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Mathematics as a Part of The Real Life

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Abstract: *A flexible instrument with a wide range of possible uses is mathematics. The Queen of all sciences is mathematics. In our daily lives, mathematics is quite important. In the modern world, practically all discoveries and facts are tied to it. An equal progress in mathematics came before every major advancement in science. Nearly every area, including physics, engineering, finance, and many more, uses mathematics. Weather forecasting, teller machines, safe websites, video games, statistical data analysis, polls, and many more applications all use mathematics. From the beginning of human society, "geometry" has played a significant role. Early folks with tools studied the shape of the wheel in an effort to find a way to reduce friction. The "Father of Geometry," the Greek mathematician Euclid of Alexandria, named it after the combination of two words: "geo" for the earth and "metron" for balance. This paper aims to provide an overview of a few mathematical applications.*

Keywords: Real-world issues, Science and Technology, and Mathematics

I. INTRODUCTION

Everyday life relies heavily on mathematics since it helps us organise our lives and make sense of the world around us. Mathematics enables us to model real-world events, draw inferences, and produce accurate forecasts.The role mathematics plays in fields like science or technology is crucial for research and development in fields like engineering, computing science, medicine, and finance. Children and adolescents can access a greater range of subjects and have the chance to follow their interests and enhance their education by learning maths. Mathematics endows us with many skills that are required for daily life, education, and employment. It's important to recognise the role that maths plays in practically every element of life. This underlines the importance of mathematics as a subject that should be valued for its depth and inclusion in lifelong learning.An orderly application of matter is mathematics. As a result of the subject, a man becomes methodical or systematic, this is how it is said. By bringing order and preventing disorder, mathematics improves our lives. Some of the qualities that mathematics nurtures include the capacity for reason, creativity, abstract or spatial thinking, critical thinking, problem-solving prowess, and even outstanding communication skills. Math forms the basis of all creativity. Everyone, whether they work as a cook, farmer, carpenter, doctor, shopkeeper, engineer, scientist, musician, or magician, uses mathematics in their daily lives. In order to survive, even insects employ mathematics daily. Several practical instances of maths in daily life.

1.1 Chess:

Figure 1: Game theory in chess.

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Every person has at least once in their life played a game of chess. The players' use of the movements will determine if they are able to win the game. It is a game of perfect information since all of the rules are understood by both players and have not altered. Therefore, chess serves as an illustration of game theory since both players are aware of the potential moves and their consequences.

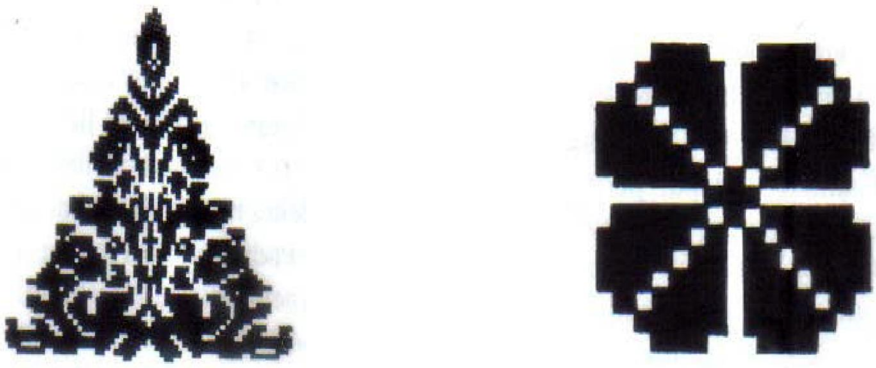
1.2 Mathematics in Nature:

Mathematics exists in nature. The mathematical concept of symmetry can be seen in both man-made and natural objects, such as carvings on wood or ceramics, woven straw for food covers (Figure 2), and motifs in songket weaving (Figure 3), in addition to natural objects like snowflakes, honeycombs, insects, leaves, flowers, butterflies, fish, crabs, and starfish (Figure 1).

a. Butterfly b. Leaves c. Sea coconut

Figure 1: Natural symmetry

Figure 2: Woven straw for food cover



a. Pucuk Rebung (Mangosteen Stalk) **b.** Tampuk Manggisnbn (bamboo Shoot)

Figure 3: Motifs in songket weaving

1.3 Actuarial Services

Actuaries use mathematics and statistics to forecast the future in terms of money. For instance, actuaries analyse large projects for corporations, assess the financial risks and possible outcomes, and provide suggestions on how to continue. They put a lot of effort into pension plans to ensure that there will be enough money when current employees retire. They also work in the insurance sector, making sure that premiums reflect the level of risk..

