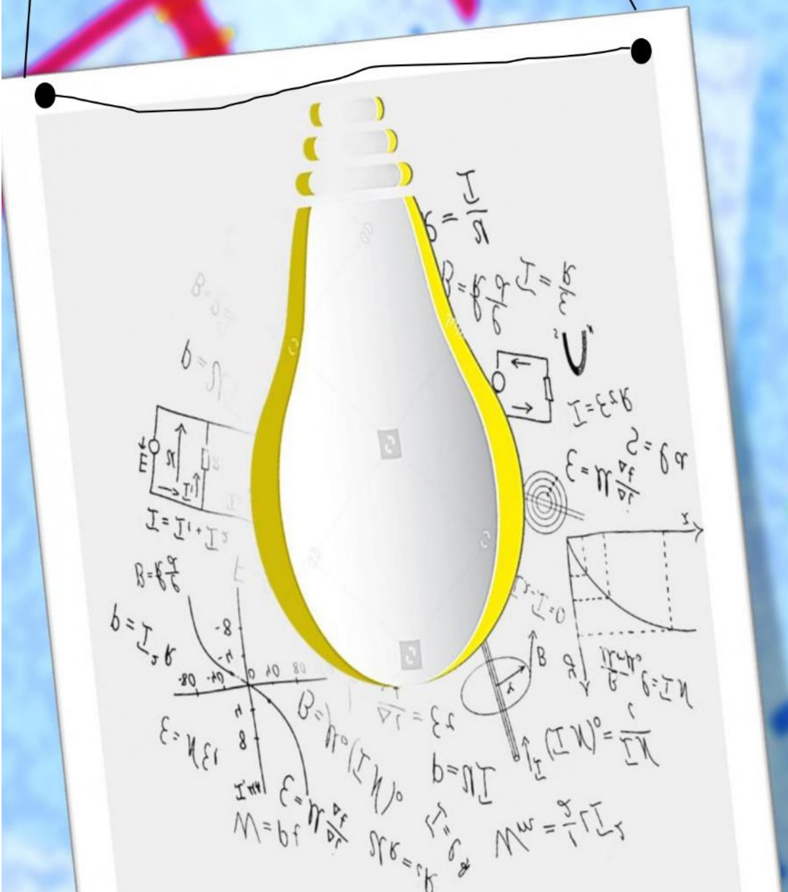
MATRIX



DEPARTMENT OF MATHEMATICS

NALBARI COLLEGE, NALBARI

MATRIX

SECOND EDITION

Mathematics Study Circle

Nalbari College

YEARLY E-MAGAZINE

2023-2024

MATRIX

SECOND EDITION : 2023-24

Editorial Board

Publisher

Mathematics study circle, Nalbari college.

Special Thanks

- Dr. Kamal Nayan Patowary, Principal, Nalbari College.
- All present and former students of Mathematics Department, staff of TNG library and all the well wishers of Nalbari college.

N.B. :For any objectionable elements, the writer will responsible.

From the Principal's Desk

It gives me immense pleasure to know that another issue of the E-Magazine "Matrix " of department of mathematics is going on to be published. It bears witness to the academic heritage and commitment of teachers and students of the department and their present leadership. I extend my warm wishes to the faculty and students of mathematics department to bring out this magazine which gives the students an opportunity to explore more than what is prescribed in their syllabus curriculum.

Dr. Kamal Nayan Patowary
Principal
Nalbari College, Nalbari

From the HOD's Desk

Mathematics is not just about playing with numbers; it is a skill for making sense of things around us. It is an intellectual endeavour and a mode of thinking about different patterns, sequences, and observations of various objects and phenomena occurring around us. It is not as abstract as it seems; it is just an abstract representation of real-life events. There is universal support for the benefits of writing as an effective means of communicating mathematically. Writing and learning are seen as homologous to each other, and writing can facilitate the understanding of mathematical thinking through interpersonal communication. Through a short writing intervention, this study investigates students' perceptions of the use of writing in the mathematics classroom and explores the effects of writing on the emotional domains of students' confidence and enjoyment levels in mathematics. The aspect of intellect is not only to focus through the examination system but also to enhance literary ability, creative expression, thinking ability, analytical ability, etc. Our E-Magazine, "Matrix," is a venue for students to pen their thoughts, express their experiences, share their creative ideas, and enrich others. I hope this E-Magazine, "Matrix," will provide students ample opportunities to bring out their literary talents and creative ideas. I am sure this will boost their confidence and add a new dimension to their student personality.

Dr. Piroja Begum
Hod, Department of Mathematics
Nalbari College, Nalbari

Editorial messages

Welcome to another edition of our department's e-magazine dedicated to the fascinating world of mathematics. As we embark on another exhilarating journey through the boundless realms of mathematics, it is with great pleasure that we present to you the latest edition of "Matrix," our annual mathematical e-magazine. Within these digital pages, you will find a treasure trove of thought-provoking articles, insightful analyses, and captivating explorations into the fascinating world of numbers, shapes, and patterns.

Each article in this edition has been carefully crafted to both inform and inspire. Whether you are a seasoned mathematician or a curious enthusiast, there is something within these virtual halls to pique your interest and expand your understanding.

As we navigate through the intricate landscapes of algebra, geometry, and beyond, let us not forget the timeless beauty and profound significance of mathematics in our lives. It is a language that transcends borders and cultures, unlocking doors to innovation, discovery, and deeper understanding of the universe we inhabit.

We extend our heartfelt gratitude to all the contributors, editors, and supporters who have made this edition of "Matrix" possible. Your dedication and passion for the world of mathematics shine through in every word and equation, enriching the minds of readers around the globe.

So, without further ado, we invite you to dive into the pages of "Matrix" and embark on a journey of intellectual exploration and discovery. May the insights contained within these digital pages ignite your curiosity and fuel your love for the infinite wonders of mathematics.

Happy Reading!!

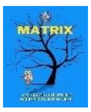
CONTENTS

Page no.

- *Applications of calculus in real life: beyond the classroom* 1
- *Famous women Mathematician: breaking barrier in a male Dominated field* 2
- *Cobweb symmetry* 4
- *Pi* 5
- *Chess and checkers* 7
- *The golden ratio in the spiral galaxy* 8
- *Women in mathematics* 9
- *The father of Indian mathematics: Aryabhata* 12
- *Father of Indian Statistics* 14
- *How mathematics important in C programming* 16
- *Mathematics in cryptography* 19

Final Semester Best Project(2021-2023 batch)

- *Five years result analysis of mathematics department* 22



First Edition

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Second Edition

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Applications of Calculus in Real Life: Beyond the Classroom

Calculus, a branch of mathematics developed independently by Isaac Newton and Gottfried Wilhelm Leibniz, is often perceived as an abstract and complex subject learned within the confines of a classroom. However, its applications extend far beyond the theoretical realm, playing a crucial role in understanding and solving real-world problems.

One prominent area where calculus finds practical use is in physics. The laws governing motion, such as those formulated by Sir Isaac Newton, heavily rely on calculus. Calculus enables the precise calculation of velocities, accelerations, and trajectories, providing the foundation for the design and analysis of structures like bridges and buildings. Engineers employ calculus to model and predict the behavior of physical systems, ensuring the safety and efficiency of various structures and devices.

In the field of economics, calculus is a powerful tool for understanding and optimizing financial processes. Whether it's analyzing cost functions, determining profit maximization, or studying the dynamics of supply and demand, calculus provides economists with the mathematical tools necessary for making informed decisions. The concept of marginal analysis, derived from calculus, helps businesses optimize production levels and pricing strategies to maximize profits.

In biology and medicine, calculus aids in modeling and analyzing biological processes. For instance, it is used to understand population dynamics, predict the spread of diseases, and optimize drug dosage regimens. Calculus plays a crucial role in medical imaging techniques like MRI and CT scans, where it is employed to reconstruct detailed images from complex data sets.

Furthermore, calculus is integral to the field of computer science. Algorithms, data analysis, and machine learning all involve mathematical modeling and optimization, often relying on calculus for efficient solutions. Whether its predicting user behavior on a website or optimizing search engine algorithms, calculus provides the mathematical foundation for these computational tasks.

In conclusion, the application of calculus in real life extends well beyond the traditional classroom setting. Its role in physics, economics, biology, medicine, and computer science demonstrate the versatility and significance of calculus in solving complex problems and advancing various fields of study. As technology continues to evolve, the practical applications of calculus are likely to expand, reinforcing its status as a fundamental and indispensable branch of mathematics in the real world.■

~Nandita Deka
Mathematics Department(2022-24)

Famous Women Mathematician:
Breaking Barrier in a Male Dominated Field

Ada Lovelace (1815-1852)

Emmy Noether (1882-1935)

Throughout history, the realm of mathematics has often been perceived as a male- dominated field, with women facing numerous barriers to entry and recognition. Despite these challenges, numerous remarkable women have made indelible contributions to mathematics, challenging stereotypes and paving the way for future generations.

One of the trailblazers in this regard is Ada Lovelace, widely considered the world's first computer programmer. Born in the 19th century, Lovelace collaborated with Charles Babbage on his proposed mechanical general-purpose computer, the Analytical Engine. Her notes on the engine included an algorithm intended for processing for Bernoulli numbers, marking a crucial step in the development of computer programming.

In the early 20th century, Emmy Noether emerged as a groundbreaking mathematician. Known for her work in abstract algebra and theoretical physics, Noether formulated Noether's Theorem, a fundamental contribution linking symmetries and conservation laws in physics. Despite facing resistance in academia due to her gender, she persisted an enduring legacy.

Moving on to the latter half of the 20th century, Mary Catwright, a British mathematician, made significant strides in nonlinear differential equations and celestial mechanics. Her exceptional work earned her recognition as one of the leading mathematicians of her time, breaking barriers in a male-dominated discipline.

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"Nature is written in mathematical language."

— Galileo Galilei

Maryam Mirzakhani (1977-2017)

In contemporary times, the likes of Maryam Mirzakhani have continued to shatter gender stereotypes. In 2014, Mirzakhani became the first women to be awarded the Fields Medal, the most prestigious prize in mathematics, for her outstanding contributions to the dynamics and geometry of Riemann surfaces and their moduli spaces.

