TUTORIAL-04 Peractice Perobleme on Master theorem: lu master theorem applies to encurrences ey the following form: T(n) = aT(n/b) + f(n)
where as and b>1 are constants and f(n) is an asymptotically positive function. There are 3 (1) ij fcn) = O(nlogba-E) for some constant Eso, then T(n) = (0 (n 108,5 a) f(n) = A(nlogbalogkn) with k>0, then T(n) = (109 ba logk+1 n). (3) if f(n) = 52 (n<sup>109</sup> a+e) with E)0 and f(n) satisfies ten enegularity condition, then T(n)= (f(n)). Regularity condition: af (n(b) \le cf(n))
for some constants (<1) and all sufficiently Q(1)  $T(n) = 3T(n/2) + n^2$ a = 3, b = 2,  $f(n) = n^2$ : a and b acce constant and fin) is a tre " Master's tworem is applicable C= log a= log 3 = 1.58 => n° = n' · 58 , which is n° > n' · 58 case 3 is applied here => T(n) = O(n²) Q(2)  $T(n) = 4T(n/2) + n^2$ a = 4, b = 2,  $f(n) = n^2$ and b constant 4 f(n) is the func. aru Masteris tueorem applicable 14

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                - dog 4 = dog 2 = 2 log 2 = 2
   case 2 is applied here
      T(n) = T(n/2) + 2^n
    a 4 b ave constants & f(n) is tre func.
          tenorem is applicable.
       = log a = log 1 = 0
             is applied
       T(n) = O(2^n)
Q(4):-T(n)=2^nT(n/2)+n^m
a = 2^n, b = 2, f(n) = n^n
 i a is not constant, value dépend on n'
 : Masteris theorem is not applicable
Q(5):- T(n)= 16 T(n/4) + n
     a = 16, b = 4, f(n) = h
 i a 4 b alle constant & f(n) is the finc.
  · Master's theorem is applicable
 = \frac{1}{2} \log a = \log 16 = \log 4 = 2 \log 4 = 2

= n^2 = n^2 = \log 4 = 2
  i case 1 is applied
  \Rightarrow |T(n) = O(n^2)|
Q(6):- T(n) = 2T(n/2) + mlogn
     \alpha = 2, b = 2, f(n) = n \log n
 e a 4 b are constant and for is a
                tunc.
                     is applicable.
            theorem
    Master's
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YOUVA b=2 f(n)=n/lognau constant 4 for non-polynomial difference blu Q8:- T(n) = 2T(n/4) + no.51 a = 2, b = 4,  $f(n) = n^{0.51}$ a and b are constant & f(n) is a trefunc. · Master's theorem is applicable C = log q = log 2 = 0.50nc = n0.50 · f(n)>nc : Case 3 is applicable  $\Rightarrow T(n) = O(n^{0.51})$ (191- T(n) = 0.5 T(n/2) + 1/n a = 0.5, b=2, f(n) = 1/5 1. a < 1 beilden ? 1 9.00 ... Master's theorem is not applicable Q 10:- T(n) = 16 T(n/4) + n! a = 16, b = 4, f(n) = n!i. a 4 b auce constant 4 fcn) is the funcapplicable theorem is 5 0 5 1000

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            au constant & f(n) is
     Masteris theorem is applicable
      T(n) = O(n^2)
Q(12):- T(n) = Jn T(n/2) + logn
   a = Jn, b = 2, f(n) = logn
in a is not constant
 . Masteeis theorem is not applicable
a(13):- T(n)= 3T(n/2) + n
    a = 3, b = 2, f(n) = h
 i a & b are constant & fon) is the func.
 . Master's theorem is applicable.
C = \log_{2} a = \log_{2} 3 = 1.58
n^{c} = n^{1-58}b
f(n) < n^{c}
case 1 is applied.
 =) T(n) = O(n^{1.58})
Q(14):- T(n) = 3T(n/3) + In
     a=3, b=3, f(n)=Jn
             constant
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    Masteu's Heerrem is applicable.
     C = log a = log 3 = 1
      case 1 is applicable
         (n) = 4T(n/2) + c.n
          auc constant & f(n) is the func.
 · Masteris theorem is applicable

C = log a = log 4 = log 2^2 = 2log 2 = 2

· n^{c-} n^2

· f(n) < n^c
           i. f(n) <ne
  =) T(n) = O(n2)
Q(16):- T(n) = 3T(n/4) + nlogn
      a = 3, b = 4, f(n) = n \log n
 at baue constant & for is the func.
· Master's tererem is applicable
  c = log_b a = log_3 = 0.79
n^c = n^{0.79} = f(n) > n^c
.. case 3:- is applied
  \Rightarrow T(n) = O(nlogn)
O(17):-T(n) = 3T(n/3) + n/2
      a = 3, b = 3, f(n) = n/2
 a & b au constant 4 f(n) is tre func.
 .. Master's tworem is applicable
    c = \log_5 a = \log_3 = 1
              applied
        (n) = 0 (n logn)
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YOUVA Q(18):- T(n) = 6T(n/3) + n2 logn 6 , b = 3 ,  $f(n) = n^2 \log n$ b are constant of fond is the func. Masteris theorem is applicable C = log a = log 6 = 1.63 3 is applied (n) = 4 T (n/2) + mlogn  $f(n) = n \log n$ are constant & for is the func.  $C = \log_2 a = \log_2 4 = \log_2 2^2 = 2\log_2 2 = 2$   $n^c = n^2$   $f(n) < n^c$ ! case 1 is applied  $\Rightarrow$   $|T(n) = O(n^2)|$ 0 (20):- T(n) = 647(n/8) - m² logn ... a and b are constant and fin) is -ve func. .. reaster's tereorem is not applicable Q(21):- T(n) = 7T(n/3) + n2 q = 7, b = 3,  $f(n) = n^2$ : a & b are constant & f(n) is the func. · Master's tworem is applicable  $C = \log_3 a = \log_3 7 = 1.77$   $n^c = n^{1.77}$  f(r)i. f(n) > nc : case 3 is applied, =) T(n) = O(n2) Q(22): T(n) = T(n/2) + m(2-(08n))f(n) is not degular function theorem is not applicable: