ANANTYA

…Beyond Infinity

VOL IV, APRIL 2020

DEPARTMENTS OF MATHEMATICS, STATISTICS AND COMPUTER SCIENCE

MATA SUNDRI COLLEGE FOR WOMEN
(UNIVERSITY OF DELHI)

MATA SUNDRI JI

Mata Sundri Ji was the wife of Guru Gobind Singh Ji, the tenth guru of the Sikhs. Born on 23rd Dec.1667, she was married to the Guru in 1686. Hers was a remarkable personality that blended to a distinction, the diverse roles of a devoted wife, an ideal mother and a confident and far-sighted guide of the community. After the death of Guru Gobind Singh Ji, the Sikh masses found themselves in a state of disarray because of State terror, in addition to other hardships. In this difficult situation, it was Mata Sundri Ji who served as their guide, raised their morale, and virtually breathed new life into them through her wisdom, erudition and spiritual power.

It was she who got the writings of Guru Gobind Singh collected and compiled as "Dasam Granth". She also persuaded devout Sikhs to prepare copies of holy hymns to be compiled in Adi Granth Sahib. Further, Mata Sundri Ji took care to ensure that the tradition of "langar" (free community kitchen) continued to flourish. Today, when moral values have declined, her lofty personality shines all the more by virtue of sheer contrast

For about forty years Mataji stayed at the premises now occupied by Gurudwara Mata Sundri Ji. The institution of higher learning built adjacent to it is an apt tribute to her. Students from diverse religious backgrounds, faiths, castes and echelons of society have come together here and excelled in their chosen areas of interest, be it academics, sports, or extra- curricular activities. As per the values promulgated by Mataji, equal opportunities and facilities are provided to all. The college imbibes her ideologies and it is an index of our homage to her memory, that this institution has been named after her. Mata sundri ji is the epitome of selflessness and austerity .She will always shine like a star and will guide the people to the right path .

We bow our heads as a mark of respect before the greatness of her soul.

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FROM PRINCIPAL'S DESK

DEAR YOUNG FRIENDS!

Heartiest greetings!!!

I extend my heartiest wishes to the Departments of Mathematics, Statistics and Computer Science for coming up with the fourth edition of their e-magazine, 'Anantya-beyond Infinity'. This magazine gives an insight into the range and scope of the imagination and creativity of our students and faculty members.

It is a platform for our students to showcase their creative abilities, hidden dreams and aspirations for writing. The current issue of Anantya is a compilation of several articles, poems, quizzes, experiences and the extra-curricular achievements of the departments. Such academic endeavors not only provide opportunity to the faculty to present their ideas and opinions in a logical sequential manner but also enable students to unravel their creativity. I am extremely impressed by the talent of our dear students who have contributed in this beautiful magazine.

I applaud the editorial team for the hard work and dedication they have invested in realising this goal, and wish my dear students success in all future accomplishments.

Prof (Dr.) Harpreet Kaur
Principal

FROM THE EDITOR'S DESK

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FROM TEACHER-IN-CHARGE DESK

Greetings to you all!

It is always a great feeling to pen down my thoughts and beliefs for the next issue of our e-magazine 'Anantya: Beyond Infinity'. Anantya is an example of our creativity and a tangible evidence of the positive successful strides of our departments which are learner-centric.

Believing in the quote of Henry Ford, "If everyone is moving forward together, then success takes care of itself", I would like to mention that we together can make success stories blossom and make a difference with our true and unconditional support. We pride ourselves to have committed and devoted teachers along with supportive students which is a perfect blend to bring up individuals with roots anchored to the basics and the apex touching the sky.

Being a part of a team of dedicated teachers that aspires to mould students into socially responsible citizens who possess the skills to thrive in a world of rapid change and hardworking students with desire to learn new things everyday gives me immense pleasure.

Speaking of session 2019-20 activities, a plastic bottles and stationery collection drive was organized from 30th September to 5th October 2019 in collaboration with NGO-The Kind Beings. 'Technophilia': A power point presentation Competition was held on 3rd October 2019 where cash prizes were also given to the winning teams. An invited talk was organized on 'Cyber Security' on 22nd October 2019 by Microsoft. Finally, the session was summed up with our annual fest 'Mastacom' on 18th January 2020 in which students of all departments participated with great zeal.

Our journey is an ongoing one and through the platform of fourth edition of 'Anantya', I would like to express my heartfelt gratitude to the faculty members and students who have worked tirelessly, shouldering the weight of the magazine from its conceptualization to execution. Start to finish, each one of us has learnt something new at every step of this journey and have been exposed to new experiences, making it extremely fulfilling. I wish the teachers and students success in all future endeavors.

