Probability and Probability Distribution
Unit No 1: Counting Principle

Unit No. 1 - Syllabus

Unit No. 1 : Counting Principles

- ❑Addition and Multiplication Principles
- ❑Permutations of n Objects,
- ❑Circular Permutation
- ❑Permutation with repetitions.

Probability

Probability is not just theory – it is applied everywhere in computer applications.

Probability theory is the branch of mathematics that deals with measuring the likelihood of uncertain events. It helps us make decisions in the face of uncertainty, predict outcomes, and analyze risks. In simple words:

👉 **Probability = Chance of an event happening** (between 0 and 1).

"**Probability is the measure of how likely an event is to occur.** It tells us the chance of something happening, expressed between **0 and 1** (or 0% to 100%)."

Probability

Examples :

Tossing a coin →
P(Head)=1/2

Rolling a dice →
P(getting 6)=1/6

Choosing a red ball from a bag of 5 red and 12 blue →
P(Red)=5/17

Applications of probability in real life:

1. Weather Forecasting

Meteorologists use probability to predict rain, storms, or sunshine.

Example: *"There is a 70% chance of rain tomorrow."*

This helps people plan travel, farming, or outdoor activities.

2. Medical Field

Doctors use probability to assess risks of diseases, success rate of surgeries, and drug effectiveness.

Example: *A medicine may cure 90% of patients (probability = 0.9).*

Applications of probability in real life:

3. Insurance and Risk Management

Insurance companies calculate the probability of accidents, illness, or natural disasters to decide premium amounts.

Example: Young drivers often pay higher premiums because their accident probability is higher.

4. Business and Marketing

Companies predict customer behavior, sales trends, and product success.

Example: *Probability models help Amazon suggest products ("Customers who bought this also bought…").*

Applications of probability in real life:

5. Finance and Stock Market

Investors use probability for risk analysis, predicting market trends, and portfolio management.

Example: Probability helps calculate chances of stock prices going up or down.

6. Sports and Games

Coaches use probability to plan strategies (e.g., probability of scoring from penalty kicks).

Casinos and lotteries are built entirely on probability models.

Applications of probability in real life:

7. Computer Science & AI

Probability is the backbone of **machine learning, artificial intelligence, and algorithms** like spam filters, speech recognition, self-driving cars.

Example: Gmail uses probability to decide if an email is spam.

8. Everyday Decisions

Deciding whether to carry an umbrella, choosing the best route to avoid traffic, or even guessing exam questions—all involve probability-based reasoning.

Conclusion:

MCA students need to learn Probability Distributions because it equips them with **mathematical tools to deal with uncertainty, analyze data, design efficient algorithms, and apply statistical models in real-world computing and business problems.**

1. Counting Principles

Counting principles are basic rules of enumeration used to determine the number of possible outcomes in a situation, without listing them all. They form the foundation of permutations, combinations, and probability theory.

1. Counting Principle

In probability, counting principles help us calculate the number of possible outcomes without listing them all.

Two basic rules are:

Addition Principle

Multiplication Principle

1. Addition Principle (Rule of Sum)

If an event can occur in m ways and another event in n ways, and the two events are mutually exclusive (cannot happen at the same time), then the total number of ways = m+n

This is also called the Rule of Sum, because we add the number of ways.

Example (MCA Context):

An MCA student can select an elective either from 5 AI subjects or from 4 Cybersecurity subjects.

Total ways = 5 + 4 = 9 ways

1. Addition Principle (Rule of Sum)

If an activity can be done in m ways, and another activity can be done in n ways, and both activities cannot happen together, then the total number of ways of doing either activity is:

$m+n$

✅ Example:

A student can choose either a Data Science elective (3 options) or a Cybersecurity elective (2 options).

Total ways to choose one elective = 3 + 2 = 5.

Example

- A student can solve a programming assignment **using Java (10 ways)** or **using**
- **Python (8 ways)**.

👉 Total = 10+8=18 ways to complete the assignment.

- While building a website, you can design a **frontend in 4 ways** or choose a
- **template in 6 ways**.

👉 Total = 4+6=10 choices.

Example

You want to travel from your home to the campus.

You can go by **bus (3 possible routes)**, or

You can go by **auto-rickshaw (2 possible routes)**.

