NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Recurrence Relation

Number of ways of climbing steps:
Recurrence relation

By
Prof. S.R.S Iyengar
Department of Computer Science
IIT Ropar

Here is a typical example of how sometimes to solve a problem you may have to solve the same problem with the smaller instance, there will be sub problems sitting there which when solved you will be solving the bigger problem, for example how do you climb 100 steps,
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a very simple question, forget the previous question, simply you want to climb 100 steps, what do you do? Climb 99 steps and then climb the last step,
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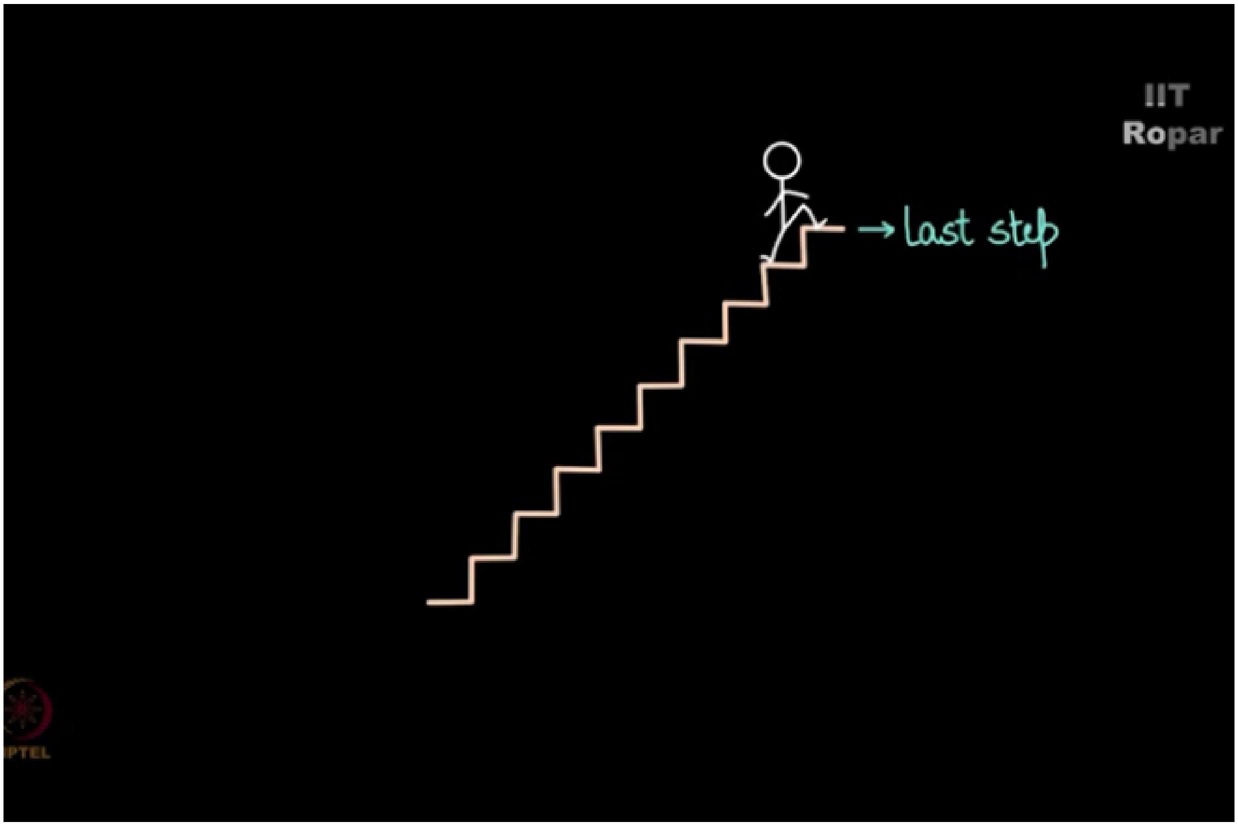

it sounds like a crazy strategy, but you see every, as I told you in the beginning of this chapter every giant mile, every giant journey starts from a simple first step, right, okay.

Now getting back to the problem the question was in how many ways can you go reach the nth step, let the answer be AN, let AN denote the total ways in which you can start from the first step and then reach the nth step by taking 1 or 2 steps. Now you see how you will end at the nth step, you are either in n-1th step and you take 1 step jump or you are at n-2 step and you are taking a jump of 2 steps,

