

Permutation and Combination

Factorial Notation:

Let n be a positive integer. Then, factorial n , denoted $n!$ is defined as:

$$n! = n(n - 1)(n - 2) \dots 3.2.1.$$

Examples:

We define $0! = 1$.

$$4! = (4 \times 3 \times 2 \times 1) = 24.$$

$$5! = (5 \times 4 \times 3 \times 2 \times 1) = 120.$$

Permutations:

The different arrangements of a given number of things by taking some or all at a time, are called permutations.

Examples:

All permutations (or arrangements) made with the letters a, b, c by taking two at a time are **(ab, ba, ac, ca, bc, cb)**.

All permutations made with the letters a, b, c taking all at a time are:
($abc, acb, bac, bca, cab, cba$)

Number of Permutations:

Number of all permutations of n things, taken r at a time, is given by:

$${}^n P_r = n(n - 1)(n - 2) \dots (n - r + 1) = n! / (n - r)!$$

Examples:

$${}^6 P_2 = (6 \times 5) = 30.$$

$${}^7 P_3 = (7 \times 6 \times 5) = 210.$$

Cor. number of all permutations of n things, taken all at a time = $n!$.

4. An Important Result:

If there are n subjects of which p_1 are alike of one kind; p_2 are alike of another kind; p_3 are alike of third kind and so on and p_r are alike of r^{th} kind, such that $(p_1 + p_2 + \dots + p_r) = n$.

Then, number of permutations of these n objects is $= \frac{n!}{(p_1!).(p_2!).....(p_r!)}$

Combinations:

Each of the different groups or selections which can be formed by taking some or all of a number of objects is called a **combination**.

Examples:

Suppose we want to select two out of three boys A, B, C. Then, possible selections are AB, BC and CA.

Note: AB and BA represent the same selection.

All the combinations formed by a, b, c taking **ab, bc, ca** .

The only combination that can be formed of three letters a, b, c taken all at a time is **abc** .

Various groups of 2 out of four persons A, B, C, D are:

AB, AC, AD, BC, BD, CD.

Note that ab ba are two different permutations but they represent the same combination.

Number of Combinations:

The number of all combinations of n things, taken r at a time is:

$${}^nC_r = \frac{n!}{r!(n-r)!} = n(n-1)(n-2) \dots \text{to } r \text{ factors.}$$

Note:

$${}^nC_n = 1 \text{ and } {}^nC_0 = 1.$$

$${}^nC_r = {}^nC_{(n-r)}$$

1. Evaluate $30!/28!$

A.970

B.870

C.770

D.670

2. Evaluate permutation equation

$$P(59,3)$$

A.195052

B.195053

C.195054

D.185054

3. Evaluate permutation

$5P_5$

A.120

B.110

C.98

D.24

4. Evaluate permutation equation

$${}_{75}P_2$$

A. 5200

B. 5300

C. 5450

D. 5550

5. How many words can be formed by using all letters of TIHAR

A.100

B.120

C.140

D.160

6. In how many words can be formed by using all letters of the word BHOPAL

A.420

B.520

C.620

D.720

7. In how many way the letter of the word
"APPLE" can be arranged

A.20

B.40

C.60

D.80

8. In how many ways can the letters of the
CHEATER be arranged

A. 20160

B. 2520

C. 360

D. 80

9. How many words can be formed from the letters of the word "SIGNATURE" so that vowels always come together.

A.17280

B.4320

C.720

D.80

10. In how many ways can the letters of the word "CORPORATION" be arranged so that vowels always come together.

A.5760

B.50400

C.2880

D.None of above

11. A box contains 4 red, 3 white and 2 blue balls. Three balls are drawn at random. Find out the number of ways of selecting the balls of different colours

A.12

B.24

C.48

D.168

12. How many words can be formed from the letters of the word "AFTER", so that the vowels never comes together.

A.48

B.52

C.72

D.120

13. From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?

A.564

B.645

C.735

D.756

14. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?

A.360

B.480

C.720

D.5040

15. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

A.210

B.1050

C.25200

D.21400

16. In how many ways can the letters of the word 'LEADER' be arranged?

A.72

B.144

C.360

D.720

17. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?

A.159

B.194

C.205

D.209

18. How many 3-digit numbers can be formed from the digits 2, 3, 5, 6, 7 and 9, which are divisible by 5 and none of the digits is repeated?

A.5

B.10

C.15

D.20

19. In how many ways a committee, consisting of 5 men and 6 women can be formed from 8 men and 10 women?

A.266

B.5040

C.11760

D.86400

20. A box contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the box, if at least one black ball is to be included in the draw?

A.32

B.48

C.64

D.96

21. In how many different ways can the letters of the word 'DETAIL' be arranged in such a way that the vowels occupy only the odd positions?

A.32

B.48

C.36

D.60

22. In how many ways can a group of 5 men and 2 women be made out of a total of 7 men and 3 women?

A.63

B.90

C.126

D.45

23. How many 4-letter words with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed?

A.40

B.400

C.5040

D.2520

24. In how many different ways can the letters of the word 'MATHEMATICS' be arranged so that the vowels always come together?

A.10080

B.4989600

C.120960

D.None of these

25. In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together?

A.120

B.720

C.4320

D.2160

26. From among 36 teachers in a school one principal and one vice principal are to be appointed. In how many ways can this be done ?

(a) 1260

(b) 1250

(c) 1240

(d) 1800

27. A boy has 3 library tickets and 8 books of his interest in the library. Of these 8, he does not want to borrow chemistry part II, unless chemistry part I is also borrowed. In how many ways can he choose the three books to be borrowed ?

(a) 56

(b) 27

(c) 26

(d) 41

28. The letters of the word PROMISE are arranged so that no two of the vowels should come together. Find total number of arrangements.

(a) 49

(b) 1440

(c) 7

(d) 1898

29. There are 30 people in a group. If all shake hands with one another , how many handshakes are possible?

a. 870

b. 435

c. 30!

d. $29! + 1$

30. In how many ways can we arrange the word 'FUZZTONE' so that all the vowels come together?

a. 1440

b. 6

c. 2160

d. 4320

31. In Cricket League, in first round every team plays a match with every other team. 9 teams participated in the Cricket league. How many matches were played in the first round?

- a. 36**
- b. 72**
- c. 9!**
- d. $9! - 1$**

32. How many combinations are possible while selecting four letters from the word 'SMOKEJACK' with the condition that 'J' must appear in it?

a. 81

b. $8!/2!$

c. $3!/2!$

d. 41

33. In a room there are 2 green chairs, 3 yellow chairs and 4 blue chairs. In how many ways can Raj choose 3 chairs so that at least one yellow chair is included?

- a. 3**
- b. 30**
- c. 64**
- d. 84**

34. On a railway line there are 20 stops. A ticket is needed to travel between any 2 stops. How many different tickets would the government need to prepare to cater to all possibilities?

- a. 760**
- b. 190**
- c. 380**
- d. 72**

35. In Daya's bag there are 3 books of History, 4 books of Science and 2 books of Maths. In how many ways can Daya arrange the books so that all the books of same subject are together?

- a. 9**
- b. 6**
- c. 8640**
- d. 1728**

36. A locker in bank has 3 digit lock. Mahesh forgot his password and was trying all possible combinations. He took 6 seconds for each try. The problem was that each digit can be from 0 to 9. How much time will be needed to by Mahesh to try all the combinations?

- a. 90 minutes**
- b. 120 minutes**
- c. 60 minutes**
- d. 100 minutes**