ALGORITHM

December 2025



Content: Disha & Muskan
Design: Pranati Khanna

HELLO READERS,

Welcome to the 13th edition of Algorithm, a space where curiosity meets creativity and mathematics becomes a lens through which we understand the world. This time, we journey into the fascinating theme of Order, Chaos and the Mathematics of Chances, a theme that captures the delicate tension between what we can predict and what continues to surprise us.

Mathematics is often seen as a realm of perfect logic, yet within its boundaries lie mysteries shaped by randomness, uncertainty and unexpected patterns. Order gives us symmetry, stability and structure, while chaos nudges us toward unpredictability and spontaneous outcomes. Between the two lies a dynamic relationship that shapes natural systems, human behaviour and technological innovation. In this edition, we explore how mathematics helps us read both the harmony and the turbulence around us.

As you move through these pages, you will encounter articles, reflections and creative writings that highlight how chance plays a role in everyday life. From the behaviour of particles to the spread of information, from decision making to the roll of a dice, probability influences far more than we often realise. Our contributors examine these ideas with curiosity and clarity, offering insights into the surprising ways in which chaos can reveal patterns and order can sometimes dissolve into uncertainty.

We also look at historical perspectives, scientific developments and real world applications of probability and chaos theory. Each piece invites you to think deeply about how small changes can create significant effects, how randomness hides meaning within it and how mathematics remains a guiding force in understanding the unexpected.

Whether you are passionate about numbers or simply intrigued by the mysteries that surround us, we hope this edition encourages wonder, reflection and a renewed appreciation for the balance between order and chaos.

Happy reading.

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Editor's Note

Design: Pranati Khanna

"Without data, you're just another person with an opinion".

In this edition of Algorithm, we've tried to make sense of uncertainty and see order where there seems to be none. You must've guessed it by now! This year, our focus turns towards Statistics, exploring how data reveals behaviour and shapes everyday decisions.

Starting as a content team member the previous year, and now stepping into the role of Editor-in-Chief for the 2025-26 session, it has been a wonderful experience working with this team, for which I couldn't be more proud. I'm deeply grateful to our writers, designers, and all team members whose ideas and effort shaped this edition. A special thank-you to our dearest Sub-Editor-in-Chief, Srishti, whose steady guidance and insights have supported this journey at every step.

May these pages inspire you to find meaning in data, confidence in uncertainty, and joy in the journey of discovery.

Happy reading!

Shruti Sachdeva

Editor-in-Chief

"Pure mathematics is, in its way, the poetry of logical ideas." – Albert Einstein

If Maths has ever felt overwhelming for you, I invite you to flip these pages with a curious mind. You might find that randomness can be playful, choices can be strategic and patterns can be more familiar than it seems.

As the Sub-Editor-in-Chief for the session of 2025-26, it is an honour to share this edition of Algorithm with you.This edition is the result of many minds working with heart. Our Content Team has shaped each article with care, and our Design Team has given life and colour to every idea. And a special thanks to our Editor-in-Chief, Shruti Sachdeva, whose clarity and vision brings new ideas to life, and whose guidance keeps us grounded and inspired.

Welcome to an edition that doesn't just explain Math ,it uncovers its magic!

Wishing you a joyful read!

Yours sincerely,

Srishti Dey

Sub - Editor In Chief

BAYES' THEOREM IN DAILY LIFE

Seeing Probability in Action

Content: Vrinda Kwatra
Design: Kashika

Introduction: Math in Real Life

Mathematics is all around us, in simple things like counting, in calculating the probability of tossing two coins, and even in the intricate fractal patterns found in nature. It is often described as the language of the universe, it helps us connect ideas, recognize patterns, and make sense of the world we live in. It is a powerful tool that helps us to reason, predict outcomes, and solve problems in our daily lives.

One of the most fascinating and widely used branches of mathematics is probability. It plays a role in almost every field, from sports and weather. Forecasting to blood testing, predicting genetic traits, understanding. Congenital conditions, and analyzing data in statistics.

A key idea within probability is Bayes' Theorem, which helps us alter our understanding of the world based on new information. It allows us to estimate how likely an event A is to occur when we already know that another event B has taken place.

The statement of Bayes' Theorem is:

"The conditional probability of an event A, given that event B has occurred, is equal to the probability of B given A, multiplied by the probability of A, and divided by the probability of B."

Mathematically

$$P(A \mid B)=P(B \mid A)\times P(A)/P(B)$$

where:

- **P(A) and P(B) are the probabilities of events A and B,**
- **P(A | B) is the probability of A when B has happened, and**
- **P(B | A) is the probability of B when A has happened.**

Applications of Bayes' Theorem

In real life, Bayes' Theorem is used in situations ranging from something as common as email spam filtering to more complex areas like DNA testing.
In email spam filtering, Bayes' Theorem helps the email service provider decide whether an email should be placed in the spam folder or not. It filters out emails based on certain words or phrases such as "Free Offer" or "Win a Prize." The theorem is used to calculate the probability of an email being spam, given that these specific words appear in it.

$P(\text{Spam} \mid \text{Words}) = P(\text{Words} \mid \text{Spam}) \times P(\text{Spam})/P(\text{Words})$
Here,

- **P(Spam) is the overall probability that any email is spam,**
- **P(Words | Spam) is how likely these words are to appear in spam emails and,**
- **P(Words) is how often these words appear in all emails.**

Updating Beliefs with Bayes

Meteorologists use Bayes' Theorem to make weather forecasts more accurate. They combine information from different sources such as satellite images, weather stations, and past weather records to estimate the chances of different weather conditions. For example, suppose the initial forecast shows a 30% chance of rain tomorrow based on past data. Later, new satellite readings show thick clouds and increasing humidity. This acts as new evidence. Using Bayes' Theorem, meteorologists update the earlier prediction, raising or lowering the probability of rain depending on how strongly the new data supports it. Bayes' Theorem helps weather forecasters bring together previous knowledge like historical weather patterns with current observations such as temperature, air pressure, and humidity to make better predictions

Another very important use of Bayes' Theorem in daily life is DNA Testing, to understand how reliable a DNA match really is. For instance, if a DNA sample found at a crime scene matches a suspect's DNA, it doesn't automatically mean that the suspect is guilty. Scientists use Bayes' Theorem to calculate how likely it is that the suspect is guilty, taking into account both the chance of a true match and the possibility of a random match that just happens to look similar. In the same way, Bayes' Theorem is used in paternity testing to check how likely it is that a man is the biological father of a child. It combines the chance of paternity before the test with the strength of the DNA evidence to give a more accurate answer. By using Bayes' Theorem, scientists can make better and more reliable conclusions from DNA results, since it allows them to consider both the evidence from the test and the background information together.

In conclusion, Bayes' Theorem is a useful tool that shows how closely mathematics and probability are connected to our everyday lives. It reminds us that probability is not just about numbers on paper but about making smarter decisions and understanding the world more clearly. By helping us use new information to update what we already know, Bayes' Theorem turns data into meaningful insights and helps us deal with uncertainty in a practical and logical way.

Glossary

1.Bayes' Theorem:

A rule in probability that helps us update what we believe after getting new information. It connects prior knowledge with new evidence to make better predictions.

2. Probability:

The likelihood or chance of something happening — for example, the chance of rain or of tossing heads in a coin flip.

3. Conditional Probability:

The probability of one event happening when we already know that another event has occurred.