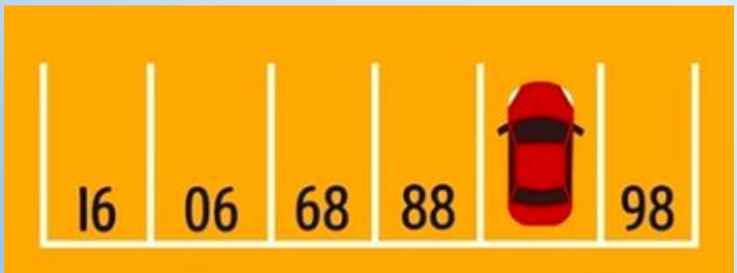
These women mathematicians not only made remarkable contributions to their field but also paved the way for future generations of female mathematicians. Their perseverance, intellect, and passion have played a pivotal role in challenging the historical gender bias within the mathematical community, demonstrating that talent knows no gender boundaries. As we celebrate the achievement of these trailblazers, it is crucial to fostering an inclusive environment that encourages and support women pursuing career in mathematics. ■

~Sagarika Bhagabati
Mathematics Department (2022-24)

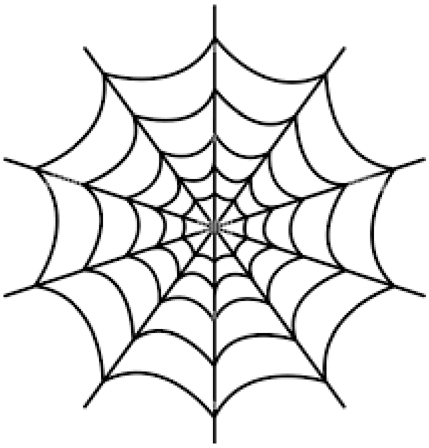
Let's Play

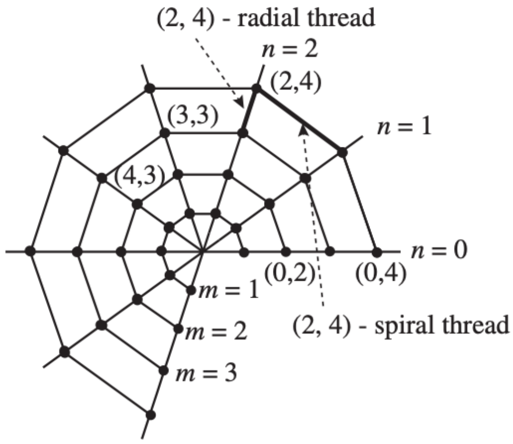
1. **If 1=3**
   2=3
   3=5
   4=4
   5=4
   Then, 6=?

2. **What is the number of parking space covered by the car?**



COBWEB SYMMETRY





Cobweb symmetry, also known as radial symmetry, refers to the balanced arrangement of elements around a central point in a cobweb-like pattern. This type of symmetry is commonly found in natural structures such as spider webs, sea anemones and certain flowers.

In cobweb symmetry, the elements are arranged in a circular or star-shaped pattern, with each element being equidistant from the central point. This creates a visually pleasing and harmonious design that is often associated with balance and stability.

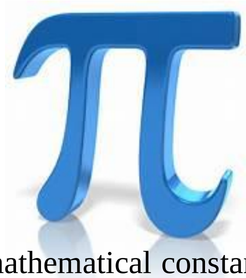
Cobweb symmetry is not only aesthetically appealing but also serves functional purposes in nature. For example, in a spider web, the radial symmetry allows for efficient trapping of prey from any direction. In sea anemones, the radial symmetry helps in capturing food and defending against predators.

Overall, cobweb symmetry is a fascinating aspect of natural design that showcases the beauty and efficiency of nature's patterns.■

~Jyotirmoy Das
Department of Mathematics (2022-25)

"Life is a math equation. In order to gain the most, you have to know how to convert negatives into positives"

— Anonymous



Pi

π is a mathematical constant that is the ratio of a circle's circumference to its diameter. This produces a number, and that number is always the same. However, the number is rather strange. The number starts as 3.141592653589793 and continues without end. Numbers like this are called irrational numbers.

The diameter is the largest chord which can be fitted inside a circle. It passes through the center of the circle. The distance around a circle is known as the circumference. Even though the diameter and circumference are different for different circles, the number π remains constant: its value never changes. This is because the relationship between the circumference and diameter is always the same.

Mathematicians have known about π for thousands of years, because they have been working with circles for the same amount of time. Civilizations as old as the Babylonians have been able to approximate π to many digits, such as the fraction 25/8 and 256/81 .Most historians believe that ancient Egyptians had no concept of π, and that the correspondence is a coincidence.

The first written reference to π dates to 1900 bce.Around 1650 bce, the Egyptian Ahmes gave a value in the *Rhind Papyrus*. The Babylonians were able to find that the value of π was slightly greater than 3, by simply making a big circle and then sticking a piece of rope onto the circumference and the diameter, taking note of their distances, and then dividing the circumference by the diameter.

Knowledge of the number π passed back into Europe and into the hands of the Hebrews, who made the number important in a section of the Bible called the Old Testament. After this, the most common way of trying to find π was to draw a shape of many sides inside any circle, and use the area of the shape to find π. The Greek philosopher Archimedes, for example, used a polygon shape that had 96 sides in order to find the value of π, but the Chinese in 500 ce were able to use a polygon with 16,384 sides to find the value of π. The Greeks, like Anaxagoras of Clazomenae, were also busy with finding out other properties of the circle, such as how to make squares of circles and squaring the number π. Since then, many people have been trying to find out more and more precise values of π.

A history of π ---

Philosopher	**Date**	**Approximation**
Claudius Ptolemy	around 150 ce	3.1416
Zu Chongzhi	430-501 ce	3.1415929203
al-Khwarizmi around	800 ce	3.1416
al-Kashi	around 1430	3.14159265358979
Viète	1540–1603	3.141592654
Roomen	1561–1615	3.14159265358979323
Van Ceulen	1600	3.14159265358979323846264338327950288

In the 16th century, better and better ways of finding π became available, such as the complicated formula that the French lawyer François Viète developed. The first use of the Greek symbol "π" was in an essay written in 1706 by William Jones.

A mathematician named Lambert also showed in 1761 that the number π was irrational; that is, it cannot be written as a fraction by normal standards. Another mathematician named Lindeman was also able to show in 1882 that π was part of the group of numbers known as transcendentals, which are numbers that cannot be the solution to a polynomial equation.

π can also be used for figuring out many other things beside circles. The properties of π have allowed it to be used in many other areas of math besides geometry, the study of shapes. Some of these areas are complex analysis, trigonometry, and series.

There are different ways to calculate many digits of π. This is of limited use though.

π can sometimes be used to work out the area or the circumference of any circle. To find the circumference of a circle, use the formula 2πr(Radius). To find the area of a circle, use the formula πr^2(radius squared). This formula is sometimes written as A= πr^2, where A is the variable for the area.

To calculate the circumference of a circle with an error of 1 mm:

- 4 digits are needed for a radius of 30 meters.
- 10 digits for a radius equal to that of the earth.
- 15 digits for a radius equal to the distance from the earth to the sun.
- 20 digits for a radius equal to the distance from the earth to Polaris.

People generally celebrate March 14 as Pi Day, because March 14 is also written as 3/14, which represents the first three numbers 3.14 in the approximation of π. Pi day was started in 1988 by physicist Larry Shaw at the San Francisco Exploratorium. On March 11, 2009, almost 21 years later US House of Representatives passed a resolution proclaiming March 14 to be celebrated as National π Day every year.■

~ ***Darshana Deka***
Mathematics Department (2022-24)

Answer's House

1. Is ***3***, because 'six' has three letters
2. **87** Believe it or not, this "math" question actually requires no math whatsoever. If you flip the image upside down, you'll see that what you're dealing with is a simple number sequence.

Chess and Checkers :
The use of Mathematics in recreational activities:

Recreational mathematics is carried out for recreation i.e entertainment rather than as a strictly research and application based professional activity or as a part of students formal education.It involves mathematical puzzles and games.

The Mathematical Association of America(MAA) includes recreational mathematics as one of its seventeen special interesting groups.

Chess and Chekers are those interesting puzzle games that falls under recreational mathematics.

Chess and Chekers are one of the oldest and most popular board games.It requires lots of patience, concentration, planning,self control,conduct rules, mistake learning,etc.It increases the intelligence and problem solving skills.

Chess is a required school subject in Armenia. In a single game of chess there are 400 possible moves after each move played. According to American Foundation for chess there are approximately 1.70*10^29 ways to play the first 10 moves of a game of chess.

Chess and checkers are unarguably mathematical; it's simply a finite set on which a finite set of restrictions are imposed. Some applications of mathematics like statistics and probability are probably used in chess to calculate the likelihood of certain moves or outcomes occurring or to analyse past games and identify patterns in opponents.

Though math and chess are requires a great deal in skill and knowledge to master but they are quite different in nature..and this differences makes the game more interesting.

The most popular checkers in Anglophone countries are America checkers which are played in 8*8 checkerboards , Russian draught and Turkish draught are on 8*8 board, international draughts are played on 10*10 board and Canadian/Singapore draughts are played on 12*12 board.

The main difference of both the games that the goal of the checkers is to capture all the opponents pieces of the board whereas the objective of chess is to deliver checkmate to your opponents team....

Thus after lots of study and observation we came to know that Mathematics is like a part of our life. Mathematics is everywhere,in every steps. Mathematics is fun.

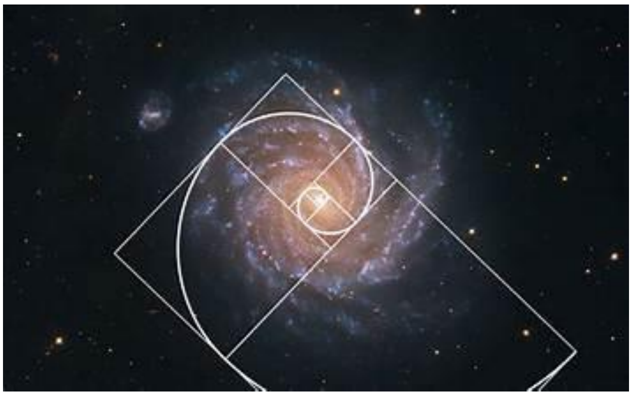
Games like chess and checkers are not only there where mathematics is used but also exist lots of games where mathematics are used.■

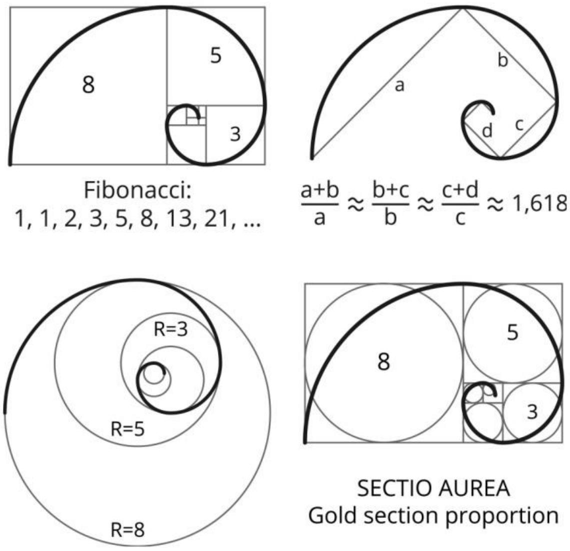
~Jyotishmita sarma
Mathematics Department (2022-24)

“Math is like going to the gym for your brain. It sharpens your mind.”

— Danica McKellar

“The Golden Ratio in the Spiral Galaxy"





The golden spiral is based on the golden ratio. Symbolised by the character (Phi), it's found when a line is split in such a way that the larger part devided by the smaller part is equal to the whole part-a ratio of 1.618. The Fibonacci sequence is a series of numbers where the ratio of successive number is very close to the golden ratio.

The golden spiral always increases by this ratio for every quarter turn the spiral makes, it gets wider by a factor of $. Here, the golden spiral fits neatly on to a spiral galaxy.■

~Kuldeep Sarma
Mathematics Department (2022-24)

Let’s Play

3. There is a basket containing 5 apples, how do you divide the apples among 5 children so that each child has 1 apple while 1 apple remains in the basket?

4. Two girls were born to the same mother, at the same time, on the same day, in the same month and the same year and yet somehow they’re not twins. Why not?

