



DEPARTMENT OF EMPLOYMENT AND TRAINING

TNPSC GROUP II A MAINS - UNIT II

Course : TNPSC Group II A Mains Material

Subject : General Intelligence and Reasoning

Topic : Permutation and Combinations

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**Director,
Department of Employment and Training.**

Permutation and Combinations

Permutation:

A permutation refers to an arrangement or reordering of the elements of a set. In mathematical terms, if we have a set of distinct elements, the number of ways we can arrange them is called the number of permutations of that set.

The permutation involves the selection of 'r' items from a set of 'n' items, where the order of selection matters and replacement is not allowed.

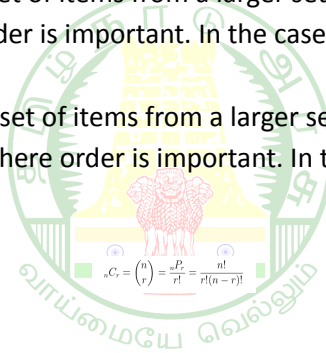
$${}^n P_r = (n!) / (n-r)!$$

$$n! = n \times (n-1) \times (n-2) \times \dots \times 2 \times 1$$

Combination:

A combination refers to selecting a subset of items from a larger set, where the order of the items does not matter. This is in contrast to a permutation, where order is important. In the case of combinations, the focus is on the selection, not the arrangement.

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Combination without Repetition:

The number of ways to choose k items from a set of n distinct items without repetition is given by the binomial coefficient, which is often read as "n choose k." The formula for this is:

$$(n/k) = n! / k!(n-k)!$$

where:

- n! is the factorial of n (the product of all positive integers from 1 to n),
- k! is the factorial of k,
- (n-k)! is the factorial of (n-k).

Variety of Questions:

1. Find the number of permutations and combinations if $n = 16$ and $r = 3$

- a. 3260, 460
- b. 3360, 560
- c. 3560, 360
- d. 3860, 660

Answer: b. 3360, 560

Explanation:

Permutation:

$${}^n P_r = (n!) / (n-r)!$$

$$= (16!) / (16-3)!$$

$$= 16! / 13! = (16 \times 15 \times 14 \times 13!) / 13! = 3360$$

Combination:

$${}^n C_r = \binom{n}{r} = \frac{{}^n P_r}{r!} = \frac{n!}{r!(n-r)!}$$

$$16! / 3!(16-3)! = 16! / 3!(13!)$$

$$= 16 \times 15 \times 14 \times 13! / 3! \times 13! = 560$$



2. In how many ways a committee consisting of 5 men and 3 women, can be chosen from 8 men and 9 women?

- a. 3680
- b. 4262
- c. 3886
- d. 4704

Answer: d. 4704

Explanation:

$${}^nC_r = n!/(n-r)!r!$$

$${}^8C_5 = 8!/(8-5)!5! = 8!/4!5!$$

$${}^8C_5 = 8 \times 7 \times 6 \times 5! / 3 \times 2 \times 1 \times 5!$$

$${}^8C_5 = 336 \times 5! / 6 \times 5!$$

$${}^8C_5 = 56$$

Thus,

We can choose 5 men out of 8 men in 56 ways

Now, further calculating for women,

Choose 3 women out of 9 women

Therefore,

$${}^nC_r = n!/(n-r)!r!$$

$${}^9C_3 = 9!/(9-3)!3!$$

$${}^9C_3 = 9!/6!3!$$

$${}^9C_3 = 9 \times 8 \times 7 \times 6! / 6! \times 3 \times 2 \times 1$$

$${}^9C_3 = 504 \times 6! / 6! \times 6$$

Simplifying Further

$${}^9C_3 = 504/6$$

$${}^9C_3 = 84$$

Thus,

Choose 3 women out of 9 women in 84 ways

Therefore,

The committee can be chosen in $56 \times 84 = 4704$ ways.

3. How many 3-letter words can be formed using the letters from the word "TABLE"?

- a. 60
- b. 50
- c. 40
- d. 70

Answer: a. 60

Explanation:

This is a permutation problem because the order of the letters matters.

Using the permutation formula, we get:

$${}^5P_3 = 5! / (5 - 3)! = 5! / 2! = 5 \times 4 \times 3 = 60$$

Therefore, there are 60 3-letter words that can be formed using the letters from the word "TABLE".

4. A committee of 5 members is to be formed from a group of 10 people. In how many ways can this be done?

- a. 126
- b. 252
- c. 312
- d. 198

Answer: b.252

Explanation:

Using the combination formula, we get:

$${}^{10}C_5 = 10! / (5! \times (10 - 5)!) = 10! / (5! \times 5!)$$

$${}^{10}C_5 = (10 \times 9 \times 8 \times 7 \times 6) / (5 \times 4 \times 3 \times 2 \times 1) = 252$$

Therefore, there are 252 ways to form a committee of 5 members from a group of 10 people.

5. How many different combinations do you get if you have 6 items and choose 4?

$$C(n, r) = n! / r! (n - r)!$$

$${}^nC_r = 6! / 4! (6 - 4)!$$

$${}^nC_r = (6 \times 5 \times 4 \times 3 \times 2 \times 1) / (4 \times 3 \times 2 \times 1 \times 2 \times 1)$$

$${}^nC_r = 15$$

The solution is 15.

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

- a. 120
- b. 600
- c. 720
- d. 560

Answer: c. 720

Explanation:

The word 'READING' has 7 different letters.

