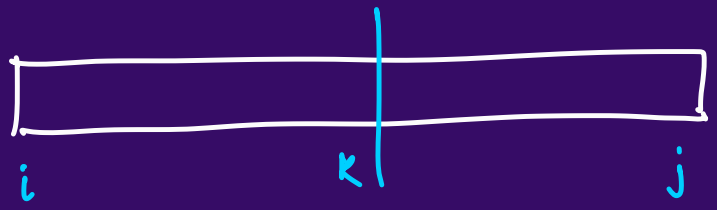
# Ques: Partition DP / MCM

PW SKILLS

## Q : Matrix Chain Multiplication




$$\underset{1\times 2}{\begin{bmatrix} a & b \end{bmatrix}} \times \underset{2\times 3}{\begin{bmatrix} c & f & g \\ h & i & j \end{bmatrix}} = \underset{1\times 3}{\begin{bmatrix} & & \end{bmatrix}}$$

$$A \times B \neq B \times A$$

# Ques:

## Q : Matrix Chain Multiplication

$A \times B \times C \Rightarrow (A \times B) \times C$

$A \times (B \times C)$

$A \times B \times C \times D =$

$A\ (B(CD))$

$A\ ((BC)D)$

$(AB)(CD)$

$((AB)C)D$

$(A(BC))D$

# Ques:

## Q : Matrix Chain Multiplication

$$\underset{10\times20}{[\ ]} \times \underset{20\times25}{[\ ]} = \underset{10\times25}{[\ ]}$$

$$\text{cost} = 10 \times 20 \times 25$$

$$A_1 \cdot A_2 \cdot A_3 \cdot A_4 \cdot A_5 = \underset{m_1 \times n_5}{[\ ]}$$

# Ques:

## Q : Matrix Chain Multiplication

$$[A]_{1\times2} \times [B]_{2\times3} \times [C]_{3\times4} = [AB]_{1\times3} \times [C]_{3\times4}$$

$6 + 12 = 18$

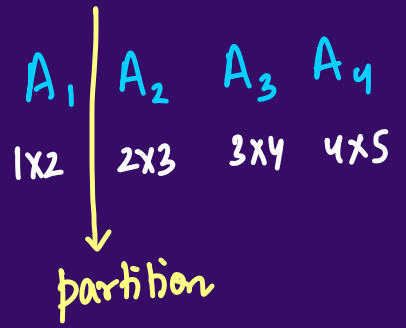
$$= [A]_{1\times2} \times [BC]_{2\times4}$$

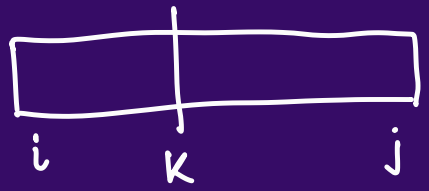
$24 + 8 = 32$

$A_1 A_2 A_3 \ldots A_n$

# Ques:

**Q : Matrix Chain Multiplication** → All possible combinations → Recursion



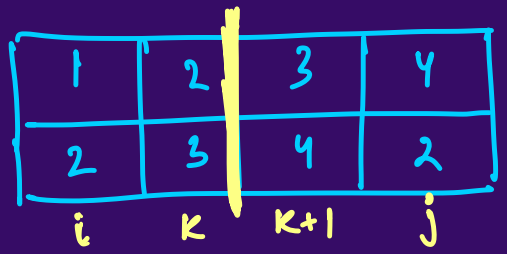

$$cost(i,j) = cost(i,k) + cost(k+1,j) + C$$

# Ques:

## Q : Matrix Chain Multiplication

input format :

arr

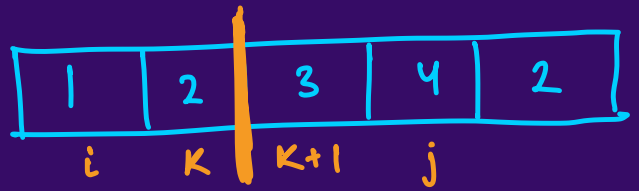



$[(1\times2)(2\times3)] \times [(3\times4)(4\times2)]$

$[1\times3] \times [3\times2]$

$1 \times 3 \times 2 = n$

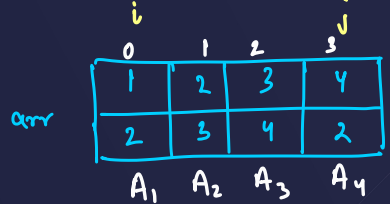
arr




4 matrices

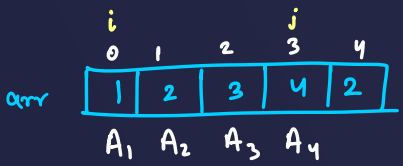
$n = 1 \times 3 \times 2$

arr[i] arr[k+1] arr[j+1]




partition → K

```
int cost ( int i, int j, arr ){
    if(i==j) return 0;
    minCost = ∞;
    for(int k= i ; k<j ;k++){
        x = arr[i][0] x arr[j][1] x arr[k][1];
        tc = cost(i,k) + cost(k+1,j) + x;
        minCost = min(minCost, tc);
    }
    return minCost
}
```




partition → K

```
int cost ( int i, int j, arr ){
    if(i==j) return 0;
    minCost = ∞;
    for(int K= i; K<j; K++){
        x = arr[i] x arr[K+1] x arr[j+1];
        tc = cost(i,K) + cost(K+1,j) + x;
        minCost = min(minCost, tc);
    }
    return minCost
}
```

