For your more preparation, we are here with an important topic of Quantitative aptitude for your exam in this blog i.e. Permutation and Combination. With these following points and steps, you may easily secure good marks in your exam.

Permutation

Permutation is a mathematical technique that determines the number of possible arrangements in a set when the order of the arrangements matter. In other words, Permutations are the different ways in which a collection of items can be arranged. Permutation is a two-step process.

Formula for permutation: $\mathbf{{}^nP_r = n!/(n - r)!}$ where, n = the total no. of elements in a set r = the no. of selected elements arranged in a specific order ! = factorial

Factorial: The product of the numbers starting from 1 up to a number 'n' is known as factorial (!) of a number 'n'. It means, n! = 1 × 2 × 3 ×………………… × (n – 2) × (n – 1) × n For example: 5! = 1 × 2 × 3 × 4 × 5 = 120

Key points to remember:

- 0! and 1! are equal to 1.
- We can't find the factorial of a negative number.
- If n = r, then nPr = n!

Let us take some examples: E.g. Find the number of words, with or without meaning, that can be formed with the letters of the word 'EQUAL'. Sol: Word 'EQUAL' contains 5 letters. Therefore, the number of words that can be formed with these 5 letters = 5! 5! = 5 × 4 × 3 × 2 × 1 = 120 words

E.g. Find the number of words, with or without meaning, that can be formed with the letters of the word "ATTITUDE". Sol: The word "ATTITUDE" contains 8 letters and 'T' comes 'thrice'. When a letter occurs more than once in a word, we divide the factorial of the number of all letters in the word by the number of occurrences of each other. Therefore, the number of words formed by "ATTITUDE" = 8! /3! = 8 × 7 × 6 × 5 × 4 = 6720 words.

E.g. In how many ways can the letters of the word "SUPER" be arranged so that all the vowels come together? Sol: In the word "SUPER", we have 2 vowels (U and E) and 3 consonants (S, P and R). In order to find the permutations that can be formed where the two vowels U and E come together. So, the letters are S, P, R, (UE). Now the number of words = 4 In U and E, number of ways in which U and E can be arranged = 2 Hence, the total number of ways in which the word "SUPER" can be arranged such that vowels are always together are = 4! × 2! = 48 ways.

E.g. In how many ways can 7 children sit in a row of 7 chairs? Sol: Number of permutations of all 7 children taking 7 chairs at a time is = ${}^7P_7$ = 7! /(7 - 7)! = 7! /0! = 7! = 7 × 6 × 5 × 4 × 3 × 2 × 1 = 5040 ways

Combinations

The different selections possible from a collection of items are called Combinations. It is a one step process. Combination is also known as collection. (Order doesn't matter)

Formula for Combination: ^nC_r = n! / [r! × (n – r)!] where, n = the total no. of elements in a set r = the no. of combinations possible ! = factorial

Key points to remember:

- $^nC_n = 1$
- $^nC_0 = 0$
- $^nC_1 = n$
- $^nC_r = {^nC_{(n-r)}}$

Let us take some examples: E.g. In how many ways can a committee of 2 men and 5 women be formed from a group of 5 men and 8 women? Sol: Total men, n = 5 No. of ways 2 men can be selected from a group of 5 men = $^5C_2$ = 5! / [3! × (5 - 3)!] = 5! / [3! × 2!] = 10 ways No. of ways 5 women can be selected from a group of 8 women = $^8C_5$ = 8! / [5! × (8 - 5)!] = 8! / [5! × 3!] = 56 ways So, total ways of selection = 5C2 × 8C5 = 10 × 56 = 560 ways

E.g. In how many different ways a team of 15 players can be formed from 20 players if 2 particular players are never selected? Sol: It is given that 2 particular players are never selected, then we will do selection from the rest of them which means we will select 15 players out of 18 players. So, total ways of selection = $^{18}C_{15}$ = 18! / [15! × (18 - 15)!] = 18! / [15! × 3!] = 816 ways

