CBSE NCERT Solutions for Class 11 Mathematics Chapter 07

Back of Chapter Questions

Exercise 7.1

1. How many 3-digit numbers can be formed from the digits 1,2,3,4 and 5 assuming that

(i)repetition of the digits is allowed?

(ii)repetition of the digits is not allowed?

Solution:

(i)Given that repetition is allowed,

Step 1:

We know that there will be as many ways as there are ways of filling 3 vacant places□□ □ in succession by the givenfive digits. In this case, repetition of digits is allowed.

Thus, the units place tens place and hundreds place can be filled in by any of the given five digits.

Therefore, by the multiplication principle, we have, $5 \times 5 \times 5 = 125$.

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

(ii)Given that repetition of the digits is not allowed:

Step 2:

Now, repetition of digits is not allowed.

If units place is filled in first, then it can be filled by any of the given five digits. Thus, the number of ways of filling the units place of the three-digit number is 5 and the tens place can be filled with any of the remaining four digits and the hundreds place can be filled with any of the remaining three digits.

Therefore, by the multiplication principle, we have, $5 \times 4 \times 3 = 60$

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

2. How many 3-digit even numbers can be formed from the digits $1, 2, 3, 4, 5, 6$ if the digits can be repeated?

Solution:

Step 1:

We know that there will be as many ways as there are ways of filling 3 vacant places □ □ □ in succession by the given six digits.

In this case, the units place should be filled with even numbers only so, it can be filled by 2 or 4 or 6 only i.e., the units place can be filled in 3 ways.

Step 2:

The tens place can be filled by any of the 6 digits in 6 different ways and also the hundreds place can be filled by any of the 6 digits in 6 different ways, as the digits can be repeated.

Thus, by multiplication principle, the required number of three digit even numbers is $3 \times 6 \times 6 = 108$

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

3. How many 4-letter code can be formed using the first 10 letters of the English alphabet, if no letter can be repeated?

Solution:

Given that no repetition should be done.

Step 1:

We know that as many codes as there are ways of filling 4 vacant places □ □ □ □ in succession by the first 10letters of the English alphabet, keeping in mind that the repetition of letters is not allowed.

Therefore the first place can be filled in 10 different ways by any of the first 10 letters of the English alphabet followingwhich; the second place can be filled in by any of the remaining letters in 9 different ways.

Step 2:

The third place can be filled in by any of the remaining 8 letters in 8 different ways and the fourth place can be filled in by any ofthe remaining 7 letters in 7 different ways.

Thus, by multiplication principle, we have, $10 \times 9 \times 8 \times 7 = 5040$

Therefore, 5040 four-letter codes can be formed using the first 10 letters of the English alphabet, if no letter isrepeated.

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

4. How many 5-digit telephone numbers can be constructed using the digits 0 to 9 if each number starts with 67 and no digit appears more than once?

Solution:

Given that the 5-digit telephone numbers always start with 67.

Step 1:

We know that there will be as many phone numbers as there are ways of filling 3 vacant places

6	7			

by the digits $0 - 9$, Given that the digits cannot be repeated.

The units place can be filled by any of the digits from $0 - 9$, except digits 6 and 7.

Thus, the units place can be filled in 8 different ways following which, the tens place can be filled in by any of the remaining 7 digits in 7 different ways, and the hundreds place can be filled in by any of the remaining 6 digits in 6 different ways.

Step 2:

Therefore, by multiplication principle, we have, $8 \times 7 \times 6 = 336$

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

5. A coin is tossed 3 times and the outcomes are recorded. How many possible outcomes are there?

Solution:

We know that we get two outcomes when a coin is tossed (Head and tail)

Step 1:

In each throw, the number of ways of showing a different face is 2.

Step 2:

Therefore, by multiplication principle, the required number of possible outcomes is $2 \times 2 \times 2 = 8$

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

6. Given 5 flags of different colours, how many different signals can be generated if each signal requires the use of 2 flags, one below the other?

Solution:

Step 1:

Given that each signal requires the use of 2 flags.

We know that there will be as many flags as there are ways of filling in 2 vacant places □□ in succession by the given 5 flags of different colours.

Thus, upper vacant place can be filled in 5 different ways by any one of the 5 flags following which; the lower vacant place can be filled in 4 different ways by any one of the remaining 4 different flags.

Step 2:

Therefore, by multiplication principle we have, $5 \times 4 = 20$

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

Exercise 7.2

1. Evaluate:

(i) $8!$

(ii) $4! - 3!$

Solution:

Step 1:

We need to evaluate 8!

$\Rightarrow 1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 = 40320$

Hint: Use the permutation formula to evaluate 8! permutations of n different objects taken r at a time,

where $0 < r \leq n$ and the objects do not repeat is $n(n-1)(n-2)...(n-r+1)$,

which is denoted by ${}^{n}P_{r}$

Step 1: We need to evaluate $4! - 3!$

$\Rightarrow 4! = 1 \times 2 \times 3 \times 4 = 24$

Step 2:

$3! = 1 \times 2 \times 3 = 6$

Therefore, $4! - 3! = 24 - 6 = 18$

Hint: Use the permutation formula to evaluate 4! And 3! And then subtract them , permutations of n different objects taken r at a time,

where $0 < r \leq n$ and the objects do not repeat is $n(n-1)(n-2)...(n-r+1)$,

which is denoted by nPr

2. Is $3! + 4! = 7!$?

Solution:

Step 1:

To check $3! + 4! = 7!$

$3! = 1 \times 2 \times 3 = 6$ and $4! = 1 \times 2 \times 3 \times 4 = 24$

Step 2:

Therefore, $3! + 4! = 6 + 24 = 30$

Whereas, $7! = 1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 = 5040$

Therefore, $3! + 4! \neq 7!$.