Since you take **either bus OR auto**,

Total ways=3+2=5

Example

A student wants to do a project in one programming language.

There are 5 available Python frameworks,

Or 3 available Java frameworks.

Total choices = 5+3=8

Example

You want to buy a gadget:

You can choose from **6 laptops**, or

From **4 tablets**, or

From **2 smartphones**.

Since it’s **either laptop OR tablet OR smartphone**,

6+4+2 =12 ways

Conclusion

The Addition Principle is about *making one choice out of multiple exclusive options*.

It is widely used in:

- Course selection problems
- Scheduling tasks
- Menu/order selection
- Computer algorithms (mutually exclusive cases in decision trees)

Examples for practice

1. A student can choose an elective subject from 3 AI courses or 4 Cybersecurity courses. How many ways can the student choose one elective?

Solution

Solution:

Ways to choose AI subject = 3

Ways to choose Cybersecurity subject = 4

Since it's either AI OR Cybersecurity:

3+4=7

Answer: 7 ways

Example

A coding competition allows participants to register in **5 Java events** or **3 Python events** or **2 C++ events**.
In how many ways can a student register for one event?

Solution:

Java events = 5

Python events = 3

C++ events = 2

By Addition Principle:

5+3+2=10

Answer: 10 ways

Example

From a college library, a student can issue **6 books on Computer Science** or **4 books on Management**.
How many ways can a book be issued?
Solution:
- Computer Science books = 6
- Management books = 4
- Either CS OR Management →

6+4=10

Answer: 10 ways

Question for Practice

Example 1 : A student can select an elective subject from 5 Data Science courses or 3 Cybersecurity courses. In how many ways can the student choose one elective?

Example 2 : In a cafeteria, a student can order:

6 types of pizzas, or

4 types of sandwiches, or

2 types of salads.

In how many ways can the student choose one food item?

Example 3. From the placement cell:

10 companies are hiring for Software roles,

5 companies are hiring for Analyst roles.

If a student can apply to only one role, in how many ways can he apply?

Example 4: A student can learn programming from:

4 online courses on Java,

5 online courses on Python,

3 online courses on C++.

If he wants to choose only one course, how many choices does he have?

Multiplication Principle (Rule of Product)

1. Definition

The **Multiplication Principle** states:

👉 If a task consists of **two or more independent steps**:

Step 1 can be done in **m ways**,

Step 2 can be done in **n ways**,

Step 3 can be done in **p ways**,

then the **entire task** can be done in:

$m \times n \times p$ ways

Example

You want to order food:

Choose a main dish (3 options)

Then choose a drink (2 options)

Total meal choices $3 \times 2 = 6$

- **Addition Principle** applies when you have to choose between different categories (OR).
- **Multiplication Principle** applies when you must make choices step-by-step in sequence (AND).
- Real-life applications: career planning, project selection, database query design, software testing cases, password security, etc.

Example 1: Password Generation

A password consists of 2 letters followed by 1 digit.

First letter: 26 ways

Second letter: 26 ways

Digit: 10 ways

Total = $26 \times 26 \times 10 = 6760$ passwords.

Example 2: Programming Assignment

To complete an assignment:

Step 1: Choose a programming language (**3 ways: Java, Python, C++**)

Step 2: Choose an IDE (**2 ways: Eclipse, VS Code**)

Total = $3 \times 2 = 6$ ways.

Comparison with Addition Principle

Addition (Either–Or):

If you can travel by **bus (3 ways)** or **bike (2 ways)** → Total = $3+2=5$.

Multiplication (And–Then):

If you travel by **bus (3 ways)** and then choose a **seat (4 ways)** → Total = $3\times4=12$.

Example

A café offers 3 mains and 4 drinks. How many distinct meal combos (one main and one drink) are possible?

Solution:

Choices happen in sequence (main and drink): $3 \times 4 = 12$

Answer: 12.

Example

Laptop configuration

A laptop can be configured with **3** CPUs, **2** RAM options, **4** storage options, and **2** GPUs. How many configurations?

Solution:

$3 \times 2 \times 4 \times 2 = 48$

Answer: 48.

Example

Routing with lane choice

A commuter can choose **2** highways or **3** city roads to reach a junction.

If a highway is chosen, there are **3** exit lanes at the end.

If a city road is chosen, there are **2** exit lanes at the end.