When the vowels EAI are always together, they can be supposed to form one letter.

Then, we have to arrange the letters RNDG (EAI).

Now, 5 ($4 + 1 = 5$) letters can be arranged in $5! = 120$ ways.

The vowels (EAI) can be arranged among themselves in $3! = 6$ ways.

Required number of ways = $(120 \times 6) = 720$.

7. In how many ways can the letters of the word 'GREETINGS' be arranged?

- a. 86060
- b. 90720
- c. 38650
- d. 64970



Answer: b. 90720

Explanation:

The word 'GREETINGS' contains 9 letters, namely 2G, 2E, 1R, 1T, 1I, 1S, 1N and

$$\text{Required number of ways} = \frac{9!}{(2!)(2!)(1!)(1!)(1!)(1!)(1!)}$$

$$= 90720$$

8. 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. 25
- b. 20
- c. 18
- d. 12

Answer: b. 20

Explanation:

- Unit place: Since each number must be divisible by 5, the unit place must be filled with the digit 5. This gives 1 choice.
- Tens place: After filling the unit place, the remaining available digits are 2, 3, 6, 7, and 9. Therefore, you have 5 choices for the tens place.
- Hundreds place: After filling both the unit and tens places, you have 4 remaining digits to choose from for the hundreds place.



Thus, the total number of such three-digit numbers is:

$$1 \times 5 \times 4 = 20$$

So, the required number of numbers is 20.

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

- a. 64
- b. 56
- c. 78
- d. 89

Answer: a.64

Explanation:

(1 blue and 2 non-blue) or (2 blue and 1 non-blue) or (3 blue).

$$\text{No. of Ways} = ({}^3C_1 \times {}^6C_2) + ({}^3C_2 \times {}^6C_1) + ({}^3C_3)$$

$$= \{ (3 \times 6 \times 5) / (2 \times 1) \} + \{ (3 \times 2 \times 6) / (2 \times 1) \} + 1$$

$$= (45 + 18 + 1)$$

$$= 64.$$

10. A college has 10 basketball players. A 5-member team and a captain will be selected out of these 10 players. How many different selections can be made?



- a. 1450
- b. 1260
- c. 1580
- d. 1320

Answer: b. 1260

Explanation:

A team of 6 members has to be selected from the 10 players. This can be done in

$${}^{10}C_6 = (10 \times 9 \times 8 \times 7 \times 5 \times 4) / (1 \times 2 \times 3 \times 4 \times 5 \times 6)$$

$${}^{10}C_6 = 210$$

Now, the captain can be selected from these 6 players in 6 ways.

Therefore, total ways the selection can be made is $210 \times 6 = 1260$

11. The number of straight lines that can be drawn out of 12 points of which 8 are collinear is

- a. 43
- b. 65
- c. 39
- d. 52

Answer: c. 39

Explanation:

The required number of lines = ${}^{12}C_2 - {}^8C_2 + 1 = 1 + 66 - 28 = 39$

12. In a cricket championship, there are 21 matches. If each team plays one match with every other team, the number of teams is

- a. 5
- b. 6
- c. 7
- d. 8

Answer: c. 7

Explanation:

Let n be the number of teams.

$${}^nC_2 = 21$$

$$n(n-1)/2 = 21$$

$$n(n-1) = 42$$

$$n = 7$$

13. In an examination, a candidate is required to pass all five different subjects. The number of ways he can fail is:

- a. 31
- b. 26
- c. 57
- d. 49

Answer: a. 31

Explanation:

The candidate will fail if he fails either in 1 or 2 or 3 or 4 or 5 subjects,

$$\therefore \text{Required number of ways } {}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5 = 31$$

14. How many numbers are there between 99 and 1000, having at least one of their digits 7?

- a. 125
- b. 383
- c. 252
- d. 189

Answer: c. 252

Explanation:

Numbers between 99 and 1000 are all three-digit numbers.

Total number of 3 digit numbers having at least one of their digits as 7 = (Total numbers of three-digit numbers) – (Total number of 3 digit numbers in which 7 does not appear at all)

$$= (9 \times 10 \times 10) - (8 \times 9 \times 9)$$

$$= 900 - 648$$

$$= 252$$

15. In how many ways can the letter of the word 'MAGIC' be arranged, so that the vowels do not come together?



- a. 65
- b. 72
- c. 58
- d. 83

Answer: b.72

Explanation:

Total words = 5

Total word - 1 = 4

Number of vowels = 2

Substituting in the formula:

$$5! - (4! \times 2!) = 120 - 48$$

$$= 72$$

Practice Questions:

1. How many ways can the letters of the word "ORANGE" be arranged, in such a way that O and A are always together?

- a. 120
- b. 240
- c. 360
- d. 480

2. In how many ways can 6 people be seated at a round table?

- a. 60
- b. 120
- c. 80
- d. 140

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

- a. 25200
- b. 27800
- c. 23700
- d. 28400

4. From 6 programmers and 4 typists, an office wants to recruit 5 people. What is the number of ways this can be done so as to recruit at least one typist?

- a. 187
- b. 329
- c. 163
- d. 246

5. Find out the distinct four-letter words that can be formed using the word SINGAPORE.

- a. 3024
- b. 2980
- c. 1468
- d. 1592

Answers:

Q.No	1	2	3	4	5
Answers	b	b	a	d	a