Hint: Use the permutation formula to evaluate 3! + 4! = 7!, "permutations of n different objects taken r at a time, where 0 < r ≤ n and the objects do not repeat is n (n – 1) (n – 2). . .(n – r + 1), which is denoted by nPr"

3. Compute $\frac{8!}{6!\times 2!}$

Solution:

Step 1:

We need to compute $\frac{8!}{6!\times 2!}$

$\Rightarrow \frac{8 \times 7 \times 6!}{6! \times 2 \times 1} = \frac{8 \times 7}{2}$

$= 28$

Hint: Use the permutation formula to Compute $\frac{8!}{6!\times 2!}$ "permutations of n different objects taken r at a time, where 0 < r ≤ n and the objects do not repeat is n (n – 1) (n – 2). . .(n – r + 1), which is denoted by nPr"

4. If $\frac{1}{6!} + \frac{1}{7!} = \frac{x}{8!}$, find x.

Solution:

Step 1:

Given, $\frac{1}{6!}+\frac{1}{7!}=\frac{x}{8!}$

$\Rightarrow \frac{1}{6!}\times\frac{7}{7}+\frac{1}{7!}=\frac{x}{8!}$

$\Rightarrow \frac{7}{7!}+\frac{1}{7!}=\frac{x}{8!}$

$\Rightarrow \frac{7+1}{7!}=\frac{x}{8!}$

Step 2:

$\Rightarrow \frac{8}{7!}\times 8!=x$

$\Rightarrow \frac{8}{7!}\times 8\times 7!=x$

$\Rightarrow x=64$

The value of xIs 64.

Hint: Use the permutation formula to find x "permutations of n different objects taken r at a time, where $0 < r \leq n$ and the objects do not repeat is n (n – 1) (n – 2). . .(n – r + 1), which is denoted by nPr"

5. Evaluate $\frac{n!}{(n-r)!}$, when

(i)$n=6, r=2$

(ii)$n=9, r=5$.

Solution:

Step 1:

Given,$n=6, r=2$

$$\frac{n!}{(n-r)!}=\frac{6!}{(6-2)!}$$

$= \frac{6!}{4!} = \frac{6 \times 5 \times 4!}{4!}$

$= 30$

Hint: Substitute for n = 6 and r = 2 in $\frac{n!}{(n-r)!}$ to evaluate

(i) Given, $n = 9, r = 5$

Step 1:

$\frac{n!}{(n-r)!} = \frac{9!}{(9-5)!}$

$= \frac{9!}{4!} = \frac{9 \times 8 \times 7 \times 6 \times 5 \times 4!}{4!}$

$= 9 \times 8 \times 7 \times 6 \times 5$

$= 15120$

Hint: Substitute for n = 9 and r = 5 in $\frac{n!}{(n-r)!}$ to evaluate

Exercise 7.3

1. How many 3-digit numbers can be formed by using the digits 1 to 9 if no digit is repeated?

Solution:

We need to form 3-digits numbers without repetition using the digits 1 to 9.

Step 1:

The order of the digits matters.

We know that there will be as many 3-digit numbers as there are permutations of 9 different digits taken 3 at a time.

Therefore, the required number of 3 − digit numbers

$= \ {}^9P_3 = \frac{9!}{(9-3)!}$

$= \frac{9!}{6!} = \frac{9 \times 8 \times 7 \times 6!}{6!}$

$= 9 \times 8 \times 7$

$= 504$

Therefore, we can form 504 numbers by using the digits 1 to 9.

Step 2:

Hint: Use the formula ${}^{n}P_{r} = \frac{n!}{(n-r)!}$

2. How many 4-digit numbers are there with no digit repeated?

Solution:

Step 1: We need to find total number of four digits numbers.

Therefore the thousands place of the 4-digit number is to be filled with any of the digits from 1 to 9 as the digit 0 cannot be included. Therefore, the number of ways in which thousands place can be filled is 9.

The hundreds, tens and unit places can be filled by any of the digits from 0to 9.

Step 2:

Anyway, the digits cannot be repeated in the 4-digit numbers and thousands place is already occupied with a digit. The hundreds, tens and unit places are to be filled by the remaining 9 digits.

We know that there will be as many such different ways as there are permutations of 9 different digits taken 3 at a time.

Therefore, the number of ways to fill remaining 3 places

$= {}^{9}P_{3} = \frac{9!}{(9-3)!} = \frac{9!}{6!} = \frac{9 \times 8 \times 7 \times 6!}{6!}$

$= 9 \times 8 \times 7$

$= 504$

Thus, by multiplication principle, the required number of 4-digit numbers is $9 \times 504 = 4536$

Hint: Use the formula ${}^{n}P_{r} = \frac{n!}{(n-r)!}$ and the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

3. How many 3-digit even numbers can be made using the digits 1,2,3,4,6,7 if no digit is repeated?

Solution:

Step 1:

We need to find the total number of even 3-digits numbers formed using the digits 1,2,3,4,6,7 without repetition.

So, units digits can be filled in 3 ways by any of the digits, 2.4, or 6.

As the digits cannot be repeated in the 3-digit numbers and units place is already occupied with a digit (which is even), the hundreds and tens place is to be filled by the remaining 5 digits.

Step 2:

Thus, the number of ways in which hundreds and tens place can be filled with the remaining 5 digits is the permutation of 5 different digits taken 2 at a time.

Therefore, number of ways of filling hundreds and tens place,

$= {}^{5}P_2 = \frac{5!}{(5-2)!} = \frac{5!}{3!} = \frac{5 \times 4 \times 3!}{3!}$

$= 5 \times 4$

$= 20.$

Thus, by multiplication principle, the required number of 3-digit numbers is $3 \times 20 = 60$

Hint: Use the formula ${}^{n}P_r = \frac{n!}{(n-r)!}$ and the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

4. Find the number of 4-digit numbers that can be formed using the digits 1,2,3,4,5 if no digit is repeated. How many of these will be even?

Solution:

Step 1: We need to form 4-digit numbers using the digits, 1, 2, 3, 4,and 5.

We know that there will be as many 4-digit numbers as there are permutations of 5 different digits taken 4 at a time.

Thus, the required number of 4 digit numbers = ${}^{5}P_4 = \frac{5!}{(5-4)!} = \frac{5!}{1!} = \frac{5\times4\times3\times2\times1}{1} = 120$

Step 2:

Among the 4-digit numbers formed by using the digits, $1, 2, 3, 4, 5$, even numbers end with either 2 or 4. The number of ways in which units place is filled with digits is 2.