Ms. Sonia Aneja
Teacher In-Charge

OUR FACULTY

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- Ms. Mandeep Walia
- Dr. Rama Verma
- Dr. Rashmi Verma
- Ms. Gurpreet Kaur
- Ms. Sonia Aneja
- Dr. Meena Baweja
- Dr. Pooja Sharma
- Dr. Preeti
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- Dr. Ramita Sahni
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- Dr. Meenu Goel
- Dr. Kalpana Yadav
- Dr. Komal Goel
- Dr. Komaldeep Kaur

COMPUTER SCIENCE:

- Ms. Vijaya Goel
- Ms. Priyanka Gupta
- Dr. Nidhi
- Ms. Ashema Hasti
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ASYMPTOTE: OUR SOCIETY

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ANNUAL REPORT

Departments of Mathematics, Statistics and Computer Science session 2019-2020

Donation Drive

"Giving is not about making a donation, its about making a difference"
- Kathy Calvin

Stationery collection drive was organized in collaboration with NGO 'Kind Beings', wherein students as well as teachers donated stationery items, from pencils, pens, crayons to notebooks and comics to the slum areas of Kalyanpuri and Bank enclave, Laxmi Nagar and distributed them to around 70-80 children.






Also, a plastic recycling drive was organized where used plastic bottles were collected and sent to the NGO 'Kind Beings' for recycling. A promise was made to limit the use of unnecessary plastic and to recycle the rest so as to leave less carbon print on the planet and be good and responsible students and future responsible citizens.

One day Hands-on Workshop on "Exploratory Data Analysis"

The workshop commenced with the welcome of the two Event Speakers, **Mr Devanshu Shukla (Director, Hackveda Ltd)** and **Mr. Subrat Sagar (Program Director, Hackveda**

Ltd) by **Ms. Sonia Aneja, Teacher-in-charge**, Department of Mathematics. The objective of the workshop was specifically to introduce techniques of performing Exploratory Data Analysis to participants and help them learn to use it practically.

The workshop was divided into two sessions. The first session introduced Basics of Exploratory Data Analysis and its various stages. In the second session, Tools for Exploratory Data Analysis (EDA) were covered and it was explained how quantitative techniques are used to perform EDA. Students used Google Collaborator to create python scripts and worked on the data-sets to implement stages of EDA.

Technophilia: PPT Presentation Competition

The competition brought forth an amalgamation of intelligence, research, and creativity. The presentation comprised of three tracks, namely, “Recreational Mathematics”, “Ubiquitous Statistics”, and “Internet of Things”, with two rounds

Round-1: **Preliminary round**
In the preliminary round, a total of 45 teams (each team having 2 students) participated across all three years: 13teams from mathematics, 12 teams from statistics and 20 teams from computer science.

Round-2: **Main round**
Out of 45 teams, 18 teams were shortlisted for the main round considering the parameters of richness of content, uniqueness of ideas, aesthetics (design, layout and organization of slides) and confidence, expression and articulation skills of students.

The students researched well to gather information on the topics and used innovative ways of presenting them. The preparation for the event began almost a month earlier. Fielding question after question by the judges, the participants displayed their undying thirst for knowledge, while showcasing their immense interest and the astonishing amount of effort and research put into each of their individual presentations.

Invited Talk on Cyber Security

A talk on "Cyber Security" was organized whose objective was to generate awareness among students to protect and keep themselves safe in the world of Internet and help students understand how to start with the basics of cyber security irrespective of their domain.

The event commenced with the welcome of the guests **Mr. Parth Shukla**, **Ms. Neha Verma** and **Mr. Priyansh Chaudhary** by **Ms. Sonia Aneja, Teacher-in-charge**, Department of Mathematics and **Ms. Mandeep Walia**, Senior Faculty, Department of Mathematics. The **Event Speaker Mr. Parth Shukla** is a Corporate trainer with Microsoft AEP and a subject matter expert in Data analytics & Cyber security. Mr. Priyansh Chaudhary is the Marketing Executive for Institution collaboration and Ms. Neha Verma is the program coordinator at 9ledgepro Microsoft AEP.



Mr. Parth Shukla explained that there are more than 2 billion people who are relying on internet to get and share information, using the internet to buy real or digital goods, making transaction etc. Yet people and organizations are vulnerable to cyber-attacks amidst widespread online transactions. Their security and data privacy is at stake whenever they are connected to internet.

MASTACOM'20

Departments of Mathematics, Statistics and Computer Science of Mata Sundri College for Women, University of Delhi jointly organized the MASTACOM'20 on 18th January 2020 from 10:00 AM to 4:00PM.