WOMEN IN MATHEMATICS

Alma Steingart,a historian of applied mathematics at Colombia University,New York quoted that " Mathematics is one of the worst field in terms of women participation". This quotation is significantly relevant from ancient times to the twenty first century. Throughout the history of mathematics , it was only the men whose contribution in mathematics were mainly cited as it was believed that Mathematics is a men's subject and it was largely closed to women most of the time . From the ancient time women found a very little encouragement , and their hunger is always being suppressed . Even today there are few numbers of female students on maths field , although the females are increasing their interests in this field . Despite all these, some women in history were able to achieve notability in the field of mathematics . Moreover there always some questions are raised ---- Why is the number of women mathematicians so few ? Are women not capable of doing mathematics?

Here I want to write about some of the women mathematicians in history and in modern age who contributed as much as they can to the mathematics field ..

Theano (546 BC): Theano , known as Theano of Croton , born probably in Crete . It is believed that she was the wife of Greek mathematician and philosopher Pythagoras . Inspired by Pythagoras , she had some significant contribution in mathematics as well as in physics. Her principal works included a Life of Pythagoras , a Cosmology. The theoram of Golden Mean , The Theory of Numbers , The Construction of the Universe and work titled on virtue .

Hypatia(370-415AD): A great mathematician and philosopher of Theon, was born in Alexandria , Egypt . She is in fact the first well organised female mathematician . She was a lecturer in Platonists school at Alexandria . Hypatia collaborated with her father on commentaries of classical mathematical works Apollonius of Perga's Conics and Diophantus of Alexandria's Arithmetic, asa well as astronomical table which was possibly a reverse virsion of Book III of her father's commentry Almagest[7], the Ptolemy's virsion of the solar system and it's motion.

Maryam Mirzakhani(1977-2017) : Maryam Mirzakhani (born in Iran)was a great mathematician of her generation , who has exceptional contributions to the study of Dynamics and geomatry of mathematical objects called Riemann surfaces. She was the first woman, and first Iranian, to be awarded a Fields Medal (also known as the International Medal for Outstanding Discoveries in Mathematics) in 2014 for "her outstanding contributions to the dynamics and geometry of Riemann surfaces and their moduli spaces".She shows us that, even in a male-dominated field, women can be role models and lead the way forward with their discoveries.

Sofia Kovalevskaya (1850–1891): Sofia Kovalevskaya was born in Russia in 1850 in a well-educated family. She had an enormous contribution in the field of analysis and partial differential equations.ial differential equations. In 1889, she became the first female professor at Stockholm University. The paper, On the Rotation of a Solid Body about a Fixed Point, gained global recognition. As a result, she was awarded the prestigious prize Prix Bordin from the French Academy of Sciences.

Dame Mary Lucy Cartwright (1900-1998) : Mary Cartwright was a British mathematician. She was the first mathematician to study what is now known as chaos theory. She was the first woman to receive the Sylvester Medal (awarded for the encouragement of mathematical research), first woman to be President of the Mathematical Association and the first woman to be President of the London Mathematical Society. Her wor on mathematics has strongly influenced the Modern Theory of Dynamical system .

Answers' House

3. 4 children get 1 apple each while the fifth child gets the basket with the remaining apple still in it.
4. Because there was a third girl, which makes them triplets! **Triplets**

Sophie Germain (1776) : Marie-Sophie Germain was a French mathematician and physicist, who had despite opposition from society and her parents due to her sex, greatly contributed to maths . Due to the unfair gender restraints at that time, she was not able to pursue a career in the subject, but that did not stop her.She worked on it independently throughout her life and through her hard work, she not only advanced the field of number theory but she was also one of the pioneers of elasticity .theory, becoming the first woman to win the grand prize from the Paris Academy of Sciences for her essay on this subject.She proved to the people around her that females are incredible mathematicians.

Emmy Noether (1882-1935): Emmy Noether is one of the greatest algebraists of all time, was born in 1882 in Erlangen, Germany. Being a woman, she faced many obstacles as most of the universities did not simply allow women, however she entered in the University of Göttingen in the year 1915. Her work completely changed the shape of mathematics as well as physics. In 1918, Noether presented her famous theorem, which states that "every differentiable symmetry of the action of a physical system has a corresponding conservation law". Furthermore, this theorem has a profound impact on physics also.On this theoram Theoretical physicist Frank Wilczek of MIT once commented "The name of Julia Robinson cannot be separated from Hilbert's 10th problem".

So at last we can say , though there were gender restriction in the earlier times but now a days the time has been changing . But according to a survey organised by American Mathematical Society only 31% of math positions in higher education were filled by women, including 30% of all tenure-track positions. Despite of social equality and the demand for equal opportunity for men and women, it is pretty unpleasant that women in mathematics are still an unfavourable word. Thus, we should take intiatives to improve the women's interest in mathematical field as mathematics is a very wonderful subject and is applied in every steps of our lives .■

~Krishna moni Deka
Mathematics Department (2023-25)

The Father of Indian Mathematics: Aryabhatta

Aryabhatta, also known as the father of Indian Mathematics, was a renowned astronomer and mathematician of the ancient times of India. Aryabhatta contributed significant work in science and mathematics and concluded theories of earth rotation on its axis, approximation of pie (π) place value system of zero, trigonometry, and many others.

One of his famous works is Aryabhatiya, a magnum opus written in the Sanskrit language and the only known surviving work of Indian mathematician Aryabhata from the fifth century. His work includes the Arya-Siddhanta, a lost treatise on astronomical calculations, Varahamihira, Bhaskara, and Brahmagupta. Aryabhatta gained worldwide recognition as a legendary mathematician.

Birth and education

Aryabhatta was born in Pataliputra, which in present times is in Patna, Bihar state, in the year 476. It is believed that he completed his studies in Kusumapura. Aryabhata was the head of a Kusumapura institution (kulapa)and was also the head of the Nalanda University, Bihar, because the university was located near Patliputra and housed an astronomical observatory.

Contribution of Aryabhatta to Mathematics

Aryabhatta made several contributions to Mathematics inventions and theories. Due to his significant contribution and achievement in mathematics, he is also called The King of Indian Mathematics. Some of the important discoveries he made in the mathematics field are:

- The place value system and zero
- Trigonometry
- Algebra
- Approximation of pi π
- Indeterminate equations
- Contribution of Aryabhatta to Astronomy

Besides mathematics, Aryabhatta also made several impactful discoveries and inventions in astronomy. Aryabhata's astronomical system was known as the audAyaka system.
Some of the Aryabhatta's significant contribution to Astronomy includes:

- Solar system motion
- Sidereal periods
- Eclipses
- Heliocentrism

Aryabhatta also wrote several books about his discovery and piece of work in mathematics and astronomy. Some of the well-known books written by Aryabhatta are:

- Aryabhatiya
- Rishab's Good Theory of Indian
- Dash Geetika
- Arya Siddhanta
- Aryabhatta Legacy

Aryabhatta died in 550 CE in Patliputra only. The contributions made by Aryabhatta are still used in today's times.

- Aryabhata's astronomical calculating methods are used in the Islamic world to calculate dates for calendars.
- Trigonometric tables are used to compute numerous Arabic astronomy tables.
- Aryabhatta's definitions of cosine, sine, versine and inverse sine impacted the development of trigonometry mathematics.
- The contemporary terms 'sine' and 'cosine' are mistranslations of Aryabhata's phrases jy and koji.
- Honours

The well-known mathematician of ancient India, Aryabhatta, has received several honours from the government of India. Today, many ventures, schools, universities, and satellites are named after the great scientist and mathematician, Aryabhatta.

- To honour such great Indian mathematicians, the Bihar Government created Aryabhatta Knowledge University (AKU) in Patna to develop and manage educational infrastructure. Moreover, the government of India names India's first satellite after Aryabhatta to embrace his contribution to astronomy and mathematics.
- The Aryabhata satellite appears on the backside of the Indian two-rupee note.

Conclusion

Aryabhatta's contributions to mathematics like trigonometry, pi, place value system, etc. solve significant problems and are still practised and taught in schools and colleges. His contribution to astronomy brought major changes in the scientific sector, which led scientists and astronauts to achieve new milestones in astronomy.■

~ Tashmiya Najil
Mathematics Department (2023-25)

"A mathematician who is not also something of a poet will never be a complete mathematician."

— Karl Weierstrass

Father of Indian Statistics

Prof. Prasanta Chandra Mahalanobis is also known as the father of Indian Statistics. He was a physicist by training, a statistician by instinct and a planner by conviction. His contributions were massive on the academic side as the builder of the Indian Statistical Institute, organizer of the Indian statistical systems, pioneer in the applications of statistical techniques to practical problems, architect of the Indian Second Five Year Plan, and much more.Prof. Prasanta Chandra Mahalanobis perceived statistics 'as a universal tool of inductive inference, research in natural and social sciences, and technological applications' and 'as a key technology for increasing the efficiency of human efforts in the widest sense'.

Prof. Prasanta Chandra Mahalanobis was born into a family well established in Calcutta (Kolkata), who were relatively wealthy and whose members were enterprising, adventurous, imbued with liberal Brahmo Samaj traditions, and active in all Bengali life.He was born on 29th June 1893 at 210 Cornwallis Street (his grandfather's house) as the elder son among two sons and four daughters of Probodh Chandra Mahalanobis and Nirodbasini Devi.He started his education at Brahmo Boys' School, which was founded by his grandfather Guru Charan Mahalanobis in 1904.Prof. Prasanta Chandra Mahalanobis earned a Bachelor degree in Science with Honours in Physics from the Calcutta University under Presidency College in 1912, before he sailed to England and joined Cambridge University.He obtained Mathematics Tripos part I in 1914, and Physics Tripos part II in 1915 from Cambridge University.

At the time Prof. Prasanta Chandra Mahalanobis was a Professor of Physics at Presidency College, he was highly involved in the work of statistics. He set up the Statistical laboratory in the baker laboratory of Presidency College, Calcutta, in the early 1920s. In the initial phase, his statistical research was in anthropometry, in meteorology and in problems of flood control in North Bengal and Orissa. On 17th December, 1931, Prof. Prasanta Chandra Mahalanobis set up the Indian Statistical Institute for advanced research and training in statistics. Later during the 1950s, ISI shifted to the present premises at Baranagar, a suburb of Kolkata, West Bengal.

The anthropometric studies led to the formulation of D2- Statistic, known in statistical literature as Mahalanobis Distance, which has proved to be a valuable tool not only in taxonomy but in many other fields including economics and geology. A rich field of research in multivariate analysis opened up; Sir Ronald Aylmer Fisher (R.A.Fisher) accepted this concept by giving it the name 'Mahalanobis D-square' or 'Mahalanobis distance'.He was the editor of Sankhya from 1933 to 1972.

Prof. Prasanta Chandra Mahalnobis was one of the first people in the country to recognize the importance of machines – mechanical, electrical as well as electronic – to make fast, accurate and complicated calculations with masses of figures. In the 1950s, Prof. Prasanta Chandra Mahalanobis arranged to have a large number of electromechanical data processing machines from IBM; the Hollerith and the Power Samas varieties were installed to process NSS data. Through his initiative in 1953, a small analog computer was designed and built in the Institute.Prof. Prasanta Chandra Mahalanobis played an important role in Indian National Economic Planning. He took major responsibility in drafting the Second Five Year Plan for India. He believed in perspective planning and used simple logical ideas in deriving an economic model for planning in a under developed country, like India.Prof. Prasanta Chandra Mahalanobis received a number of awards and honors in India and abroad for his outstanding and fundamental contribution to Statistics and Planning. ■

~Barasha Kalita

Mathematics Department (2023-25)

Did you know ?