4. Spam Filtering:

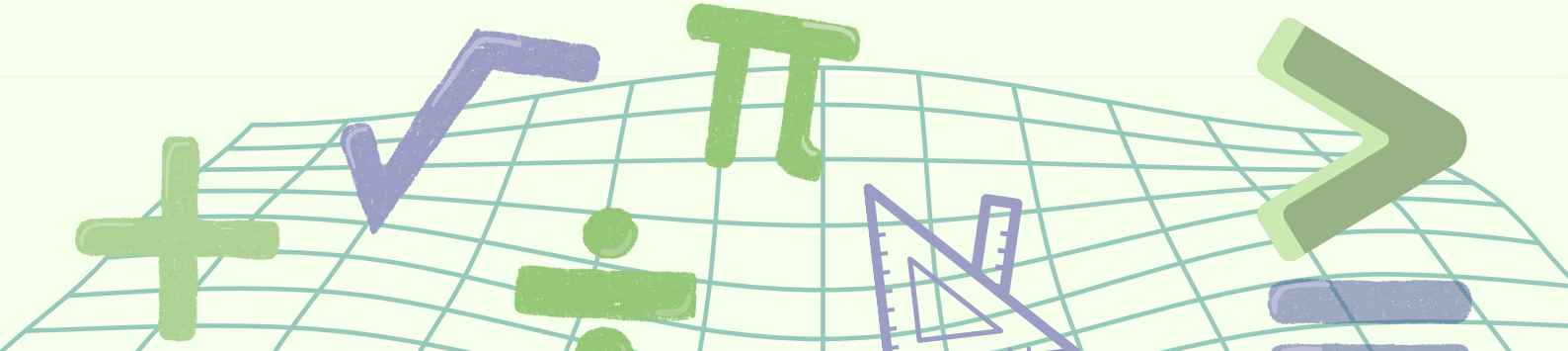
A process used by email providers to identify junk or unwanted emails using probability and keywords.

5. Weather Forecasting:

Using data from satellites, weather stations, and past records to predict weather conditions. Bayes' Theorem helps improve the accuracy of these predictions.

6. DNA Testing:

A scientific process that compares DNA samples to determine identity or relationships, where Bayes' Theorem helps assess how reliable a DNA match really is.



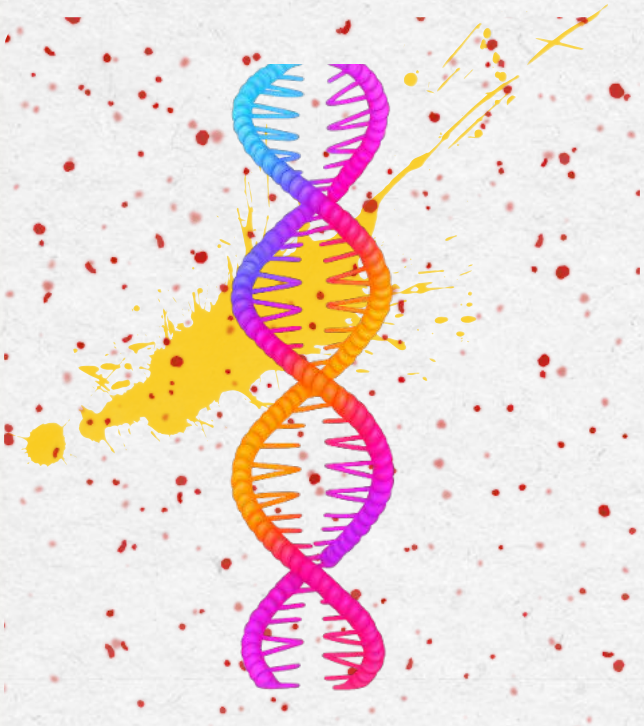
WHEN NUMBERS MEET THE LAW: PROBABILITY IN JURY DECISIONS

Should justice rely on numbers—or on human judgment

Content & Design: Disha

This question brings out the argument that still surrounds the application of probability in contemporary courtrooms. Technology and data science are getting better, and so courts are receiving increased evidence based on statistics, such as the likelihood of a DNA match, fingerprint records, and the likelihood of specific things. Although numbers appear to be precise, their interpretation can be misleading and even trigger disagreements and difficult ethical dilemmas.





Advocates of probabilistic reasoning think that statistics render justice more objective. They claim that statistics ensure that rational thinking is involved in making legal decisions, which are usually subjected to emotion. Bayesian thinking is useful when there is uncertainty in the evidence, like an eyewitness report or a DNA match. In fact, an example of such a theory is Bayes' Theorem, which demonstrates that determining guilt relies not only on the accuracy of the evidence but also on its rarity. A very unlikely match in DNA that cannot occur by chance is more significant when there is a limited number of people who might be the cause of such a match, than when any individual can be a suspect. This method of court work assists in distinguishing a coincidence and an actual relationship.

Probability adds transparency and organization to the legal decisions. It puts the legal system under the obligation to evaluate the power of evidence rather than to use intuition as the sole method. In the United Kingdom, a few courts have begun to accept the application of Bayesian analysis by experts in complicated cases, particularly those that involve medical statistics or DNA evidence. Advocates assume that, when juries are guided appropriately, it is the moral responsibility of society to apply the finest reasoning means possible.



But the relationship between mathematics and the law does not always make sense. Some view that the application of mathematics may affect the use of human judgment in formulas that are not well comprehended. The prosecutor's fallacy, that is, the most traditional, and is known as confounding the rarity of the evidence with the rarity of innocence, exhibits this hazard. As an illustration, using a DNA test as an example, when there is a 99.9% accurate DNA test, and there is a match, a prosecutor can argue there is a 99.9% possibility that the defendant is guilty. The reality is that in the event that DNA is placed in a large pool of comparison, a large number of innocent individuals could be matched by mere chance. This must be interpreted in the right way based on the probability of guilt prior to the test, rather than the accuracy of the test.



This type of misunderstanding may be misleading the juries. Out of context numbers can present as persuasive, but can be uncertain. Ethical questions also arise: is it possible to reduce justice to numbers in case the human actions and intentions are so complicated? Critics place blame on the fact that the presumptions of innocence might be undermined by the use of probabilities to establish guilt. It might make the idea of beyond a reasonable doubt simply a number, as opposed to a moral and legal norm.

The challenge, however, lies in integration. Courts must strike a delicate balance—acknowledging the value of probability without letting it overshadow human judgment. Statistics can inform justice but should never dictate it. It is the duty of experts to explain, not obscure, and of judges to ensure that juries comprehend both the meaning and the limitations of the numbers before them.

Glossary:

Probabilistic Reasoning – A method of thinking or decision-making that uses probability to judge how likely something is to be true.

Bayesian Analysis – A statistical approach that applies Bayes' theorem to analyze evidence and update conclusions based on new data.

Prosecutor's Fallacy – A common logical error in court cases where people confuse the accuracy of evidence with the likelihood of guilt.

Prior Probability (or Base Rate) – The initial estimation of how likely something is before new evidence is considered.

FINDING PATTERNS IN RANDOM THINGS: THE POISSON WAY

Content: Somedutta Design: Sejal

Interviewer : Today we will talk about a topic that sounds difficult to most students. At least it did to me, when I was in school. It's the Poisson distribution. To help us understand it, we have Dr. Ian Malcolm, a mathematician.
So, Dr. Malcolm, what is Poisson distribution?



Dr. Malcolm: Let us say, you're at a bus stop. We don't know when the buses will arrive, but we do know that on an average, about 3 buses come every hour. That's what the Poisson distribution is about. It helps us estimate how many times something might occur in a given period of time, even if it is just a random situation.

Interviewer: So it applies to random events?

Dr. Malcolm: Exactly. These events are independent, meaning one event doesn't influence another. For example, if one bus arrives, it doesn't speed up or slow down another bus. Each bus comes on its own. The Poisson distribution works best when events happen rarely but consistently on an average. Such as, shooting stars we can see in an hour. We don't see them every minute, do we? But over a period of time, we can calculate how many we see on an average basis, say, in an hour.



Interviewer: You mentioned an "average rate." What does that mean?