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1.4 Economics

The majority of the government's economic planning is supported by quantitative analysis and projections. Big firms also employ statisticians to research markets and assess risk. For stock market trading and financial modelling, City financial organisations recruit a lot of math graduates. Pharmaceutical companies hire groups of mathematicians to assess clinical data on the effectiveness or hazards of innovative drugs. Mathematicians are also required in pure scientific research in the domains of biology and chemistry to develop models of complicated natural processes.

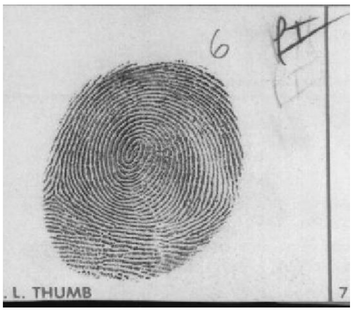
1.5 Teaching

At all levels of the educational system, mathematicians can find employment. You must complete the Postgraduate Certificate in Education after earning your degree in order to teach in a school. Having a Ph.D and actively conducting research are typically requirements for becoming a university lecturer.

1.6 Image Processing

Techniques for mathematically processing images allow us to take, send, and store pictures and videos. Additionally, they enable us to repair damaged or noisy photos as well as extract relevant information from visual data. We may consult [6] for various purposes. The "Fast Fourier transform" (FFT) algorithm, which was developed in the 1960s, marked the beginning of image processing. The mathematical procedure known as the Fourier transform has been used for signal division into distinct pieces that can be analysed independently for 200 years. Straight edges and right angles are less suited for the Fourier transform than smooth, curved features. Alternative approaches are more adapted to addressing these features, such as the wavelet decomposition developed in the 1980s and used to store and transmit the zillions of JPEG images on the internet. The FBI use mathematics to store the data from 30,000,000,000 fingerprints.

1.7 Image Compression



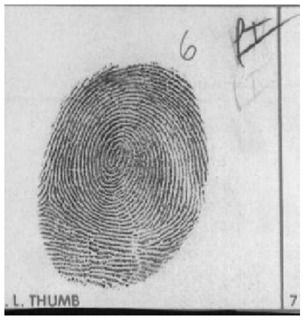


Fig. 1 Original image 541832 bites 768x768   Reconstructed image (compressed file size 32702, compressed ratio 18:1)

1.8 Medical Imaging

We can now look into the human brain thanks to medical imaging techniques, which advances our understanding of how the brain works and offers hope for curing crippling conditions like Alzheimer's and schizophrenia. The study of mathematics, which is at the heart of these techniques, combines with technological advancement to significantly advance civilization. We take [7] as an example. In addition to studying inverse problems in brain imaging, mathematicians also study inverse problems in a variety of other applications, such as radar detection, weather forecasting, and face recognition. Only complex mathematics was able to overcome the inverse problem of calculating interior brain activity from external magnetic or radioactive data. The neuronal current in the brain may be included in the integral equation that describes the magnetic field outside the head in the context of MEG, however it is very challenging to reverse this integral. The equation shows that the magnetic field produced is independent of the radial component of the cerebral current, allowing the same magnetic field to be produced by current levels at different places across the brain. Thanasis Fokas and colleagues found that, if the brain current also satisfied certain requirements, expressing the current in the proper coordinates enabled them to pinpoint certain parts of the current that could be specifically detected by the magnetic field. Without the use of intricate mathematics, brain scanning techniques like MEG would not be possible.