How many total ways to travel (route **and** lane)?

Solution:

Two branches:

Highway branch: $2\times3=6$

City-road branch: $3\times2=6$

Total $=6+6=12$.

Answer: 12.

Examples

Simple Examples

Clothing Choice

You have **3 shirts** and **2 trousers**.

Number of ways to dress = **3 × 2 = 6 ways**.

Password Creation

A password requires:

- First character = **10 digits (0–9)** choices
- Second character = **26 letters (A–Z)** choices

Total possible passwords = **10 × 26 = 260**.

Food Menu

Suppose a restaurant allows you to pick:

- 2 types of soups
- 3 types of main courses
- 2 types of desserts

Total meal combinations = **2 × 3 × 2 = 12 meals**.

Example (Practice Question)

A college canteen offers:

3 types of sandwiches (Veg, Cheese, Paneer),

2 types of drinks (Tea, Coffee), and

4 types of desserts (Ice cream, Pastry, Gulab Jamun, Rasgulla).

If a student wants to buy one sandwich + one drink + one dessert, in how many different ways can he choose the meal?

Example (Practice Question)

Q1. A car showroom has **4 models of cars** and each model comes in **3 different colors**. In how many ways can a customer choose a car?

Q2. A password system requires **2 letters** followed by **2 digits**. How many possible passwords can be created?
(Assume 26 letters and 10 digits).

Q3. An online examination has **5 questions**, each with **4 options**. In how many ways can a student attempt the paper?

Q4. A library offers **3 books in Mathematics**, **2 in Computer Science**, and **2 in Management**. If a student has to borrow **one book from each subject**, in how many ways can he select?

Q5. A travel company offers **3 flight routes** from Mumbai to Delhi, **2 hotel options** in Delhi, and **4 sightseeing packages**. In how many ways can a traveler plan the trip?

Permutations of n Objects

Permutation

A permutation is an arrangement of objects in a specific order.

It is different from just a selection, because here order matters.

Permutation means arrangement of objects where order is important.

Permutations of *n* Objects

Concept

A **permutation** is an arrangement of objects **in a particular order**.
If we have *n* different objects and we want to arrange all of them, the total number of permutations is:

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

Formula

Permutations of *n* different objects taken all at a time:

$n!$

Permutations of *n* different objects taken *r* at a time:

$$P(n,r) = \frac{n!}{(n-r)!}$$

Example

A student is asked to create a password using **3 different characters**: A, B, C
How many different 3-letter passwords can be formed?

$P(3,3)=3!=6$

Answer :
6 different passwords are possible.

Example

In how many different ways can 5 students sit in a row of chairs?

Answer :

Arrange all 5 students in a line → 5!.

Calculation: $5! = 5\times4\times3\times2\times1 = 120$

Answer: 120 ways.

Example

If there are 6 programming languages, in how many ways can they be arranged in a sequence?

Solution :

Arrange all 6 → 6!

6!=720

Answer: 720 ways.

Example :

A question bank has 12 questions. In how many different ways can 4 questions be arranged in sequence for an online test?

Solution :

Order matters → P(12,4)

Answer: 11,880 sequences.

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Ex. 1 : In how many different ways can 4 subjects (DBMS, OS, Networking, AI)

- **be scheduled in 4 lecture slots?**
- Arrange all 4 subjects → 4!=24.4!=24.4!=24.
- **Answer: 24 timetables.**

Ex. 2 How many unique ways can 6 MCA students be assigned 6 different project roles?

- All 6 assigned distinct roles → 6!=720.6!=720.6!=720.
- **Answer: 720 assignments.**

Ex. 3In how many ways can 5 colored flags be arranged on a vertical flagpole?

- Positions are linear (top→bottom), so order matters → 5!=120.5!=120.5!=120.
- **Answer: 120 arrangements.**

Example

From **6 students**, a teacher wants to assign a **Leader and Assistant**.

Since order matters (Leader ≠ Assistant):

$$P(6,2) = \frac{6!}{(6-2)!} = \frac{720}{24} = 30$$

Solution : 30 possible role assignments.

Example :

An online exam system picks 3 questions in sequence from a question bank of 10 questions.

Number of different sequences:

$$P(10,3) = \frac{10!}{(10-3)!} = \frac{10!}{7!} = 10 \times 9 \times 8 = 720$$

Solution : 720 possible question sequences.