As the digits are not repeated and the units place is already occupied with a digit (which is even), the remaining places are to be filled by the remaining 4 digits.

Thus, the number of ways in which the remaining places can be filled is the permutation of 4 different digits taken 3 at a time.

Number of ways of filling the remaining places,

$$= \ {}^4P_3 = \frac{4!}{(4-3)!} = \frac{4!}{1!}$$

$$= \frac{4 \times 3 \times 2 \times 1}{1}$$

$$= 24$$

Therefore, by multiplication principle, the required number of even numbers is $24 \times 2 = 48$

Hint: Use the formula ${}^nP_r = \frac{n!}{(n-r)!}$ and the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

5. From a committee of 8 persons, in how many ways can we choose a chairman and a vice chairman assuming one person cannot hold more than one position?

Solution:

Step 1: There is a committee of 8 persons from which a chairman and a vice chairman are to be chosen in such a way that one person cannot hold more than one position.

Now, the number of ways of choosing a chairman and a vice chairman is the permutation of 8 different objects taken 2 at a time.

Step 2:

Thus, the required number of ways,

$$= {}^8P_2 = \frac{8!}{(8-2)!} = \frac{8!}{6!}$$

$$= \frac{8 \times 7 \times 6!}{6!}$$

$= 8 \times 7$

$= 56$

Hint: Use the formula ${}^{n}P_r = \frac{n!}{(n-r)!}$

6. Find n if ${}^{n-1}P_3 : {}^{n}P_4 = 1 : 9$.

Solution:

Step 1: Given, ${}^{n-1}P_3 : {}^{n}P_4 = 1 : 9$

$\Rightarrow \frac{{}^{n-1}P_3}{{}^{n}P_4} = \frac{1}{9}$

$\Rightarrow \frac{\left\{\frac{(n-1)!}{(n-1-3)!}\right\}}{\left\{\frac{n!}{(n-4)!}\right\}} = \frac{1}{9}$ $\left[\because {}^{n}P_r = \frac{n!}{(n-r)!}\right]$

$\Rightarrow \frac{(n-1)!}{n!} = \frac{1}{9}$

Step 2:

$\Rightarrow \frac{(n-1)!}{n \times (n-1)!} = \frac{1}{9}$

$\Rightarrow \frac{1}{n} = \frac{1}{9}$

$\Rightarrow n = 9$

Therefore, the value of $n$is 9.

Hint: Use the formula ${}^{n}P_r = \frac{n!}{(n-r)!}$ then take the ratio and find value of n

7. Find r if

(i) ${}^{5}P_r = 2\ {}^{6}P_{r-1}$

(ii) ${}^{5}P_r = {}^{6}P_{r-1}$

Solution:

(i) Step 1: Given, ${}^5P_r = 2\,{}^6P_{r-1}$

$\Rightarrow \frac{5!}{(5-r)!} = 2 \times \frac{6!}{(6-r+1)!}$ $\left[\because {}^nP_r = \frac{n!}{(n-r)!}\right]$

$$\Rightarrow \frac{(7-r)!}{(5-r)!} = 2 \times \frac{6!}{5!}$$

$$\Rightarrow \frac{(7-r)(6-r)(5-r)!}{(5-r)!} = 2 \times \frac{6 \times 5!}{5!}$$

$\Rightarrow (7-r)(6-r) = 12$

$\Rightarrow 42 - 13r + r^2 = 12$

$\Rightarrow r^2 - 13r + 30 = 0$

Step 2:

$\Rightarrow r^2 - 10r - 3r + 30 = 0$

$\Rightarrow r(r-10) - 3(r-10) = 0$

$\Rightarrow (r-10)(r-3) = 0$

$\Rightarrow r = 3$ or $r = 10$

We know that, $0 \le r \le n$, here $n = 5$ therefore, $r \ne 10$.

Therefore, ,$r = 3$.

Hint: Use the permutation formula ${}^nP_r = \frac{n!}{(n-r)!}$ and factorize the quadratic equation to get the roots

(ii) Step 1: Given, ${}^5P_r = {}^6P_{r-1}$

$\Rightarrow \frac{5!}{(5-r)!} = \frac{6!}{(6-r+1)!}$ $[\because {}^nP_r = \frac{n!}{(n-r)!}]$

$$\Rightarrow \frac{(5)!}{(5-r)!} = \frac{6 \times 5!}{(7-r)!}$$

$$\Rightarrow \frac{1}{(5-r)!} = \frac{6}{(7-r)(6-r)(5-r)!}$$

$$\Rightarrow 1 = \frac{6}{(7-r)(6-r)}$$

Step 2:

$\Rightarrow 42 - 13r + r^2 = 6$

$\Rightarrow r^2 - 13r + 36 = 0$

$\Rightarrow r^2 - 9r - 4r + 36 = 0$

$\Rightarrow r(r-9) - 4(r-9) = 0$

$\Rightarrow (r-4)(r-9) = 0$

$\Rightarrow r = 4$ or $r = 9$

We know that, $0 \leq r \leq n$, here $n = 5$ or 6 therefore, $r \neq 9$.

Therefore, $r = 4$.

Hint: Use the permutation formula ${}^{n}P_r = \frac{n!}{(n-r)!}$ and factorize the quadratic equation to get the roots

8. How many words, with or without meaning, can be formed using all the letters of the word EQUATION, using each letter exactly once?

Solution:

Step 1:

EQUATION is 8 letters word

Thus, the number of words that can be formed using all the letters of the word EQUATION, using each letter exactly once, is the number of permutations of 8 different objects taken 8 at a time. Which is ${}^{8}P_8 = 8!$.

Step 2:

Therefore, required number of words that can be formed $= 8! = 40320$

Hint: Use the permutation formula ${}^{n}P_r = \frac{n!}{(n-r)!}$

9. How many words, with or without meaning can be made from the letters of the word MONDAY, assuming that no letter is repeated, if.