The much-awaited event commenced at 10:00 AM in Mata Sahib Kaur Auditorium with inauguration ceremony that began with welcome and introduction of the invited speaker for

the event, Ms. Avneet Kaur, Deputy Director, Ministry of Statistics and Programme Implementation, by Ms. Sonia Aneja, Teacher-In-Charge of Department of Mathematics. The event was attended by more than 250 students and faculty members.

The event also included dances, quiz and many competitions for students to participate in and show their diverse talents while enjoying to the fullest.

Talk on Statistical Indicator for Sustainable Development Goals in India

The esteemed guest speaker, Ms. Avneet Kaur delivered an interesting talk on Statistical Indicator for Sustainable Development Goals in India, emphasising on the role of statisticians to provide a nation-wide balanced model for sustainable development.

The aim of the session was to highlight one of the major issues of our times that all of us must work towards – sustainability of our resources and our planet. The speaker discussed about 8 Millennium Development Goals (MDGs) and 17 Global Sustainable Development Goals (SDGs) that all 189 UN member states have agreed to try to achieve by the year 2030 in the 70th Session of the United Nations (UN) General Assembly held on 25th September 2015 via the document titled "Transforming our World: the 2030 Agenda for Sustainable Development".

She emphasized on India's significant progress towards achieving these goals viz., reducing the poverty by half, universal primary education, providing clean drinking water etc. through various government schemes and programs. The talk concluded with an interactive session between the students and the speaker, followed by vote of thanks by Ms. Sonia Aneja.

Cultural Program

The talk session was followed by the cultural program where the students of all the three departments showcased their talents. The program included dances both Punjabi and western which both the audience and the performers enjoyed very much.

inQUIZitive

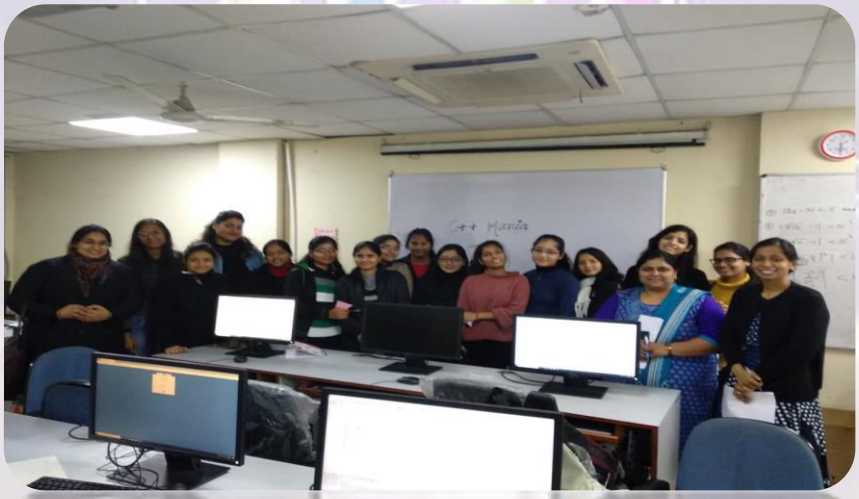
The quiz competition organized by the Department of Mathematics took place in the Mata Sahib Kaur Auditorium. A thrilling competition commenced amongst a total of 31 teams from across the courses. The first round was a Preliminary Round where the teams were given multiple-choice questions to solve on paper, on the basis of which 10 teams were shortlisted for Round 1. Round 1 – The logical round, ended with a tie between 5 teams. A tie breaker round was conducted which led 3 teams out of those 5, making a total of 7 teams to enter Round 2 -The Visual Round. 5 teams qualified for Round 3- MCQ and 4 teams made it to the final round 4- The Rapid-Fire fighting for the prizes. In Rapid-Fire rounds the teams were supposed to play Antakshri using Mathematical/ Statistical terms only. This round was the highlight of the event and received appreciation from everyone. After this round, another

tie-breaker was played for the third position, which gave us our final three winners for the event.

First position was grabbed by students of B.Sc. (H) Statistics 1st year, whereas second and third positions were grabbed by B.Sc. (H) Mathematics 2nd Year and B.Com. (H.) 3rd Year students, respectively. Audience also got a chance to play and win prizes via the Audience Rounds.

C++ Mania

This contest was aimed to gather attention and interest from both beginners and experienced coders took place in the Vocational Lab. There were seventeen teams (team of 2) were registered for the contest that consisted of three rounds. First round was preliminary round which was an online based exam. It comprised of MCQ's. The questions in this round were based on concepts of C++. A total of 50 questions were set in this round, with the time limit of 15 minutes. The top 12 scorers were selected for the next round. Second round was logical round based on error finding, output finding and finding the missing code questions. It comprised a total 10 questions. Maximum time allotted to solve all these questions were 15 minutes. The top 7 scorers were selected for the next round. Round three was a computer based that consisting of 2 programming questions about real life concepts of C++ from which participating teams were required to answer only one of their choice. Time limit for this round was 30 minutes.