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Circular Permutation

What is a circular permutation?

A circular permutation is a mathematical concept that deals with the arrangement of objects in a circular manner, where the order of arrangement matters, but there is no distinct starting or ending point.

Circular Permutation

The circular permutation Formula is a mathematical concept that deals with the arrangement of objects in a circular fashion.

Example :

- consider a circular arrangement of seats in a theater,
- A round table at a party,
- The positions of the hands on a clock.

In these situations, the order in which objects or people are arranged matters, but there is no distinct "start" or "end" point.

In a linear permutation, such as arranging books on a shelf, the order matters, and there is a clear starting point and ending point. However, in a circular permutation, the arrangement forms a closed loop, and there is no inherent beginning or end. This distinction makes circular permutations unique.

How do circular permutations differ from linear permutations?

In linear permutations, objects are arranged in a straight line, and there is a clear start and end point. In circular permutations, objects are arranged in a circle, and there is no inherent beginning or end.

Circular Permutation

Circular permutations occur in 2 cases.

- Clockwise and Anti-Clockwise Order is Different

- Clockwise and Anti-Clockwise Order is Identical

Formula for Clockwise and Anti-Clockwise [When Order is Different]

When the clockwise and anticlockwise arrangements of the numbers are identical after they have been organized, the formula yields the total number of potential circular permutations. So, the formula is:

$$\mathbf{P_n = (n - 1)!}$$

Where,

P_n stands for a circular permutation,

n stands for the number of objects

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Formula

The Total Number of Circular Permutations (n-1)!

In a circular permutation of 'n' distinct objects, there are (n-1)! different arrangements. This formula is based on the idea that we can fix one object in a particular position (say, the top of the circle), and then arrange the remaining (n-1) objects linearly. Since linear permutations are well-understood, we simply calculate (n-1)! to find the number of circular permutations.

Hence Number of Circular Permutations: The number of circular permutations of 'n' distinct objects is (n-1)!.

For example, if you have five distinct objects, there are (5-1)! = 4! = 24 different circular permutations.

What does (n-1)! mean in circular permutations?

(n-1)! represents the factorial of (n-1), which means multiplying all positive integers from 1 to (n-1) together. It accounts for the number of distinct circular permutations by fixing one object as a reference point and arranging the remaining (n-1) objects linearly.

Example 1: Seating People Around a Round Table

Question: In how many ways can 5 MCA students be seated around a circular table?

Solution:

Linear arrangement = $5! = 120$

Circular arrangement = $(5-1)! = 4! = 24$

Answer: 24 ways

Example 2: Group Picture Seating

Question: 7 MCA classmates are to sit in a circular row for a group photo. In how many ways can this be done?

Solution:

Formula = $(n-1)!$

$(7-1)!=6!=720$

👉 **Answer:** 720 ways

Example 3: Fixing One Position

Question: In how many ways can 4 MCA students sit around a circular table if one specific student insists on sitting at the front?

Solution:

If one position is fixed, the problem reduces to a linear arrangement of the remaining students.

Arrangements = $(4-1)! = 3!$

Answer: 6 ways

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Example 4: Password Dial Lock

Question: A circular lock has 5 different symbols. How many distinct circular arrangements of these symbols are possible?

Solution:

Circular arrangement formula = $(5-1)!=4!=24$

Answer: 24 distinct lock arrangements

Example 5

Find the number of ways in which 7 friends can sit around a round table if clockwise and anticlockwise orders are considered different.

Solution:

Here $n=7$

$P_n=(n-1)!$

$P_7=(7-1)!$

$P_7=6!$

$P_7=6\times5\times4\times3\times2\times1=720$

Answer = 720 ways

Example for Practice

1. 8 participants join a video conference arranged in a circular view.

In how many different seating arrangements can they appear?

2. 7 students around a table where Professor P must have a specific

chair facing the board (chair is fixed).

Formula for Clockwise and Anti-Clockwise [When Order is Identical]

The number of cyclic permutations is determined by the formula when there is no difference in the orders of the elements in the clockwise or anticlockwise directions, i.e., when both orders of the members of the set are identical. So, the formula is:

$$\mathbf{P_n = (n - 1)! / 2!}$$

Where,

$\mathbf{P_n}$ stands for a circular permutation.

n stands for the number of objects

Example 1

Calculate the circular permutation of 6 people seated around a round table while (i) If the anticlockwise and clockwise orders are different. (ii) If the anticlockwise and clockwise orders are the same.

