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Discrete Mathematics

Let Us Count

Permutations - Part 2

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We saw a video where five people let's say A, B, C, D, and E these five girls want to come forward and then take a picture but they have a small constraint that the picture should be taken with three friends only which means two persons, two people should step back. Right. In how many ways can these five girls take a picture ensuring that the picture comprises of precisely three people? Now A, B, C let's say comes forward and as we have seen there are three factorial ways in which they can take a picture. Right. And then A, B, D comes forward and C, E steps back. And you have three factorial ways. You are probably worried if there are anything overlapping between this and this obviously not. In a picture here C is included. In a picture here, D is included and C is not there. Although A and B are definitely there here and here. Right. These are obviously different pictures.

So you have six here and six here. Now let's try enumerating more. ABC, ABD and there are no more options with AB, well there is another one which is ABE, again three factorial ways in which you can make these people take all possible pictures. And you are done. You cannot have AB standing in the pictures anymore because you have exhausted all possibilities with A, B included.

Now next. What is the immediate next possibility? Let me think. So maybe BC. BC and A is already included so I will start with BCD. Three factorial ways. BCE, three factorial ways. With AB we had three possibilities and each possibility had three factorial ways. With BC we have only two because we are excluding the possibility with BC including A because it is exhausted already.

Now AB is done, BC is done. BC along with D, BC along with E exhaust all possibilities. Now let me move onto let's say AD, A and D along with B. Now that's exhausted here as you can see. So this possibility should not be considered. AD along with let's say C. Is that over? No it's not over. So three factorial permutations.

AD along with B is over. AD along with C just got over. AD along with E three factorial permutations. Right and that ends all possibilities with AD. How about AE? AE with D is over. AE with B is over. AE with C is not over as you can see. So AE with C and AE with – that's it. AE with D is over. AE with C just got over. AE with B is over. This is three factorial ways. Done.

Now next. Let me think of different ways of having this. One nice way to exhaust everything is to go in ascending order. Right. Okay. So let me start with C. CDE, three factorial ways. Correct. The last possibility that we are missing here is DB and E again three factorial ways. As you can see ABC, ABD, ABE, BCD, BCE, ADC, ADE, AEC, CDE, and DEB are all the possible ways in which three people can step forward. They are precisely ten in number and each of them can take pictures in six ways so ten of them each of them with six ways is going to be 60 ways. What did we just show? We showed that number of ways in which five people can decide to take pictures with three in each frame all possible ways is going to be precisely 60 ways.

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