Manvi Bhandari and Mansi Goel both from B.Sc. (H) Computer Science 2nd year bagged the first position with the cash prize of Rs 1200. Sejal Mishra from B.Sc. (H) Computer Science 2nd year and Sweta Khatri from B.Sc (H) Computer Science 3rd year bagged the second position with the cash prize of Rs 1000. Divya Chaudhry and Nida Khan from B.Sc. (H) Computer Science 2nd year bagged the third position with the cash prize of Rs 800.

Poster Making

The theme of the poster making competition was “Technology & Sustainable Development”. Many students from various courses of college participated in the event with full zeal. The posters were adjudged on the basis of creativity, clarity, visual appeal and relevance to the theme of the competition. Participants were also given time to elaborate the context and details of their work. The winners were awarded by cash prizes. The first prize was bagged by Somya Agarwal of B.Sc. (H) Computer Science. Rashma Zarrin of B.A. (P) secured second position followed by Bharti Bisht of B.Sc. (H) Mathematics at the third place.

Just a Minute

Just-A-Minute is an all-round fun event that is organized every year in MASTACOM. It took place in the Mata Sahib Kaur Auditorium. The competition consisted for performing different tasks within 1 minute each. This year a total of 23 teams participated. The First round of game was ‘Collecting Straws’. One member took a straw in the fork and carried it towards the other member. From the midway the second member inserted the straw in her fork and moved to reach the destination. The teams with highest number of straws were qualified to the next round. In round two, ‘Balancing Balloons’, the team members were facing in opposite direction. They placed a balloon between their necks and moved from source to destination. Teams having maximum number of balloons at destination were promoted to the next round. For the Third round ‘Stuck to toothpick’, we tied the left hand of one member to the right hand of another member. The members had to insert 3 thermocol balls in each toothpick using their tied hands only. Teams with the highest number of such toothpicks prepared were qualified to the final round. The Final round was “Blow and Burst the balloons”. In this round, both the team members blown and busted the balloons. The teams which busted the maximum number of balloons were declared as winners.

Nisha Sharma and Chanchal Kumari from B.com (H) 2nd Year won the 1st prize, 2nd price was grabbed by Harshita and Riya Garg from 2nd year B.Sc. (H) Computer Science, and Sanskriti Singhal and Palak Garg from B.Com (H) 1st year stood third.

Treasure Hunt

Treasure hunt is the most popular of all events in the MASTACOM. This year 38 teams from different courses participated with huge enthusiasm, where each team consisted of three members. The game was conducted in three rounds with elimination in each round. In the first round each team had to find four parts of a picture, similar to the one given to them, which were hidden at different places. There was a lot of exhilaration as students ran from pillar to post in search of the parts of their picture. 23 teams bid adieu in the first round with only 15 teams proceeding to next round where they were tested on speed and swiftness. Each team had to solve riddles and perform certain tasks to know where they will find their next clue. Various parts of the college premises were used to place the clues. There was display of tremendous team work and coordination among the team members as they ran from one place to another solving the clues. 6 teams made it to the last round where they had to perform some more similar types of tasks.

There were two cash prizes, first prize was of Rs 1500 and second prize of Rs 900. Two teams which came first and second beat each other by mere seconds. Both the teams were from Statistics first year. It was a treat to watch the winners find the 'treasure' with huge smiles on their faces.

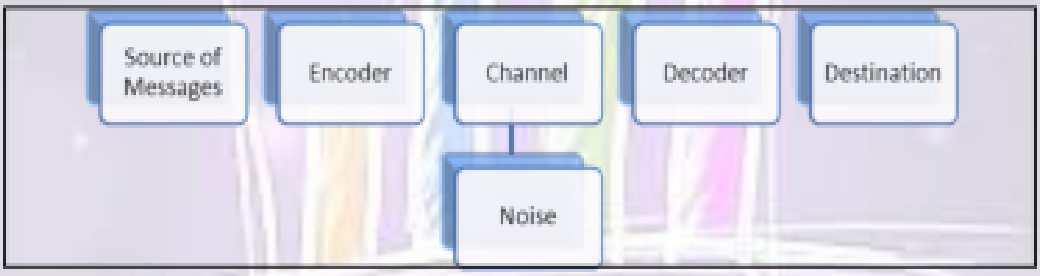

MATHEMATICS

INFORMATION THEORY: A THEORY OF AN INFORMATION AGE

-Dr. Ramita Sahni

Information theory is a mathematical theory of communication that deals with measurement and transmission of information through a channel. The subject of 'Information Theory' is developed out of mathematical studies of the problems connected with communication, storage and transmission of messages. It is a probabilistic based approach that focuses on the measurement of uncertainty relating information. It has vast extensive potential applications in areas like pattern detection, statistical inference, natural language processing, thermal physics, quantum computing etc. This theory is at the heart of compression and reliable transmission of data on the internet, in landline and wireless telephone systems and storage devices from computer hard disks to DVDs.

