}

14/1/25

```
Addition (A, B, C) {
    for (i=0; i<n; i++) {            → n+1
        for (j=0; j<n; j++) {        → n(n+1)
            C[i,j] = A[i,j] + B[i,j] → n×n
        }
    }
}
```

$$T(n) = (n+1) + n(n+1) + n \times n$$

$$= 2n^2 + 2n + 1$$

$$O(n) = n^2$$

$$S(n) = \overset{a,\,b,\,c}{3n^2} + \overset{i,\,j,\,n}{3}$$

$$O(n^2)$$

Multiplication

```
for (i=0; i<n; i++){            → n+1
    for (j=0; j<n; j++){        → n(n+1)
        C[i,j]=0;               → n×n
        for (k=0; k<n; k++){    → n×n×(n+1)
            C[i,j] = C[i,j] + A[i,j]*B[j,k]
                                ↳ n×n×n
        }
    }
}
```

$$T(n) = (n+1) + n(n+1) + n\times n\times(n+1) + n^3$$

$$= n^3 + n^3 + n^2 + n^2 + n + n + 1$$

$$= 2n^3 + 2n^2 + 2n + 1$$

$O(n^3)$

$S(n) = 3n^2 + 4$

$O(n^2)$

$n=1$
$i=1$
$j=1$
$k=1$
$C \to n^2$
$A \to n^2$
$B \to n^2$

15/1/25 recurrance relation,

$$T(n) = T(n/2) + 1$$

2nd time $= T\left(\frac{n}{2^2}\right) + 1 + 1$

3rd time $= T\left(\frac{n}{2^3}\right) + 1 + 1 + 1$

$\vdots$

kth time, $= T\left(\frac{n}{2^k}\right) + k$ —— (1)

considering Terminating condition, $T(n) = 1$ [if $n=1$]

assume $\frac{n}{2^k} = 1$

$n = 2^k$

$\log_2 n = \log_2 2^k$

$k = \log_2 n$

from (1) $T\left(\frac{n}{2^k}\right) + k = T(1) + \log n = O(\log n)$

T(0) meaningless term.

Q Find minimum & maximum

divide when no of element $n > 2$

when $n == 1 \rightarrow$ min = max = a[i] = a[i]

when $n == 2 \rightarrow$ one is min, another is max

$$\begin{cases} T(1) = 1 \\ T(2) = 1 \\ T(n) = 2 \cdot T(n/2) + 2, \quad n > 2 \end{cases}$$

2 ↓ cause considering both side of division

+2 ↳ for T(1) & T(2)

1st step $T(n) = 2T(n/2) + 2$

2nd step $\Rightarrow$ $\cancel{2/T\left(\frac{n}{2^2}\right)}$

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$$T(n) = 2T(n/2) + 2$$

$$= 2\left[2T\left(\frac{n}{2^2}\right) + 2\right] + 2$$

Substituting $\left[\because T\left(\frac{n}{2}\right) = 2T\left(\frac{n}{2^2}\right) + \right.$

2nd step $= 2^2 T\left(\frac{n}{2^2}\right) + 2^2 + 2$

3rd step $= 2^3 T\left(\frac{n}{2^3}\right) + 2^3 + 2^2 + 2^1$

⋮

kth step $= 2^k T\left(\frac{n}{2^k}\right) + 2^k + \dots 2^3 + 2^2 + 2$

$\because [T(n) = 1$ where $n = 2]$

assume $\frac{n}{2^k} = 2$

or, $2^k = n/2$

$$= \frac{n}{2} T(2) + [2^k \dots 2^2 + 2^1]$$

$$= n/2 \times 1 + 2 \cdot \frac{2^k - 1}{2 - 1}$$

$$= \frac{n}{2} + 2\left(\frac{n}{2} - 1\right)$$

$$= \frac{n}{2} + n - 2$$

$$\boxed{T(n) = \frac{3n}{2} - 2}$$

$$2(n-1) - 2n - 2 > \frac{3n}{2} - 2$$