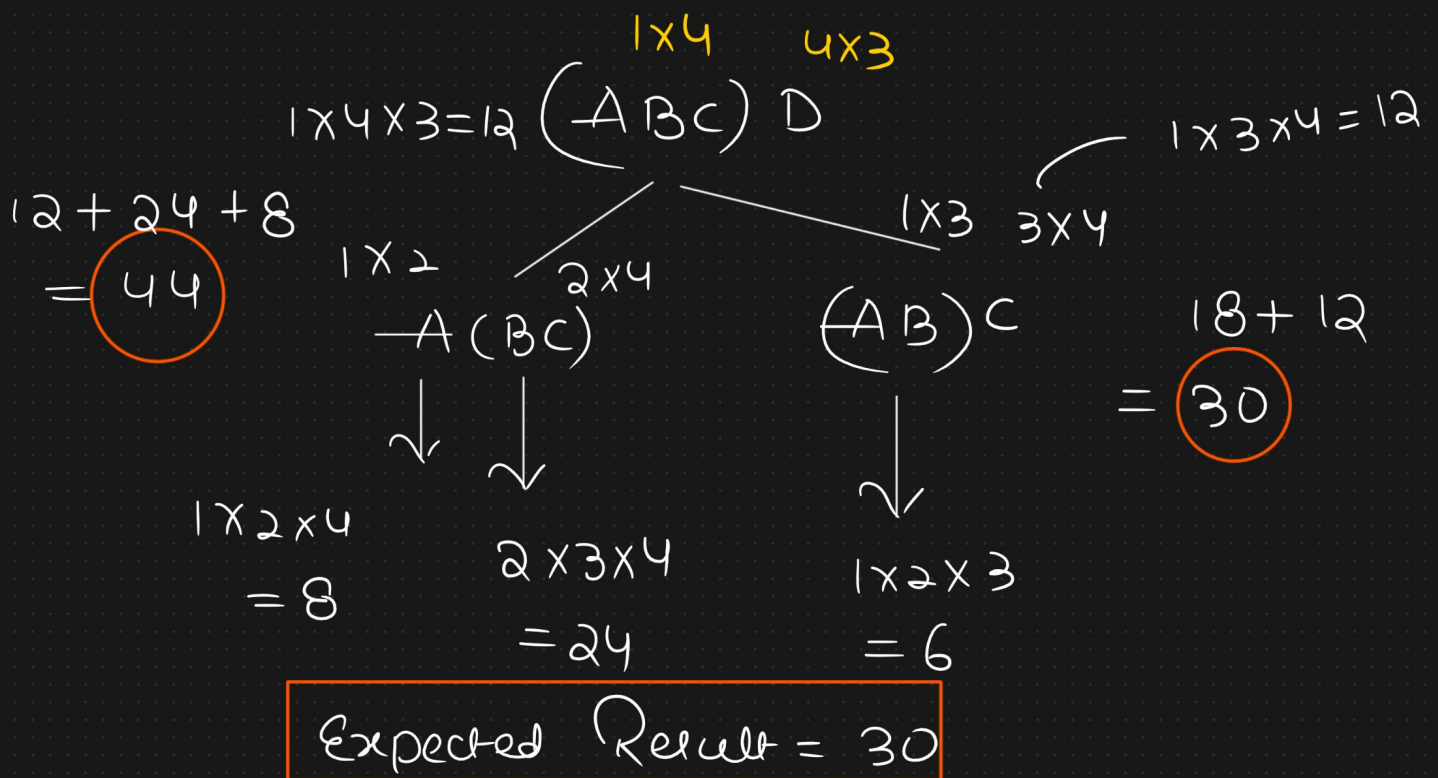
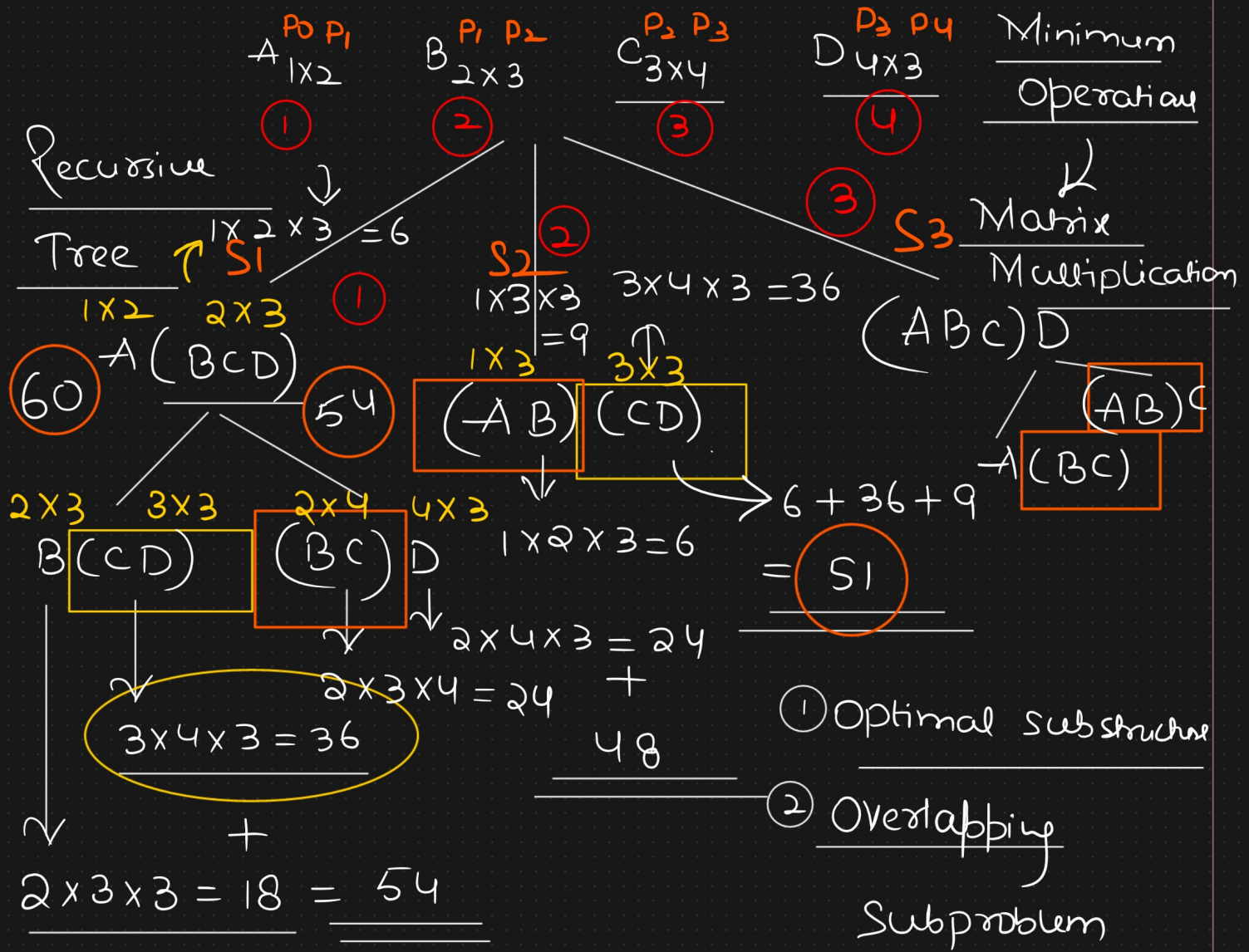