- **First person to use the Greek letter pi (π) to denote the constant?**

  Answer: William Jones in 1706

- **Who discovered Fibonacci Sequence?**

  Answer: Leonardo Pisano Bigollo

- **Who discovered Logarithms and the Decimal point?**

  Answer: John Napier

- **Who discovered the center of gravity?**

  Answer: Archimedes

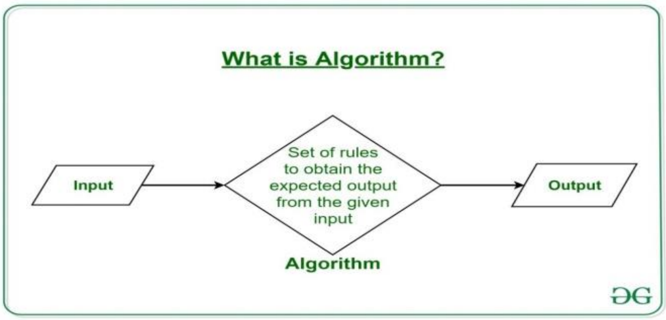
How Mathematics Important in C Programming

In C programming, mathematics plays a key role in determining how algorithms are created and data is managed. Math comprehension is essential for handling real numbers, working with arrays, and making logical decisions. Math is necessary in graphics and game development to create 3D graphics. Mathematics is used in even simple bitwise operations and control flow. In the end, math improves productivity, assisting programmers in C programming to optimise their code and successfully address issues.

The following main ideas demonstrate how crucial mathematics is to C programming:

Algorithm Design :

In C programming, algorithm design is creating a precise collection of instructions that provide a step-by-step solution to a task. It is comparable to formulating an easy-to-follow recipe for the computer. Programmers ensure that the C programme can accurately execute complex tasks and deliver the intended results by using logical thinking to break them down into smaller, manageable steps.



Data Structures :

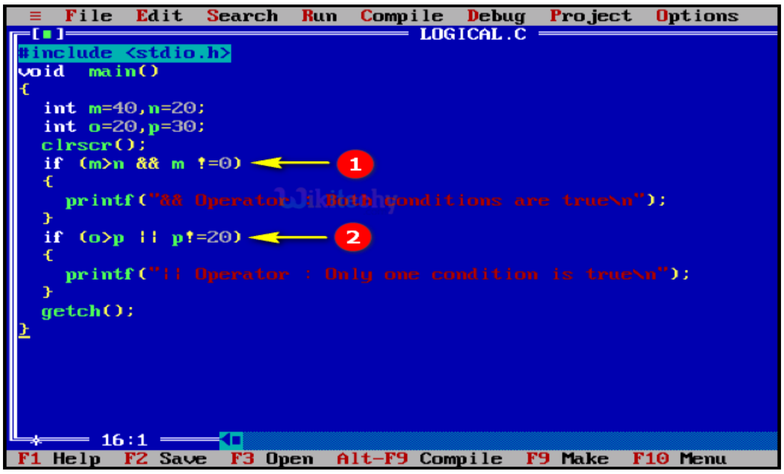
Data structures are specific containers used in C programming that aid in the organisation and storing of data. Programmers can handle and work with data in their programmes more easily when they use containers like arrays or linked lists. It's like having different kinds of boxes to store different things. Creating well-structured and effective programmes requires an understanding of C data structures.

Numerical Computations :

Numerical computations in C programming entail applying mathematics to real-number calculations. Mathematical principles are used by programmers to design strategies for running simulations, optimising workflows, and solving equations. The precision and dependability of computations in scientific, engineering, and other applications are dependent on this mathematical basis, which is necessary for accurate and efficient numerical operations in C.

Logical Operations :

Logical operations in C programming employ mathematical concepts to determine programme decisions. To construct logical expressions, programmers use Boolean algebra, a branch of mathematics that deals with true and false values. The program's flow is determined by these expressions using conditions such as "if," "else," and "while." C programmers make sure their code can make wise decisions and carry out particular tasks by using mathematical reasoning, which improves the logic and control flow of their programmes.



Complex Calculations :

Using mathematical ideas to carry out elaborate computations is a common practice in C programming. To tackle challenging jobs like signal processing, cryptography, and simulations, programmers employ mathematical techniques and algorithms. This mathematical base is necessary to create precise and effective algorithms in C, allowing the programme to precisely handle complex calculations. The ability of C programmes to handle complex computational problems across a range of domains is improved by an understanding of certain mathematical concepts.

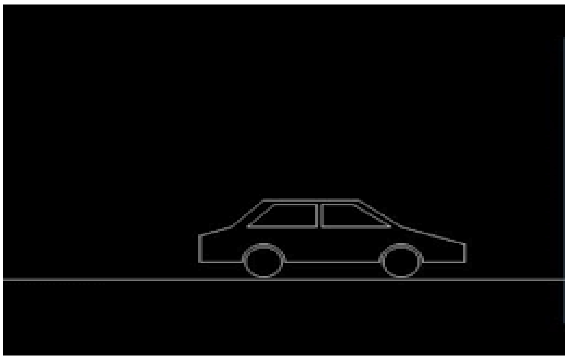
Bitwise Operations :

Bitwise operations in C programming are similar to utilising binary math to manipulate bits, which are the smallest units of data. Consider bits as little switches with two possible states: on (1) and off (0). Programmers can flip these switches to regulate the storage or manipulation of data by using bitwise operations. This bit-level math facilitates effective data management.

Control Flow and Decision Making :

In C programming, control flow and decision-making include utilising mathematical ideas to steer the program's progress. Boolean algebra is the foundation for logical expressions, which programmers use to make decisions such as "if this, then that." It's similar to controlling the program's flow with basic maths. These mathematical ideas underpin conditional statements, loops, and other control structures, which let C programmers write programmes that follow predetermined routes and make intelligent judgements in response to various scenarios.

Graphics and Game Development :



Graphics and game creation in C programming use mathematical ideas to provide visual experiences. For the purpose of creating realistic 3D images and animations, programmers utilise geometry, trigonometry, and linear algebra. It's similar to controlling the forms, positions, and motions of items on the screen through math. This mathematical basis allows C programmers to transform numerical calculations into visually appealing pieces, bringing graphics to life in games and other graphical applications.

Mathematical thinking, data management, algorithm design, numerical computations, and other parts of computer programming are all based on it, which is why mathematics is an essential component of C programming. A programmer can tackle complicated problems and produce dependable, efficient code more easily if they have a strong grasp of mathematical ideas.■

~Kangkan Baishya
Mathematics Department (2021-23)

Did you know?

- Father of Trigonometry?

  Answer: Hipparchus

- Who discovered Line Graph, Bar Chart, Circle Graph?

  Answer: William Playfair

- Who is the Father of Analytic Geometry?

  Answer: René Descartes and Pierre de Fermat

- Who is considered as the Father of Calculus?

  Answer: Isaac Newton and Gottfried Leibniz

MATHEMATICS IN CRYPTOGRAPHY:

Securing the digital world

In our increasingly interconnected world, where information flows freely across digital networks, the need for robust security measures has never been more critical. Cryptography, the art and science of securing communications and data, plays a central role in protecting our online interactions. But how does mathematics make this possible? Let's delve into the fascinating realm of mathematics in cryptography.

The Foundation of Cryptography: Mathematical Principles

At its core, cryptography relies on mathematical principles to ensure the confidentiality, integrity, and authenticity of data. The most fundamental of these principles is the concept of encryption. Encryption is the process of converting plaintext, or readable data, into ciphertext, which is incomprehensible without the proper decryption key.

Symmetric and Asymmetric Cryptography

Two primary cryptographic techniques exist: symmetric and asymmetric cryptography.

1. **Symmetric Cryptography:**
   In symmetric cryptography, a single secret key is used for both encryption and decryption. The mathematics behind symmetric encryption algorithms, such as the Advanced Encryption Standard (AES), involve operations like substitution, permutation, and + modular arithmetic. These mathematical operations make it extremely challenging for unauthorized parties to decipher the ciphertext without knowing the key.
2. **Asymmetric Cryptography:**
   Asymmetric cryptography, on the other hand, employs a pair of keys: a public key for encryption and a private key for decryption. The security of asymmetric encryption, exemplified by algorithms like RS-1 and ECC (Elliptic Curve Cryptography), relles on complex mathematical problems. RS1 encryption, for instance, is based on the difficulty of factoring large composite numbers, while ECC relles on the discrete logarithm problem. These mathematical problems form the bedrock of asymmetric encryption's security.

Prime Numbers and Modular Arithmetic

Prime numbers are central to many cryptographic algorithms. The difficulty of factoring large composite numbers into their prime components serves as the basis for the security of RSA encryption. Additionally, modular arithmetic, where calculations wrap around after reaching a certain value, is vital in various cryptographic operations, such as modular exponentiation in RSA.

Key Exchange Protocols:

The mathematics behind key exchange protocols like the Diffle-Hellman key exchange enables secure communication over untrusted networks. In the Diffie-Hellman protocol, two parties can agree on a shared secret key without ever transmitting it directly. Th protocol relles on the computational infeasibility of calculating discrete logarithms in a finite field, a challenging mathematical problem that forms the basis of lis security.

Digital Signatures and Hash Functions

Digital signatures ensure data integrity and authenticity. These signatures are generated using asymmetric cryptography. Hash functions play a crucial role in creating a fixed-size representation of data. 11 change in the data leads to a vastly different hash, making it nearly impossible for an attacker to alter the data without detection.

Current Challenges in Cryptography

Quantum Computing Threat:

The most formidable challenge-to modern cryptography is the adver of quantum computing. Quantum computers can potentially break many of the cryptographic algorithms currently in use by exploiting their ability to solve complex mathematical problems much faster than classical computers.

Increased Computational Power:

As conventional computing power continues to grow, cryptographic algorithms that were once considered secure are now becoming more vulnerable. This necessitates continuous advancements in cryptographic methods to stay ahead of potential threats.

Adapting to New Threats:

The landscape of digital threatzis ever changing, requiring cryptographic methods to be not only redunt bull aitse miligititite. The mathematics underlying these systems must witve to nititrenam ferms of cyberattacks and vulnerabilities.

Future Advances in Cryptography

Post-Quantum Cryptography:

In response to the quantum computing threat, post-quantum cryptography is emerging as a key area of focus. This involves developing new algorithms that are secure against both quantum and classical computers, using advanced mathematical concepts.

Homomorphic Encryption:

This innovative approach allows computations to be carried out on encrypted data without needing to decrypt it. The development of efficient and practical homomorphic encryption schemes is a significant area of research, promising enhanced security for cloud computing and data privacy.

Quantum Cryptography:

Beyond defending against quantum threats, leveraging quantum mechanics for cryptography itself is a promising frontier Quantum hey distribution (QKD), for instance, uses quantum properties to securely distribute encryption keys, offering theoretically unbreakable security.

Cryptographic Agility:

With the rapid evolution of digital threats, cryptographic systems need to be agile. This means they must be designed to easily Incorporate new algorithms and update key sizes to respond to emerging threats. Research in this area focuses on creating flexible, adaptable cryptographic frameworks.

In conclusion, mathematics is the cornerstone of cryptography, providing the essential tools to secure our digital world. From the prime numbers underpinning RSA encryption to the complex mathematical problems that drive asymmetric encryption and key exchange protocols, mathematics ensures that our sensitive information remains confidential and our digital interactions remain secure. As technology advances, the field of cryptography continues to evolve, driven by the relentless pursuit of mathematical solutions to emerging security challenges.

