**Permutations**

Suppose there are three persons A, B and C contesting for the post of president and vice preside-of an organization and we have to select two persons we can do it in 3! Ways. For example, (A, B), (E C), (A, C) (B, A), (C, B) and (C, A). Here, the first person can be the president and the second person can be the vice president, means here we are talker; about the order of arrangement. The arrangements of a number of things taking some or all of them at a time are called permutations. For example, if there are 'n' number of person’s are we have to select Y persons at a time, then the total

Number of permutations is denoted by or by P(n, r).

First person can be selected in 'n' ways. Second person can selected in 'n -1' ways. Third person can be selected in 'n - 2' ways. Similarly, the th person can be selected in 'n-(r4 1)' = '(n - r + 1)' ways.

Total number of ways of arranging these 'r' selectee persons = n (n-1) (n-2).... (n – r +1) =

**Example 6:**

There are four persons A, B, C and D and at a time we can arrange only two persons. Find the total number of arrangements.

**Solution:**

Total number of arrangements (permutations) is AB.BA, AC, CA, AD, DA, BC, CB, CD, DC, BD and DB or we can say that out of 4 persons we have to arrange

Only 2 at a time, so the total number of permutations s = =

**Example 7:**

In the above question, if all the persons are selected at a time, then how many arrangements are Possible?

**Solution:**

We have to arrange 4 persons, so this can be = =

**Example 8:**

There are 4 flags of different colures. How many Afferent signals can be given, by taking any number: f flags at a time?

**Solution:**

Signals can be given either taking all or some of the flags at a time. Number of signals that can be given by taking 1 flag =

Number of signals that can be given by taking 2 flags =

Number or signals that can be given by taking 3 flags =

Number of signals that can be given by taking 4 flags=

So the total number of signals

= + + + = + = 4 + 12 + 24 + 24 = 64

**Example 9:**

Find the number of ways in which 5 boys and 5 girls: e seated in a row so that:

I. All the boys sit together and all the girls sit Together.

II. Boys and girls sit at alternate positions.

III. No two girls sit together.

IV. All the girls always sit together.

V. All the girls are never together.

**Solution:**

I. All the boys can be arranged in 5! Ways and all the girls can be arranged in 5! Ways.

Now we have two groups (boys, girls) and these 2 groups can be arranged in 2! Ways, [boys-girls and girls-boys] so total number of arrangements is 5! 5! 2! = 28,800

II. Boys and girls sit alternately; this can be arranged like this B GB G B G B G B G or G B G B G B G B G B In the first case boys can be arranged in 5! And girls can be arranged in 5! Ways. In the second case also, the number of arrangement is same as first case so the total number of arrangement = 5! 5! +5! 5! Or =

= 120 x 120 + 120 x 120 = 14,400 + 14,400 = 28,800 ways

III. No two girls sit together - In this case \_\_B\_B\_B\_B\_B\_\_there are 6 spaces where a girl can find her seat.5 girls can be arranged in

= 5 boys can be arranged in

= = 120 ways Total number of arrangements = 720120 = 86,400

IV. When all the girls are always together, and then treat them as one group. So now we have 5 boys and 1 group of 6 girls and this can be permutated in 6! Ways at the same time 5 girls in the group can be permutated in 5! Ways, so total number of required ways is 6! 5 !. = 720 120 = 86400

V. All the girls are never together Total number of arrangements of 5 boys and 5 girls is 10! Number of arrangements in which all the girls are always together = = 6! 5! = 8, 64, 00 So number of arrangements in which all the girls are never together = total arrangement - number of arrangements when girls are always together. = 10! - (6! 5!) = 3,54,2400

**Example 10:**

Find the number of permutation of the letters of the word FOLDER taking all the letters at a time?

**Solution:**

Number of letters in the word FOLDER is 6 So the number of arrangements = = 6!

**Alternate method:**

First place can be filled by any one of the six letters. The second place can be filled by any one of the five remaining letters, the third, place can be filled by any one of the four remaining letters and so on. So the total number of arrangements is 654321 = 720

**Example 11:**

How many four digit numbers greater than 5000 can be formed by using the digits 4, 5,6 and 7? (Repetition of the digits is not allowed.)

**Solution:**

Total number of arrangements possible is 4p = 4! Total number of arrangements by using the digits 5, 6 and 7 is = 3! So the total number of required arrangements is 41 - 31 = 24 - 6 = 18

**Alternative method:**

Thousand's place can be filled in 3 ways. Hundred's place can be filled in 3 ways. Ten's place can be filled in 2 ways. Unit's place can be filled in 1 ways. So total number of arrangements =3321=18

**Example 12:**

In Q. 11, find the number of four digit numbers that can be formed if the repetition of digits is allowed.