Matrix Chain Multiplication



$P_0 P_1 P_2 \rightarrow \text{Ops}$
Basic

$$\begin{array}{c}
 \downarrow \quad \downarrow \quad \downarrow \\
 A_{1 \times 3} \quad B_{3 \times 2} \Rightarrow (N)_{1 \times 2} \\
 \hline
 P_0 P_1 \quad P_1 P_2 \\
 \text{Num of operations} \Rightarrow 1 \times 3 \times 2 \\
 \hline
 = 6
 \end{array}$$

$P_0 P_1 P_2 P_3 P_4$
 $arr = \{1, 2, 3, 4, 3\}$
Recursion

$n = 5$

$\text{minOps} = \text{Integer.MAX_VAL};$

① Base case condition

$\text{MCM}(arr, i, j)$ if $(i == j)$

$\text{return } 0;$

② Recursive function call

$\text{for}(k=i; k < j; k++)$

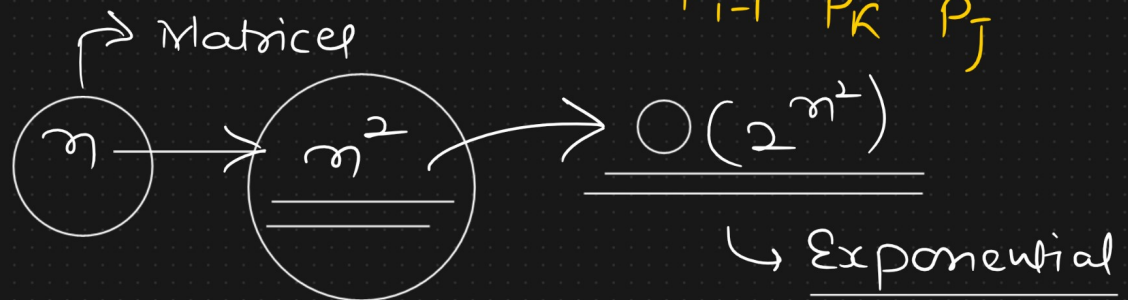
$$\text{Ops} = \text{MCM}(arr, i, k) + \text{MCM}(arr, k+1, j) + P_{i-1} P_k P_j$$

Pseudocode

$\text{minOps} = \text{Math.min}(\text{Ops}, \text{minOps});$

$\text{return minOps};$

$$\begin{aligned}
 & \text{MCM}(i, j) = \min \left\{ \begin{aligned}
 & \text{S1} \quad \overbrace{\text{MCM}(1,1) + \text{MCM}(2,4) +}^{A \quad BCD} \\
 & \quad \quad \quad \overbrace{P_{i-1}^k \quad P_k \quad P_j^{k+1} \quad j}^{P_0 * P_1 * P_4} \\
 & \quad \quad \quad \overbrace{\text{MCM}(1,2) + \text{MCM}(3,4) +}^{AB \quad i \quad k \quad CD \quad j} \\
 & \text{S2} \quad \overbrace{P_0 * P_2 * P_4}^{ABC \quad P_{i-1} \quad P_k \quad P_j \quad j} \\
 & \quad \quad \quad \overbrace{\text{MCM}(1,3) + \text{MCM}(4,4) +}^{i \quad k \quad k+1} \\
 & \text{S3} \quad \overbrace{P_0 * P_3 * P_4}^{P_{i-1} \quad P_k \quad P_j}
 \end{aligned} \right.
 \end{aligned}$$



① Memoization (Enhanced Recursion)

→ Avoid the
re-computation
of the
function call