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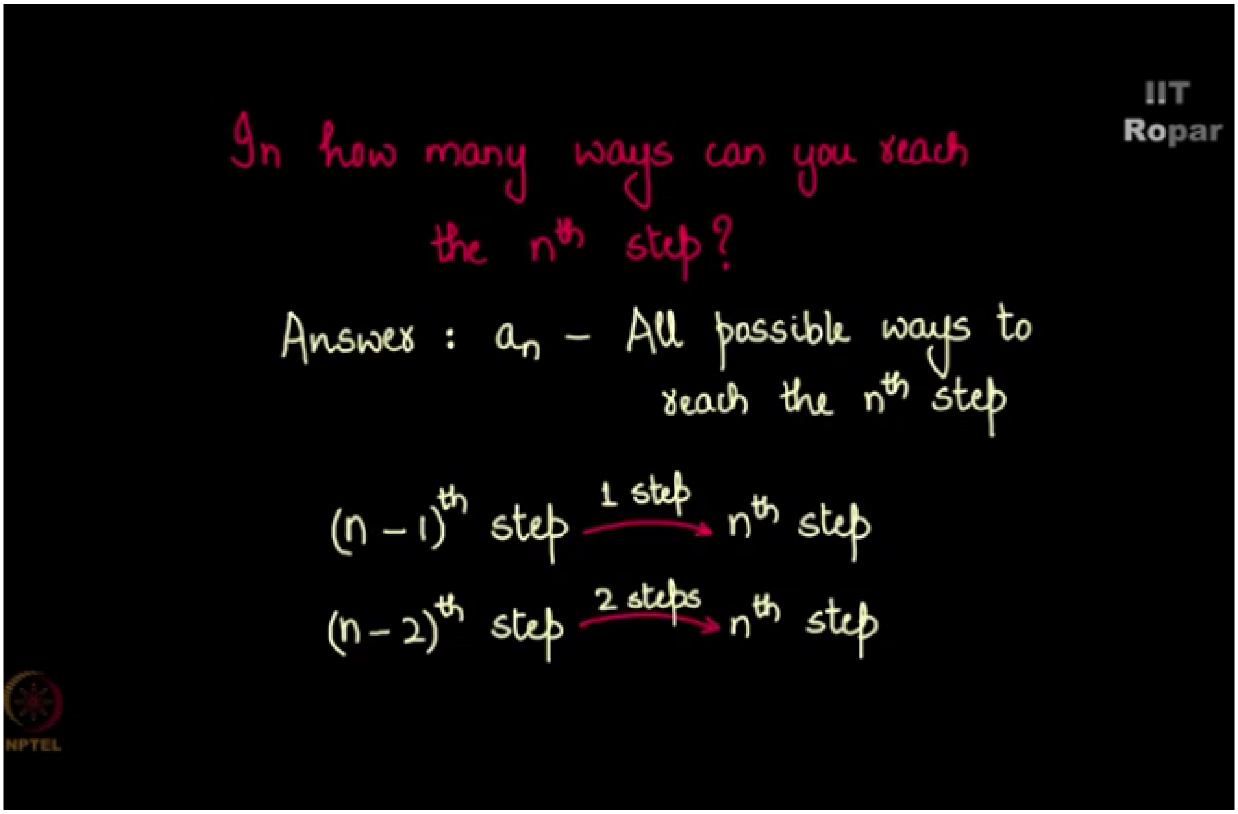

so patiently observe, think, you will realize that the answer for AN is equal to AN-1 + AN-2, why is that? The total number of ways in which you can go and reach the Nth step is precisely equal to the total number of ways in which you can reach AN-1 step and take 1 step + AN-2th step and take a 2 step jump,

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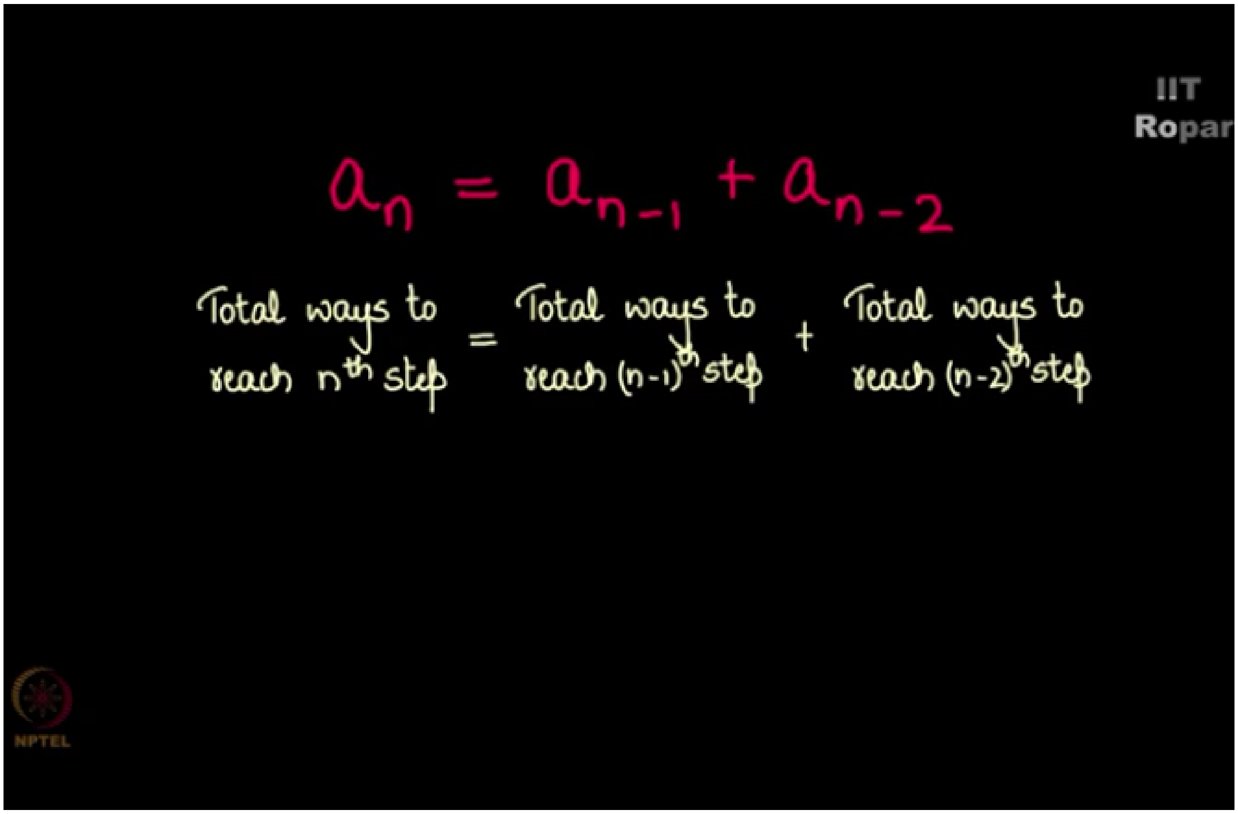