E.g. Among a set of 6 white balls and 9 yellow balls, how many selections of 6 balls can be made such that at least 3 of them are white balls? Sol: Selecting at least 3 white balls from a set of 6 white balls in a total selection of 6 balls can be: 3 W and 3 Y, 4 W and 2 Y, 5 W and 1 Y, 6 W and 0 Y Balls Therefore, total ways of selection = $^6C3 \times {^9C_3} + {^6C_4} \times {^9C_2} + {^6C_5} \times {^9C_1} + {^6C_6} \times {^9C_0}$ = 2275 ways

These are the questions based on Permutations and Combinations for this chapter. We will cover more questions in the Exercise as well.

Probability

Probability means the chances of happening/occurring of an event. This topic would be sufficient for your basic knowledge of probability.

Probability of an event P = Number of favorable outcomes / Sample space

A sample space of an experiment is the set of all possible outcomes of that experiment. The value of probability always lies between 0 and 1(including both)

Tossing coins

If we toss a coin then we are sure we have two possible outcomes heads(H) & tails(T). Sample space = 2 Probability of getting head is = 1/2 If we toss two coins simultaneously, our outcomes would be HH, TT, HT & TH. Sample space = 4 Similarly, if we toss 'n' coins then our sample space would be = 2^n

Throwing a dice

An unbiased or normal dice has six sides written as 1, 2, 3, 4, 5 & 6 of sample space = 6. Probability of getting an even number in tossing a dice = 3/6 = 1/2. On a similar note, if we throw 'n' die simultaneously, sample space would be = 6^n

E.g. Two dice are rolled simultaneously. Find the probability that the sum of the numbers on them is not 8. Sol: Probability of sum of the numbers is not 8 = 1 - (Probability of sum of the numbers on them is 8) Favourable cases of sum = {(2,6),(3,5),(4,4),(5,3),(6,2)} Probability of sum of the numbers on them is 8 = 5 × (1/6) × (1/6) = 5/36 Required probability = 1 – 5/36 = 31/36 (Ans.)

Suit of cards

In childhood, we all played cards and were aware of that but still let's revise it a bit. Total number of cards = 52 Total number of red cards = 26 Total number of black cards = 26 Face cards are J (Jack), Q (Queen), and K (King) which are a total 12 in a suit.

E.g. From a pack of 52 cards, two cards are drawn at random, what is the probability that both cards are king. Sol: We will solve this question with a very simple approach, Probability of picking a king from a deck of 52 cards = 4/52 = 1/13 After picking a king we have to pick another king from the left cards = 3/51 = 1/17 Both events are to be done one by one = (1/13) × (1/17) = 1/221 (Ans.)

E.g. A bag contains 3 blue balls, 4 green balls, and 5 red balls. A ball is drawn at random. Find the probability that it is not a green ball. Sol: Probability that it is not a green ball = 1 – (probability of drawing a green ball) Total number of green balls = 4 probability of drawing a green ball = 4/(3 + 4 + 5) = 4/12 = 1/3 Probability that it is not a green ball = 1 – 1/3 = 2/3 (Ans.)

E.g. In a box there are 6 blue balls, X red balls & 10 green balls. Probability of choosing one red ball from the given box is 1/3, then find the sum of red and blue balls in the box? Sol: Blue balls = 6 Red balls = X Green balls = 10 Total balls = 16 + X Probability of choosing one red ball from box = X / (16 + X) = 1/3 ⇒3X = 16 + X ⇒ 2X = 16⇒X = 8 Sum of blue and red balls = 6 + 8 = 14 (Ans.)

I hope till now you don't have any difficulty in solving these questions.

E.g. If three dice are rolled together, the probability of getting composite numbers on all the three dice is? Sol: The number of possibilities of getting a composite number when a dice is rolled is 2 (4,6) The probability of getting composite number when one dice is rolled = 2/6 = 1/3 When three dice are rolled = (1/3) × (1/3) × (1/3) = 1/27 (Ans.)

I hope you find this useful for your studies. Do remember formulas and not let quant get out of your grip once you catch it.