

Daniyal Aghaz  
S3731  
BS DS

## Class Activity.

### Master Theorem

$$\text{i) } T(n) = 3T\left(\frac{n}{2}\right) + 1$$

$$a=3, b=2, d=0$$

$$a = b^d$$

$$3 = 2^0$$

$$\begin{aligned} T(n) &= \mathcal{O}(n^{\log_2 3}) \\ &= T(n) = \mathcal{O}(n^{\log 3}) \end{aligned}$$

$$\text{ii) } T(n) = 8T\left(\frac{n}{2}\right) + n^1$$

$$a=8, b=2, d=1$$

$$a = b^d$$

$$8 = 2^3$$

$$8 > 4$$

$$T(n) = \mathcal{O}(n^{\log_2 3})$$

$$\text{iii) } T(n) = 2T\left(\frac{n}{4}\right) + \sqrt{2}$$

$$a=2, \quad b=4, \quad d=\frac{1}{2}$$

$$\begin{aligned} a &= b^d \\ 2 &= 4^{1/2} \\ 2 &= \sqrt{4} \\ 2 &= 2 \end{aligned}$$

$$T(n) = O(n^{1/2} \log n)$$

$$\text{iv) } T(n) = 4T\left(\frac{n}{2}\right) + n^3$$

$$a=4, \quad b=2, \quad d=3$$

$$\begin{aligned} a &= b^d \\ 4 &= 2^3 \\ 4 &= 8 \\ 4 &< 8 \end{aligned}$$

$$T(n) = O(n^3)$$

$$v) T(n) = 3T\left(\frac{n}{4}\right) + n \log n$$

$$a=3, b^d=4, d=1$$

$$b^d = 4^1 = 4$$

$$a < b^d$$

$$3 < 4$$

$$\mathcal{O}(n^{\log b})$$

$$\mathcal{O}(n \log 4^3)$$

$$\mathcal{O}(n \log 64)$$