(i)4 letters are used at a time,

(ii) all letters are used at a time,

(iii)all letters are used but first letter is a vowel?

Solution:

MONDAY is 6 letters word,

(i) Step 1:

Number of 4-letter words that can be formed from the letters of the word MONDAY, without repetition of letters, is the number of permutations of 6 different objects taken 4 at a time, which is ${}^6P_4$.

Step 2:

Therefore, the required number of words that can be formed using 4 letters at a time is given by

$${}^6P_4 = \frac{6!}{(6-4)!}$$

$$= \frac{6!}{2!} = \frac{6 \times 5 \times 4 \times 3 \times 2!}{2!}$$

$$= 6 \times 5 \times 4 \times 3$$

$$= 360$$

Hint: Use the permutation formula ${}^nP_r = \frac{n!}{(n-r)!}$

(ii) Step 1:

Number of words that can be formed by using all the letters of the word MONDAY at a time is the number of permutations of 6 different objects taken 6 at a time, which is ${}^6P_6 = 6!$.

Step 2:

Therefore, the required number of words that can be formed when all letters are used at a time $\Rightarrow 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

Hint: Use the permutation formula ${}^nP_r = \frac{n!}{(n-r)!}$

(iii) Step 1:

In the word MONDAY, there are 2 different vowels, which have to occupy the right most place of the words formed. This can be done only in 2 ways.

As the letters cannot be repeated and the rightmost place is already occupied with a letter {which is a vowel), the remaining five places are to be filled by the remaining 5 letters. This can be done in ${}^5P_5 = 5!$ ways.

Step 2:

Therefore, in this case, required number of words that can be formed is

$\Rightarrow 5! \times 2 = 120 \times 2 = 240$

Hint: Use the permutation formula ${}^nP_r = \frac{n!}{(n-r)!}$

10. In how many of the distinct permutations of the letters in MISSISSIPPI do the four I's not come together?

Solution:

Step 1:

Given word MISSISSIPPI, I appear4 times, S appears 4 times, P appears 2 times, and M appears just once.

Thus, number of distinct permutations of the letters in the given word

$$\Rightarrow \frac{11!}{4!\,4!\,2!} = \frac{11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4!}{4! \times 4 \times 3 \times 2 \times 1 \times 2 \times 1}$$

$$= \frac{11 \times 10 \times 9 \times 7 \times 5}{4 \times 3 \times 2 \times 1 \times 2 \times 1}$$

$= 34650$

Step 2:

We know that here are 4‘I’s in the given word. When they occur together, they are treated as a single object for the time being. This single object ‘IIII’ together with the remaining 7 objects will account for 8 objects.

Therefore, these 8 objects in which there are 4‘S’ and 2‘P’ can be arranged in

$\frac{8!}{4!2!} = \frac{8\times7\times6\times5\times4!}{4!\times2\times1} = 840$ ways.

Number of arrangements where all ‘I’ occur together $= 840$

Therefore, number of distinct permutations of the letters in MISSISSIPPI in which four ‘I’ do not come together $= 34650 - 840 = 33810$

Hint: Arrange all the letters, the number of permutations and the factorial of the count of the elements is the same if the letters were all unique, such as ABCDEF, that'd be the final answer. Use the formula for number of distinct permutations "The number of permutations of n different objects taken r at a time,where $0 < r \leq n$ and the objects do not repeat is $n(n-1)(n-2)...(n-r+1)$,which is denoted by ${}^nP_r$"

11. In how many ways can the letters of the word PERMUTATIONS be arranged if the

(i)words start with P and end with S,

(ii)vowels are all together,

(iii)there are always 4 letters between P and S?

Solution:

Step 1:

Given word is PERMUTATIONS, there are 2'T' and all the other letters appear only once.

(i)If P and S are fixed at the extreme ends (P at the left end and S at the right end) ,then 10 letters are left.

Step 2:

Therefore, in this case, required number of arrangements

$$\frac{10!}{2!} = \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2!}{2!} = 1814400$$

Hint: Use the permutation formula ${}^nP_r = \frac{n!}{(n-r)!}$

(ii) Step 1:

In the given word there are 5 vowels, each appearing only once.

As they have to always occur together, they are treated as a single object for the time being. This single object together with the remaining 7 objects will account for 8 objects. These 8 objects in which there are 2'T' can be

arranged in $\frac{8!}{2!}$.

Step 2:

Therefore, corresponding to each of these arrangements, the 5 different vowels can be arranged in 5! ways.

Thus, the required number of arrangements

$\Rightarrow \frac{8!}{2!} \times 5! = \frac{8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2!}{2!} \times 120$

$= 2419200$

Hint: Use the permutation formula ${}^{n}P_{r} = \frac{n!}{(n-r)!}$

(iii) Step 1:

We should arrange the letters in such a way that there are always 4 letters between P and S.

Thus, in a way, the places of P and S are fixed and the remaining 10 letters in which there are2'T' can be arranged in $\frac{10!}{2!}$ways.

And the letters P and S can be placed such that there are 4 letters between them in $2 \times 7 = 14$ ways.

Step 2:

Thus, by multiplication principle, required number of arrangements in

this case

$\Rightarrow \frac{10!}{2!} \times 14 = \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2!}{2!} \times 14$

$= 25401600$

Therefore, we can arrange in 25401600 ways.

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n."

Exercise 7.4

1. If ${}^{n}C_{8} = {}^{n}C_{2}$,find ${}^{n}C_{2}$.

Solution:

Step 1:

Given, ${}^{n}C_{8} = {}^{n}C_{2}$.

It is known that if ${}^{n}C_{a} = {}^{n}C_{b}$, then $a = b$ or $a + b = n$.

Therefore, ${}^{n}C_{8} = {}^{n}C_{2} \Rightarrow n = 8 + 2 = n \Rightarrow n = 10$

Thus, ${}^{n}C_{2} = {}^{10}C_{2}$

Step 2:

$$= \frac{10!}{2!\,(10-2)!} = \frac{10!}{2!\,8!}$$

$$= \frac{10 \times 9 \times 8!}{2 \times 1 \times 8!}$$

$$= 5 \times 9$$

$$= 45$$

Hint: Use the formula if ${}^{n}C_{a} = {}^{n}C_{b}$, then $a = b$ or $a + b = n$ and then find ${}^{n}C_{2}$.