**Solution:**

If the repetition is allowed then the total number of arrangements is 4444 = 256 ways because on the first place any one of the four number can come, similarly on the 2nd, 3rd and 4th place also. Total number of arrangements beginning with 4 is 4 4 4 = 64 so, total number of required arrangements = 256 - 64=192

**Alternative method:**

Thousand's place can be filled in 3 ways Hundred's place can be filled in 4 ways.

Ten's place can be filled in 4 ways. Unit's place can be filled in 4 ways. So the total number of arrangements = 3444 =192

**Combinations**

Suppose three persons A, B and C are contesting for the post of president and vice president of an organization and we have to select two persons. We can select either (a, b) or (b, c) or (a, c) = 3 ways because here we are talking about the selection, not about the order. Whether 'a' is a president or 'b' is a vice president or vice-versa, doesn't matter.

Suppose there are 10 persons in class and we have to select any 3 persons at a point regardless of the order, it is a case of combination. If there are n number of things and we have to select some or all of them it is called combinations. If out of n things we have to select r things (1 r n), then the number of combinations is denoted by

We already know that the number of arrangements of 'r' things out of the 'n' things is given by =

Combination does not deal with the arrangements of the selected things. 'r' selected things can be arranged in r! Ways. (r!) ) = =

**Difference between permutations and Combinations**

Suppose that there are five persons A, B, C, D and E and we have to choose two persons at a time then

**Permutation**

Number of required ways = = =

**Combinations**

Number of required ways = = =

So it is clear that in permutations (rearrangement) order matters but in combinations (selections) order does not natter.

**Example 13:**

In. a class there 5 boys and 6 girls. How many different committees of 3 boys and 2 girls can be formed?

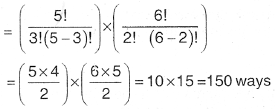
**Solution:**

Out of 5 boys we have to select 3 boys, this can be done in ways.

Out of 6 girls we have to select 2 girls, this can be done in ways.

So, selection of 3 boys and 2 girls can be done in ( ( ways

**[Basic rule of multiplication]**

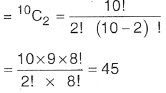
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**Example 14:**

If there are 10 persons in a party, and each person shake hands with all the persons in the party, then how many hand shakes took place in the party?

**Solution:**

It is very obvious that when two persons shake hands, it is counted as one handshake. So we can say that there are 10 hands and every combination of 2 hands will gives us one handshake. So the number of handshakes

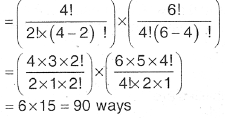


**Example 15:**

For the post of Maths faculty in Career Launcher there are 6 vacant seats. Exactly 2 seats are reserved for MBA's. There are 10 applicants out of which 4 are MBA's. In how many ways the selection can be made?

**Solution:**

There are 4 MBA's and 6 other candidates. So we have to select 2 candidates out of the 4 MBA's and the rest 4 candidates out of 6 other candidates. So the total number of ways of selection = (



**Example 16:**

There are 10 points out of which no three are collinear. How many straight lines can be formed using these 10 points?

**Solution:**

By joining any two points we will get one line. So the total number of lines formed

= =

**Example 17:**

Find the number of diagonals that can be drawn by joining the vertices of a decagon.

**Solution:**

In decagon there are 10 vertices and by joining any two vertices we will get one line. So in a decagon total number of lines formed

= =

But out of these 45 lines, 10 lines will be the sides of the decagon. So total number of diagonals = 45 -10 = 35

**Example 18:**

In the above question how many triangles can be formed?

**Solution:**

We know that in a triangle there are three vertices and by joining any three points we will get a triangle. So number of triangles formed

=

**Example 19:**

There are 5 boys and 6 girls. A committee of 4 is to be selected so that it must consist at least one boy and at least one girl?

**Solution:**

The different possibilities are I. 1 boy and 3 girls II. 2 boys and 2 girls III. 3 boys and 1 girl

In the first possibility total number of combination; is

In the second possibility total number of combination is

In the third possibility total number of combinations is

So the total numbers of combinations are

= + = 310

**Circular combination**

If n persons are seated around a circular table then they can be arranged in (n - 1) I ways. For example: If three persons are there they can be arranged in (3 -1)! = 2! Ways. [We fix the position of 1 person and then arrange the remaining (n -1) persons.]