Solution:

Case 1: If the anticlockwise and clockwise orders are different. Here n = 6. Use the Formula

$P_n = (n - 1)!$

$\Rightarrow P_6 = (6 - 1)!$

$\Rightarrow P_6 = (5)!$

$\Rightarrow P_6 = 5 \times 4 \times 3 \times 2 \times 1$

$\Rightarrow P_6 = 120$

Case 2: If the anticlockwise and clockwise orders are the same. Here n = 6. Use the Formula

$P_n = (n - 1)! / 2!$

$\Rightarrow P_6 = (6 - 1)! / 2!$

$\Rightarrow P_6 = 5! / 2!$

$\Rightarrow P_6 = 60$

Example 2

Find the number of ways in which 7 friends can sit around a round table if clockwise and anticlockwise orders are the same.

Solution:

Here $n = 7$

$$P_n = \frac{(n-1)!}{2}$$

$$P_7 = \frac{6!}{2}$$

$$P_7 = \frac{720}{2} = 360$$

Answer = 360 ways

Permutation with repetitions

Permutation with repetitions

Permutation = arrangement of objects in a specific order

If all objects are distinct = n!

If some objects are repeated (identical) then the number of distinct arrangements decreases.

This is call Permutation with Repetition (also called multinomial permutations).

Concept: Permutation with Repetitions

In normal permutations, we arrange n objects where all objects are distinct.

But if some objects are repeated, we need to adjust for those repetitions

because identical objects are indistinguishable.

Formula:

If we have n objects, in which

- n_1 objects are of one kind,
- n_2 objects are of another kind,
- n_3 objects are of another kind, …

then the total permutations =

$$\frac{n!}{n_1!\, n_2!\, n_3! \dots}$$

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Example :

How many distinct arrangements of the letters of the word STATISTICS are possible.

Solution:

S = 3, T=3, A-1, I=2, C=1

$$\text{Total Permutations} = \frac{n!}{n1!*n2!*n3\ldots!\ldots\ldots} = \frac{10!}{3!3!2!}$$

N = 10

$$\text{Circular Permutation} = \frac{(n-1)!}{n1!*n2!*n3\ldots!\ldots\ldots} = 9!/3!3!2!$$

◆ Example 2 (Bigger Word):

👉 Find the number of distinct permutations of the word **BALLOON.**

- Total letters = 7
- B = 1, A = 1, L = 2, O = 2, N = 1

$$\frac{7!}{1! \cdot 1! \cdot 2! \cdot 2! \cdot 1!} = \frac{5040}{4} = 1260$$

So there are **1260 distinct arrangements.**

◆ Example 3 (Application for MCA Students):

Suppose a system auto-generates a password of **6 characters** using the set {A, A, B, B, C, D}.

👉 How many unique passwords are possible?

- Total = 6
- A repeated = 2, B repeated = 2, C = 1, D = 1

$$\frac{6!}{2! \cdot 2! \cdot 1! \cdot 1!} = \frac{720}{4} = 180$$

✅ 180 unique passwords are possible.

A CAPTCHA displays the letters in the word PROGRAMMER (10 Letters). How many distinct CAPTCHAs can be formed if letter positions matter?

Solution :

10!/3!2!= 302400 Possible CAPCHAs

1. A new system generates IP-like codes using digits 112233(6 digits) How many distinct codes are possible?

2.A database key is made using the word STATISTICS. How many distinct arrangements of the key are possible?

2.In a computer system, 7 processes need scheduling

- 3 are identical I/O bound
- 2 are identical CPU bound
- 2 are unique

How may distinct schedules(orderings) are possible.

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Additional examples for Practice

Exercise 1: Addition and Multiplication Principle

1. Calvin wants to go to Dehradun. He can choose from 3 bus services or 2 train services to head from home to Delhi. From there, he can choose from 2 bus services or 3 train services to head to Dehradun. How many ways are there for Calvin to get to Dehradun?