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1.9 Smart Phones

There are more active mobile phones than people in India. The mobile communications industry is enabled by the mathematical study of signal processing, which allows us to extract useable information from the noisy, unseen sea of radio waves over our heads. Despite the problems that the rise of smart phones and mobile internet will provide to mobile networks, modern mathematics is prepared to provide everyone with more inexpensive, energy-efficient, and high-quality communications. The basis for mobile networks and all other forms of communication is information theory, a branch of mathematics [1,4,5]. It was created in the late 1940s by American mathematician Claude Shannon, who realised there is a maximum amount of information that can be transferred across a communications channel, such as a radio frequency band, before mistakes arise. To approach the "Shannon limit," a mathematical description of the message known as an error-correcting code is required, but for decades the best codes could only run at around half-capacity. These improvements make use of MIMO, which stands for "multiple input and multiple output," a major new innovation in broadcasting technology. MIMO employs software that detects the direction of the strongest signal, as well as arrays of "smart" radio antennas in both the transmitter and receiver. A mathematical software, like tuning an FM radio to your preferred station, swiftly tries numerous array configurations until it finds which signal is stronger.

1.10 Geometry

Geometry is a crucial area of mathematics where characteristics of shapes, diagrams, sizes, positions, angles, etc. are read and described to help researchers and students grasp them.It is a crucial component of mathematics that has been used in other fields of study. Geometry has been around for thousands of years, ever since the Egyptian Civilization began. The Indus Valley Civilization also provided evidence of its existence and applications. They had a reputation for being the first to identify and make advantage of "obtuse triangle" features. Greeks developed geometric ideas starting in the sixth century BCE.The indigenous people of this civilization conducted investigation and learned that several shapes can be found in nature. Additionally, they made considerable progress and discovered the four-dimensional pyramid was remarkably sturdy. Although it took decades to finish, the Pyramid was left unmoving in the middle of the desert for thousands of years. If we pay close attention, we can uncover many wonderful applications of "geometry" in our everyday lives.

1.11 How Geometry Evolve?

Geometry has existed since the beginning of human history. Although the topic was non-existent at the time, artefacts, fossils, and ruins all witness to the application of geometric concepts. The concept of a round item that minimises friction was used to design wheels. One of the best methods to use geometry in daily life is in this way. Even today, we still prefer driving automobiles with rounded wheels. This is how geometry came into existence and came to be seen as a topic in Greek civilisation.The principal development of geometrical mathematics took place during the Greek civilization. Well-known philosophers and mathematicians like Pythagoras, Archimedes, Thales, and Euclid all provided explanations for a number of geometrical properties while also coming up with a number of innovative creations. These civilizations established the ideas and concepts we study over a lengthy period of time, and they are tied to the basics of how geometry is used in daily life. The Thales served as the foundation for geometry and attested to numerous mathematical relationships and functions. Additionally, Pythagoras proved that a triangle's entire sum of all angles will always be 180 degrees. He is remembered for the name of the theory that explains the relationship between the hypotenuse, the perpendicular, and the right-hand triangle's base.The foundation for geometry, laid by "the father of geometry" Euclid in the third century BCE, served as the inspiration for a number of lectures. In his book, "The Elements of Geometry," he describes how he set up the special basis for the many geometric elements that have been employed up to this point. His two-point ideas can be merged to produce a straight line while also retaining the usefulness of all the correct angles.

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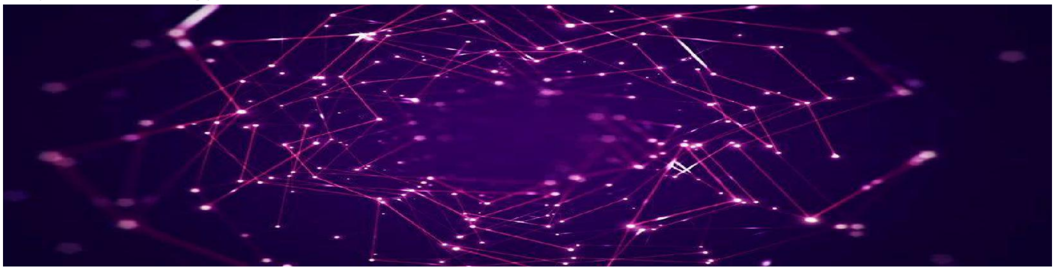
1.12 Geometry in Nature

