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Discrete Mathematics
Recurrence Relation

Solution for the recurrence relation of Binary search

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We are now going to see the solution for the recurrence relation of binary search, so the recurrence relation goes like Tn is Tn/2 + 1 and the initial condition is given by T1 = 0, we know that Tn/2 can be written as Tn/4 + 1, and +1 remains as it is.

Now 4 can be written as 2 square and hence this becomes Tn/2 square + 2, I have opened the bracket and added the 2 once, N/2 square if I expand it as I had done earlier Tn/2 square can be written as Tn/2 cube + 1, and +2 remains as it is, again opening the bracket I can write this as Tn/2 cube + 3, now what happens at the Rth step, when we write it, it becomes Tn is Tn/2 to the R + R,
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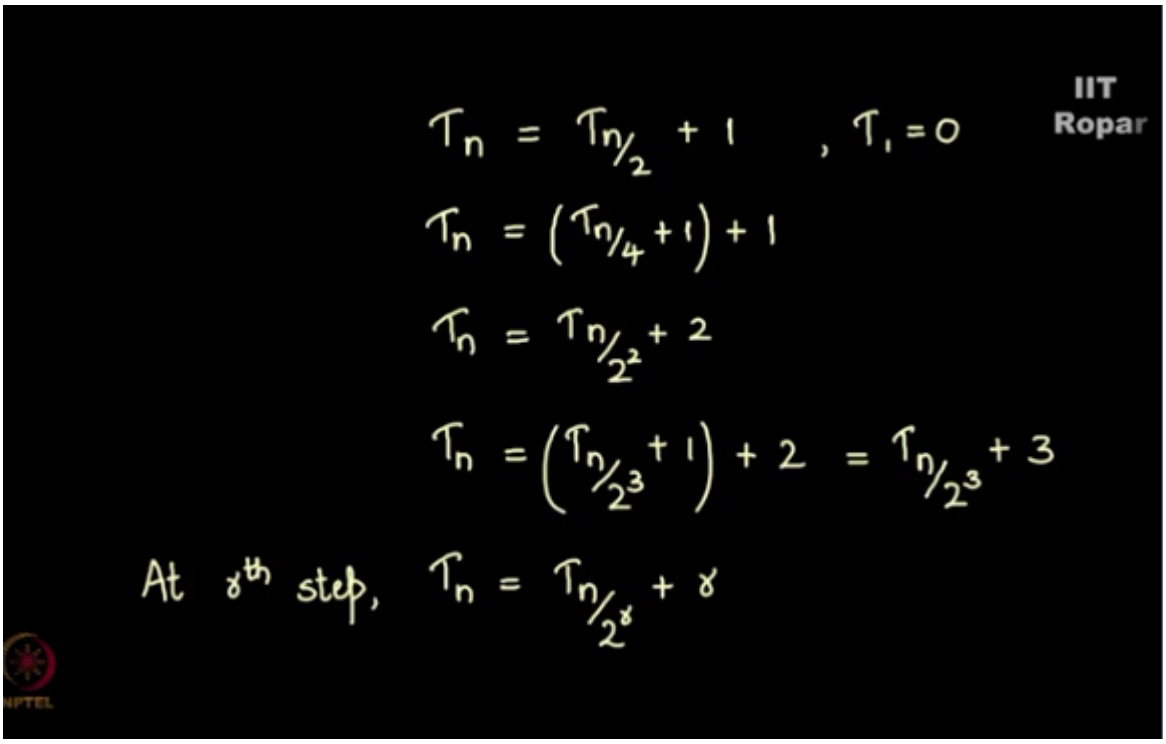

you might be wondering here how did I get this, observe the previous step you might find the pattern and hence Tn is Tn/2 to the R + R.

Now we know that T1 is 0, and we have here Tn/2 to the R, so N/2 to the R = 1, I am going to write it like this which implies N is 2 to the R, now if N is 2 to the R, what does R become? R = log N, and Tn becomes Tn/2 to the R + R substituting for Tn/2 to the R, and R we get Tn is T1 + log n, T1 as we know is 0 and hence Tn becomes log n, so this is the solution for the recurrence relation of binary search.

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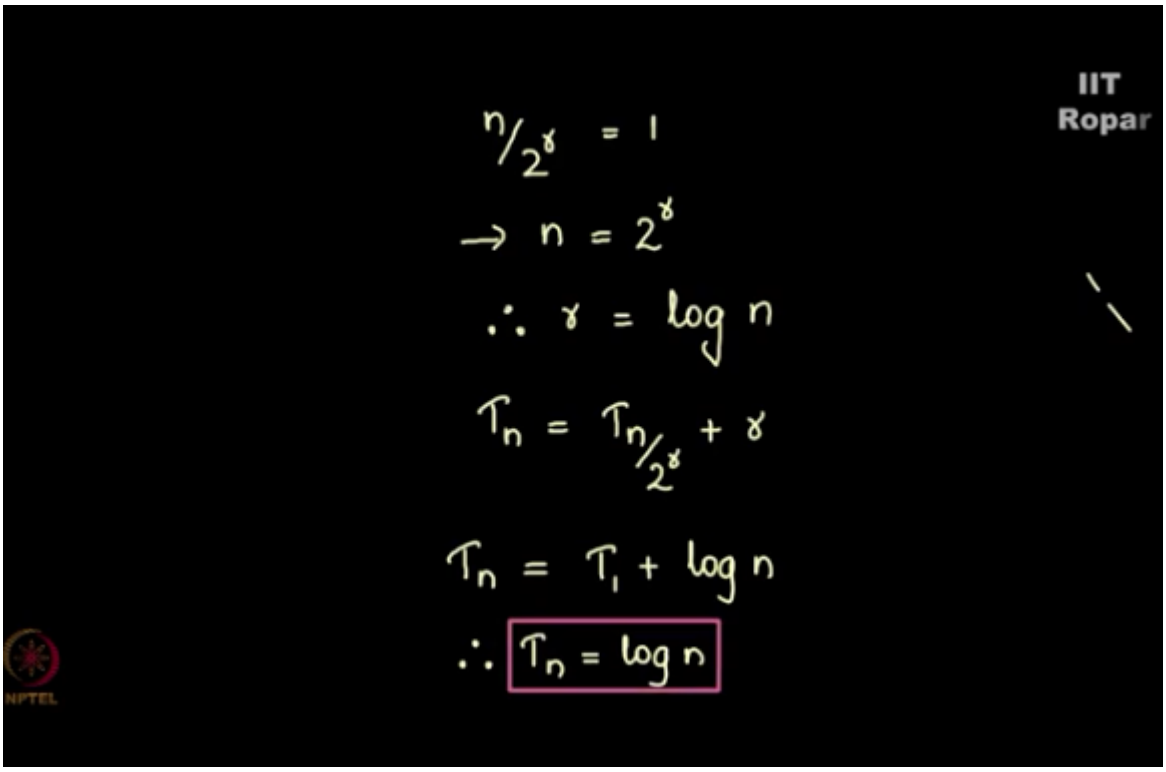

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