2. Naema goes to the store to buy juice for her birthday party. The store sells jugs of orange juice, apple juice, and cranberry juice. The store also sells frozen cans of grape juice, peach juice, mango juice, and pear juice. If Naema wants only one can or jug of juice, how many different choices does she have?

3. How many different license plates are there if a standard license plate consists of three letters followed by three digits?

4. If you go outside to buy sweets and suppose a bakery has a selection of 15 different cupcakes, 20 different doughnuts, and 13 different muffins. If you are to select a tasty treat, how many different choices of sweets can you choose from?

Solutions

1. He has 3+2=5 ways to get to Dehli . (Rule of sum)
   From there, he has 2+3=5 ways to get to Dehradun. (Rule of sum)
   Hence, he has 5×5=25 ways to get to Dehradun in total. (Rule of product)

2. Since Naema can bring only one jug or one can of juice, we use the Rule of Sum. She has 3 choices for jugs and 4 choices for cans, so she has 3+4=7 choices in total.

3. There are 26 choices for each of the three letters, and 10 choices for each digit. So there are 26·26·26·10·10·10=260*260*260 different license plates.

4. Here we used the Addition Principle of Fundamental Counting. We have to choose from either a cupcake or doughnut or muffin,
   So, we have 15+20+13 = 48 treats to choose from.

Exercise:2

1. Find the value of

6p4, 7p7, 7p4/8p3

2. Four students while entering a room found that seven chairs were lying vacant. In how many ways could the seats be occupied?

3.Show that the permutation of the letter of the word “Calcutta” is twice the permutations of the letter of the word “America”.

4. In how many ways the letters of the word “Daughter” can be arranged keeping the vowels together?

5. How many ways can 7 people be seated at a round table if 3 people refuse to sit next to each other ?

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6. A project password must be created using the letters **A, B, C, D, E**.
(i) How many 4-letter passwords can be formed if no letter is repeated?
(ii) How many if repetition is allowed?

7. In how many ways can **7 team members** sit around a **round table** for discussion:
(i) If clockwise and anticlockwise orders are different.
(ii) If clockwise and anticlockwise orders are the same.

8. How many different 5-digit numbers can be formed using the digits 1,2,3,4,5 without repetition?

9. How many different arrangements can be made with the letters of the word **BALLOON**?

Solutions

1.

$6p4 = 6!/2! = 360$

$7p7 = 7! = 5040$

$7p4/8p3 = 2.5$

2. Four students while entering a room found that seven chairs were lying vacant. In how many ways could the seats be occupied?

Solution :

Let the 4 students be A,B,C and D

Required no of ways $= 7p4 = 840$

Solution 3

3.Show that the permutation of the letter of the word “Calcutta” is twice the permutations of the letter of the word “America”.

Solution :

There are 7 letters in the word “ America of which 2 are ‘a’ and the rest are all different.

Therefore the total number of permutations = 7!/2!=2520

There are 8 letters in word “Calcutta” of which 2 are a, 2 are c, 2 are t and rest are all different. Therefore the total number of permutations that can be obtained by taking all the letters of the word culcutta = 8!/2!*2!*2!=5040.

Clearly 5040 is twice the number 2520

Solution 4

4. In how many ways the letters of the word “Daughter” can be arranged keeping the vowels together?

Solution :

The vowels in the word “Daughter” are a, u and e and the consonants are D g h t and r.

Since the vowels are taken together, so the number of letters, taking the vowels as one letter along with the 5 consonants will be 6 viz. D, g, h, t, r, (aue). These 6 letters can be arranged in 6! Ways among themselves (when we take the vowels as one letter it mean that they are together). Again we can arrange the vowels(a,e,u) in 3! Different ways.

Therefore keeping the vowels together the number of ways in which the letters of the “Daughter” can be arranged. = 6! * 3! = 4320

Solution 5

5. How many ways can 7 people be seated at a round table if 3 people refuse to sit next to each other ?

Solution :

Number of ways in which 7 people can be seated around in a round table.

(n-1)!= (7-1)! = 6!

Now, let us assume these three particular people always sit together

A B C D EFG = (5-1)! (3)! = 4! * 3! =

So therefor = 6!- (4) ! (3)! = 720-144 = 576 ways

Answer : The Number of ways 7 people can be seated at a round table if 3 people refuse to sit next to each other is 576

Solution 6

6. A project password must be created using the letters **A, B, C, D, E**.
(i) How many 4-letter passwords can be formed if no letter is repeated?
(ii) How many if repetition is allowed?