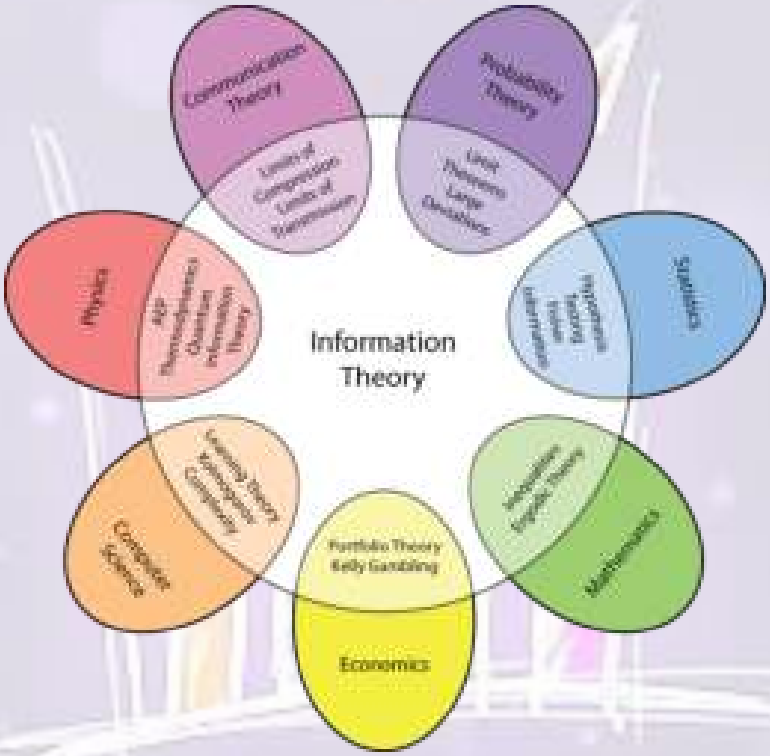
This theory involves the study of any system that includes information dispensation, storage, recovery and decision making. In other words, information theory concentrates all problems related to the entity called communication framework which is diagrammatically represented the following block diagram:



In information, the source of messages, encoder, channel, noise, decoder and destination forms the general structure of communication system. Each medium has its own importance. The role of source of messages is to generate the messages. This medium can be either a man or a machine. The messages from this source go to the encoder which helps in converting these messages into a suitable form like a sequence of binary digits (0's and 1's) for transmission. A medium through which transmission of the coded message is carried out is known as a channel. The output obtained from the channel is converted to the original message with the help of decoder to be transported to the destination. This process of transporting message to the destination cannot be done with absolute consistency; this is due to some disorder present in the system which is termed as noise. Information theory is a probabilistic methodology dealing with evaluating and defining the amount of information contained in a message. While dealing with real world problems, we cannot avoid uncertainty. The paramount goal of information theory is to capture or reduce this uncertainty.

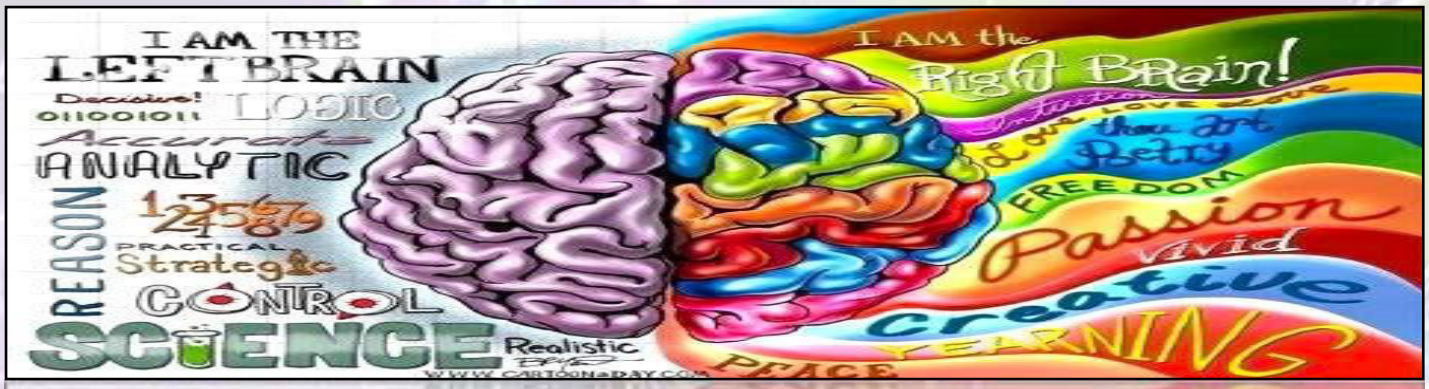
The primary studies in this direction were attempted by Nyquist in 1924 and 1928 and by Hartley in 1928. They perceived the logarithmic nature of the information measure.