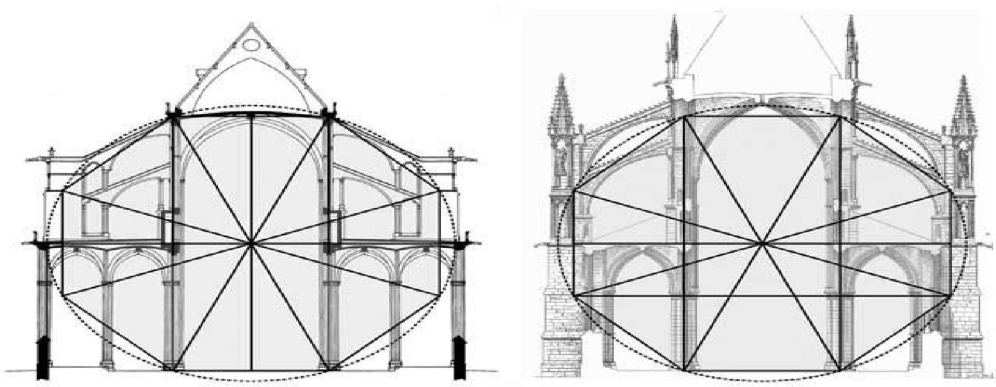
The world around us is made up of the most essential geometric pattern ever. If we look closely, we can see geometric patterns and a wide variety of floral, leaf, root, stem, and bark patterns. Tree leaves come in a variety of shapes, sizes, and proportions. Different fruits and vegetables have different geometric forms. For instance, an orange has a circular shape, and when it is peeled, we can see how the individual pieces join together to make a whole sphere.

1.13 Geometry in Technology



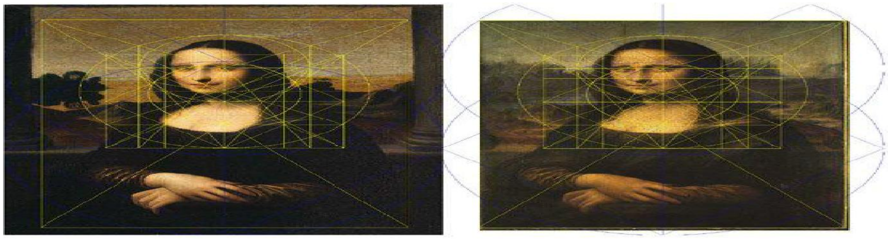
The most prevalent application of geometry in daily life is in technology. Virtually all of their fundamental principles, whether they are in computers, robotics, or video games, employ geometry. Due to the constant presence of geometric notions, computer programmers can work every day. Geometric calculations help create sophisticated video game images, which in turn enable its visual world. A 2-dimensional (2D) map is used in the shooting technique known as raycasting to promote the 3-dimensional (3D) world in video games. Additionally, raycasting contributes to process extension by calculating straight lines on the screen.

1.14 Geometry in Architecture:



Every building's and monument's construction and geometry have a significant relationship. Geometry, mathematics, and architectural forms are used to create a building plan before construction begins. Every type of architectural designs and styles incorporate measurement theories and symmetries. Geometry and Pythagoras' "Principles of Compatibility" were applied in architectural designs and styles in the sixth century BC. Large buildings' beauty, harmony, and religious worth were all enhanced by the geometrical foundations of geometry, which also helped to lessen the hazards that come with strong winds.

