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Tutorial - 4 (Masteris Method)
1. T(n) = 3T(n/2) + n^2
    a=3, b=2, f(n)=n^2; a>1, b>1
       (= log d = log 3 = 1.58
       Mc = 41.18
        : f(n) > n^{c}
: T(n) = O(f(n)) = O(n^{2})
2. T(n) = 4T(n/2) + n2
      a=4, b=2, f(n^2)

(= log_2 a^2 = 2
       n^{c} = n^{2}
       =) f(n) = n^{c}
T(n) = O(n^{c} \log n) = O(n^{2} \log n)
3. T(n) = T(n/2) +2m
       a = 1, b = 2, f(n) = 2^n
        c= log_1 = 0
         n^{c} = n^{o} = 1
1 < 2^{n} \Rightarrow f(n) > n^{c}
T \cdot c = O(n^{o} \log n^{o}) O(2^{n})
    T(n) = \partial^n T(n/2) + n^n
      a=a^n, b=a f(m)=n^n
c=\log_2 a^n=n
n^c=n^n
                                     f(n) = n^{c}
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:. O(nmlogn)

5.  $T(m) = 16T(\frac{n}{u}) + n$ 

a = 16 16 = 2 f(n) = n

c= logy16 = 92

 $n^{c} = n^{2}$   $n^{c} > f(n)$   $T \cdot c = O(n^{2})$ 

T(n) = aT(n|2) + mlogn  $a = a, b = a \qquad f(n) = nlogn$  = n' log'n

e=log\_0 = log\_2 = 1

 $n^{c} = n' \cdot \Rightarrow log_{b}\alpha = k$ and p > -1  $T \cdot c = O(m^{k} log_{p}^{p+1} m)$   $= O(n log_{p}^{2} m)$ 

 $T(n) = a \dagger (n/2) + n / log n$   $a = a, b = a, \qquad f(n) = o(n) \Rightarrow n k = 1, p = -1$  (log n)

log b = log 2 = 1 = K

and p=-1

Til= O (nk loglogn) = O(nk loglogn)

8. 
$$T(m) = 2T(\frac{m}{4}) + m^{0.5}$$

$$a=2$$
,  $b=4$ 
 $\log_{1} a = \log_{1} 2 = 0.5$ 
 $k=0.51$ ,  $p=0$ 
 $\log_{1} a = \log_{1} 2 = 0.5$ 

$$T \cdot C = O\left(\frac{n^{0.51} \log n}{\log n}\right) = O(n^{0.51})$$

g. 
$$T(n) = 0.5T(n) + \frac{1}{n}$$

$$a = 0.5$$
,  $b = 2$ ,  $k = -1$ 

$$a = 0.5$$
,  $b = 2$ ,  $k = -1$   
 $logh ab = log_2 0.5 = -1 = K$ 

$$T - C = O(n^{k} \log^{p+1} n)$$

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

10. 
$$T(n) = 16T(n/4) = m1$$

$$T(n) = 16T(n/4) = n1$$
 $a = 16, b = 4, f(n) = n! = n^n, f = 0$ 

$$T \cdot C = O(n^n + \log^0 n) = O(n^n)$$

$$a = 4$$
  $b = 2$   $k = 0$   $p = 1$ 

11. 
$$T(n) = 4T(n/2) + log n$$
  
 $a = 4 + b = 2 + k = 0 + p = 1$   
 $log b = log 24 = 2 > k$ 

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

rage No\_ 12.  $T(n) = \sqrt{n} T(\frac{n}{2}) + \log n$ a=Jn, b=2 k=cogno, p=1logba = log n/2 = 1 > K  $T \cdot C = O(m^{1/2})$ 13. I(n)=31(n/2)+n a=3, b=2, k=1, p=0lega = log 3 = 1:58 > k :. T.C= O(n158) 14. T(n) = 3T(n/3) + Jn a = 3 b = 3 f(n) = Jn K = 1/2 f(n) = 0log 0 = log 3 = 1 > k :. T' L = 0(n) 5. T(n) = HT(n/2) + (n a=4, b=2, f(n)=(on, k=1), p=0log a = log 4 = 2 7 K  $of n^2$ 16.  $T(n) = 3T(n/4) + n \log n$  a=3 b=4 on K=1 p=1  $\log_{1} a = \log_{1} 3 = 0.79$ ,  $\Re_{1} 2$ · · · O(nklogPn) = o(nlogn)

Page No. 17. T(m) = 3T(m/3) + m/2  $\alpha = 3$  b = 3 , f(m) = m/2 ,  $\rho = 0$ , k = 1  $c = log_3 3 = 1 - k$ in Tic=  $O(n^k \log^{p+1} n) = O(n \log n)$ 18.  $T(n) = 6T(n|3) + n^2 \log n$  a = 1, b = 3 k = 2, p = 1  $\log_{10} a = \log_{10} 6 = 0.63 \langle k \rangle$  and p > -1 $T \cdot C = O(n^k \log^{p+1} n) = O(n^2 \log^2 n)$ 19.  $T(n) = 4T(n/2) + n/\log n$  a = 4, b = 2, k = 1, p = -1  $\log_{2} a = \log_{2} 4 = 2$  > k· . T. (= 60 R(n2)  $T(n) = 64 T(n/8) + (-n^2 \log n)$  a = 64, b = 8, k = a p = 1  $\log_{10} a = \log_{10} 64 = a = k$  and p > -1200 To  $C = O(n^k \log^{p+1} n) = O(n^2 \log^2 n)$  $T(n) = 7T(n|3) + n^2$   $a = 7 \quad 16 = 3 \quad 16 = 2 \quad p = 0$   $log_b a = 1.77 \quad \langle k$  $i \cdot T \cdot C = \delta(n^k \log^k n) = \delta(n^2)$ 

22. 
$$T(n) = T(n/2) + n(2-logn)$$
 $a=1, b=2, f(n) = k=1, p=0$ 
 $log_1 a = log_2 1 = 0, k$ 
 $T(l) = 8(nklog_1 p_1) = 8(n)$