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SUBJECT : DESIGN AND ANALYSIS OF ALGORITHM

SUBJECT CODE : TCS 505

Tutorial - 4

Ans 1 =

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

$a = 3 \quad b = 2$

$k = \log_2 3 = 1.58$

$n^2 > n^{1.58}$

$= \Theta(n^2)$

Ans 2 =

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

$k = \log_2 4 = 2$

$n^2 = n^2$

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

Ans 3 =

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

As $F(n)$ is not a polynomial

$\therefore$ Master's Theorem does not abbly.

Ans 4 =

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

This recurrence relation Can't be Solved using Masters method.

Ans 5 =

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

$$k = \log_4 16 = 2$$

$$n^2 > n$$

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

Ans 6 =

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

$a = 2$ $b = 2$ $K = 1$ $p = 1$

Using Extended Master's Theorem

$$T(n) = aT(n/b) + \Theta(n^k \log^p n)$$

$a = b^k$ $2 = 2$

$$T(n) = \Theta(n^{\log_2 2} \log^{1+1} n)$$

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

Ans 7 =

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

Using Extended Master's Theorem

$$T(n) = aT(n/b) + \Theta(n^k \log^p n)$$

$a = 2$. $b = 2$ $k = 1$ $b = -1$

$p = -1$

$$\therefore T(n) = \Theta(n^{\log_2 2} \log\log n)$$

$$\Theta(n \log\log n)$$

Ans 8 = $T(n) = 2T(n/4) + n^{0.51}$

$a = 2 \quad b = 4$

$k = \log_4 2 = 0.5$

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

$\Theta(n^{0.51})$

Ans 9 = $T(n) = 0.5T(n/2) + n^{-1}$

As $a < 1 \therefore$ Master's Theorem does not apply.

Ans 10 = $T(n) = 16T(n/4) + n!$

$k = \log_4 16 = 2$

$n^2 < n!$

$= \Theta(n!)$

Ans 11 = $T(n) = 4T(n/2) + \log n.$

~~k = log~~ $a = 4 \quad b = 2 \quad k = 0 \quad p = 1$

Using extended Master Theorem

$T(n) = aT(n/b) + \Theta(n^k \log^p n)$

$a > b^k$
$4 > 2^0$

$\Theta(n^{\log_2 4})$

$= \Theta(n^2)$

Ans 12 = $T(n) = \sqrt{n}\,T(n/2) + \log n$

As a is not constant!

$\therefore$ Master's Theorem doesn't apply.

Ans 13 = $T(n) = 3T(n/2) + n$

$k = \log_2 3 = 1.58$

$n^{1.58} > n$

$= \Theta(n^{1.58})$

Ans 14 = $T(n) = 3T(n/3) + \sqrt{n}$

$k = \log_3 3 = 1$

$n^1 > \sqrt{n}$

$= \Theta(n)$

Ans 15 = $T(n) = 4T(n/2) + cn$

$k = \log_2 4 = 2$

$n^2 > n$

$= \Theta(n^2)$

Ans 16 = $T(n) = 3T(n/4) + n\log n$

Using Extend Master's Theorem

$T(n) = aT(n/b) + \Theta(n^k \log^p n)$

$a = 3 \quad b = 4 \quad k = 1 \quad p = 1$

$a < b^k$

$3 < 4^1$

$p >= 0$

$\therefore \quad T(n) = \theta(n^k \log^p n)$

$= \theta(n \log n)$

Ans 17=

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

$k = \log_3 3 = 1$

$n^1 = n$

$\theta(n \log n)$

Ans 18=

$T(n) = 6T(n/3) + n^2 \log n$

Using Extended Master's Theorem

$T(n) = aT(n/b) + \theta(n^k \log^p n)$

$a = 6 \quad b = 3 \quad k = 2 \quad p = 1$

$a < b^k$

$6 < 3^2$

$p >= 0$

$\therefore \quad T(n) = \theta(n^k \log^p n)$

$\theta(n^2 \log n)$

A A=

$$T(n) = 4T(n/2) + n \log^{-1} n$$

Using Extended Master's Theorem

$$T(n) = aT(n/b) + \theta(n^k \log^p n)$$

$a = 4$ $b = 2$ $k = 1$ $p = -1$

$a > b^k$

$4 > 2^1$

$$T(n) = \theta(n^{\log_2 4})$$

$$\theta(n^2)$$

A 20 =

$$T(n) = 64T(n/8) - n^2 \log n$$

As $f(n)$ is -ve

∴ Master's Theorem Doesn't Apply.

A 21 =

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

$k = \log_3 7 = 1.77$

$n^{1.77} < n^2$

$= \theta(n^2)$

A 22 =

Master's Method doesn't apply.