Information Theory had an identifiable beginning in Claude Shannon's 1948 paper- "A Mathematical Theory of Communication" in the *Bell Systems Technical Journal*. In this paper, Shannon (1948) explained how information can be quantified with absolute accuracy and exhibited the essential unity of all information media. This paper provided a "Blueprint for the Digital Age". This article was proposed in order to bring in mathematicians from many disciplines to describe some basic definitions and results of information theory in a precise language. The recent literature on information theory is voluminous and the theory permeates into a number of other disciplines such as Coding Theory, Cybernetics, Economics, Medical Science, Quantum Physics, Statistics, Mathematics, Computer Vision etc. Klir (2004) has generalized information theory its aims, results and open problems.



DYSCALCULIA: A MATHS DISORDER

-Muskan Lakra



A child with dyscalculia has difficulty adding, subtracting, multiplying, and dividing numbers, is slow at performing mental math, and is likely to have trouble with money-related tasks. It is difficult for a child with dyscalculia to understand and remember basic mathematical facts and formulas. The child's math ability is often inconsistent; they may be able to perform calculations one day but then forget how to do so on a test the following day. Overall, a child with dyscalculia may appear absent- minded, with a tendency to get lost, lose things, lose track of time, or easily become disoriented. It can also be difficult for a child with dyscalculia to remember names o r t o a s s o c i a t e f a c e s w i t h names. Researchers do not know for sure what causes dyscalculia, but continue to try to work out the differences between those whose problems with math stem from deficits in brain processing and those whose problems are related to factors such as poor instruction, poverty, or coexisting conditions.

Research has also found that, for people with math anxiety, the anticipation of having to do math activates the same centres in the brain that register visceral threats and physical pain. Since this was not observed during the actual performance of maths problems researchers suspect the mere anticipation of math is more anxiety-provoking than the math itself and can cause those affected to try to avoid math problems altogether. Children with dyscalculia are best served by early intervention and specialised coaching in all skills related to basic arithmetic and mathematics. After observation and an initial assessment of the child's listening and learning skills and motivation levels by teachers and other school professionals, as well as considering factors such as seeing or hearing impairment, school attendance, or emotional or motor difficulties that could interfere with learning, the academic accommodations necessary for improvement can be put into place. These interventions may include specialised teaching and working on graph paper to help with organisation. Children may require additional tutoring and reinforcement in and out of the classroom and help in understanding their academic strengths and weaknesses -and how to use them to their advantage. Treatment therapies may vary with the nature and degree of dyscalculia.

DIGITAL SIGNATURES

-Dr. Neha Goel

Digital signature is the method of digitally binding the identity of sender to the message which the sender wants to send over open communication channel to the receiver. Digital signatures are of two types:

Signature with message recovery: A digital signature scheme with mes- sage recovery is a digital signature scheme for which a priori knowledge of the message is not required for the verification algorithm.

Signature without message recovery (or with appendix): Digital sig-nature schemes which require the message as input to the verification algo-rithm are called digital signature schemes with appendix.

Digital Signatures provides the following properties

- Authenticity
- Easily verifiable by anyone
- Non-repudiation
- Data integrity

Digital Signatures are used in following areas:

- E-Governance, E-Learning, E-Shopping, E-Voting, etc.
- Use of digital signature speed up the communication between parties.
- Prevents from the risks of document being intercepted, read, destroyed or altered during communication.
- A digitally signed document can be easily tracked and located in a short amount of time.
- Certification of public keys in large networks.

To apply digital signature we need;

- key pair of signer;
- hash function;
- a mathematical algorithm

The digital signatures are issued by a certifying authority (CA). Parties that pro- vide digital signatures in INDIA are as follows:

1. Safescrypt
2. TCS
3. e-Mudra
4. National Informatics Centre
5. Code Solutions Ltd
6. IDRBT
7. MTNL Trustline

The CCA which was set up in 2000, licences CAs to issue digital signatures certificates under the IT Act 2000. Section 5 of the Act gives legal recognition to digital signatures based on asymmetric cryptosystems. A registration authority (RA) act as verifier for the certifying authority before a digital signature certificate is issued to a requester.