2. Determine n if

(i) ${}^{2n}C_{3} : {}^{n}C_{3} = 12 : 1$

(ii) ${}^{2n}C_{3} : {}^{n}C_{3} = 11 : 1$

Solution:

Step 1:

(i) Given, ${}^{2n}C_{3} : {}^{n}C_{3} = 12 : 1$

$$\Rightarrow \frac{{}^{2n}C_{3}}{{}^{n}C_{3}} = \frac{12}{1}$$

$$\Rightarrow \frac{\left\{\frac{2n!}{3!(2n-3)!}\right\}}{\left\{\frac{n!}{3!(n-3)!}\right\}} = \frac{12}{1} \qquad \left[{}^{n}C_{r} = \frac{n!}{r!(n-r)!}\right]$$

$$\Rightarrow \frac{\left\{\frac{2n\times(2n-1)\times(2n-2)\times(2n-3)!}{(2n-3)!}\right\}}{\left\{\frac{n\times(n-1)\times(n-2)\times(n-3)!}{(n-3)!}\right\}} = \frac{12}{1}$$

Step 2:

$$\Rightarrow \frac{2 \times (2n-1) \times (2n-2)}{(n-1) \times (n-2)} = \frac{12}{1}$$

$$\Rightarrow \frac{2 \times (2n-1) \times 2(n-1)}{(n-1) \times (n-2)} = \frac{12}{1}$$

$$\Rightarrow \frac{4(2n-1)}{(n-2)} = \frac{12}{1}$$

$$\Rightarrow 8n - 4 = 12n - 24$$

$$\Rightarrow 4n = 20$$

$$\Rightarrow n = 5$$

Hint: Use the formula $^nC_r = \frac{n!}{r!(n-r)!}$ and then find n

(ii) Step 1:

Given, $^{2n}C_3 : {}^nC_3 = 11 : 1$

$$\Rightarrow \frac{^{2n}C_3}{^nC_3} = \frac{11}{1} \Rightarrow \frac{\left\{\frac{2n!}{3!(2n-3)!}\right\}}{\left\{\frac{n!}{3!(n-3)!}\right\}} = \frac{11}{1} \qquad \left[\because {}^n C_r = \frac{n!}{r!(n-r)!}\right]$$

$$\Rightarrow \frac{\left\{\frac{2n \times (2n-1) \times (2n-2) \times (2n-3)!}{(2n-3)!}\right\}}{\left\{\frac{n \times (n-1) \times (n-2) \times (n-3)!}{(n-3)!}\right\}} = \frac{11}{1}$$

Step 2:

$$\Rightarrow \frac{2 \times (2n-1) \times (2n-2)}{(n-1) \times (n-2)} = \frac{11}{1}$$

$$\Rightarrow \frac{2 \times (2n-1) \times 2(n-1)}{(n-1) \times (n-2)} = \frac{11}{1}$$

$$\Rightarrow \frac{4(2n-1)}{(n-2)} = \frac{11}{1}$$

$$\Rightarrow 8n - 4 = 11n - 22$$

$$\Rightarrow 3n = 18$$

Therefore, $n = 6$

Hint: Use the formula $^nC_r = \frac{n!}{r!(n-r)!}$ and then find n

3. How many chords can be drawn through 21 points on a circle?

Solution:

Step 1 : We know that for drawing one chord on a circle, only 2 points are required.

We need to find the number of chords that can be drawn through the given 21 points on a circle, the number of combinations have to be counted.

Thus, there will be as many chords as there are combinations of 21 points taken 2 at a time.

Step 2:

Therefore, the required number of chords

$^{21}C_2 = \frac{21!}{2!(21-2!)}$ $\left[\because {}^n C_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{21!}{2!\,19!} = \frac{21 \times 20 \times 19!}{2 \times 1 \times 19!}$

$= 21 \times 10$

$= 210$

Thus, 210 chords can be drawn through 21 points on a circle.

Hint: Use the formula $^nC_r = \frac{n!}{r!(n-r)!}$ and then find the number of chords that can be drawn through the given 21 points on a circle

4. In how many ways can a team of 3 boys and 3 girls be selected from 5 boys and 4 girls?

Solution:

Step 1:

We should select a team of 3 boys and 3 girls from 5 boys and 4 girls.

So, 3 boys can be selected from 5 boys in $^5C_3$ ways.

Also, 3 girls can be selected from 4 girls in $^4C_3$ ways.

Step 2 :

Thus, by multiplication principle, number of ways in which a team of 3 boys and 3 girls can be selected

$= {}^5C_3 \times {}^4C_3 = \frac{5!}{3!(5-3)!} \times \frac{4!}{3!(4-3)!}$ $\left[\because {}^n C_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{5 \times 4 \times 3!}{3!\,2!} \times \frac{4 \times 3!}{3!\,1!}$

$= 10 \times 4$

$= 40$

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n." and the formula ${}^{n}C_r = \frac{n!}{r!(n-r)!}$ and then find the number of ways in which a team of 3 boys and 3 girls can be selected

5. Find the number of ways of selecting 9 balls from 6 red balls, 5 white balls and 5 blue balls if each selection consists of 3 balls of each colour.

Solution :

Step 1:

Given that there are a total of 6 red balls, 5 white balls, and 5 blue balls.

We need to select 9 balls in such a way that each selection consists of 3 balls of each colour.

So, 3 balls can be selected from 6 red balls in ${}^{6}C_3$ ways.

3 balls can be selected from 5 white balls in ${}^{5}C_3$ ways.

3 balls can be selected from 5 blue balls in ${}^{5}C_3$ ways.