Solution :

Case (i): Without Repetition

You have 5 letters: **A, B, C, D, E**
Password length = **4**

For the 1st place → 5 choices (A–E)

For the 2nd place → 4 choices (since one letter is already used)

For the 3rd place → 3 choices

For the 4th place → 2 choices

Total passwords=5×4×3×2=120

That's why we use **P(5,4)**

Solution 6

Case (ii): With Repetition

Now repetition is allowed, so **a letter can be reused**.

For the 1st place → 5 choices (A–E)

For the 2nd place → again 5 choices (since repetition allowed)

For the 3rd place → 5 choices

For the 4th place → 5 choices

👉 Since each of the **4 positions** can be filled in **5 ways independently**, we apply the **Multiplication Principle**:

Total passwords=5×5×5×5==625

Solution 7

7. In how many ways can **7 team members** sit around a **round table** for discussion:
(i) If clockwise and anticlockwise orders are different.
(ii) If clockwise and anticlockwise orders are the same.

Solution:
Circular Permutation:
(i) $(7-1)! = 6! = 720$
(ii) $(7-1)!/2! = 720/2 = 360$

8. How many different 5-digit numbers can be formed using the digits 1,2,3,4,5 without repetition?
Solution :
We must arrange all 5 distinct digits in order — that is the number of permutations of 5 distinct objects.
Number = $5! = 5\times4\times3\times2\times1 = 120$.
Answer: 120 different 5-digit numbers.

9. How many different arrangements can be made with the letters of the word **BALLOON**?

Solution (stepwise):

Count letters: B, A, L, L, O, O, N → total 7 letters.

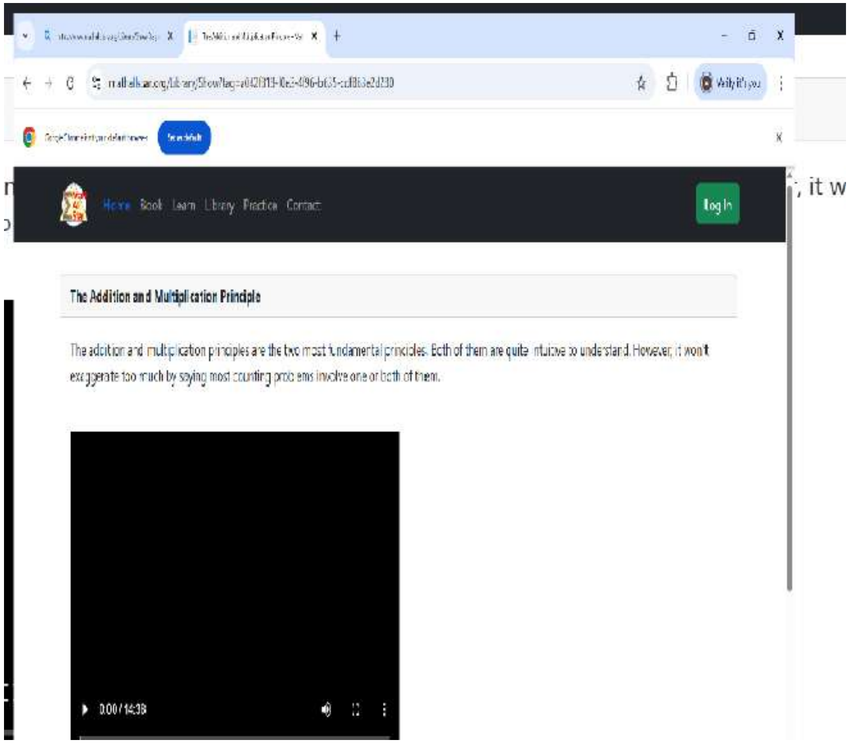
Identify repeats: L appears twice, O appears twice; all other letters appear once.

Number of distinct arrangements of 7 letters with these repeats:

$7!/2!\ 2! = 5040/2\times 2 = 5040/4 = 1260$ distinct arrangements.

Video Link

https://www.mathallstar.org/Library/Show?tag=a042f818-f0e3-4f96-b635-cdf863e2d280



Thank You

D Y PATIL
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