References:

1. J. Katz Digital Signatures, Springer, New York, 2010.
2. J. Katz and Y. Lindell Introduction to Modern Cryptography, Chapmen & Hall/CRC Press, Taylor & Francis Group, 2007.

CONCEPTION OF MATHEMATICS

-Ishika Gupta

With this… I hope I am able to express my views openly and change one's perspective towards MATH.

In our everyday life, we often come across people with different views and opinions about various fields of interest. But what I have experienced is the conception of people towards mathematics. Maybe many of you could relate to this. No matter to which age group they belong to the word 'math' has an undefined terror in their minds.

As a student, Mathematics (Hons.) completely changed my perception over the subject. It is far beyond than just calculation. Being a mathematics student, I can say that what we study is inter-related to various spheres of life which is quite different from the opinion which most of the people have in this society. Though, not an easy field of study but not that complicated even. Maybe it depends on how much time you spend on it or if it seems interesting to you or not. According to me, it depends on the person teaching you. Many times, you start disliking the subject because of the person who taught you before. It is one's framework of mind which doesn't let him/her get interested which further becomes a prolonged cause of disinterest.

But considering elders' conception, they will be the ones to encourage and appreciate you for choosing such a "difficult" subject. Also, some people have converted this into a male dominant subject but being in an all-girls college it is quite hard for me to believe that. If I could ever change someone's opinion about the subject, nothing could be ever better than that since this is something that I am not just doing for my career but specifically due to my love for the subject. Lastly, Mathematics is something that keeps no restrictions on an individual since it is such a vast field of research whose logics, methods and applications are endless.

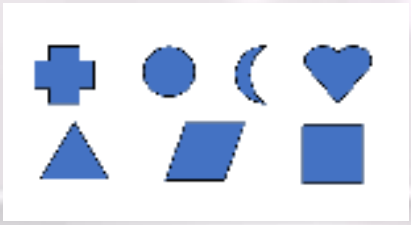
THE MATHEMATICS BEHIND EARLY FORTS

-Dr. Karuna Mamtani

Most of the forts in India are actually castles, fortified palaces or fortresses, but when the British Government in India were cataloguing the defences in the 17th–19th century, they used the word forts which became the common description across India. Mathematics can help in both making castles easier to defend and also in making them look good.

Early Hill Forts – what is the best shape?

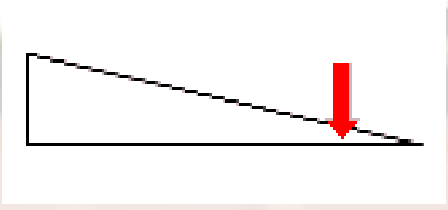
If you are living in ahill fort then you will want to choose the best shape to fit your needs. You will be looking for a shape which encloses the maximum area, but has the shortest perimeter. This will mean that lots of people can fit in your fort, and that you don't have as much perimeter to defend.



Which shape has the shortest perimeter compared to area? One of the reasons why many early hill forts are built in a broadly "circular" shape. In fact, the *isoperimetric theorem* states that "among all 2D shapes with the same perimeter, the circle has the largest area". Choosing a circular shape for a fort is also a good idea for other reasons.

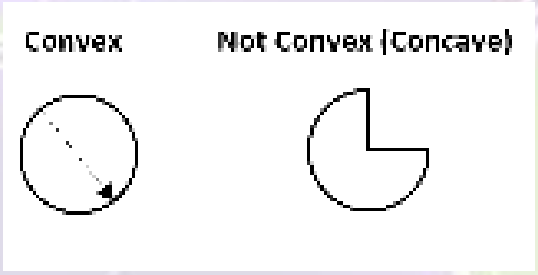
Symmetry

Symmetry is important to fort design because it means that you won't have a fort which contains a weak point –



all parts of your fort should be equally difficult to get into.
Asymmetric shapes have weak points:

Convex versus Concave



A circular fort also has the advantage that it is convex. This means that there are no dents or bits that point inwards. Any two defenders are able to see each other, whereas in the concave shape the defenders could be stood in places where they can't see each other.

Medieval Castles

As per the thinking so far, castles should all be perfectly round? There are however a few other points to take into consideration, affecting castle design. It is much harder to build a round keep than a square keep, meaning that it was always a trade-off between building an ideal shape and having a design which could actually be built.

Most castles were still built in a symmetrical design, but with *turrets or bastions*.

