

Name - Dhruv Goyal

Section - F

Roll No - 54

University Roll No - 2016729

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

$$a=3, b=2, f(n)=n^2$$

$$\text{Now, } c = \log_b a = \log_2 3 = 1.584$$

$$n^c = n^{1.584} < n^2$$

$$\therefore f(n) > n^c$$

$$T(n) = \Theta(n^2)$$

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

$$a=4, b=2, f(n)=n^2$$

$$c = \log_2 4 = 2$$

$$n^c = n^2 = f(n) = n^2$$

$$T(n) = \Theta(n^2 \log n)$$

$$3.) T(n) = T(n/2) + 2^n$$

$$a=1, b=2, f(n)=2^n$$

$$c = \log_b a = \log_2 1 = 0$$

$$n^c = n^0 = 1$$

$$f(n) > n^c$$

$$T(n) = \Theta(2^n)$$

$$4.) T(n) = 2^n T(n/2) + n^n$$

a is not constant

$$5.) T(n) = 16 T\left(\frac{n}{4}\right) + n$$

$$a=16, b=4$$

$$c = \log_4 16 = 2$$

$$n^c = n^2$$

$$f(n) < n^c$$

$$T(n) = \Theta(n^2)$$

$$6.) T(n) = 2T\left(\frac{n}{2}\right) + n \log n$$

$$a=2, b=2$$

$$c = \log_2 2 = 1$$

$$n^c = n^1 = n$$

$$n \log n > n$$

$$f(n) > n^c$$

$$T(n) = \Theta(n \log n)$$

$$7.) T(n) = 2T\left(\frac{n}{2}\right) + \frac{n}{\log n}$$

Does not apply

non-polynomial difference b/w
 $f(n)$ & $n \log n^a$

$$9.) T(n) = 0.5 T\left(\frac{n}{2}\right) + \frac{1}{n}$$

Does not apply ($a < 1$)

$$11.) T(n) = 4T\left(\frac{n}{2}\right) + \log n$$

$$a=4, b=2, f(n) = \log n$$

$$c = \log_2 4 = 2, n^c = n^2$$

$$\log n < n^2$$

$$T(n) = \Theta(n^2)$$

$$13.) T(n) = 3T\left(\frac{n}{2}\right) + n$$

$$a=3, b=2, f(n)=n$$

$$c = \log_2 3 = 1.5849$$

$$n^c = n^{1.5849}$$

$$n < n^{1.5849}$$

$$T(n) = \Theta(n^{1.5849})$$

$$8.) T(n) = 2T\left(\frac{n}{4}\right) + n^{0.51}$$

$$a=2, b=4, f(n)=0.51$$

$$c = \log_4 2 = 0.5$$

$$n^c = n^{0.5}$$

$$n^{0.51} < n^{0.5}$$

$$T(n) = \Theta(n^{0.51})$$

$$10.) T(n) = 16T\left(\frac{n}{4}\right) + n!$$

$$a=16, b=4, f(n)=n!$$

$$c = \log_4 16 = 2, n^c = n^2$$

$$n! > n^2$$

$$T(n) = \Theta(n!)$$

$$12.) T(n) = \text{sept}(2) T\left(\frac{n}{2}\right) + \log n$$

$$a=\sqrt{2}, b=2$$

$$c = \log_2 \sqrt{2} = \frac{1}{2}, n^c = n^{\frac{1}{2}}$$

$$n^{\frac{1}{2}} > \log n$$

$$T(n) = \Theta(\sqrt{n})$$

$$14.) T(n) = 3T\left(\frac{n}{3}\right) + \text{sept}(n)$$

$$a=3, b=3$$

$$c = \log_3 3 = 1, n^c = n^1 = n$$

$$\text{sept}(n) < n$$

$$\Theta(n)$$

$$T(n) = 4T\left(\frac{n}{2}\right) + cn$$

$$a=4, b=2, f(n)=cn$$

$$c = \log_2 4 = 2, n^c = n^2$$

$$cn < n^2$$

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

$$16) T(n) = 3T\left(\frac{n}{4}\right) + n \log n \quad (3)$$

$$a=3, b=4, f(n)=n \log n$$

$$c = \log_4 3 = 0.792$$

$$n^{0.792} < n \log n$$

$$T(n) = O(n \log n)$$

$$17) T(n) = 3T\left(\frac{n}{3}\right) + \frac{n}{2}$$

$$a=3, b=3, f(n)=\frac{n}{2}$$

$$c = \log_3 3 = 1$$

$$n^c = n$$

$$T(n) = n \log n$$

$$18) T(n) = 6T\left(\frac{n}{3}\right) + n^2 \log n$$

$$a=6, b=3, f(n)=n^2 \log n$$

$$c = \log_3 6 = 1.6309$$

$$n^c = n^{1.6309}$$

$$T(n) = O(n^2 \log n)$$

$$19) T(n) = 4T\left(\frac{n}{2}\right) + \frac{n \log n}{2}$$

$$a=4, b=2, f(n)=\frac{n \log n}{2}$$

$$c=2$$

$$\frac{n \log n}{2} < n^2$$

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

$$21) T(n) = 7T\left(\frac{n}{3}\right) + n^2$$

$$a=7, b=3, f(n)=n^2$$

$$c = \log_3 7 = 1.7712, n^c = 1.7712$$

$$n^{1.7712} < n^2$$

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

$$20) T(n) = 6T\left(\frac{n}{3}\right) - n^3 \log n$$

Does not apply

($f(n)$ is not positive)

$$22) T(n) = T\left(\frac{n}{2}\right) + n(2 - \cos n)$$

Does not apply.