**Computer Science and Engineering Discipline**

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**PROBLEM :** ) T(n) = 2 T(n/2) + nlog2n

Here *a =2, b = 2* and **f(n) = nlog2n, p= 1.**

**x= logba** = **log22** = 1. Here **x=p**, but **nx ≠** **f(n),**

**Find out the solution of the recurrence in term of asymptotic notation.**

**Solution :**

nlogba = nlog22= n1 = n

Comparing nlogba= n and f(n) = n log n

Does not satisfy either Case 1 or 2 or 3 of the Master’s theorem .

Case 3 states that f(n) should be polynomially larger but here it is asymptotically larger than n logb a only by a factor of log n

Let us take n=2m. Then we have the recurrence

m) = 2T(2m-1)+ 2mlog2(2m) = 2T(2m-1) + m2m

Calling T(2m) as f(m), we get that

f(m) = 2f(m-1)+m2m

= 2(2f(m-2)+(m-1)2m-1)+m2m

= 4f(m-2) + (m-1)2m+m2m

= 4(2f(m-3) + (m-2)2m-2) + (m-1)2m + m2m

= 8f (m-3) + (m-2)2m + (m-1)2m + m2m

Proceeding on these lines, we get that

f(m) = 2mf(0) + 2m(1+2+3+....+m)

= 2mf(0)+2m(1+2+3+…+m) = 2m  f(0) +2m +

= 2m f(0) +m(m+1)2m-1

Hence , T(n) = n(T1) + n ( = Θ(*n*log2*n*).

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