1.16 Geometry in Art:

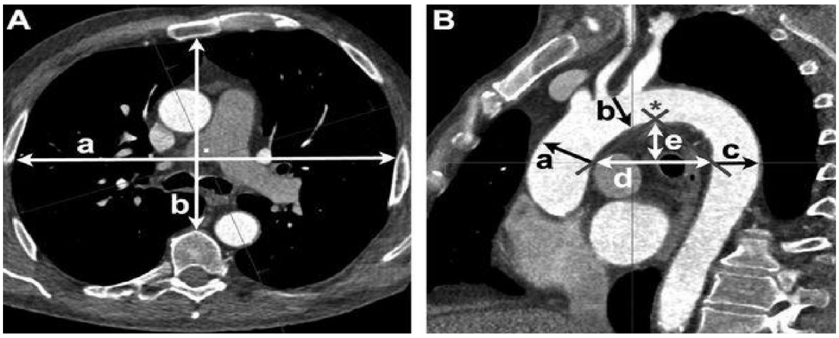


What is the nature of art? Art includes mathematical scenarios, information about basic 2-D and 3-D concepts, information about spatial concepts, as well as the contribution of measurements and patterns. It is evident from the foregoing that geometry and art are closely related. Geometric shapes like a square, triangle, circle, octagon, or mandala are used to create shape. The choice and design of frames also have a significant impact on the content of sculptures and drawings. The concept that is the foundation of many designs is also based on useful geometric principles.

1.17 Geometry in Sports:

Sports frequently seize every chance to use geometric principles. Geometric shapes are taken into consideration in stadium structures and stadiums. Athletes utilise geometry. Football, soccer, basketball and hockey all use rectangular courts. The field is marked with corner points, poles, a D-section, a centre circle and arcs. In addition to these, because these regions have clearly designated oval and circular arcs, many other sports' stadiums, such those for basketball and volleyball, take geometric elements into consideration. Additionally, the majority of the track tracks are in semicircular shapes. Angles are crucial for predicting a player's moves, enhancing their effectiveness, and scoring.

1.18 Geometry in Medicine:



Reconstruction of body parts, tumours, and bones using only geometry is required for methods like X-rays, MRIs, ultrasounds, and nuclear imaging. Geometry is used in physiotherapy as well. Images in digital grids are defined by its qualities and properties. Geometric ideas are essential for improving productivity, dependability, and stability in addition to helping with image visualisation, transformation, separation, fixing, and representation. In radiology, the bisection angle procedures and other comparable approaches are crucial.

1.19 Reading CD's and DVD's :

More than 10 times smaller than the width of a human hair, data is kept on CDs and DVDs as a series of very tiny "hills" and "valleys" cut into the discs' surface. Scratches and dust on the disk's surface may obliterate the hills and valleys as well as the data they encode. Either a DVD or CD shouldn't play at all, or it ought to play badly as a consequence. Reed-Solomon codes, which can be decoded using mathematics, are used to encrypt the data stored on discs. These are designed to allow computers to discover and correct errors even if part of the data is incorrect or missing by completing the gaps with the remaining data.

1.20 Digital Music:

The instruments, loudspeakers, air molecules, and the human ear all experience minute vibrations that result in waves. These waves may be recorded on a CD as a string of numbers by taking samples at regular intervals, generally 44100 times per second. These are a lot of numbers, which is why CDs typically have a file size of 700MB.Multiple waves of different frequencies combine to form sound waves. Although a CD includes all frequencies, only a limited range of frequencies may be audible to human ears. The mathematical Fourier transform may be used to separate a complex sound wave into multiple basic sine waves with different frequencies. Only the frequencies that people can hear are preserved in MP3 audio formats, greatly reducing the file size. Huffman Codes may further assist in file size reduction by assessing the digital content of music and ensuring that common components are encoded using less space than atypical components. Without mathematics, there would be no Spotify, iTunes, or iPods. Much more mathematics is employed when editing digital music, including Eqing, reverb, noise reduction, and mixing.

1.21 Microwaves:

In microwave ovens, the water molecules in food are given energy. Unlike stoves and ovens, which cook from the outside in, microwaves cook at the molecular level from the inside out. Magnetrons are a vital component of microwave ovens. The electromagnetic radiation it emits at a certain frequency level is referred to as "microwaves". Without much of an effect on other molecules, 12.2 cm microwaves excite water molecules. This explains why heating will be limited when a plate or other dry, non-metallic item is placed in the microwave. Many areas of mathematics and physics are combined to define the forces that drive the microwave oven. The link between the force experienced by a particle travelling in an electric and magnetic field at a certain velocity is explained in detail by the Lorentz Force Law. To apply this rule, differential equations are required.