these are mutually exclusive events, that are complicated way of saying in math that 2 things a problem can be divided into 2 cases, and then you can call the answer to be case 1 + case 2, the case 1 here is you go up to AN-1 and take one step, case 2 is you go up to AN-2th step and take or 2 step link, so AN = AN-1 + AN-2, so if you want to compute A10 it will be A9+A8, but you know A9 recursively speaking is A8+A7, and then your A8 is A7+A6, you can keep breaking this smaller and smaller and you will have all terms A1's and you know what is A1, A1 is 1, so adding up you will get the answer for A10.

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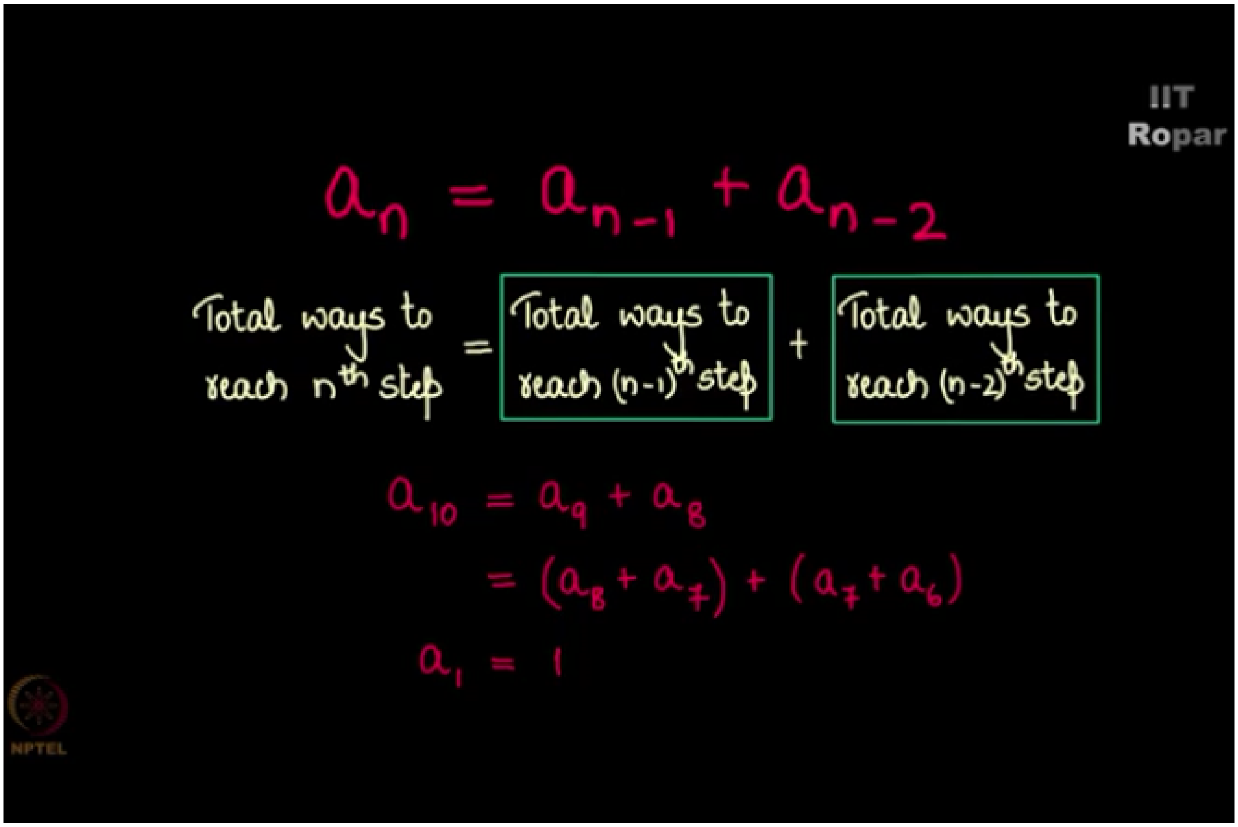

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