Memoization : $i \to n \to 0$, $j \to m \to 0$ ] → Tabulation → $i \Rightarrow 0$ to $n$, $j \Rightarrow 0$ to $m$

$i \to 0$ to $n$, $j \to n$ to $0$ ] → tabul → $i = n \to 0$, $j \to 0$ to $n$

# Ques:

## Q : Matrix Chain Multiplication

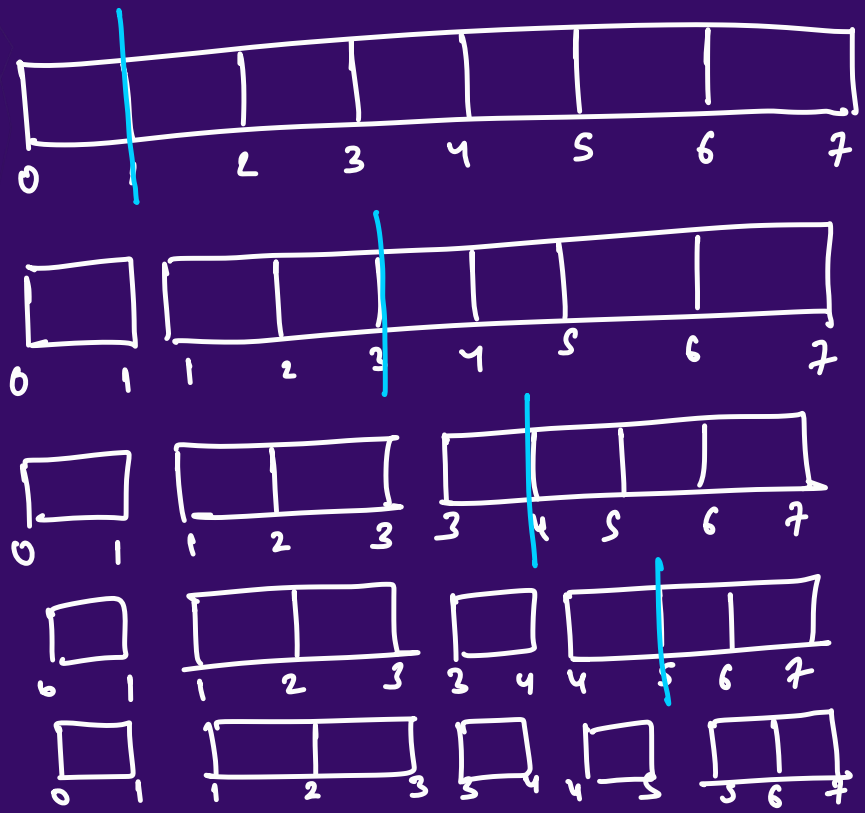
# Ques:

minimize

**Q : Minimum cost to cut a stick**

1, 3, 4, 5

n=7




cuts = {1, 3, 4, 5}

cost = 7 + 6 + 4 + 3

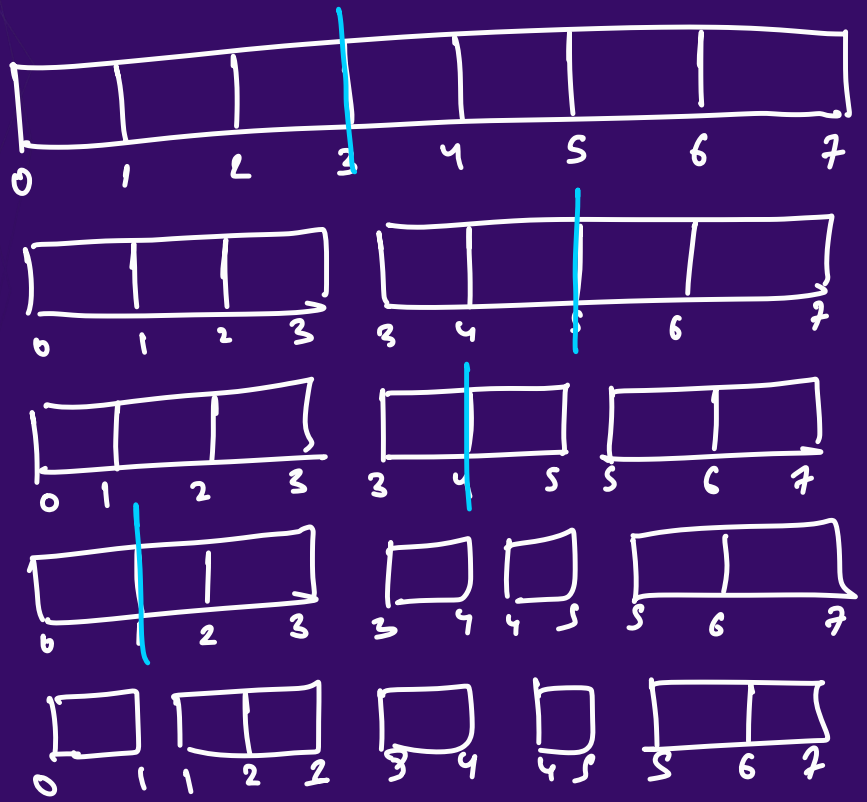
= 22

[Leetcode 1547]