Wrapping Up: The Mathematics of Cryptography

The relationship between mathematics and cryptography is a testament to the importance of mathematics in real-world applications. It underscores the need for continual research and development in mathematical theories to stay ahead in the game of digital security. The future of cryptography is an exciting and evolving field, promising a safer and more secure digital world for generations to come.■

~Nibedita Nath

Mathematics Department (2022-25)

“Mathematics is the most beautiful and most powerful creation of the human spirit.”

– Stefan Banach

FIVE YEARS RESULT ANALYSIS OF

MATHEMATICS DEPARTMENT NALBARI COLLEGE

INTRODUCTION:

R was first implemented in the early 1990's by Robert Gentleman and Ross Ihaka, both faculty members at the University of Auckland. The R language was closely modeled on the S Language for Statistical Computing conceived by John Chambers, Rick Becker, Trevor Hastie, Allan Wilks and others at Bell Labs in the mid 1970s, and made publicly available in the early 1980's. When we see powerful analytics, statistics, and visualizations used by data scientists and business leaders, chances are that the R language is behind them. Open-source R is the statistical programming language that data experts the world over use for everything from mapping broad social and marketing trends online to developing financial and climate models that help drive our economies and communities.

DATA COLLECTION:

Data collection is the process to gathering quantitative and qualitative information on specific variable with the aim of evaluating outcomes or gleaning actionable insights. Good data collection requires a clear process to ensure the data we collect is clean, consistent and reliable.

There are many ways to collect informations when doing a project or a research. Some data collection methods include surveys, interviews, observations, focus groups, experiments, and secondary data analysis. Essentially there are four choices for data collection – in-person interviews, mails, phone and online. There are advantages and disadvantages to each of these modes. These follows:

1. **In-Person Interviews:**
   Advantage: In-depth and a high degree of confidence in the data.
   Disadvantage: Time consuming, expensive and can be dismissed as anecdotal.
2. **Mail Surveys:**
   Advantage: We can reach anyone and everyone-no barrier.
   Disadvantage: Data collection errors, less response
3. **Phone Surveys:**
   Advantage: High degree of confidence in the data collected, reach almost anyone.
   Disadvantage: Need to hire an agency, expensive, time consuming.
4. **Web/Online Surveys:**
   Advantage: Cheap, can self-administer, very low probability of data errors.
   Disadvantage: People wary of divulging information online.

We choose the Web/Online survey which is very useful for us to collect informations from the students. So, we can create a "Google Form" to collect informations consistently.

Google Form gives us a great way to gather responses from people. From a one-question form to a long multiple-section quiz, a Google Form eliminates the need to decipher and tally responses on sheet of paper. A form also serves as an elegant alternative to asking a group of people questions in mail, whatsapp etc. Google Form gives us all the standard survey field – such as text, multiple choice question, short answers, drop downs, linear scales, grids, file uploading – to serves all sorts of data collection needs.

For gathering informations we called some pervious years passed out students and we shared them the Google Form link through Whatsapp and talked them to shared the Google Form link in their batch Whatsapp group. In the Google Form we included short answer, multiple choice questions, file uploading options, we can convert the responds of the Google Form to Excel sheets. It can helps us to categorised our data sets. This data sets were analysed with the help of "R Programming". R Programming is a open-source statistical environmental programming language, which is a powerful statistical program.

DATA VISUALIZATION:

Data visualization is the representation of data through use of common graphics such as charts, plots, maps and even animations. These visual display of informations communicate complex data relationships and data-driven insights in a way that is easy to understand. Data visualization can be utilized for variety of purpose.

Data visualization is commonly used to spur idea generation across teams. The start of a project by supporting the collection of different perspectives and highlighting the common concerns of the collective. While these visualizations are usually unpolished and unrefined, they help set the foundation within the project to ensure the problem.

Data visualization is very essential for visual communication, visual communication should be simple and deliberate to ensure that our data visualization helps our target viewers arrive at our intended, insight or conclusion. The following best practices can help ensure our data visualization is useful and clear:

1. Know Our Viewers: The first and most important consideration is our viewers. Their preferences will guide every other decision about our visualization—the dissemination mode, the graph type, the formatting, and more. We might be designing charts for college administration, students, the general public, or your own organization's leaders, among many others. What type of decisions do our viewers make? What information do they already have available? What additional information can our charts provide? Do they have time and interest to explore an interactive project? We'll want the data that we provide to motivate people.

2.Choose An Effective Visual: Specific visuals are designed for specific types of datasets. For instance, scatter plots display the relationship between two variables well, while line graphs display time series data well. Ensure that the visual actually assists the audience in understanding our main takeaway. Misalignment of charts and data can result in the opposite, confusing our audience further versus providing clarity.

3. Keep it simple: Data visualization tools can make it easy to add all sorts of information to our visual. For example, do I need data labels on every bar in our bar chart? Perhaps we only need one or two to help illustrate our point. Do I need a variety of colors to communicate our idea? We're using those colors which are accessible to a wide range of viewers. Design our data visualization for maximum impact by eliminating information that may distract our target viewers.We have used to visualized our datas with the help of “R Programming”. In R, we can create visually appealing data visualizations by writing few lines of code. For this purpose, we use the diverse functionalities of R.

Types of Data Visualization:

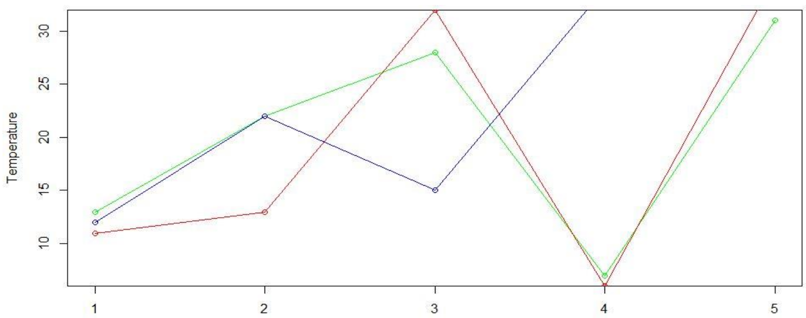
Some of the various types of visualizations offered by R are:

1. Pie chart: A pie-chart is a representation of values in the form of slices of a circle with different colors. Slices are labeled with a description, and the numbers corresponding to each slice are also shown in the chart. However, pie charts are not recommended in the R documentation, and their characteristics are limited. So, we do not used the pie chart. e.g.-

```
> x <- c(21, 62, 10, 53)
> labels <- c("London", "New York", "Singapore", "Mumbai")
> pie(x,labels)
```

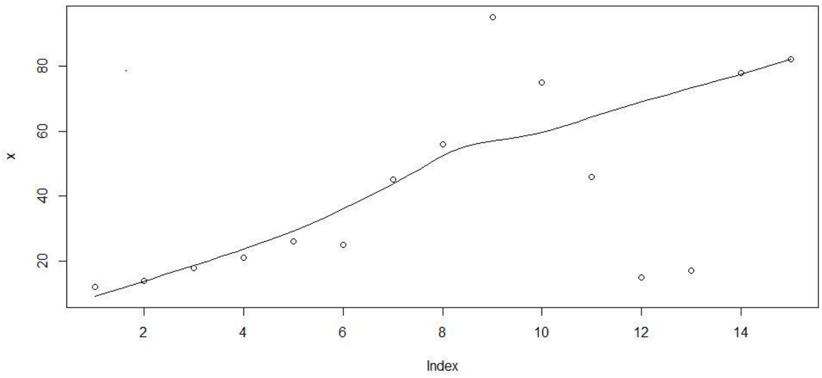
2**. Line Graph**: A line graph is a pictorial representation of information which changes continuously over time. A line graph can also be referred to as a line chart. Within a line graph, there are points connecting the data to show the continuous change. The lines in a line graph can move up and down based on the data. We can use a line graph to compare different events, information, and situations. e.g.-

```
> v <- c(13,22,28,7,31)
> w <- c(11,13,32,6,35)
> x <- c(12,22,15,34,35)
> plot(v,type = "o",col="green",xlab="Month",ylab="Temperature")
> lines(w, type = "o", col = "red")
> lines(x, type = "o", col = "blue")
```



3.Scatter Plot: A scatter plot is composed of many points on a Cartesian plane. Each point denotes the value taken by two parameters and helps us easily identify the relationship between them. Each point on the scatter plot defines the values of the two variables. One variable is selected for the vertical axis and other for the horizontal axis. e.g.-

```
> x<-c(12,14,18,21,26,25,45,56,95,75,46,15,17,78,82)
> scatter.smooth(x)
```

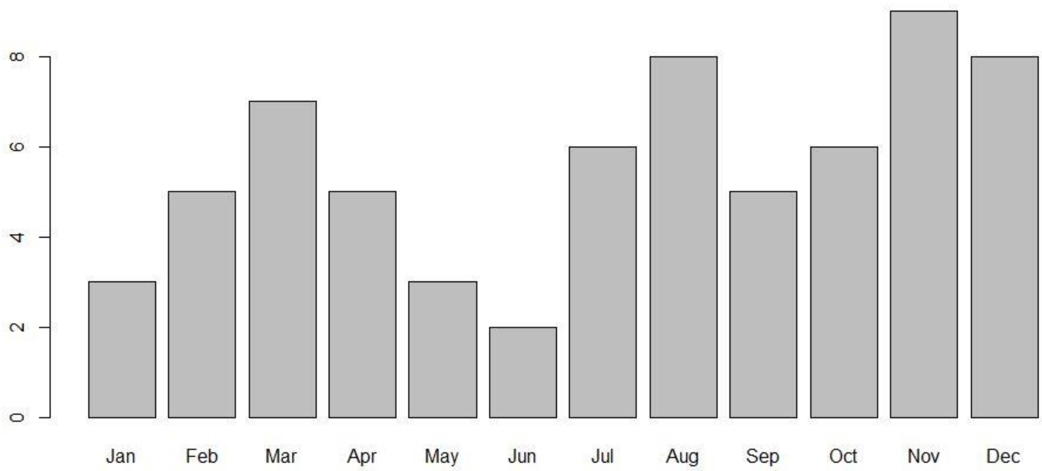


4. Bar Chart: The bar chart is suitable for showing data that fall into discrete categories. There are two types of bar plots- horizontal and vertical which represent data points as horizontal or vertical bars of certain lengths proportional to the value of the data item. They are generally used for continuous and categorical variable plotting. We use the barplot() command to produce bar charts. By setting the horiz parameter to true and false, we can get horizontal and vertical bar plots respectively.