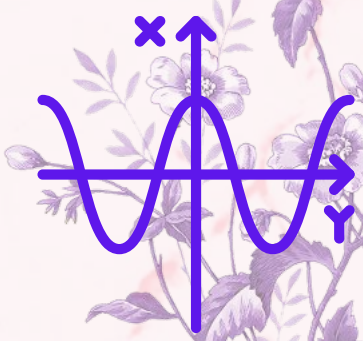
Dr. Malcolm: We use a symbol called λ (lambda) to represent the average number of times an event occurs in a certain time frame. For instance, if 4 kids usually come to the playground every 10 minutes, then λ equals 4. The Poisson distribution can help us understand how likely it is that 0 kids, 2 kids, or 5 kids come to the park on an average basis.



Interviewer: How does this differ from other types of probability?

Dr. Malcolm: Great question! There's another model called binomial distribution, which is similar to flipping a coin a certain number of times, like 10 flips.

You know exactly how many attempts you have. But with the Poisson distribution, we don't set the number of attempts. We just observe how many times something occurs over a time period, like counting how many cars pass a traffic signal in an hour. Also, when the number of attempts is very high and the event is rare, binomial and Poisson distributions produce almost the same results!



Interviewer: Where do we see Poisson distribution in everyday life?

Dr. Malcolm: Almost everywhere. Counting how many cars pass through a toll gate in 5 minutes. How many calls does a helpline receive in an hour? How many earthquakes occur in a year? Even though these events seem random, the Poisson distribution helps us predict how often they might happen.



Interviewer: So even random events can have patterns?

Dr. Malcolm: That's right! The Poisson distribution reveals that randomness has a pattern. We can't say for sure what will happen next, but we can recognize patterns over time.

Interviewer: Thank you, Dr. Malcolm. You've made tricky math sound simple!

GLOSSARY



1.Poisson Distribution
A probability model used to predict how many times a rare event will happen in a fixed time or space.

2. Rare Events
Events that don't happen all the time but do occur every now and then.

3. Independent Events
Events that don't influence each other. The occurrence of one doesn't make another more or less likely.



4. Binomial Distribution
A different probability model used when there's a fixed number of trials, each with the same chance of success or failure.

5. Measurable Order
A measurable function is a function that works nicely with measurement — meaning, if you take a set you can measure (like an interval or region), then all the inputs that map into that set can also be measured.

PREDICTING THE UNPREDICTABLE : HOW PROBABILITY SHAPES NATURE

Content: AVNI JAIN
Design: DIZA

We live in a world that appears to be chaotic, incoherent and completely random. But under all of this lies a simple phenomenon which harmonises it all. That simple phenomenon exists in mathematics: probability. Probability is the study of chances. It unravels the likelihood of a certain event occurring.

Though the concept may appear abstract, it forms the foundation of how we interpret data, recognize regularities, and build theories to make sense of the world (i.e. probability distributions), all of which form our perspective of the world we live in and how the world responds to our interventions.

For several years, the ubiquity of the normal distribution has been widely believed in. It is believed that almost everything in nature can be represented by the bell curve. The normal distribution is a type of frequency distribution characterized by its bell shape, that is, symmetrical about its average value with a decreasing probability of occurrence at its extreme values.

I know of scarcely anything so apt to impress the imagination as the wonderful form of cosmic order expressed by the "law of frequency of error" [the normal or Gaussian distribution]. Whenever a large sample of chaotic elements is taken in hand and marshaled in the order of their magnitude, this unexpected and most beautiful form of regularity proves to have been latent all along. The law ... reigns with serenity and complete self-effacement amidst the wildest confusion. The larger the mob and the greater the apparent anarchy, the more perfect is its sway. It is the supreme law of unreason.
-Francis Galton,1889



Anything that can be measured through numbers tends to follow this phenomenon, from the IQs of a large group to the length of a handful of almonds. For example, while measuring the heights of adults of the same gender, you will find that the distribution of heights closely follows a normal curve.

This principle follows from the Central Limit Theorem. The idea behind this principle, in simple language, is that almost everything that exists in nature is the aggregate of many small things. This can be better illustrated using the following example.

A person's height is akin to the sum of rolling many dice**.** Each die parallels one of the above factors. I.e., the genes match the 1st die, the hormones the 2nd, etc. So, to end up being very tall, you need them all working in favour of you: the genes, the hormones, the environment, the activity, etc. It's as if scoring 16 heads in a row in the random walk setting. That's why there are few very tall people. The same logic applies to very short people. In this case, you need to have everything working against you: bad genes, poor nutrition, no activity, etc. However, most people have an average height because some factors contribute positively and others negatively.

But the normal distribution is only one of nature's many signatures. Mathematicians later found that when different constraints shape aggregation, other limiting distributions arise. Processes that preserve the mean give rise to exponential patterns; those preserving the geometric mean form power laws, which describe phenomena ranging from earthquake magnitudes to wealth inequality. Here, the Central Limit Theorem broadens into a deeper principle: the mathematics of emergence, showing how large-scale regularities arise from the aggregation of many small events.

Hereon, we will venture out to see how probability helps shape our interventions in nature. In meteorology, ensemble forecasts and Lorenz's chaos theory explain why hurricanes are predicted as cones of uncertainty rather than single paths. In seismology, the Gutenberg–Richter law and Poisson models quantify earthquake risk, shaping building codes worldwide. In ecology, stochastic birth–death models and species–area curves estimate extinction risks and biodiversity thresholds. And in epidemiology, stochastic SIR (susceptible–infectious–removed) models and real-time estimates of the reproduction number have guided global responses to pandemics. Across disciplines, probability acts as the grammar of uncertainty.

It is through probability that decision-making forms a strategy to combat the uncertainties of life. Beneath the randomness of life, the quiet symmetry of probability endures, harmonising the world's apparent chaos into a pattern of cosmic order.

Glossary

1. PROBABILITY DISTRIBUTION: a probability distribution is **a function that gives the probabilities of occurrence of possible events** for an experiment.
2. CENTRAL LIMIT THEOREM: In probability theory, the central limit theorem states that, under appropriate conditions, the distribution of a normalized version of the sample mean converges to a standard normal distribution. This holds even if the original variables themselves are not normally distributed.
3. LORENZ'S CHAOS THEORY: Lorenz chaos theory is the set of three differential equations wherein He constructed a weather model showing that almost any two nearby starting points, indicating the current weather, will quickly diverge trajectories and will quite frequently end up in different "lobes," which correspond to calm or stormy weather.
4. GUTENBERG-RITCHER LAW: the Gutenberg–Richter law[1] (GR law) expresses the relationship between the magnitude and total number of earthquakes in any given region and time period of at least that magnitude.

THE BIRTHDAY PARADOX: WHY SHARED BIRTHDAYS ARE MORE COMMON THAN YOU THINK

Content: Suhani Design: Pavni

Characters:

Suhani - A curious college student who believes that probability is just luck in mathematical terms.

Pierre-Simon Laplace - An 18th century French Mathematician who somehow steps out of her textbook.