# Ques:

## Q : Minimum cost to cut a stick

n=7




cuts = {1, 3, 4, 5}

3, 5, 4, 1

Cost = 7 + 4 + 2 + 3

= 16

[Leetcode 1547]

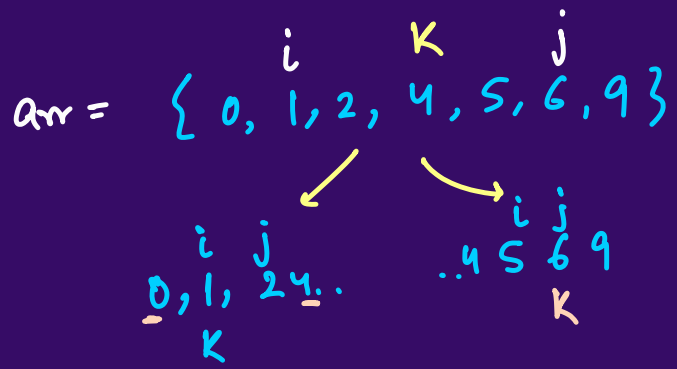
# Ques:

cuts → sort

cuts → front → 0 , end = n → Partition DP

## Q : Minimum cost to cut a stick

n=9 , cuts = {5, 6, 1, 4, 2} →




$$cost(i,j) = cost(i, K-1) + cost(K+1, j) + len$$

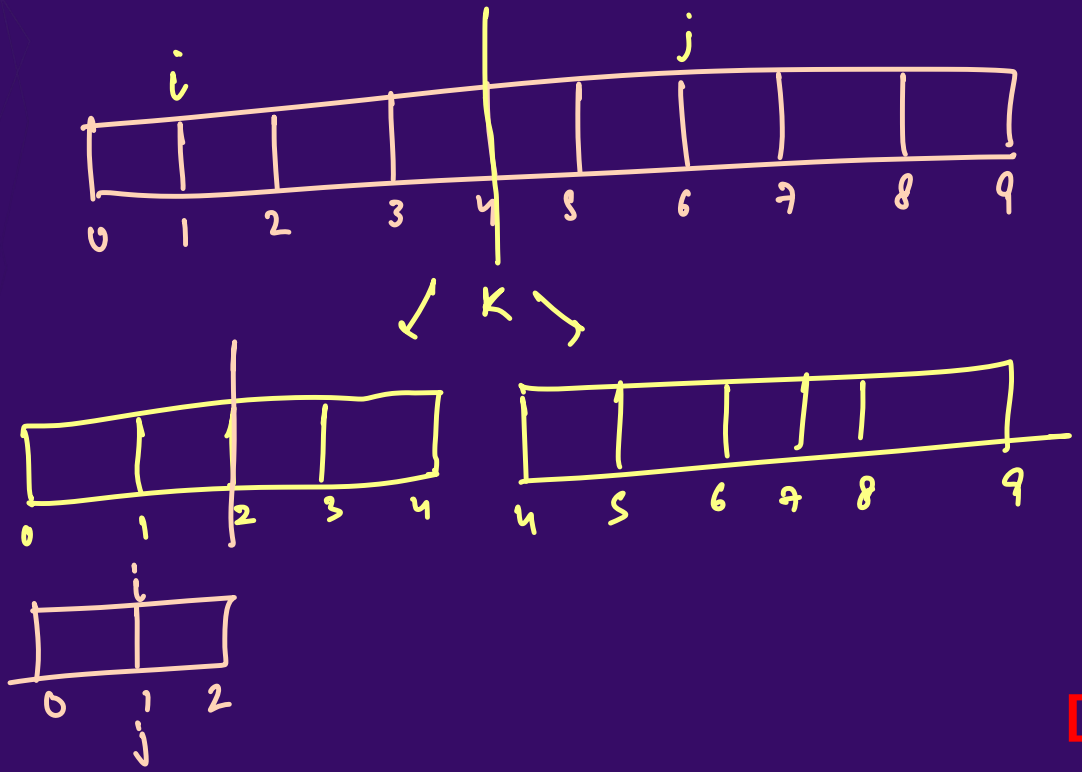
$$len = arr[j+1] - arr[i-1]$$

[Leetcode 1547]

# Ques:

PW SKILLS

## Q : Minimum cost to cut a stick




[Leetcode 1547]

# THANK YOU