There are many types of bar charts and these follows:

Single – Category Bar Chart : Single – Category bar chart is a very simplest plot. This simplest plot can be made from a single vector of numeric values. e.g.

```
> rain<-c(3,5,7,5,3,2,6,8,5,6,9,8)
> month<-c("Jan","Feb","Mar","Apr","May","Jun","Jul","Aug","Sep","Oct","Nov","Dec")
> rain ; month
 [1] 3 5 7 5 3 2 6 8 5 6 9 8
 [1] "Jan" "Feb" "Mar" "Apr" "May" "Jun" "Jul" "Aug" "Sep" "Oct" "Nov" "Dec"
> names(rain) = month
> rain
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
  3   5   7   5   3   2   6   8   5   6   9   8
> barplot(rain)
```

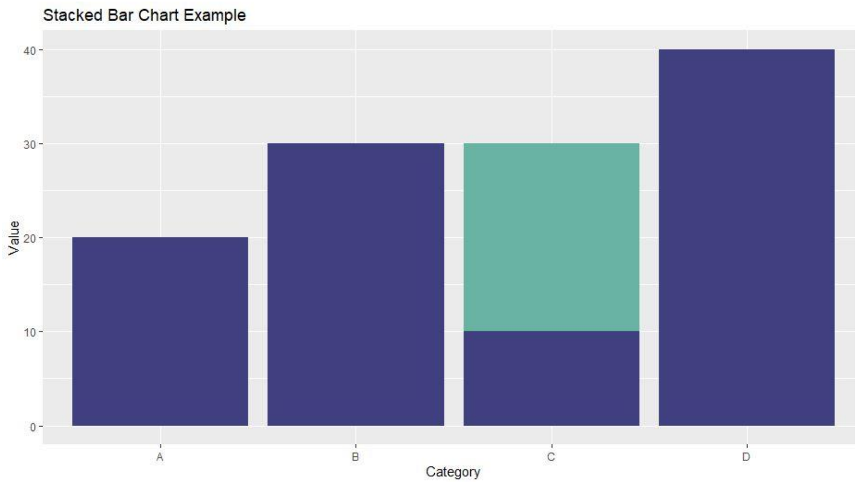


Multiple Catogary Bar Chart: The examples of bar charts we have given so far have all involved a single "row" of data, that is, all the data relate to categories in one group. It is also quite common to have several groups of categories. We can display these groups in several ways, the most primitive being a separate graph for each group. However, we can also arrange our bar chart so that these multiple categories are displayed on one single plot. We have two options: stacked bars and grouped bars.

(a) Stacked Bar Charts: If our data contains several groups of categories, we can

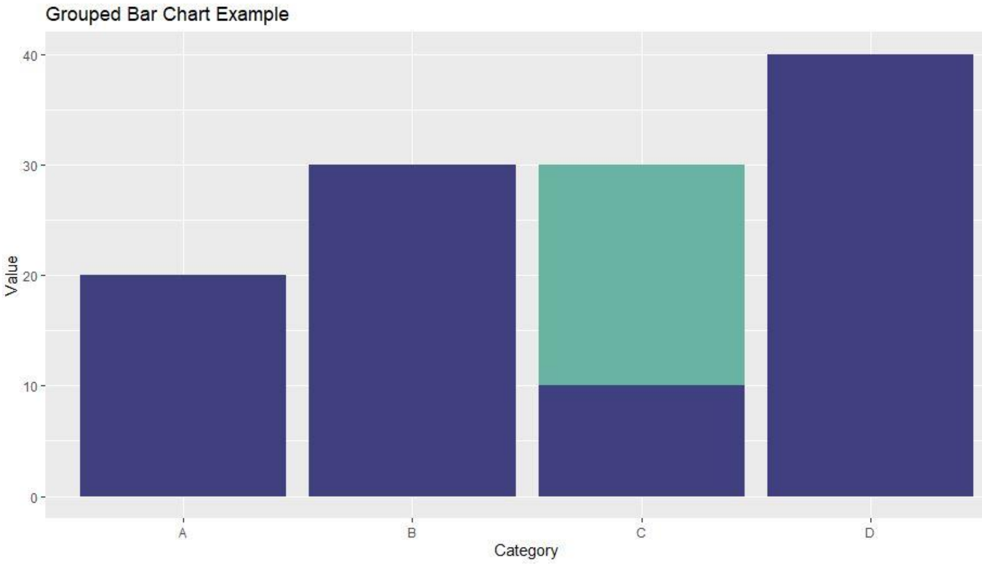
display the data in a bar chart in one of two ways. We can decide to show the bars in blocks or groups or we can choose to have them stacked. e.g.-

```
> data <- data.frame(category = c("A", "B", "C", "D"),
+     value1 = c(10, 20, 30, 40),
+     value2 = c(20, 30, 10, 40))
> library(ggplot2)
> ggplot(data, aes(x = category, y = value1)) +
+     geom_bar(stat = "identity", fill = "#69b3a2") +
+     geom_bar(aes(y = value2), stat = "identity", fill = "#404080") +
+     labs(title = "Stacked Bar Chart Example", x = "Category", y = "Value")
```



(b) Grouped Bar Charts: When our data are in a matrix with several rows, the default bar chart is a stacked chart as we saw in the previous section. We can force the elements of each column to be unstacked by using the beside = TRUE instruction in the barplot. e.g.-

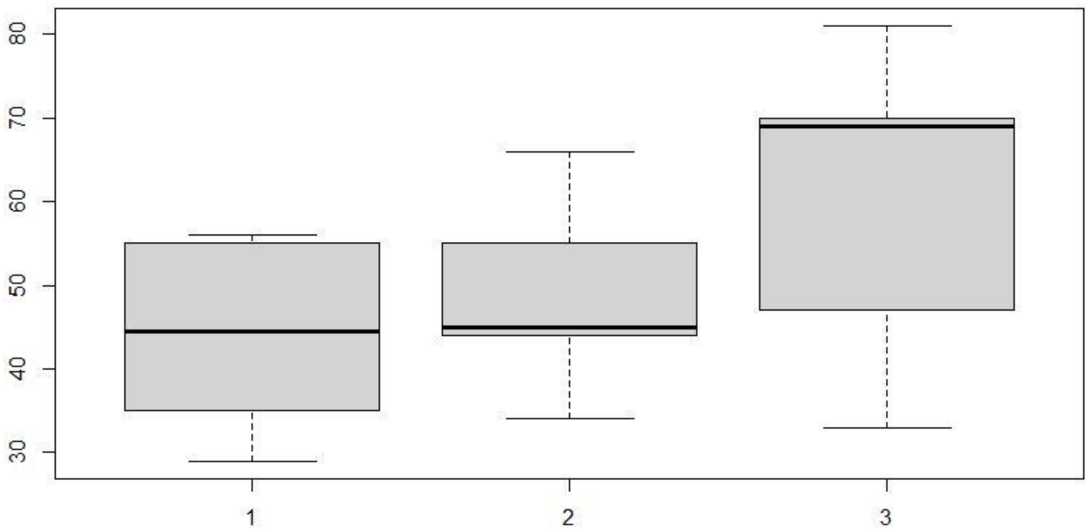
```
> data <- data.frame(category = c("A", "B", "C", "D"),
+ value1 = c(10, 20, 30, 40),
+ value2 = c(20, 30, 10, 40))
> library(ggplot2)
> ggplot(data, aes(x = category)) +
+     geom_bar(aes(y = value1), stat = "identity", position = position_dodge(width = 0.8), fill = "#69b3a2") +
+     geom_bar(aes(y = value2), stat = "identity", position = position_dodge(width = 0.8), fill = "#404080") +
+     labs(title = "Grouped Bar Chart Example", x = "Category", y = "Value") +
+     scale_x_discrete(breaks = data$category)
```



We used the bar chart to visualized the datas in the project.

5. Box-Whisker Plot: The box-whisker plot (often abbreviated to boxplot) is a useful way to visualize complex data where we have multiple samples. In general, we are looking to display differences between samples. The basic form of the box-whisker plot shows the median value, the quartiles and the max/min values. This means that we get a lot of information in a compact manner. The box-whisker plot is also useful to visualize a single sample because we can show outliers if we choose. We can use the boxplot() command to create box-whisker plots. The command can work in a variety of ways to visualize simple or quite complex data. e.g.

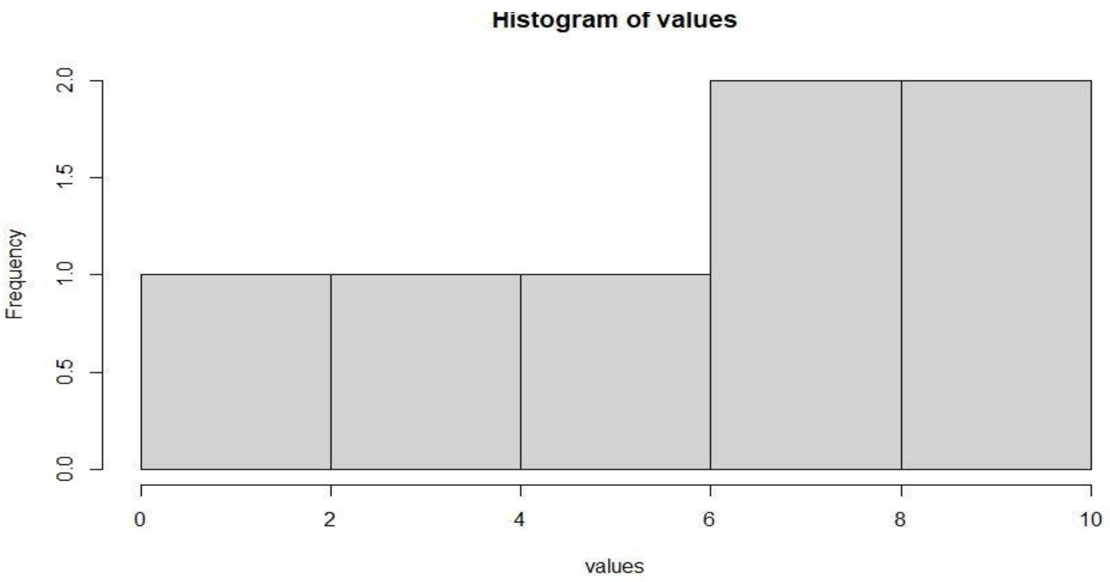
```
> v1<-c(29,35,40,55,56,49)
> v2<-c(45,44,55,66,34)
> v3<-c(70,69,47,81,33)
> boxplot(v1,v2,v3)
```



Also, we used the box plot to visualized our data sets in the project.

6.Histogram: The histogram is the classic way of viewing the distribution of a sample. We can create histograms using the graphical command hist(). However, in a histogram values are grouped into consecutive intervals called bins. In a Histogram, continuous values are grouped and displayed in these bins whose size can be varied. e.g.

```
> values<-c(1,4,6,7,8,9,10)
> hist(values)
```



Advantages of Data Visualization in R:

R has the following advantages over other tools for data visualization:

• R offers a broad collection of visualization libraries along with extensive online guidance on their usage.

• R also offers data visualization in the form of 3D models and multipanel charts.

• Through R, we can easily customize our data visualization by changing axes, fonts, legends, annotations, and labels.

Disadvantages of Data Visualization in R:

R also has the following disadvantages:

• R is only preferred for data visualization when done on an individual standalone server.

• Data visualization using R is slow for large amounts of data as compared to other counterparts.

Application Areas:

• Presenting analytical conclusions of the data to the non-analysts departments of your company.

• Health monitoring devices use data visualization to track any anomaly in blood pressure, cholesterol and others.

• To discover repeating patterns and trends in consumer and marketing data.

• Meteorologists use data visualization for assessing prevalent weather changes throughout the world.

• Real-time maps and geo-positioning systems use visualization for traffic monitoring and estimating travel time.

R EXCEL FILE:

The xlsx is a file extension of a spreadsheet file form at which was created by Microsoft to work with Microsoft Excel. In the present era, Microsoft Excel is a widely used spreadsheet program that sores data in the .xls or .xlsx format. R allows us to read data directly from these files by providing some excel specific packages. There are lots of packages such as XL Connect, xlsx, gdata, etc. We will use xlsx package, whichnot only allows us to read data from an excel file but also allow us to write data in it.