Scene 1

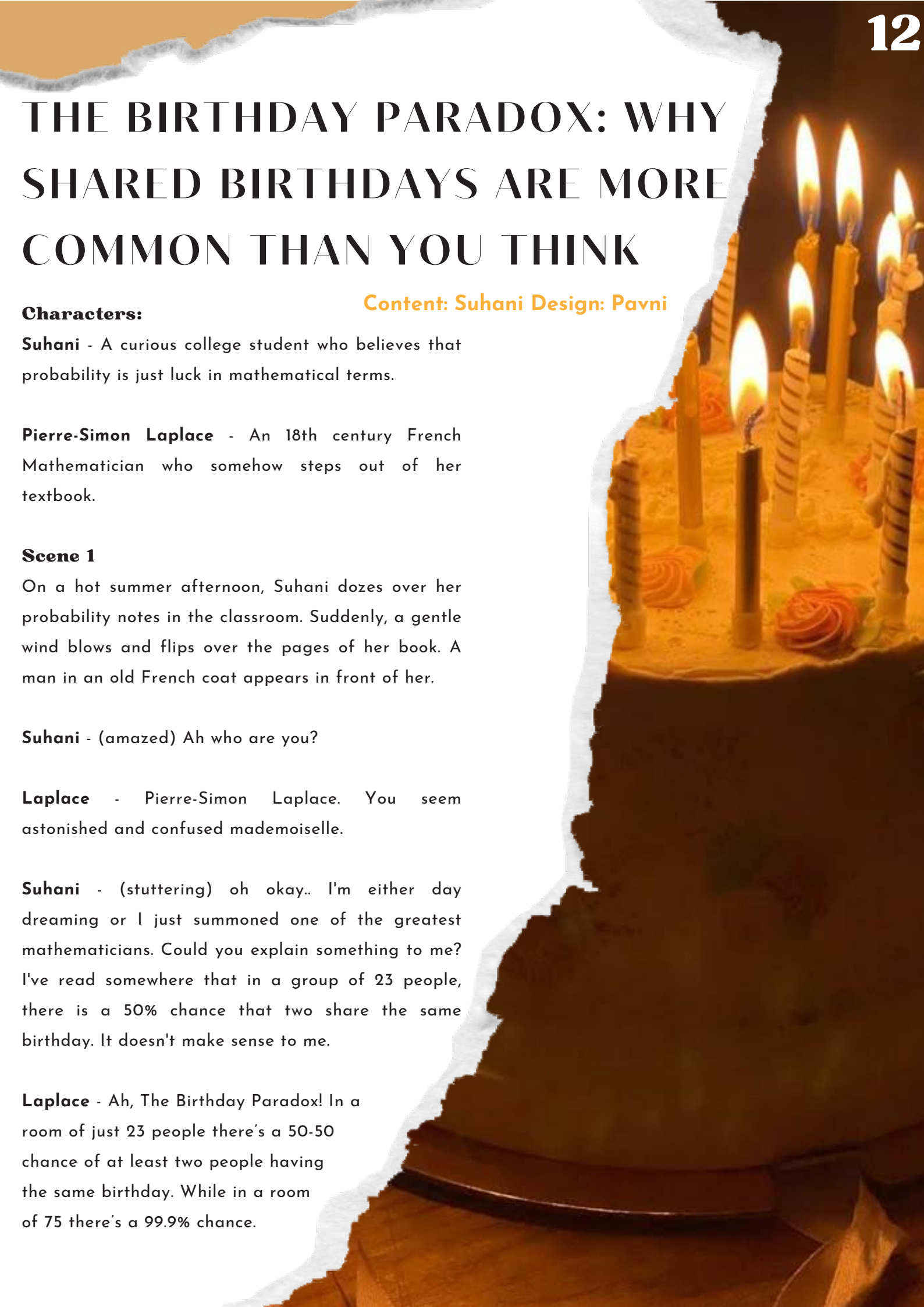
On a hot summer afternoon, Suhani dozes over her probability notes in the classroom. Suddenly, a gentle wind blows and flips over the pages of her book. A man in an old French coat appears in front of her.

Suhani - (amazed) Ah who are you?

Laplace - Pierre-Simon Laplace. You seem astonished and confused mademoiselle.

Suhani - (stuttering) oh okay.. I'm either day dreaming or I just summoned one of the greatest mathematicians. Could you explain something to me? I've read somewhere that in a group of 23 people, there is a 50% chance that two share the same birthday. It doesn't make sense to me.

Laplace - Ah, The Birthday Paradox! In a room of just 23 people there's a 50-50 chance of at least two people having the same birthday. While in a room of 75 there's a 99.9% chance.



Suhani - So...is it magic?

Laplace - Not magic, its mathematics. Let's untangle it.

Scene 2

Laplace - Let's imagine that you wish for no shared birthdays.
With 23 people we have 253 pairs.
23 x 22/ 2 = 253

The chance of 2 people having different birthday is:
1 - 1/365 = 364/365 = 0. 9972

We use exponents to find the probability now.
(364/364)^253 = 0. 4995

The chance we find a match is:
1 - 49.95% = 50.05%



Suhani - Oh, so that means that 0.5005 or 50.0%, is for at least one shared birthday?

Laplace - Très bien! Exactly. You see, 23 people from possible pairs. That is 253 chances for coincidence.

Scene 3

Suhani - So technically, the Paradox is not that the birthdays repeat. It's just our mind not being able to think mathematically.

Laplace - Yes, indeed. Its only a "paradox" because our brains can't handle the compounding power of exponents. We expect probabilities to be linear and only consider the scenario we're involved in (both faulty assumptions, by the way).

Scene 4

Suhani - It happens in cryptography too, right? When two flied share the same hash its like their digital birthdays match.

Laplace - (nodding) Absolutely! The same logic that surprises us in the classroom safeguards your data.
So probability is not mere luck. Its how the universe keeps things balanced.

Glossary:

1. **Hash Collision** - When two different digital files produce the same unique code (hash).
2. **Cryptography** - The science of protecting data through mathematical codes.
3. **"Très bien"** (*French*) - Means "very good".
4. **Combinatorial Probability** (*or compounding power of exponents, as used in the above text*) - The math of counting outcomes formed by pairs or groups.
5. **Formula used** -
p(n) = 1 - (364/365)^C(n,2) = 1 - (364/365)^n(n-1)2



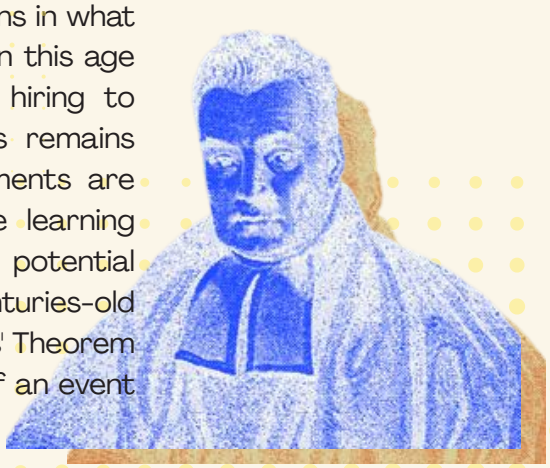
Content: Manya bhatia Design: Shaila

BREAKING NEWS

BREAKING THE CODE : INSIDE THE MATH OF MODERN POLICING

Can a machine learning model predict a crime before it even happens?

In a world where artificial intelligence claims to see patterns in what human eyes miss , the idea is no longer science fiction . In this age where artificial intelligence influences everything from hiring to healthcare , one of its most controversial applications remains predictive policing . Across major cities ,police departments are experimenting with **predictive policing,** where machine learning algorithms are used to forecast crime hotspots and potential offenders . Behind this futuristic promise lies a centuries-old principle of probability: **Bayes' Theorem**. At its core, Bayes' Theorem calculates conditional probability , which is the likelihood of an event occurring given that another event has already occurred .



This is expressed mathematically as --

$$P(A|B) = [P(B|A) \times P(A)] / P(B)$$

Here, P(A|B) represents the probability of an event, say a theft happening in a neighbourhood, given evidence B, let's suppose it stands for recent reports of thefts.

This formula helps computers learn from data and then it adjusts probabilities dynamically as conditions change. In simple words , imagine you have some important papers that you need to see

everyday. You always find your papers on top of the desk, the next day, you need to see the papers, you automatically come and look for them on the desk . That's called using probability, guessing what might happen next based on what's happened before .

Think the same for police who want to find where crimes might happen .Some police departments use computers and machine learning for this. The computer looks at old records where crimes happened before and then thinks this place might be doing more crime again.

Sounds smart, right? But there's a big problem that if in the past the police checked some areas more than others, the computer learns that those areas have more crime. It doesn't know the difference between **more crime** and **more checking**. So it might keep sending police to the same areas again and again, even if those people aren't doing anything wrong.

That bring us to getting to know of **bias**, it is when the computer's thinking becomes unfair because it learned from unfair examples.

For example , if a city records that 60% of thefts occur in **Region X** , a model designed for policing might initially assign a prior probability of 0.6 to future thefts there . Even though the reason is just that there isn't much historical data and information about **Region Y** and **Region Z**, indirectly making things hard for Region X .

