

Tutorial - 4

Ques 1  $T(n) = 3T(n/2) + n^2$

$$C = \log_2 3$$

$$C = 1.584$$

$$n^C = n^{1.584}$$

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

here,

$$f(n) > n^C$$

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

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

$$C = \log_2 4$$

$$C = 2$$

$$n^C = n^2$$

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

here,

$$f(n) = n^C$$

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

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

$$C = \log_2 1$$

$$C = 0$$

$$n^C = 1$$

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

here,  $f(n) > n^C$

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

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

$$C = \log_2 2^n$$

$$C = n$$

$$n^C = n^n$$

$$f(n) = n^n$$

here,  $f(n) = n^C$

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

5.  $T(n) = 16T(n/4) + n$

$$C = \log_4 (4)^2$$

$$C = 2$$

$$n^C = n^2$$

$$f(n) = n$$

$$n^C > f(n)$$

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

6.  $T(n) = 2T(n/2) + n \log n$

$$C = \log_2 2$$

$$C = 1$$

$$n^C = n$$

$$f(n) = n \log n$$

here,  $f(n) = n^C$

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



$$\underline{\underline{7.}} \quad T(n) = 2T(n/2) + n/\log n$$

$$C = \log_2 2$$

$$C = 1$$

$$n^C = n$$

$$f(n) = n/\log n$$

$$n^C > f(n)$$

Here

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

$$\underline{\underline{8.}} \quad T(n) = 2T(n/4) + n^{0.51}$$

$$C = \log_4 2$$

$$C = 0.5$$

$$n^C = n^{0.5}$$

$$f(n) = n^{0.51}$$

$$f(n) > n^C$$

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

$$\underline{\underline{9.}} \quad T(n) = 0.5T(n/2) + 1/n$$

$$C = \log_2 0.5$$

$$C = -1$$

$$n^C = n^{-1} = 1/n$$

$$f(n) = 1/n$$

$$f(n) = n^C$$

$$T(n) = \Theta(1/n)$$

$$\underline{\underline{10.}} \quad T(n) = 16T(n/4) + n!$$

$$C = \log_4 16$$

$$C = 2$$

$$n^C = n^2$$

$$f(n) = n!$$

$$f(n) > n^C$$

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

$$\underline{\underline{11.}} \quad T(n) = 4T(n/2) + \log n$$

$$C = \log_2 4$$

$$C = 2$$

$$n^C = n^2$$

$$f(n) = \log n$$

$$n^C > f(n)$$

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

$$\underline{\underline{12.}} \quad T(n) = \sqrt{n} T(n/2) + \log n$$

$$C = \log_2(n)^{1/2}$$

$$C = \frac{1}{2} \log n$$

$$n^C = n^{\frac{1}{2} \log n}$$

$$f(n) = \log n$$

$$f(n) > n^C$$

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



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

$$C = \log_2 3$$

$$C = 0.581$$

$$n^C = n^{0.581}$$

$$f(n) = n$$

$$n^C > f(n)$$

$$\textcircled{13} \quad T(n) = \Theta(n^{0.581})$$

$$\underline{14.} \quad T(n) = 3T\left(\frac{n}{3}\right) + \sqrt{n}$$

$$C = \log_3 3$$

$$C = 1$$

$$n^C = n$$

$$f(n) = \sqrt{n}$$

$$n^C > f(n)$$

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

$$\underline{15.} \quad T(n) = 4T\left(\frac{n}{2}\right) + cn$$

$$C = \log_2 4$$

$$C = 2$$

$$n^C = n^2$$

$$f(n) = cn$$

$$n^C > f(n)$$

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

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

$$C = \log_4 3$$

$$C = 0.792$$

$$n^C = n^{0.792}$$

$$f(n) = n \log n$$

$$f(n) > n^C$$

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

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

$$C = \log_3 3$$

$$C = 1$$

$$n^C = n$$

$$f(n) = n/2$$

$$n^C > f(n)$$

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

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

$$C = \log_3 6$$

$$C = 1.6309$$

$$n^C = n^{1.63}$$

$$f(n) = n^2 \log n$$

$$f(n) > n^C$$

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



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

$$C = \log_2 4$$

$$C = 2$$

$$n^C = n^2$$

$$f(n) = \frac{n}{\log n}$$

$$n^C > f(n)$$

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

22.  $T(n) = T(n/2) + n(2 - \cos n)$

$$C = \log_2 1$$

$$C = 0$$

$$n^C = 1$$

$$f(n) = n(2 - \cos n)$$

$$f(n) > n^C$$

$$T(n) = \Theta(n(2 - \cos n))$$

20.  $T(n) = 64T(\frac{n}{8}) - n^2 \cdot \log n$

$$C = \log_8 64$$

$$C = 2$$

$$n^C = n^2$$

$$f(n) = -n^2 \cdot \log n$$

$$f(n) > n^C$$

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

21.  $T(n) = 7T(n/3) + n^2$

$$C = \log_3 7 = 1.7712$$

$$n^C = n^{1.77}$$

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

$$f(n) > n^C$$

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