Like the CSV file, we can read data from an excel file. R provides read.xlsx() function, which takes two arguments as input, i.e., file name and index of the sheet. This function returns the excel data in the form of a data frame in the R environment. There is the following syntax of read.xlsx() function:

read.xlsx(file_name,sheet_index)

In R, we can also write the data into our .xlsx file. R provides a write.xlsx() function to write data into the excel file. There is the following syntax of write.xlsx() function:

write.xlsx(data_frame,file_name,col.names,row.names,sheetnames,append)

The two excel datasets are merged using merge() function which is in base package and comes pre-installed in R.

Now, the collected data sets using Google Form was converted into the “xlsx” or Excel file, those files are as follows :

5 YEARS RESULT DATA COLLECTION SHEET

Sl. No.	Name	Gender	Caste	Batch Year	CGPA(final semester)
1	Niharika Barman	Female	OBC	2018-2021	8.22
2	Pakija Sultana	Female	General	2018-2021	8.28
3	Banani Nath	Female	OBC	2018-2021	8.23
4	Bikash Das	Male	OBC	2018-2021	7.84
5	Rubi Ahmeda	Female	OBC	2018-2021	8.19
6	Hemanta Nath	Male	OBC	2018-2021	8.58
7	Rakesh baruah	Male	OBC	2018-2021	7.01
8	Parimita Kashyap	Female	SC	2018-2021	9.47
9	Dhrubajyoti Baishya	Male	General	2020-2023	5.63
10	Bishnu Ram Medhi	Male	General	2018-2021	8.09
11	Debashree Saikia	Female	General	2018-2021	7.49
12	Nibha Moni Haloi	Female	General	2018-2021	8.65
13	Abhijit Haloi	Male	General	2020-2023	6.93
14	Neeta Moni Haloi	Female	General	2018-2021	8.67
15	Kangkan Baishya	Male	General	2020-2023	6.29
16	Dhritisman dutta	Male	General	2020-2023	7.50
17	Jayanta Bezbaruah	Male	OBC	2020-2023	7.29
18	Rintu Kalita	Male	General	2020-2023	8.14
19	Sagar Kashyap	Male	General	2020-2023	6.93
20	Aminul Abdullah	Male	General	2016-2019	7.10
21	Koushik Kumar Deka	Male	General	2016-2019	7.80
22	Hirak Jyoti Rajbongshi	Male	OBC	2016-2019	8.30
23	Jemin Sajid Ikbal	Male	General	2016-2019	8.0
24	Dibyajyoti Deka	Male	General	2016-2019	7.60
25	Brajen Barman	Male	General	2017-2020	10
26	Dhritismita Chakravarty	Female	General	2017-2020	8.22
27	Bipasha Sarma	Female	General	2018-2021	8.0
28	Sagarika Deka	Female	General	2017-2020	6.81
29	Puja Haloi	Female	SC	2017-2020	8.39
30	Sonali Sarma	Female	General	2017-2020	7.01
31	Jintu Haloi	Male	General	2017-2020	10
32	Juri Barman	Female	General	2018-2021	8.03
33	Dikshita Deka	Female	General	2018-2021	8
34	Dhanjit Barman	Male	General	2017-2020	7.62
35	Sourav Barman	Male	General	2017-2020	6.61
36	Mayuri Baishya	Female	General	2017-2020	6.67
37	Uddipta Patowary	Male	General	2018-2021	7.38
38	Krishanu Barman	Male	General	2017-2020	9.84
39	Suman Bez	Male	OBC	2018-2021	7.94
40	Bhaswati Dutta	Female	General	2020-2023	5.29
41	Pallavi Sarma	Female	General	2020-2023	6.29
42	Nilanjana Baishya	Female	OBC	2020-2023	7.36
43	Jublismita Talukdar	Female	OBC	2020-2023	7.93
44	Rimpy Ahmed	Female	OBC	2020-2023	7.07
45	Bismita Talukdar	Female	General	2020-2023	7.14

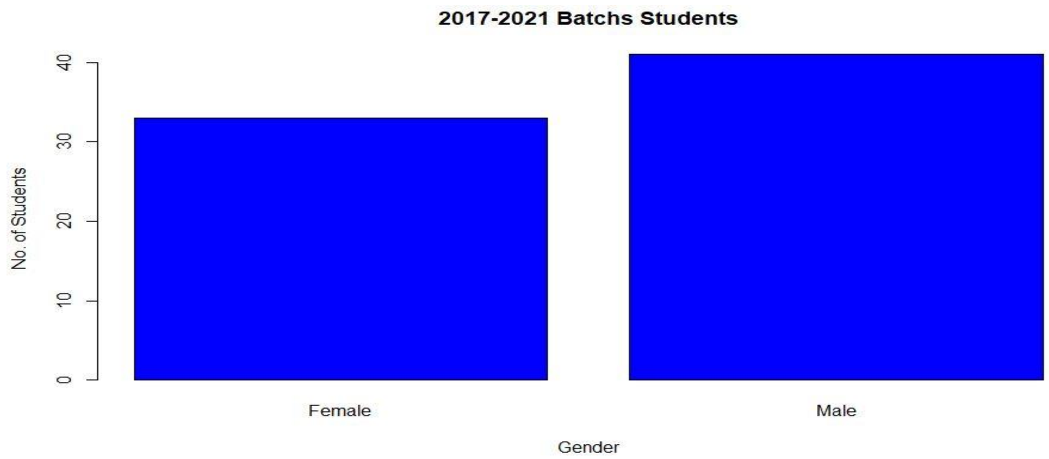
46	Nidhi Talukdar	Female	OBC	2020-2023	7.14
47	Bhitalee Deka	Female	General	2019-2022	8.38
48	Bibhash Barman	Male	OBC	2019-2022	7.39
49	Bidisha Dutta	Female	General	2019-2022	8.34
50	Bitopan Kumar	Male	General	2019-2022	7.18
51	Chandan Das	Male	SC	2019-2022	8.77
52	Chinmoy Talukdar	Male	General	2019-2022	8.22
53	Dhiraj Choudhury	Male	SC	2019-2022	7.62
54	Dhrubajyoti Kalita	Male	General	2019-2022	8.89
55	Dipinti Barman	Female	General	2019-2022	9.41
56	Fardik Ahmed	Male	General	2019-2022	8.34
57	Gitartha Kalita	Male	General	2019-2022	8.86
58	Himashri Kalita	Male	General	2019-2022	7.85
59	Jahnavi Goswami	Female	General	2019-2022	7.78
60	Jeshmin Sultana	Female	General	2019-2022	8.28
61	Jigyasa Barman	Female	General	2019-2022	8.43
62	Jubin Deka	Male	General	2019-2022	7.15
63	Jyotirmoy Baishya	Male	General	2019-2022	7.99
64	Jyotirmoy Deka	Male	General	2019-2022	7.77
65	Kangkan Kalita	Male	General	2019-2022	7.89
66	Manjima Sarma	Male	General	2019-2022	9.35
67	Mridupaban Kashyap	Male	General	2019-2022	7.46
68	Mriganka Sarma	Male	General	2019-2022	7.82
69	Nabajit Sarania	Male	ST	2019-2022	8.34
70	Partha Kalita	Male	General	2019-2022	7.61
71	Pritismita Deka	Female	General	2019-2022	8.05
72	Priyanka Deka	Female	General	2019-2022	7.32
73	Rinismita Sarma	Female	General	2019-2022	7.77
74	Rupjyoti Sarma	Male	General	2019-2022	9.03

These data sets were visualized using “R Programming”.

Bar Charts:

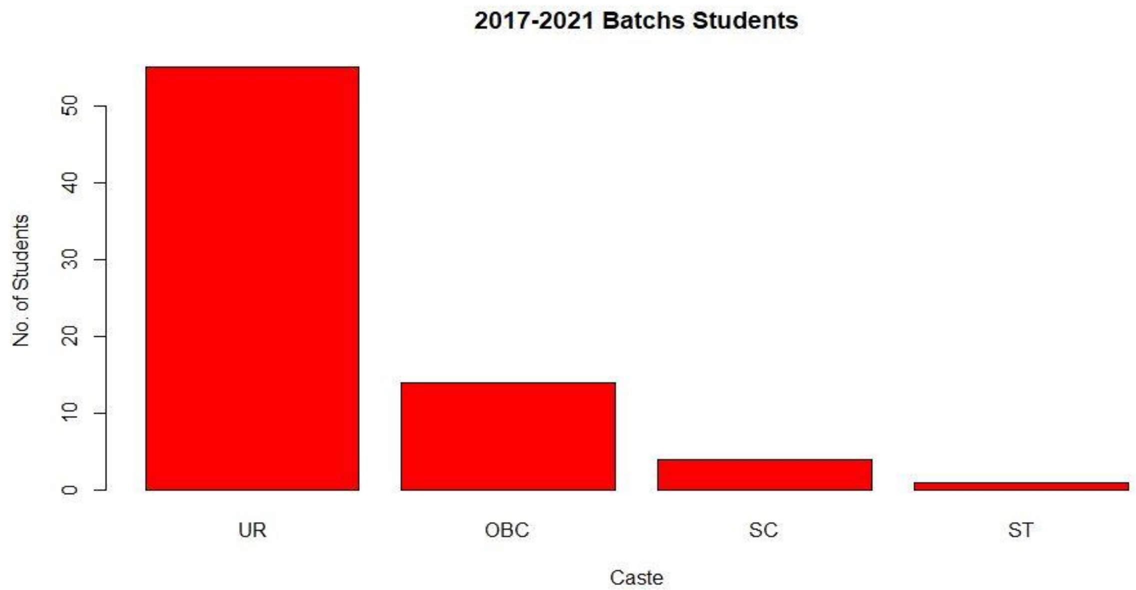
A) Distribution of Gender:-

```
> Students<-c(33,41)
> Gender<-c("Female", "Male")
> barplot(Students,names.arg=Gender,xlab="Gender",ylab="No. of Students",
+ col="blue",main="2017-2021 Batchs Students")
```



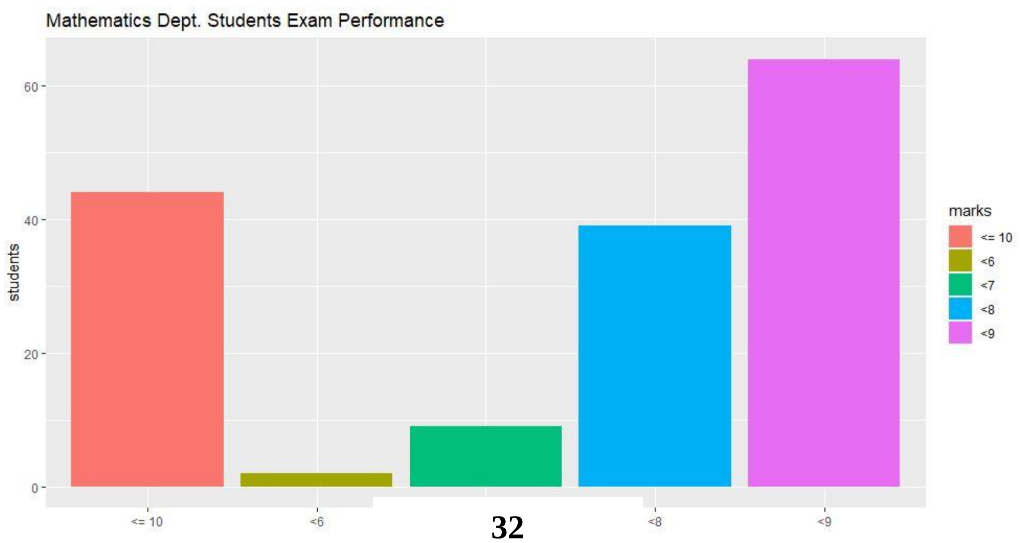
B) Caste Distribution:-

```
> Students<-c(55,14,4,1)
> Caste<-c("UR","OBC","SC","ST")
> barplot(Students,names.arg=Caste,xlab="Caste",ylab="No. of Students",
+ col="Red",main="2017-2021 Batchs Students")
```