"Probability itself doesn't discriminate, but when social bias enters the dataset, even a perfect algorithm can produce unfair outcomes." -Dr. Ananya Mehta, a data ethics researcher

Experts argue that this issue is not a failure of mathematics but of implementation.

Hence we learn that probability gives us the power to predict, but fairness gives us the wisdom to act. If data can learn from the past, so can we. The future of policing lies not in eliminating human judgment, but in combining it with mathematics that remembers compassion as much as precision.

GLOSSARY

1. Predictive Policing - A technique that uses data and machine learning models to examine crime data in order to predict future criminal activity or the most risky areas.

2. Algorithm - A well-defined and systematic collection of mathematical instructions that empower computers to tackle problems or give predictions.

3. Bayes' Theorem - A formula that is mathematically derived to compute conditional probability, thereby facilitating the continuous updating of predictions as new proofs come in.

4. Probability – The chance of an event happening, shown as a number between 0 (impossible) and 1 (certain).

Naive Bayes Classifier

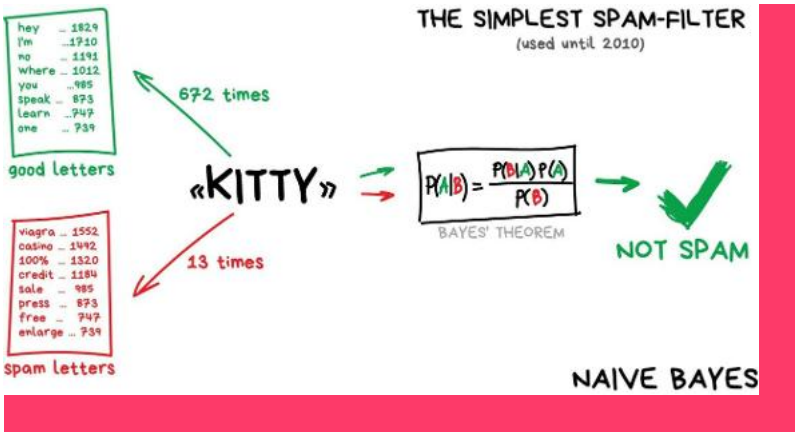
Content: Zainab Abbas

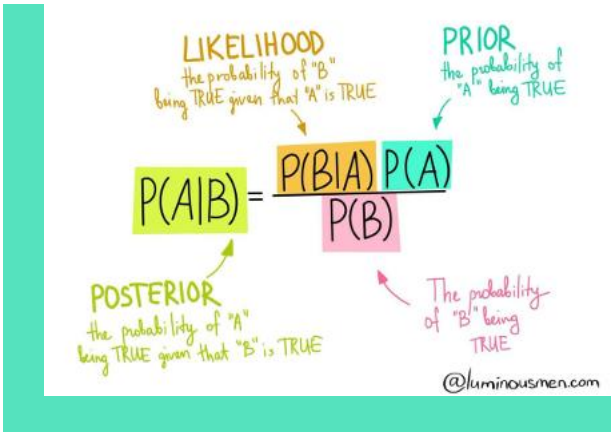
From Learning Algorithms to AI Implications

Design: Disha Sharma

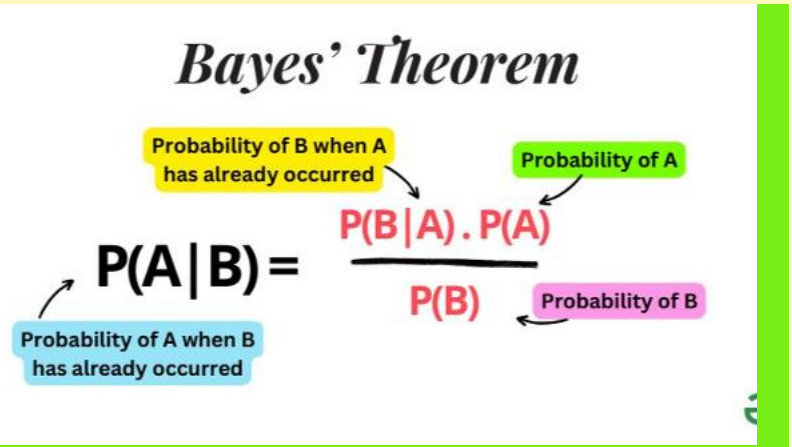
Long ago in computer land and data land, there was a smart algorithm named Naive Bayes. Naive Bayes was not the most complex nor the most elegant algorithm but was described as extremely simple, quick, and extremely powerful. People used Naive Bayes to assist computers in making decisions and predicting things, particularly if there was a lot of data to handle. Naive Bayes was a machine learning algorithm. Machine learning was the way computers learned from information and made decisions or predictions without being explicitly told what to do. Naive Bayes was a classifier, meaning it assisted computers in categorizing things. It might assist with determining whether an email was spam or not spam, or whether a review was good or bad.

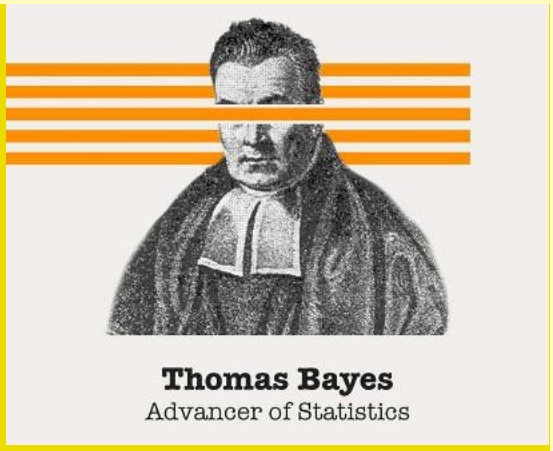
Naive Bayes' trick was based on something called Bayes' Theorem. Bayes' Theorem is a probability rule that allows humans to determine how likely a thing is to be, given what they already know about it. Naive Bayes applied the rule to examine the attributes of a data point such as the words in an e-mail message, and determine what category it fell into. Why, then, was it "naive"? The reason is easy to see: Naive Bayes made a gigantic assumption. It assumed that each feature, or bit of information, was independent of every other feature. That is, it assumed that one feature would not influence another feature. For instance, if Naive Bayes was choosing an email, it would separate the word "free" from the word "money" entirely, even if in the real world those two words as a combination might have been special in some way. That shortcut reduced the math to much less complexity, but wasn't always actually true. But Naive Bayes did perform well in a very high percentage of cases despite this "naive" assumption.





Naive Bayes performed particularly well on text. With many words and many documents, Naive Bayes was able to classify them rapidly into groups. It was used in spam filtering, to delete unwanted messages from their inboxes. It was also used in document classification, to label articles or news stories. Another typical use was in sentiment analysis, where Naive Bayes determined whether a review or comment was happy, sad, or angry. One of the greatest things about Naive Bayes was just how easy it was to implement. It did not require much configuration or parameters to get going. This allowed people to develop machine learning models with Naive Bayes without having to have a lot of experience in the topic. And since the math was easy, Naive Bayes was able to make its predictions in the blink of an eye. And best of all, it was usually faster than other, more complex algorithms. Of course, Naive Bayes used not to be so great. Its grand simplification, the assumption that features were independent, did not always hold. Occasionally features did influence each other slightly, and Naive Bayes would be in error. But a lot of times, particularly with huge big collections of data and easy categories, Naive Bayes performed wonderfully well. In the end, Naive Bayes was a default resource for countless individuals who worked with data. It demonstrated that frequently the most basic ideas are incredibly powerful. Employing probability and making some intelligent assumptions, Naive Bayes permitted computers to learn from data and make decisions speedily and easily. And that's Naive Bayes, the powerful but simple classifier, history.





