Norme: - Abhay Rawat Course: - B. Tech (CSE) Sec. :- B Roll No: - 01 University Roll No:- 1961002 Design & Abralysis of Algorithm Tutorial Sheet 4 Ear each of the following recurrences, que an expression for the runtime T(n) if the recurrence con be solved with raster Theorem. Otherwise, industes that the Master Theorem does not apply) T(n) = 3T(n/2) + m2. Moster equiation is T(n) = a T (n/b) + f(n) Since B>1 and a>0 Hence here master

method is applied.

c = log, a => c = log, 3 mc => m log2 3  $f(n) = m^2$ 

me > f(n)  $T(m) = O(m^2)$  Ques 2  $T(n) = 4T(n/2) + m^2$ And Moster Method is  $T(m) = aT(m/b) + m^2 f(m)$ Here a = 4 & b = 2Since b > 1 and a > 0 Hence here moster method is applied.  $C = log_b a = log_2 4 = 2 log_2 2 = 2$   $m^c = m^2 \qquad f(m) = m^2$   $m^c = f(m)$   $T(m) = O(m^2 log_m)$ 

Ques 3 T(n) = T(n/2) + 2<sup>m</sup> Ans Master Method is

T(n) = a T(n/B) + f(n)

Here

a=1 & B=2

Since b>1 & a>0 Hence here mosters method is applied

$$c = log_B a = log_2 1 = 0$$
  
 $m^c = m^o = 1$   $f(m) = 2^m$ 

$$m^c < f(m)$$

$$T(m) = o(2^m)$$

Quesy T(n) = 2m T(n/2) + mm

Ame raster equation is T(n) = a T(n/b) + f(n)

Here

a = 2m, B = 2

stere a is depending on n since we com't apply raster method.

Ques5 T(m) = 16T(m/4)+m.

Ans raster equation is

T(m) = a T(m/b) + f(m)

Here

a=16, b=4

Since B> 1 and a>0. Hence here master method is applied

 $C = log_b a \Rightarrow c = log_4 16 \Rightarrow log_4 4^2 = 2$   $m^c = m^2 \qquad f(m) = m$ 

m=> f(m)

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

Ques6 T(n) = 2T(n/2) + m logm sons Master equation is T(m) = aT(m/B) + f(m)Here a = 2, b = 2Since b) 1 and a) 0 Hence here master method is applied. c = log, a =) c = log, 2 = 1 f(n) = m log n n° < f(n) (m)= 0(mlogm) Ques7 T(n) = 2T(n/2) + n/log/n Ame Master equation is T(m) = aT(m/B) + f(m)Here a = 2, B = 2Since b>1 and a>0. Hence here master method is applied c = log , a => c = log 2 = 1 mc = m' f(n) = n/logn m => f(m) T(m) = O(m)

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

Anster Method equation is

 $T(n) = 2T(m/4) + m^{0.51}$ 
 $T(n) = aT(m/b) + f(n)$ 

Here

 $a = 2$ ,  $b = 4$ 

Sience  $b > 1 & a > 0$ . Hence here master

method is applied

 $C = log > a \Rightarrow C = log > 2 = log > 4 = log$ 

$$T(n) = O((lgn)/n)$$
Questo  $T(n) = 16 T(n/4) + m!$ 
Ans tasten equation is
$$T(m) = a T(n/b) + f(n)$$

$$a = 16, b = 4$$
Since  $b > 1 & a > 0$ . Hence here master
method is applied
$$C = log > a \Rightarrow C = log > 16 = 2$$

$$m^{c} = m^{2} \qquad f(m) = m!$$

$$m^{c} < f(m)$$

$$T(m) = e(m!)$$
Quest  $T(m) = 4T(m/2) + log m$ .