Step 2:

Therefore, by multiplication principle, required number of ways of selecting 9 balls

$\Rightarrow {}^{6}C_3 \times {}^{5}C_3 \times {}^{5}C_3 = \frac{6!}{3!(6-3)!} \times \frac{5!}{3!(5-3)!} \times \frac{5!}{3!(5-3)!}$ $\left[\because {}^{n}C_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{6 \times 5 \times 4 \times 3!}{3!\,3!} \times \frac{5 \times 4 \times 3!}{3!\,2!} \times \frac{5 \times 4 \times 3!}{3!\,2!}$

$= (5 \times 4) \times (5 \times 2) \times (5 \times 2)$

$= 20 \times 10 \times 10$

$= 2000$

Hint: Use the multiplication principle "If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n.” and the formula $^nC_r = \frac{n!}{r!(n-r)!}$ and then find the number of ways in which selecting 9 balls

6. Determine the number of 5 card combinations out of a deck of 52 cards if there is exactly one ace in each combination

Solution:

Step 1:

We know that in a deck of 52 cards, there are 4 aces. A combination of 5 cards have to be made in which there is exactly one ace.

So, 1 ace can be selected out of 4 ace in $^4C_1$ ways and

The left 4 cards can be selected out of the 48 cards in $^{48}C_4$ ways.

Step 2:

Therefore, by multiplication principle, required number of 5 card combinations

$= {}^4C_1 \times {}^{48}C_4 = \frac{4!}{1!(4-1)!} \times \frac{48!}{4!(48-4)!}$ $\left[\because {}^n C_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{4 \times 3!}{3!} \times \frac{48 \times 47 \times 46 \times 45 \times 44!}{4!\, 44!}$

$= 4 \times 194580$

$= 778320$

Hint: Use the multiplication principle “If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n.” and the formula $^nC_r = \frac{n!}{r!(n-r)!}$ and then find the number of ways in which of 5 card combinations

7. In how many ways can one select a cricket team of eleven from 17 players in which only 5 players can bowl if each cricket team of 11 must include exactly 4 bowlers?

Solution:

Step 1:

Given that out of 17 players, 5 players are bowlers.

A cricket team of 11 players is to be selected in such a way that there are exactly 4 bowlers.

And, 4 bowlers can be selected out of 5 bowlers in ${}^{5}C_4$ ways and

The left7 players can be selected out of the 12 players in ${}^{12}C_7$ ways.

Step 2:

Therefore, by multiplication principle, required number of ways of selecting cricket team.

$= {}^{5}C_4 \times {}^{12}C_7 = \frac{5!}{4!(5-4)!} \times \frac{12!}{7!(12-7)!}$ $\left[\because {}^{n}C_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{5 \times 4!}{4!\,1!} \times \frac{12 \times 11 \times 10 \times 9 \times 8 \times 7!}{7!\,5!}$

$= 5 \times 792$

$= 3960$

Hint: Use the multiplication principle "If an event can occur in m different ways, Following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n." and the formula ${}^{n}C_r = \frac{n!}{r!(n-r)!}$ and then find the number of ways of selecting cricket team

8. A bag contains 5 black and 6 red balls. Determine the number of ways in which 2 black and 3 red balls can be selected.

Solution:

Step 1:

Given that there are 5 black and 6 red balls in the bag.

So, 2black balls can be selected out of 5 black balls in ${}^{5}C_2$ ways and

3 red balls can be selected out of 6 red balls in ${}^{6}C_3$ ways.

Step 2:

Therefore, by multiplication principle, required number of ways of selecting 2 black and 3 red.

$= {}^5C_2 \times {}^6C_3 = \frac{5!}{2!(5-2)!} \times \frac{6!}{3!(6-3)!}$ $\left[\because {}^nC_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{5 \times 4 \times 3!}{2!\,3!} \times \frac{6 \times 5 \times 4 \times 3!}{3!\,3!}$

$= 10 \times 20$

$= 200$

Hint: Use the multiplication principle "If an event can occur in m different ways, Following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n." and the formula ${}^nC_r = \frac{n!}{r!(n-r)!}$ and then find the number of ways of selecting 2 black and 3red.

9. In how many ways can a student choose a programme of 5 courses if 9 courses are available and 2 specific courses are compulsory for every student?

Solution:

Step 1:

Given that there are 9 courses available out of which, 2 specific courses are compulsory for every student and has to choose 3 courses out of the remaining 7 courses.

So, 2courses can be selected out of 2 specified courses in ${}^2C_2$ ways and

3.courses can be selected out of the remaining 7 courses in ${}^7C_3$ ways.

Step 2:

Therefore, required number of ways of choosing the programme

$\Rightarrow {}^2C_2 \times {}^7C_3 = \frac{2!}{2!(2-2)!} \times \frac{7!}{3!(7-3)!}$ $\left[\because {}^nC_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{2!}{2!\,0!} \times \frac{7 \times 6 \times 5 \times 4!}{3!\,4!}$

$= 1 \times 35$

$= 35$

Hint: Use the formula ${}^nC_r = \frac{n!}{r!(n-r)!}$ and then find the number of ways of choosing the programme.

Miscellaneous Exercise 7

1. How many words, with or without meaning, each of 2 vowels and 3 consonants can be formed from the letters of the word DAUGHTER?

Solution:

Step 1:

Given word is word DAUGHTER, there are 3 vowels namely. A, U, and E, and 5 consonants namely, D, G, H, T, and R.

So, number of ways of selecting 2 vowels out of 3 vowels

$= {}^3C_2 = \frac{3!}{2!(3-2)!} = 3$ $\left[\because {}^n C_r = \frac{n!}{r!(n-r)!}\right]$

And, number of ways of selecting 3 consonants out of 5 consonants

$= {}^5C_3 = \frac{5!}{3!\,(5-3)!}$

$= \frac{5\times4\times3!}{3!2!} = 10!$

Step 2:

Thus, number of combinations of 2 vowels and 3 consonants $= 3 \times 10 = 30$

Each of these 30 combinations of 2 vowels and 3 consonants can be arranged among themselves in $5!$ ways.

Therefore, required number of different words $= 30 \times 5! = 3600$

Step 3:

Hint: Use the formula ${}^nC_r = \frac{n!}{r!(n-r)!}$

2. How many words, with or without meaning, can be formed using all the letters of the word EQUATION at a time so that the vowels and consonants occur together?