GLOSSARY

Classifier: A model that categorises data into specific groups.
Baye's Theorem: A formula for calculating conditional probability.
Probability: The likelihood of an event occurring.
Spam Filtering: Detecting and removing unwanted email messages.
Sentiment Analysis: Determining emotional tone in text.
Simplification: Reducing complexity while retaining essential meaning or function.

Chaos Theory in Game Design: When Butterflies Change Everything

Content: Sejal & Taarini Design: Nyssa

A Butterfly Flaps Its Wings and a Game Changes Forever

It's 1961. Meteorologist Edward Lorenz is rerunning a weather simulation. Instead of typing 0.506127, he shortcuts it to 0.506. The forecast completely changes. That tiny difference—three decimal places—created an entirely different prediction. This accident gave birth to the butterfly effect: a butterfly flapping its wings in Brazil could trigger a tornado in Texas weeks later. And it's secretly running half the games you've ever played

The Logistic Map: Simple Rules, Complex Outcomes

The logistic map looks boring on paper—just a basic equation. But feed it numbers and patterns emerge, then chaos, then order again, all from the same simple rule. Sound familiar? That's Minecraft. You've got maybe a dozen core actions: mine, craft, build, fight. Yet players recreate the Sistine Chapel, build functioning calculators, and program entire games within the game. Complexity doesn't come from adding more rules—it comes from letting simple rules collide

Understanding Chaos Theory: From Lorenz Equations to Game Worlds

Here's the wild part about Lorenz's discovery: his equations were deterministic. Same inputs, same outputs, every time. But change your starting number by a fraction? The whole thing spins off in a completely different direction. XCOM players know this pain. You've got a 95% chance to hit. The soldier's three tiles away. Clear line of sight. You take the shot... and miss. Your entire strategy crumbles. The game's math is fixed, but it feels unpredictable because tiny differences in positioning and turn order compound into wildly different outcomes

Simulation and Feedback Systems: Chaos Behind the Scenes

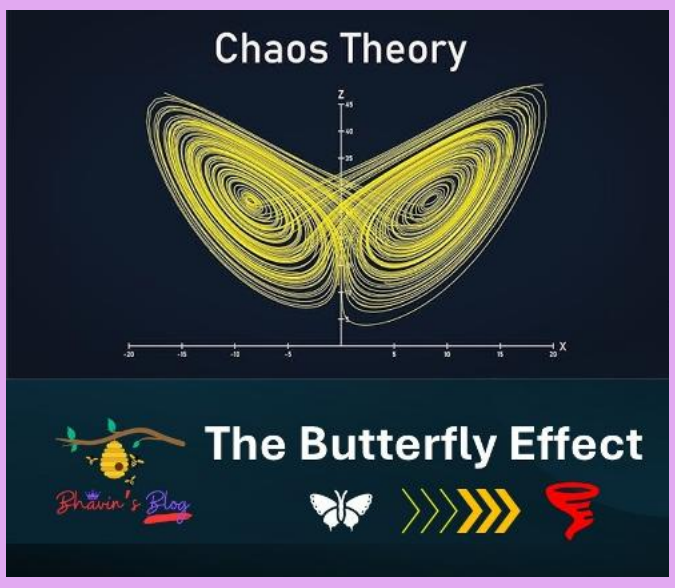
Ever wondered how virtual worlds feel so alive? Beneath the surface, simulation and feedback systems quietly balance logic, chaos, and chance. Each action you take triggers a reaction, forming endless loops of cause and effect. From dynamic weather to adaptive AI, these systems keep digital worlds in constant motion. When those loops collide, unpredictability takes over. One tiny change can create entirely new outcomes, proving that even in order, chaos always finds a way.

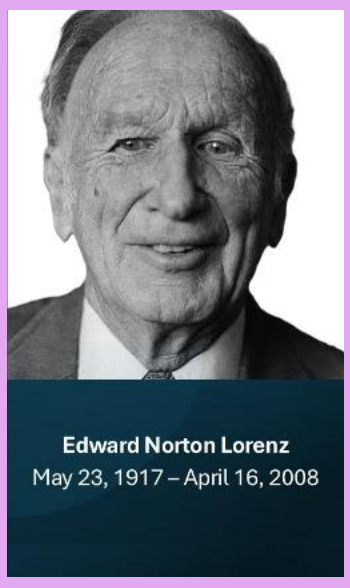
Strategic Unpredictability in Gameplay

Great games thrive on controlled chaos, balancing strategy and surprise. Players make calculated moves, but chance always lurks in the background, ready to change the outcome.This tension between predictability and randomness keeps gameplay engaging. It reflects life's own rhythm, where logic sets the stage, but uncertainty determines the ending. In the end, strategy may guide you, but chance makes the story worth playing.

Hidden Order in Chaos: Finding Patterns in Play

Patterns can be found even in the most chaotic gameplay. A sense of order is created in the midst of unpredictability by the hidden rules and structures that govern the action behind surprise and randomness.This interaction between reason and chance is a reflection of life itself, where order and disorder coexist





Conclusion: Embracing Chaos as the Heart of Gaming

Gaming isn't just about rules or strategy. It's about the thrill of the unexpected. Behind every carefully planned move lies a spark of chaos, transforming simple choices into epic consequences. This balance between order and unpredictability brings games to life. Chance can surprise you, patterns can guide you, and sometimes, a small decision can change everything. In the end, chaos isn't the enemy. It's the heartbeat, the secret ingredient that makes every game unforgettable.



GLOSSARY

The Butterfly Effect - Small changes leading to dramatically different outcomes.

The Logistic Map - Simple rules generating complex, chaotic behavior.

Lorenz Equations - Systems where tiny differences create wildly different results.

Sensitivity to Initial Conditions - Small early choices compounding into major consequences.

Nonlinear Dynamics - Combined elements creating disproportionate effects.

Butterfly Effect in Narrative Games - Minor story choices cascading into unexpected outcomes.

Simulation and Feedback Systems - Action-reaction loops creating dynamic game worlds.

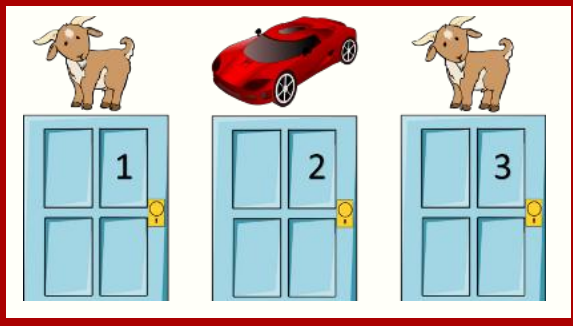
FOOTFALLS OF MATHEMATICS

THE MONTY HALL PROBLEM

DESIGN: DISHA SHARMA

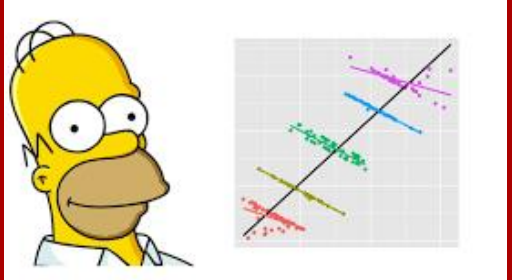
The Monty Hall problem's setup is simple having three doors, one prize, and two goats. We pick a door, and the host, who already knows what's behind each, opens one we didn't choose and it always has a goat. Then we are asked if we want to stay with our first choice or switch with one of the remaining unopened doors. At this point, most of us naturally assume that the chance of getting the prize or a goat is now equal between the remaining two doors so we tend to stick with our first choice. Most of us feel it shouldn't matter. There are two doors left, so it feels like a 50–50 chance. But when we first choose, our door has only a 1/3 chance of having the prize, while later the other two doors together have 2/3 chance. When we break it down this way, switching doors means we're choosing the option that still holds the bigger share of probability.