Ans taster equation is
$$T(n) = a T(n/b) + f(n)$$

$$a = 4, b = 2$$
Since  $b > 1 & a > 0$ . Hence here master
method is applied
$$C = log > a = log = 4$$

$$C = log > a = log = 4$$

$$T(m) = log = 6$$

$$T(m) = log = 6$$

$$T(m) = log = 6$$

Ques 12 T(n) = squet (n) T(n/2) + log n Ans Master equation is T(n) = aT(n/b) + f(n) $a=\sqrt{m}$ , b=2n since use comit Here a is depending on apply raster method Ques 13 T(m) = 3T(m/2)+m Ans raster rethod equation is T(m) = aT(m/b) + f(m)a = 3, B = 2Since B>1 & a >0. Hence here moster method is applied c = logs a => c = logs 3 mc = m log23 f(m) = mn° > f(n)  $T(m) = O(m^{\log_2 3})$ Ques 14 T(m) = 3T (m/3) + Jm ams raster rethod equation is T(n) = a T(n/b) + f(n)

Since 
$$a > 0$$
 &  $b > 1$ . Hence here moster  
method is applied  
 $c = log_b a \Rightarrow log_3 3 = 1$   
 $m^c = m'$   $f(m) = \sqrt{m}$   
 $m^c > f(m)$   
 $T(m) = O(m)$ 

Ques 15 T(m) = 4T(m/2) + cm.

Ans Moster Method equation is T(n) = a T(n/b) + f(n)Here,

a = 4, B = 2

Since B>1 & a> 4. Hence here masters method is applied

$$m^c = m^2$$

$$f(m) = m$$

mc > f(n)

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

Ques 16  $T(n) = 3T(n/4) + n \log_2 n$ Ans Master Method equation is T(n) = aT(n/b) + f(n)

Here a = 3, B = 4 Since b) 1 & a) 0. Hence here master method is applied c = log/s a => c = log/43 mc = mlogu3 f(n) = m log n m < f(m) T(m)= 0 (m log n) Ques 17 T(m) = 3T(m/3) + m/2 some Master Method equation is T(m) = a T(m/B) + f(m)a = 3, b = 3Since a >0 & b>1. Hence here moster method is applied c = logs a => c = logs 3 = 1 m°= m' f(m) = m/2 $m^c = f(m)$ T(n) = 0 (n lg n) Ques 18 T(n) = 6T(n/3) + m2 log) m Ams Master Method equation is

T(n) = aT(n/b) + f(n)

Here B=3 Since B>1 & a > 0. Hence here moster method is applied c = logo a => c = log 3 6 mc = m logs 6  $f(n) = m^2 \log m$ m° < f(m) T(n) = 0 (n2 log n) Ques 19 T(n) = 4T(n/2) + n/logn Ans Master Method equation is T(m) = aT(m/B) + f(m)a=4, B=2 Since B>1& a>0. Hence here moster mothod is applied. c = logs a => c = log2 4 = 2  $m^c = m^2$ f(m) = m/logm

$$m^2 \rangle f(m)$$

$$T(m) = o(m^2)$$

ans Moster Method equation is  $T(n) = a T(n/B) - m^2 \log n$  T(n) = a T(n/B) + f(n)

Sleve a = 64 b = 8Since b>1 & a>0. Hence here moster method is applied.  $c = log_8 64 = 2$   $m^c = m^2$   $f(m) = m^2 log m$   $m^c < f(m)$   $T(m) = 0 (m^2 log m)$ Ques 21  $T(m) = 7 T(m/3) + m^2$ Ans Master Method equation is

Here a = 7, b = 3

Since B>1&a>0. Hence here master method is applied.

 $c = \log_3 a = \log_3 7$   $m^c = m^{\log_3 7} \qquad f(m) = m^2$   $m^c < f(m)$   $T(m) = O(m^2)$ 

T(m) = aT(m/b) + f(m)

Ques  $2^2 T(n) = T(n/2) + m(2 - \cos m)$ Ans Master Method equation is T(n) = a T(n/b) + f(n)Here Since b>1 & a>0. Hence here moster method is applied  $c = log > a \Rightarrow c = log > 1$   $m^c = m^{log > 1}$  f(m) = o(m(2 - cos m)) T(m) = o(m)