BSCMA1002

STATISTICS I NOTES

WEEK 5 NOTES

IIT MADRAS B.S DEGREE

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★ Basic Principles of Counting

You go to a shop with a gift card. It allows you to buy either a shirt or a pant.

SHIRT	PANT
Yellow	Black
Blue	Blue
Green	Brown
Red	

In how many ways can you use a gift card.

4 shirt choices, 3 pant choices, no buying both.
Total 7 choices. There is a dependency here.
Actions are dependent, which means you cannot buy a pant(shirt) if you have bought a shirt(pant).

- Addition Rule: If action A can occur in n_1 diff ways, action B can occur in n_2 diff ways, total no. of occurrences of action A or B is $n_1 + n_2$.

If the card allows you to get a shirt and a pant, you have 3 pant combos with yellow shirt, 3 for blue, 3 for green, 3 for red. Total 12 unique combinations.

- Multiplication Rule: If action A can occur in n_1 ways. action B can occur in n_2 ways (all different), total no. of occurrences of action A and B are $n_1 \times n_2$.

Now if you add in 2 shoe choices, total occurrences = 24

12×2

- If r actions are to be performed in a definite order. Suppose that there are n_1 possibilities for the first action and that corresponding to these possibilities, there are n_2 possibilities for the second action, etc. Then there are $n_1 \times n_2 \times n_3 \times \ldots \times n_r$ possibilities for all r actions.

- Suppose six digit code has 2 alphabets, 4 numbers.
  If repetition allowed :→ $26 \times 26 \times 10 \times 10 \times 10 \times 10 = 6760000$
  If repetition not allowed: → $26 \times 25 \times 10 \times 9 \times 8 \times 7 = 3276000$

- 8 athletes in 100m race. In how many ways can they finish the race? (no ties)

  There are 8 choices for 1st, 7 for 2nd (since 1st place can't appear twice), 6 for 3rd.... and so on.

  By multiplication rule, total ways = $8 \times 7 \times 6 \ldots \times 3 \times 2 \times 1$
  $= 8!$
  $= 40320$

  * $0! = 1$ * $5! = 5 \times 4!$ i.e $n! = n \times (n-1)!$
  In general, for $i < n$, $n! = n \times (n-1) \ldots \times (n-i+1) \times (n-i)!$

- Express $25 \times 24 \times 23$ in factorial form.

$$= \frac{25 \times 24 \times 23 \times 22 \times \ldots \times 1}{22 \times 21 \times \ldots \times 1} = \frac{25!}{22!}$$