Solution:

Step 1:

Given word is EQUATION, there are 5 vowels, namely. A, E, I, 0, and U, and 3 consonants, namely, Q, T, and N.

As all the vowels and consonants have to occur together, both (AEIOU) and (QTN) can be assumed as single objects.

And the permutations of these 2 objects taken all at a time are counted. This number would be $^2P_2 = 2!$

Step 2:

Corresponding to each of these permutations, there are 5! permutations of the five vowels taken all at a timeand 3! permutations of the 3 consonants taken all at a time.

Therefore, by multiplication principle, required number of words

$= 2! \times 5! \times 3! = 1440$

Hint: Use the permutation formula $^nP_r = \frac{n!}{(n-r)!}$ and the multiplicative principle "If an event can occur in m different ways, Following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n." to calculate the required number of words

3. A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of:

(i)exactly 3 girls?

(ii)at least3 girls?

(iii)at most3 girls ?

Solution:

Step 1:

Given that a committee of 7 has to be formed from 9 boys and 4 girls.

(i) As exactly 3 girls are to be there in every committee, each committee must consist of $(7 - 3) = 4$ boys only.

Step 2:

Therefore, the required number of ways

$= {}^4C_3 \times {}^9C_4 = \frac{4!}{3!1!} \times \frac{9!}{4!5!}$ $\left[\because {}^nC_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{4 \times 3!}{3!} \times \frac{9 \times 8 \times 7 \times 6 \times 5!}{4!\,5!}$

$= 4 \times 126$

$= 504$

Hint: Use the combinttion formula
${}^{n}C_r = \frac{n!}{r!(n-r)!}$ To calculate the required number of ways

Step 1:

(ii) As at least 3 girls are to be there in every committee, the committee can consist of

3girls and 4 boys or4 girls and 3 boys

3girls and 4 boys can be selected in ${}^{4}C_3 \times {}^{9}C_4$ways.

4girls and 3 boys can be selected in ${}^{4}C_4 \times {}^{9}C_3$ ways.

Step 2:

Thus, in this case, required number of ways

$= {}^{4}C_3 \times {}^{9}C_4 + {}^{4}C_4 \times {}^{9}C_3$

$= 504 + 84$

$= 588$

Hint: Use the combination formula ${}^{n}C_r = \frac{n!}{r!(n-r)!}$

Step 1:

(iii) A sat most3 girls are to be there in every committee, the committee can consist of

(A)3girls and 4 boys

(B)2 girls and 5 boys

(C)1 girl and 6 boys

(D)No girl and 7 boys

Step 2:

3 girls and 4 boys can be selected in ${}^{4}C_3 \times {}^{9}C_4$ ways.

2 girls and 5 boys can be selected in ${}^{4}C_2 \times {}^{9}C_5$ ways.

1 girl and 6 boys can be selected in ${}^{4}C_1 \times {}^{9}C_6$ ways.

No girl and 7 boys can be selected in ${}^4C_0 \times {}^9C_7$ ways.

Step 3:

Thus, in this case, required number of ways

$= {}^4C_3 \times {}^9C_4 + {}^4C_2 \times {}^9C_5 + {}^4C_1 \times {}^9C_6 + {}^4C_0 \times {}^9C_7$ $\left[\because {}^nC_r = \frac{n!}{r!(n-r)!}\right]$

$= \frac{4!}{3!\,1!} \times \frac{9!}{4!\,5!} + \frac{4!}{2!\,2!} \times \frac{9!}{5!\,4!} + \frac{4!}{1!\,3!} \times \frac{9!}{6!\,3!} + \frac{4!}{0!\,4!} \times \frac{9!}{7!\,2!}$

$= 504 + 756 + 336 + 36$

$= 1632$

Hint: Use the combination formula ${}^nC_r = \frac{n!}{r!(n-r)!}$

4. If the different permutations of all the letter of the word EXAMINATION are listed as in a dictionary, how many words are there in this list before the first word starting with E?

Solution:

Step 1:

In the given word EXAMINATION, there are 11 letters out of which, A, I, and N appear 2 times and all the other letters appear only once.

The words that will be listed before the words starting with E in a dictionary will be the words that start with A only.

Step 2:

Thus, to get the number of words starting with A, the letter A is fixed at the extreme left position, and then the remaining 10 letters taken all at a time are rearranged. Since there are 2'I' and 2'N' in the remaining 10 letters,

Number of words starting with

$$A = \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2!}{2 \times 1 \times 2!} = 907200$$

Step 3:

Therefore, the required numbers of words is 907200.

Hint: To get the number of words starting with A, the letter A is fixed at the extreme left position, and then the remaining 10 letters taken all at a time are rearranged. Since there are 2'I' and 2'N' in the remaining 10 letters

5. How many 6-digit numbers can be formed from the digits $0, 1, 3, 5, 7$ and 9 which are divisible by 10 and no digit is repeated?

Solution:

Step 1:

A number is divisible by 10 if its units digits is 0.

Therefore, 0 is fixed at the units place.

Step 2:

Therefore, There will be as many ways as there are ways of filling 5 vacant places

					0

insuccession by the remaining 5 digits (i.e., $1, 3, 5, 7$ and 9).

The 5 vacant places can be filled in $5!$ ways.

Hence, required number of 6-digit numbers $= 5! = 120$

Hint: There will be as many ways as there are ways of filling 5 vacant places

					0

insuccession by the remaining 5 digits (i.e., $1, 3, 5, 7$ and 9).

The 5 vacant places can be filled in $5!$ ways

6. The English alphabet has 5 vowels and 21 consonants. How many words with two different vowels and 2 different consonants can be formed from the alphabet?

