NPTEL

NPTEL ONLINE COURSE

Discrete Mathematics

Let Us Count

Combinations - Part 1

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Here we present yet another counting strategy called the combinations. There is a strong link between permutations and combinations which one has to observe carefully. We will as and always solve a lot of problems to make the concept clear to your minds. You will appreciate and enjoy the beauty of this concept. It is elegant yet very rigorous.

Now getting back to our five friends where three people came forward and took their photos in all possible ways what if our friends decided order is not important, how does it matter. It is three of us taking a picture together that matters. So let us not try all possible positions with three of us, let us just take one picture of all three of us. So given five friends in how many ways three people can come forward and take a picture without worrying about all possible orderings.

What we have been seeing so far is nPr, the P there stands for permutations. So we saw that given n people if you pick r people with order respected you will have nPr number of choices. Now let us get back to our previous example of five people and three of them trying to take a picture. You have A, B, C, D, and E and you have three people taking all possible pictures. If you remember it right we saw that for every choice of three people we had three factorial photos. Now let us modify our question. The modification is that these three people once they come forward of course two people go backward and three people will come forward and these three people can change their positions and take three factorial pictures. What if they decide that hey come on all three of us are in the picture why does order matter. Let us take only one picture with three of us in it in some order. Then in how many ways can these five friends take pictures with three of them in it not worrying much about all possible order in which these three people can

take pictures. They just stand in some order and click a picture. In how many ways can they click?

Let us go ahead and enumerate it the way we did for the previous case. So ABC come forward, DE step backward. ABC take a picture. Now please note ACB is not another picture. ABC take a picture and boom it's over. Next comes AB and D another pictures, and they are done. ABE is at another picture and then we have ACD, ACE, then ADE followed by BCD, BDE and then finally CDE. So you have one, two, three, four, five, six, seven, eight, nine, and finally I have left out just one thing which is BCE I left that out. It should be here BC and E, which makes it one, two, three, four, five, six, seven, eight, nine, and ten. There are ten possibilities in which three people can come forward and take pictures out of five people. So this is same as the previous one just that we don't take the 3 factorial combinations of each option which means every single person appeared three factorial number of times in the previous case while these three factorial amount of counting will not happen. Correct. So 5P3 was the total number of ways and I am now going to ensure that I divide this by 3 factorial which gives me the answer from my question in how many ways can five people take a picture with three people coming forward not worrying much about the order. This goes by the name combinations. So 5C3 stands for in how many ways can you pick three people out of five people not worrying much about the ordering of these three people once picked.

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