C) Students Performance:-

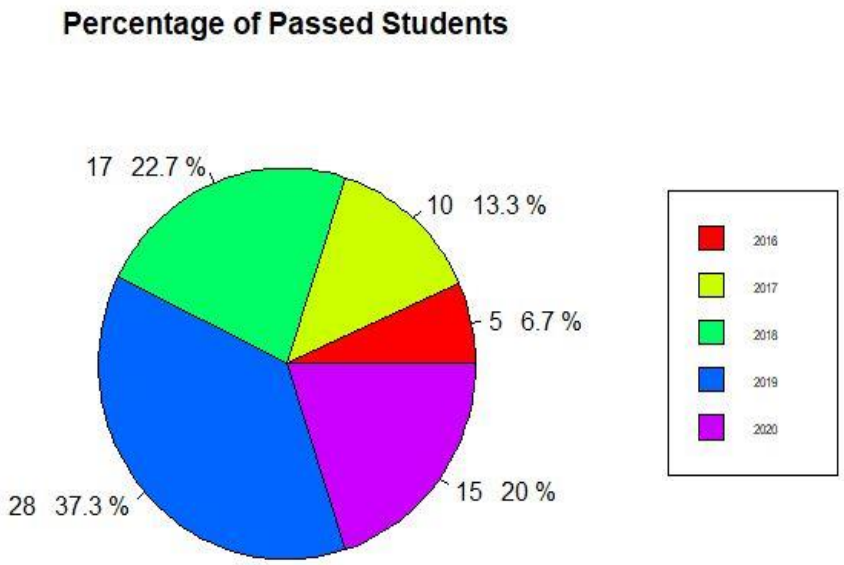
```
> students=c(2,9,39,64,44)
> marks=c("<6" , "<7" , "<8" , "<9" , "<= 10")
> final_year_marks<-data.frame(marks,students)
> final_year_marks
  marks students
1    <6        2
2    <7        9
3    <8       39
4    <9       64
5 <= 10       44
> library(ggplot2)
> ggplot(final_year_marks,aes(x=marks,y=students,fill=marks)) + geom_bar(stat
 = "identity") + labs(title = "Mathematics Dept. Students Exam Performance",x
="marks",y="students")
```



Pie Charts:

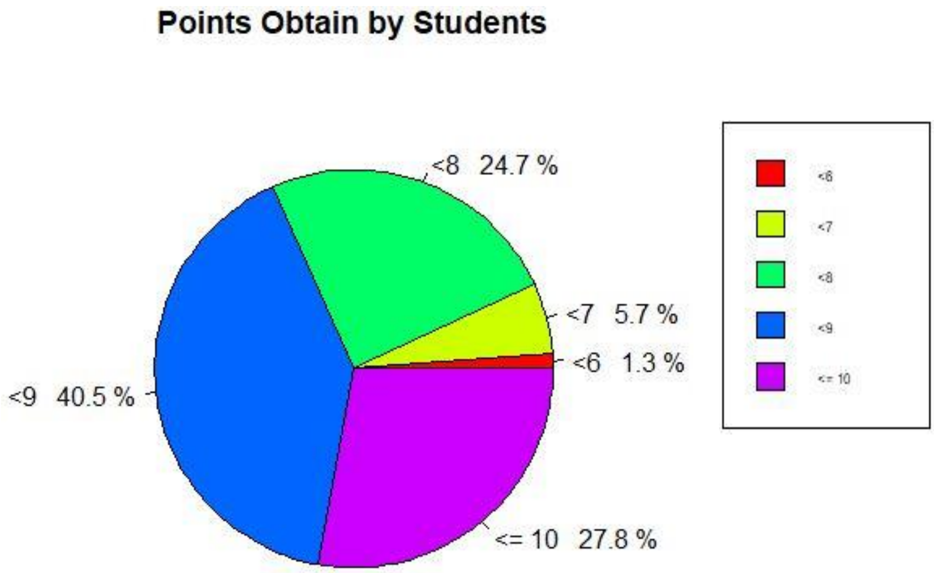
A)Passed Percentage:

```
> students<-c(5,10,17,28,15)
> labels<-c("2016","2017","2018","2019","2020")
> piepercent<-round(100*students/sum(students),1)
> pie(students,labels =paste(students, x = " ", piepercent, "%"),col = rainbow
(length(students)),main="Percentage of Passed Students")
> legend("topright",  c("2016","2017","2018","2019","2020"), cex = 0.5,fill =
 rainbow(length(students)))
```



B) Marks obtain Percentage:

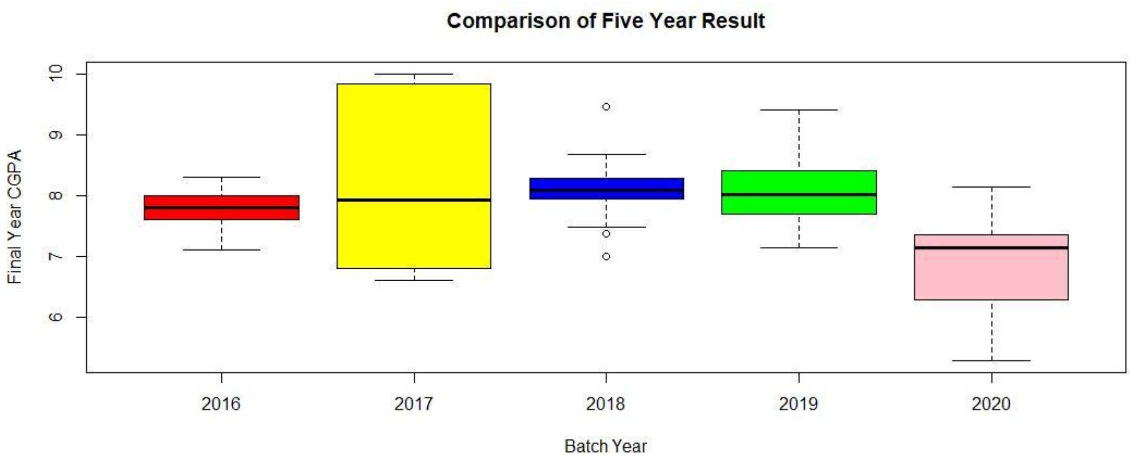
```
> students<-c(2,9,39,64,44)
> marks<-c("<6" , "<7" , "<8" , "<9" , "<= 10")
> final_year_marks<-data.frame(marks,students)
> final_year_marks
  marks students
1    <6        2
2    <7        9
3    <8       39
4    <9       64
5 <= 10       44
> piepercent<-round(100*students/sum(students),1)
> pie(students,labels =paste(points, x = " ", piepercent, "%"),radius=2,col =
 rainbow(length(students)),main="Points Obtain by Students")
> legend("topright",  c("<6" , "<7" , "<8" , "<9" , "<= 10"), cex = 0.5,fill =
 rainbow(length(students)))
```



Box Whisker Plot:

A) Comparison of five years result:

```
> batch16<-c(7.10,7.80,8.30,8.0,7.60)
> batch17<-c(10.0,8.22,6.81,8.39,7.01,10.0,7.62,6.61,6.67,9.84)
> batch18<-c(8.22,8.28,8.23,7.84,8.19,8.58,7.01,9.47,8.09,7.49,8.65,8.6
7,8.0,8.03,8.0,7.38,7.94)
> batch19<-c(9.03,7.77,7.32,8.05,7.61,8.34,7.82,7.46,9.35,7.89,7.77,7.9
9,7.15,8.43,8.28,7.78,7.85,8.86,8.34,9.41,8.89,7.62,8.22,8.77,7.18,8.3
4,7.39,8.38)
> batch20<-c(5.63,6.29,7.5,7.29,8.14,6.93,5.29,6.29,7.36,7.93,7.07,7.1
4,7.14)
> boxplot(batch16,batch17,batch18,batch19,batch20,names=c("2016","201
7","2018","2019","2020"),col=c("red","yellow","blue","green","pink"),xl
ab="Batch Year",ylab="Final Year CGPA", main="Comparison of Five Year R
esult")
```



CONCLUSION:

In conclusion, the "Five Year Result Analysis" project provides an in-depth examination of the performance trends of a particular metric over the past five years. The analysis was carried out using R programming language, and three types of charts were used to visualize the results: bar chart, pie chart, and box plot.

The bar chart was used to show the percentage of change in the metric over the past five years, and it revealed that there has been a consistent increase in performance over the years. The pie chart was used to show the distribution of performance across different categories, and it indicated that most of the performance was concentrated in the top categories.

The box plot was used to visualize the distribution of data and identify outliers. It revealed that the data was normally distributed and did not contain any significant outliers. The box plot also provided information about the median, quartiles, and range of the data.

Overall, the project was successful in identifying trends and patterns in the data, and the use of different chart types helped to effectively communicate the findings. The project can be useful for decision-making in areas such as resource allocation, processimprovement, and performance management.■

REFERANCES:

• Beginning R - The Statistical Programming Language – Dr. Mark Gardener (Wrox, 2012)

• A Student’s Guide To The Study, Practice, and Tools of Modern Mathematics - Donald Bindner and Martin Erickson

• https://www.javatpoint.com/r-data-visualization

• https://www.geeksforgeeks.org/data-visualization-in-r/

~Sagar Kashyap

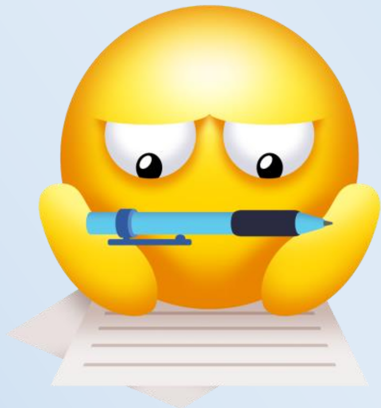
Mathematics Department(2021-23)

Did you Know?

- Inventor of ± sign – William Oughtred
- Father of Cryptology – Leon Battista Alberti
- The movie based on Srinivasa Ramanujan – The Man who knew Infinity
- Inventor of "▼" the Nabla symbol – William Rowan Hamilton
- The person is known as Human Computer – Shakuntala Devi
- The smallest perfect number – Six (6)

Symbols	**Discover**
/	Thomas Twining
α (proportionality)	William Emerson
Γ (gamma function)	Leonhard Euler
! (factorial)	Christian kramp
[…] (matrix)	Gerhard Kowalewski
|x|	Karl Weierstrass

- The number known as Ramanujan-Hardy number – 1729
- The name of the symbol 'φ' - Golden ratio
- Value of Napier's Constant (e) ≈ 2.71828



Celebrations

World Environment Day 2023

National Mathematics Day

Student Nilotpal Barman memorial quiz competition

Achievements

HOD ma'am has been awarded the PhD

Intra college magazine competition and win 1[st] place

THANK YOU