1.22 Defence and Military:

In addition to providing the foundation for developing new technology, weaponry, or solutions to logistical problems like the transportation of troops, ammunition, and food, mathematical models may be used to create and simulate complex military plans. In these simulations, probability or statistics from game theory may be applied. In recent years, cyberwarfare has become more important for counterintelligence, business espionage, terrorism, and sabotage.

1.23 Rockets and Satellites:

In order to reach space, a rocket must escape the gravitational pull of the Earth. This is only practical at high enough speeds and with enough fuel. Although the weight of the fuel also decreases during the course of the flight, the rocket becomes heavier and more challenging to accelerate as it holds more fuel. These and many other factors must be taken into account while manufacturing rockets and modelling their flight path. It involves mathematics, but it's not rocket science. The movement of satellites and rockets is still governed by gravity even in space. For the space shuttles to rendezvous with the ISS, for GPS and television satellites to be in the right place at the right time, and for lunar modules to be able to land on the moon, it is necessary to use differential equations and spherical geometry. Once rockets or satellites are launched, scientists on Earth need to communicate with them. However, because of the distance, some received signals include noise and minuscule errors, making the data unreliable or even unusable. There are several clever methods for encoding data in mathematics that allow for the detection and even partial correction of transmission errors.

1.24 Carbon Dating:

Living organisms, such as plants, animals, and people, acquire carbon. There are several distinct isotopes (types) of carbon, including one that is very insignificantly radioactive (Carbon-14). When an animal or plant dies, it ceases accumulating new carbon-14, and the remaining atoms begin to disintegrate at a steady pace.Carbon-14 levels in discovered bones may be measured by scientists. Mathematical calculations can be used to determine the time since Carbon-14 started degrading as well as the original proportion of Carbon-14. The plant or animal passed away during this time.In other areas of archaeology, mathematics can be useful. The size of the bones, for instance, can be utilised to determine the weight that they had to sustain and, thus, the size of the related animals or humans.

1.25 Computer Games

In many video games, 3D visuals are employed. The ability to move and manipulate these objects on a two-dimensional screen as well as generate colours, light, and shadows requires the use of vectors, matrices, and a variety of other concepts from linear algebra and three-dimensional geometry. Aside from producing realistic water, computer games also need to animate moving and colliding actual things. The suitable partial differential equations, such as the Navier-Stokes equations for fluid modelling, are usually solved numerically using them. Eventually, computer programmes must provide random numbers to increase the excitement of the game and replicate the artificial intelligence of virtual participants. This would not be achievable without complex maths.

1.26 Roller Coaster:

Designing a roller coaster is challenging because it must be exhilarating without moving too rapidly, capable of quick stops, and most importantly, safe. Mathematical calculations may be used to determine the structural support needed to sustain these forces as well as the forces operating on roller coaster trains as they accelerate. Calculus and mathematical equations may be used to determine the design of a smooth track, including loops, "corkscrews," and many other characteristics.

1.27 Search Engines

There are billions of users on the internet every day. One of the reasons is how simple it is to get information online, for instance when using search engines like Google. In order to choose the most useful websites and put them at the top, Google represents all web pages on the internet in a huge matrix. Because the matrix is aware of the connections between the many websites, you may apply graph theory and probability in linear algebra to identify the most popular websites. Many other Google services also employ mathematics, including YouTube (which compresses videos), Android (which recognises voice commands), Gmail (which finds spam), and Maps (which offers directions).

1.28 Glacier Melting

One of the biggest problems facing humanity this century will be climate change. The melting of the polar icecaps, which has a substantial impact on the world's sea level and temperature, is particularly noteworthy.

