

NPTEL

NPTEL ONLINE COURSE

Discrete Mathematics

Let Us Count

Permutations - Part 3

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We asked a question in how many ways can we pick three elements from five elements? Right. Three from five. There's a notation for this for ease of usage, we call it $5P3$ in how many ways can you bring three elements from five elements, right, where ordering is important. Three friends will stand in different ways. Each way is considered different from the other right. There are three factorial ways with three friends and we enumerated that the 60 ways that we got is basically the representation $5P3$. This is just a standard. One needn't worry much about it but whenever you see a symbol like this in general nPr it means that this is the question of picking r people from n people and these are people taking different photos of them and the total number of ways for this to happen. So basically total ways to line up r objects out of n objects, and when we line up the way we line up these objects, the order is important. If you take five elements three elements let's say ABC. ABC will be different from BAC and so on. We have discussed that.

Now you saw that $5P3$ is 60 what exactly do you think is $10P4$ by that we mean ten people you pick four people randomly, by randomly I mean you try all possible ways in which you can pick four people and these four people should take all possible pictures. What are the total possible pictures that you can think of? Total ways to line up four people out of ten people. Let us answer this question.

So you see there are these ten people let's say a_1, a_2 up to a_{10} it might help to imagine them in different colors and you have 4 slots for it and the first slot can have any of these 10 numbers and once you put a fellow here from these 10 people you are left with 9 choices for the next one, and

once you put someone here another one here you are left with eight choices for this one and as in always as you can see, ten here, one less means nine here. One less means eight here and one less here means seven. So you can put in ten ways a fellow here and you will be left with nine more ways for this, eight more ways for this, seven more ways for this you may want to pause here think about it. Now we should take the product of these which is 10 into 9 into 8 into 7 is the number of ways in which we can pick four objects from ten objects and line them up and consider all possible orderings. So if it's not clear to you, you probably should revise the rule of products.

So this concept isn't very straightforward. Of course, there are easier ways of explaining this but I leave it to you for you to pause and think about what exactly one means by nPr . It is indeed very difficult for one to get it in the first attempt but as in when we encounter more examples it becomes very clear to you what one means by nPr .

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