Solution:

Step 1:

Given that there are 2 different vowels and 2 different consonants are to be selected from the English alphabet. Since there are 5 vowels in the English alphabet?

number of ways of selecting 2 different vowels from the alphabet

$$= {}^5C_2 = \frac{5!}{2!\,3!} = \frac{5 \times 4 \times 3!}{2 \times 1 \times 3!} = 10$$

Step 2:

As there are 21 consonants in the English alphabet,

number of ways of selecting 2 different consonants from the alphabet

$$= {}^{21}C_2 = \frac{21!}{2!\,19!} = \frac{21 \times 20 \times 19!}{2 \times 1 \times 19!} = 210$$

Therefore, number of combinations of 2 different vowels and 2 different consonants $= 10 \times 210 = 2100$

Each of these 2100 combinations has 4 letters, which can be arranged among themselves in $4!$ ways.

Step 2:

Therefore, required number of words $= 2100 \times 4! = 50400$

Hint: Use the combination formula ${}^{n}C_r = \frac{n!}{r!(n-r)!}$

7. In an examination, a question paper consists of 12 questions divided into two parts i.e., Part I and Part II, containing 5 and 7 questions, respectively. A student is required to attempt 8 questions in all. selecting at least 3 from each part. In how many ways can a student select the questions?

Solution:

Step 1:

Given that the question paper consists of 12 questions divided into two parts - Part I and Part II, containing 5 and 7 questions, respectively.

A student has to attempt 8 questions, selecting at least 3 from each part. This can be done as follows.

(A)3 questions from part I and 5 questions from part II

(B)4 questions from part I and 4 questions from part II

(C)5 questions from part I and 3 questions from part II

Step 2:

3questions from part I and 5 questions from part II can be selected in ${}^{5}C_3 \times {}^{7}C_5$ ways.

4 questions from part I and 4 questions from part II can be selected in ${}^{5}C_4 \times {}^{7}C_4$ ways.

5questions from part I and 3 questions from part II can be selected in ${}^{5}C_5 \times {}^{7}C_3$

ways.

Step 3:

Therefore, required number of ways of selecting questions

$= {}^5C_3 \times {}^7C_5 + {}^5C_4 \times {}^7C_4 + {}^5C_5 \times {}^7C_3$

$= \frac{5!}{3!\,2!} \times \frac{7!}{5!\,2!} + \frac{5!}{4!\,1!} \times \frac{7!}{4!\,3!} + \frac{5!}{5!\,0!} \times \frac{7!}{3!\,4!}$

$= 210 + 175 + 35$

$= 420$

Hint: Use the combination formula ${}^nC_r = \frac{n!}{r!(n-r)!}$ multiply them and add them

8. Determine the number of 5-card combinations out of a deck of 52 cards if each selection of 5 cards has exactly one king.

Solution:

Step 1:

We know that in a deck of 52 cards, there are 4 kings. A combination of 5 cards have to be made in which there is exactly one king.

So, 1 king can be selected out of 4 kings in ${}^4C_1$ ways and

The remaining 4 cards can be selected out of the 48 cards in ${}^{48}C_4$ ways.

Step 2:

Therefore, by multiplication principle, required number of 5 card combinations

${}^4C_1 \times {}^{48}C_4 = \frac{4!}{1!\,(4-1)!} \times \frac{48!}{4!\,(48-4)!}$

$= \frac{4 \times 3!}{3!} \times \frac{48 \times 47 \times 46 \times 45 \times 44!}{4!\,44!}$

$= 4 \times 194580$

$= 778320$

Hint: Use the multiplicative principle "If an event can occur in m different ways, Following which another event can occur in n different ways, then the total number of occurrence of the events in the given order is m×n." and the combination formula ${}^nC_r = \frac{n!}{r!(n-r)!}$ multiply

9. It is required to seat 5 men and 4 women in a row so that the women occupy the even places. How many such arrangements are possible?

Solution:

Step 1:

We know that 5 men and 4 women are to be seated in a row such that the women occupy the even places. The 5 men can be seated in 5! ways.

So,4 women can be seated only at the cross marked places (so that women occupy the even places).$M \times M \times M \times M \times M$

Step 2:

Thus, the women can be seated in 4! ways.

Step 3:

Therefore, possible number of arrangements $= 4! \times 5! = 24 \times 120 = 2880$

Hint: We know that 5 men and 4 women are to be seated in a row such that the women occupy the even places. The 5 men can be seated in 5! ways.

So,4 women can be seated only at the cross marked places (so that women occupy the even places).$M \times M \times M \times M \times M$

10. From a class of 25 students, 10 are to be chosen for an excursion party. There are 3 students who decide that either all of them will join or none of them will join. In how many ways can the excursion party be chosen?

Solution:

Step 1:

Given that from the class of 25 students, 10 are to be chosen for an excursion party.

As there are 3 students who decide that either all of them will join or none of them will join, there are two

Step 2:

Case 1: All the three students join.

So, the remaining 7 students can be chosen from the remaining 22 students in ${}^{22}C_7$ ways.

Step 3:

Case II: None of the three students join.

Therefore, 10 students can be chosen from the remaining 22 students in ${}^{22}C_{10}$ ways. Hence, the required number of ways of choosing the excursion party is ${}^{22}C_7 \times {}^{22}C_{10}$.

Hint: Apply the combination for the two given conditions then multiply them

11. In how many ways can the letters of the word ASSASSINATION be arranged so that all the S's are together?

Solution:

Step 1:

Given word is ASSASSINATION, the letter A appears 3 times, S appears 4 times, I appears2 times, N appears 2 times, and all the other letters appear only once.

As all the words have to be arranged in such a way that all the 'S' are together, SSSS is treated as a single object for the time being. This single object together with the remaining 9 objects will account for 10 objects.

Step 2:

Therefore, number of arrangements of 10 objects in which there are 3'A', 2 'I' and 2'N'

$$\Rightarrow \frac{10!}{3!\,2!\,2!} = \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3!}{3! \times 2 \times 1 \times 2 \times 1} = 151200$$

Step 3:

Therefore, the required number of ways of arranging the letters of the given word is

151200.

Hint: As all the words have to be arranged in such a way that all the 'S' are together, SSSS is treated as a single object for the time being. This single object together with the remaining 9 objects will account for 10 objects. Therefore, number of arrangements of 10 objects in which there are 3'A', 2 'I' and 2'N' can be calculated using the combination formula ${}^{n}C_r = \frac{n!}{r!(n-r)!}$