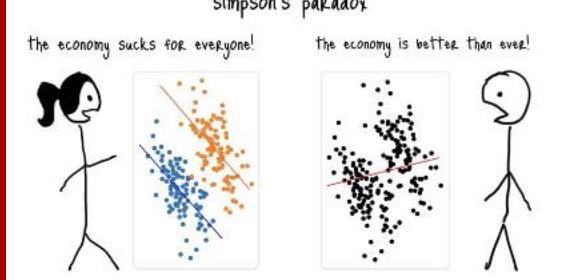




SIMPSON'S PARADOX

Simpson's Paradox happens when information is pointing in one direction, but when we look at the same information after grouping it differently, it suddenly points in the opposite direction. We usually expect more data to make information or a pattern clearer, not completely reverse it. The hidden differences between the groups are actually the ones influencing the final outcome without us noticing. This paradox was first discovered in studies. It happened while researchers were comparing success rates such as medical treatments or university admissions. One famous example where, a university was accused of having lower admission rates for women. But when the data was separated department-wise, each department actually admitted women at equal or higher rates. The overall numbers looked unfair only because more women applied to highly competitive departments with low acceptance rates. So, Simpson's Paradox shows how more doesn't always lead us closer to one specific result but can actually change the whole pattern completely.





GAMBLER'S FALLACY

The Gambler's Fallacy is our brain tricking us that a certain outcome influences the chances of the next outcome in any way. If something has happened many times in a row, then people start believing that the opposite simply has to happen next. Say, a coin lands on heads five times. We instinctively feel the next flip to be tails. But mathematically, it doesn't work that way at all.

This idea becomes a problem in gambling situations, where people believe that outcomes are due to change. One famous case happened in 1913 at a Monte Carlo casino, where the roulette landed on black over and over twenty times in a row. Many people kept losing there as they kept betting on red because they were convinced, after so many blacks showed as the outcome, red simply had to appear 'next'. While in reality, each spin is independent and its the players' belief that makes the simultaneous streak seem impossible even though it isn't.

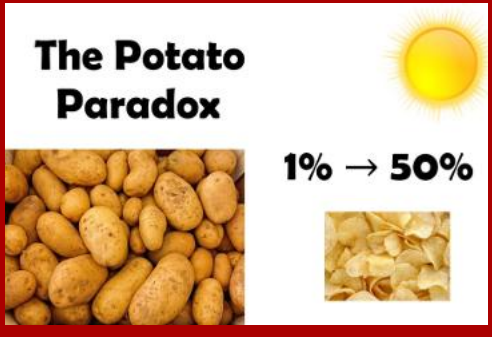


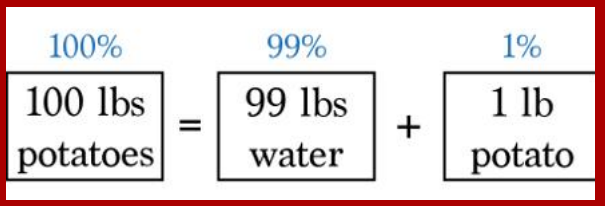


THE POTATO PARADOX

The Potato Paradox says if potatoes that are 99% water (1% solid) dry to become 98% water we assume the remaining total weight to change only a little since the water content changes by only 1%. But in reality, their total weight actually completely reduces to half.

To understand better, here the solid part stays the same while the water decreases. So, for example, the solid part weighs 1 kg. If solids are 1% of the potatoes, then the whole batch must weigh 100 kg because 1 kg is only a tiny part of it. After drying, the solids become 2% of the potatoes (98% water). For the same 1 kg of solids to be 2%, the total weight can only be 50 kg. So the total weight drops becomes half the initial and here, from 100 kg to 50 kg. Hence, even though the change in the solid mass seems to be little, mathematics proves it to be its complete half.





Harmony In Dice

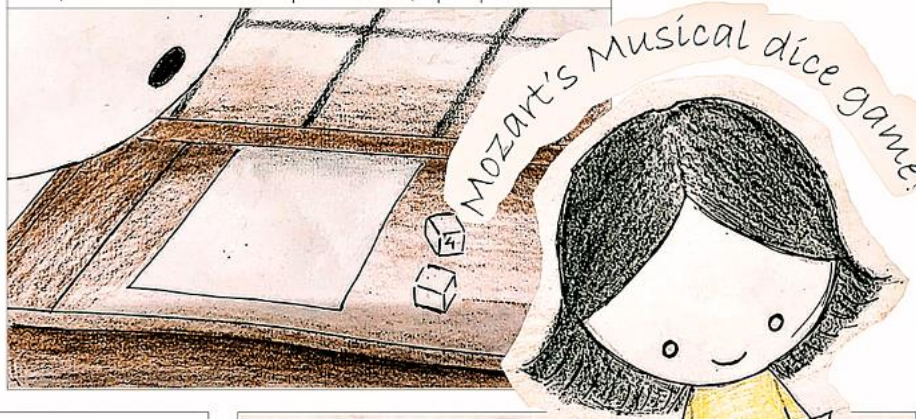
By: Yurmipei Mahung



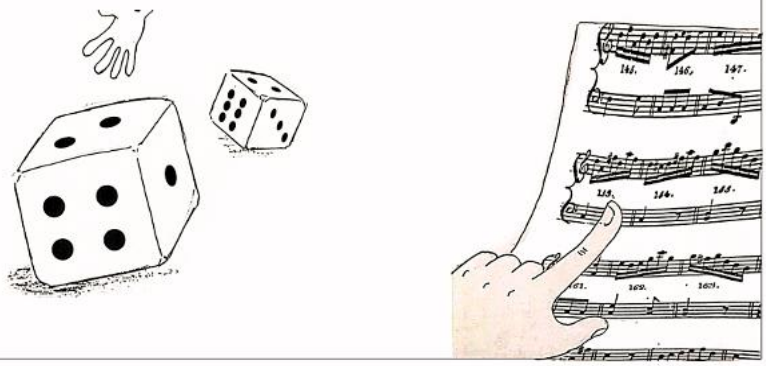
After class Mira stays behind to help clean up the lab.



Mira spots a small, old pair of dice and a piece of paper



Mira rolls the dice across the table and following the instructions she reads the paper grid of numbers to play a song.





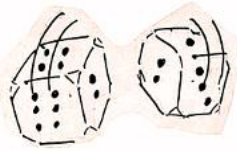
Her teacher, Arti noticed Mira inside the class.



Yes ma'am! This says, "Mozart's Musical Dice Game". It makes melodies using dice.



Ah, Mozart's Musical Dice Game. A lovely old example of how music and maths interwine.

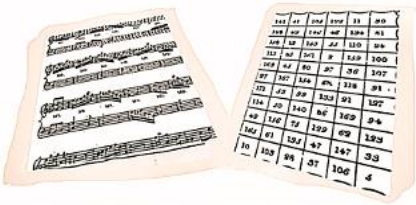




Really?! Math? How?



Each roll picks one musical bar from a set of choices. Its the same principal as probability every outcome forms part of a larger pattern.



So Randomness create structure?



Mira does a quick calculation on a notepad she finds nearby.



If there are 11 choices for each of 16 measures, thats 11^{16} possible melodies!



miss Arti Why dont we play a around and you play us a piece





Exactly! Endless tunes from a simple set of rules.



A pair of dice, a sheet of notes and a curious mind who would have thought



a simple experiment in music could unfold into a quiet lesson on probability, pattern and possibility.

GAMER'S LENS

CONTENT: SOUMYA DESIGN: RIA

ROCK, PAPER, SCISSORS – A LESSON IN EQUILIBRIUM

We've all played Rock, Paper, Scissors, right? A quick, silly, and fun game. But if you think about it, there's a bit of strategy hidden inside. Many people don't play randomly. Some keep picking "rock" because it feels strong, or they change their move after losing.
Without realizing, they form patterns.