Unfortunately, information about the condition of the entire ice shield or the mechanisms causing its melting is scarce from satellite photographs taken from above. Statistics and probability can be used to assess environmental data, such as the thickness and composition of ice.Scientists can better comprehend the interactions between wind, sea ice, ocean currents, and heat transport by utilising sophisticated mathematical models that combine differential equations and thermodynamics.

1.29 Internet and Phones:

The internet and phone lines work together to provide data communication between users, whether via conversations or websites. Every user is connected by several distinct connections, each with a unique capability. When you make a phone call or request anything from a website, network operators are required to connect sender and receiver without exceeding the limit of any one connection. Without the mathematics of queuing theory, a reliable service could not be provided. Mathematical models that use Poisson processes almost guarantee the existence of a dial tone during a phone conversation. Due to the unpredictable nature of demand and the wide range of request durations, it is much more difficult to route internet connections. This led to the development of packet switching, a method of sending data through a network in discrete "packets" (including files, emails, and websites). However, despite the network being more effective and resilient as a consequence, routers periodically get overloaded with too many packets, which breaks the connection.

1.30 MRI & Tomography:

By obtaining multiple two-dimensional "snapshots" of the human body from various angles, MRI scanners are able to produce three-dimensional representations of the body. Tomography is the process of using these images to reconstruct the original 3-dimensional model; this procedure is impossible without sophisticated mathematics like Radon Transforms.

1.31 Building Bridges:

Elegant suspension bridges can stretch between 300 and 2300 metres. They are excellent for engineering because of their flexibility and minimal deadweight. The same attributes might also be disadvantages. To avoid buckling, suspension bridges are actually fairly flexible. These bridges are resonance-prone due to their flexibility. Second-order differential equations are used to model the phenomenon of resonance.

1.32 Census :

The most crucial statistical component used by government agencies is the census. Every ten years, government organisations conduct a census, but both public and commercial organisations can benefit from the data that is obtained to study demographic differences. We may learn about our population growth, the expansion of different religions, the gender ratio of men to women, the level of education, and many other facts about the human population with the use of census data. With the aid of a survey created by statisticians, it is possible to draw a variety of conclusions from the information that the government collects through census. The government conducts a livestock census every five years, just like it does for the population, to learn more about the various traits of a given animal, such as cows, buffalo, sheep, etc. State-level and national-level approaches are both possible.

1.33 Sampling :

Typically, samples make up the majority of the data that go into statistics. Most of the time, a sample of the whole population is used in statistical applications. The sample assists us in comprehending the whole population. This sample may be a group of individuals that a researcher needs to study or it may be a sample of fabric that was taken in order to determine the qualities of the whole batch. Every sector, every kind of company, and even residences use sampling. We can better comprehend the features of the whole population thanks to this sample. Women try the rice after it has been prepared. She hasn't had to inspect the whole batch of rice. In the medical sciences, such as blood tests of any individual, sampling is often employed. Only a blood sample is required. Only one or two chalk from the batch must be taken if we want to examine the strength of the chalk. Sampling is used in so many different ways in everyday life.

II. CONCLUSION

In many occupations, mathematics is useful. The ability to apply mathematical thinking to novel problems in other domains is not limited to the mathematics itself, but also to true mathematical problem solving and research. The ability to lead a meaningful and responsible life improves one's quality of life. It may be possible for you to avoid being misled or influenced by others' false views in your everyday life away from work if you understand and analyse certain events and news items.Teachers should emphasise to their pupils the value of mathematics in everyday life and help them become ready for the future by emphasising the key competencies and procedures needed in the job. The sole goal of a university education is to broaden one's thinking, provide them the ability to recognise new issues and seek answers. Education is merely a ladder to reach the fruits, not the fruits themselves. It is up to the populace to keep up with scientific and technological developments, adapt them to an ever-changing environment, and interpret the answers. In the process, it imparts knowledge on subjects like estimate technique and the consequences of size, specifically what transpires as objects get larger. Readers will have a deeper understanding of natural phenomena including puddles and mud fissures, tree heights, leaf patterns, butterfly and moth wings, and even cloud formations, halos, and splendour. Additionally, they will learn about the relationship between basic scientific ideas and their mathematical representations.

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