Now, imagine playing against a computer or AI that studies your moves. It'll easily guess what you'll throw next and win. That's the smartest move is to be unpredictable —that is, to mix things up so no one can read your moves. That's called **OPTIMAL RANDOMNESS.**

When both players do this, it becomes fair, and no one can outsmart the other. That's what game theorists call a **NASH EQUILIBRIUM.**

This idea shows up literally everywhere- in sports, business, even life decisions. Whether it's how companies compete, how players plan their next move, or how you handle a situation where everyone's guessing what comes next.
So yeah, it might look like a simple game, but it actually shows how even small choices can turn into strategy if you think deeper.

THE PRISONER'S DILEMMA – RATIONAL YET WRONG

Suppose you and your friend are caught cheating on a test. The teacher separates you both and gives an offer — "If you confess and your friend stays quiet, you'll be free, and they'll get suspended. But if both of you confess, you'll both lose marks. If you both stay quiet, you'll just get a warning."

Now you're stuck thinking, "What if my friend confesses and I don't?" So to be safe, you confess. Your friend thinks the same way. In the end, both of you confess and both get punished. That's the Prisoner's Dilemma: when trying to protect yourself leads to a worse outcome for everyone. This idea shows up everywhere — friends who stop talking because each waits for the other to text first. (both want to fix things, but no one does, and the friendship just fades).

Being selfish doesn't always lead to the best result. Sometimes, trusting and working together even though it feels risky, actually creates a stronger outcome.

DEPARTMENT OF MATHEMATICS

Design: Disha Sharma













2026

Department report

Design: Pranati Khanna

Teacher's Day



On 3rd September 2025, the Department of Mathematics celebrated Teacher's Day in Room 302 with a vibrant Bollywood-themed event. The celebration opened with warm greetings, followed by energetic Bollywood dance performances that instantly lifted the mood of the room. Students then engaged teachers in a lively round of Bollywood trivia, sparking friendly competition and laughter. The excitement continued with a spirited game of Tambola, adding a cheerful, relaxed charm to the morning. The event concluded with a heartfelt vote of thanks and group photographs, creating a warm and memorable tribute to the department's faculty.

Fresher's Day



On 25th September 2025, the Department of Mathematics welcomed its new batch with an elegant Freshers' Day celebration in Room 302, themed "A Night in Paris." The venue was decorated to reflect the charm and romance of Paris, setting a delightful atmosphere for the event. The evening featured engaging dance performances by seniors, followed by a light-hearted and entertaining skit that captured the excitement of beginning college life. The highlight of the celebration was the crowning ceremony, where Ms. Nyssa Dara was awarded Miss Mathematics, and Ms. Taarini Trehan was crowned Miss Personality. The event concluded with photographs and warm exchanges, offering the freshers a memorable and welcoming start to their journey.

Assemblies

The Department of Mathematics conducted two assemblies during the academic year, each presenting mathematics through thoughtful and engaging themes. On 16th September 2025, the assembly titled “Man, Machine, and the Math in Between” explored the link between humans, technology, and mathematics. The programme included a prayer, thought for the day, and news, followed by a short thematic presentation. The Principal Ma’am addressed the students, emphasising the role of mathematics in a rapidly evolving technological world. The second assembly, held on 28th October 2025, carried a festive theme titled “Symmetry and Spark.” Along with the prayer, thought, news, and a poem highlighting the symmetry found in festive traditions, the students were addressed by Prof. (Dr.) Alka Marwaha, who shared insightful remarks on the beauty of mathematical patterns in everyday life.



Academic & Cultural Exchange Programme

The Department of Mathematics organised an exchange programme titled “The Knowledge Bridge – Connecting Campuses, Connecting Minds.” Guests from Jayaraj Annapackiam College for Women, Tamil Nadu, Dr. P. K. Santhi and Mrs. B. Jasmine, were warmly welcomed and felicitated. The event featured an inaugural dance and a mime act, “Pause the Phone, Play the Life.” The academic sessions included a talk by Dr. Santhi on neutrosophic approaches in disease detection and a lecture by Mrs. Jasmine on machine learning. A South Indian folk dance added a cultural touch. The programme concluded with a Vote of Thanks, strengthening academic and cultural ties between the two institutions.

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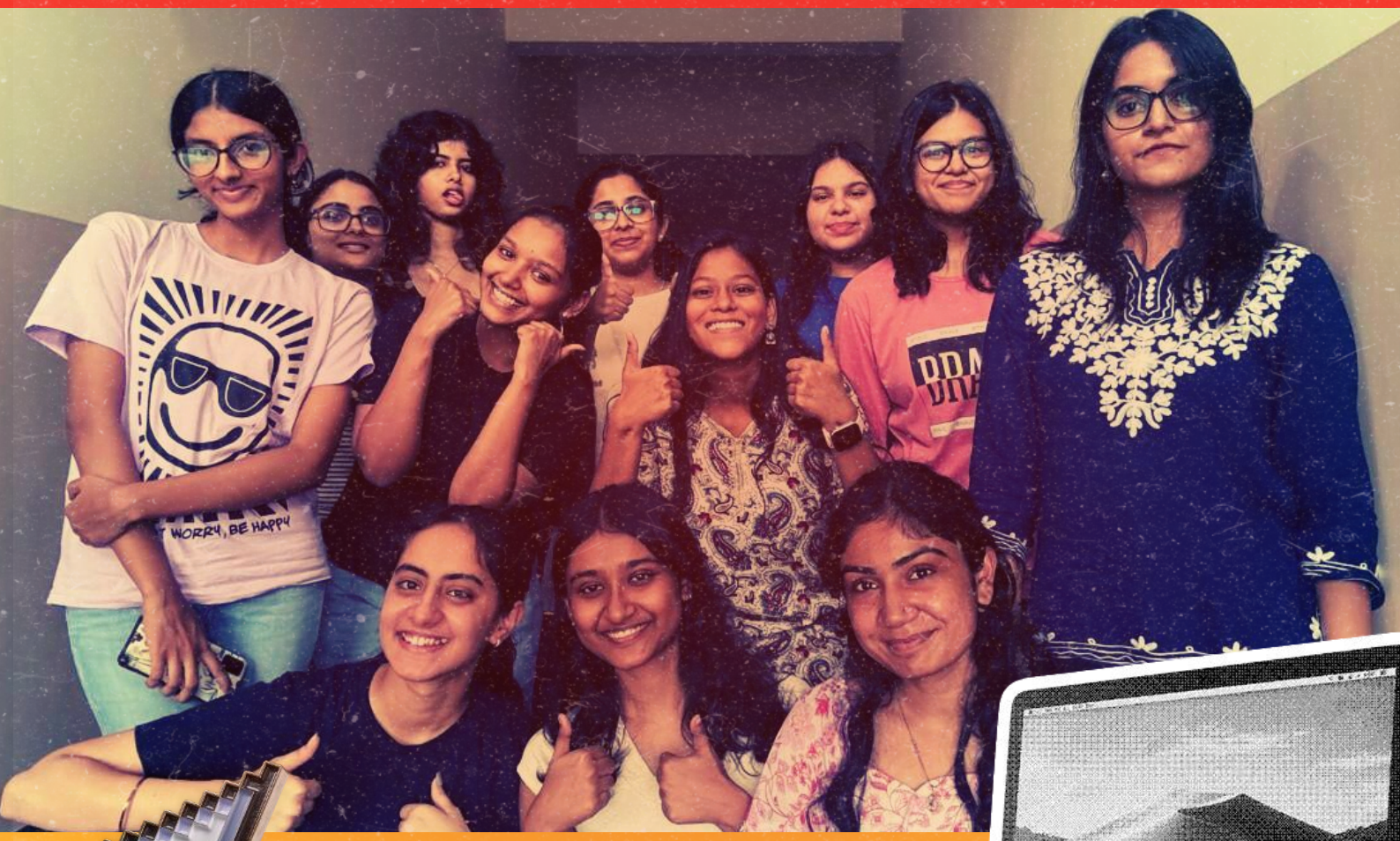
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ALGO

team photo. edition 13.

session 2025-26.



team algo, out!