Gwalior Fort

Amer Fort, Jaipur

Line of sight

A major consideration in medieval castles is the line of sight for archers who are defending the castle through arrow slits. If you have a flat wall, then there will be areas which your defenders can and can't reach with their arrows. If you have multiple arrow slits (Fig. 1) or a square corner to defend (Fig. 2), then you will still have areas which are undefended:

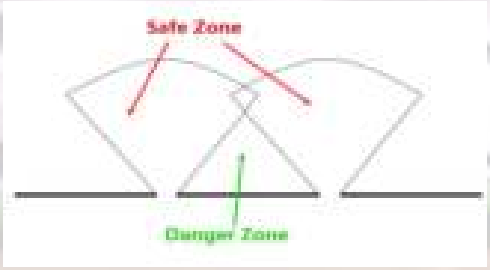


Fig. 1

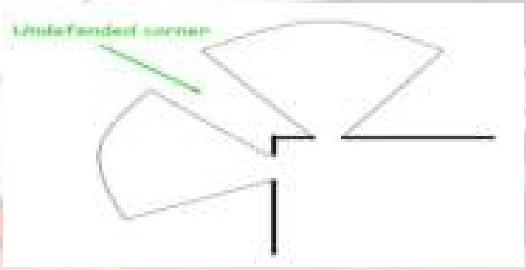


Fig. 2

This is why the builders of castles chose to build turrets. Some castles went even further and added turrets on turrets in order to maximise the area which the defenders could reach. They used maths and in particular, geometry to optimise their defence capabilities.

A star-shaped wonder

As Tipu Sultan wanted to secure the highway from the port city of Mangalore to the natural resource rich Coorg, he took help from the French to build a fort along the lines of the design developed by the French military engineer, Sébastien Le Prestre de Vauban, who pioneered the star-shaped design for forts. The fort at ***Manjarabad*** in Sakleshpur (Fig. 3), completed in 1792, is probably the only remaining example of this kind of defence architecture. Built atop a hill, the Manjarabad Fort is the shape of an *eight-pointed star* when seen from above. The arrow-head shaped bastions give the fort its star shape. This shape of the bastion uses mathematics and geometry in particular to enable a panoramic view of the battlefield and also provides no dead zones (a space between two bastions where the enemy is relatively safe from being attacked by those inside the fort) unlike circular or rectangular bastions. As can be seen in Fig. 4, every angle is now covered.

Fig 3

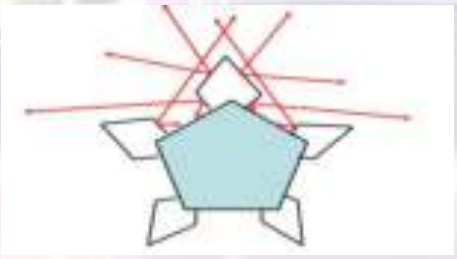
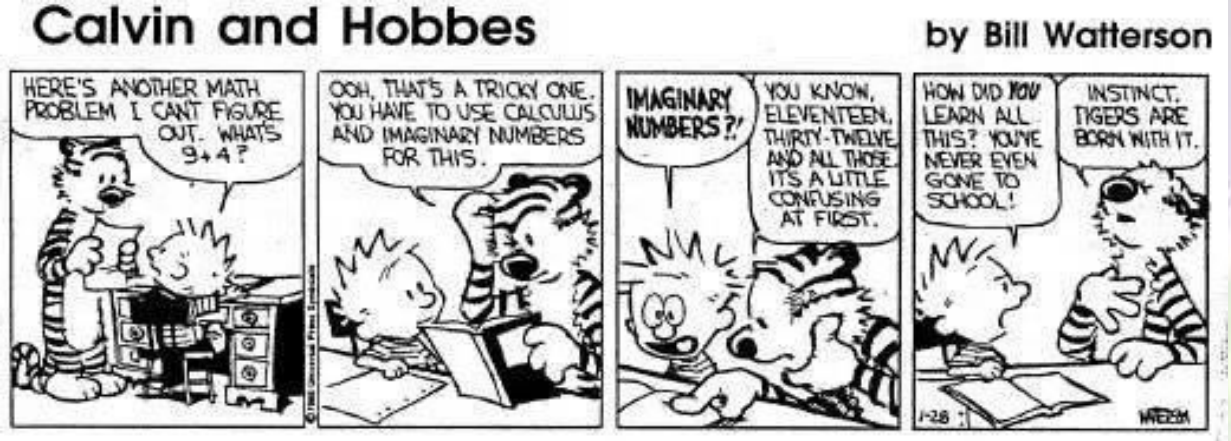


Fig 4



THE TAIL OF IMAGINARY NUMBER 'i'

-Dr. Preeti

The study of *numbers* comes usually in succession. Starting with the counting numbers, moving to the negative integers, fractions, digging into the decimal fractions and continuing to the real numbers. The complex numbers come last. Surprisingly complex numbers arose from the need to solve cubic equations, and not (as it is commonly believed) quadratic equations.

A Persian scholar **Al-Khwarizmi,** who is also known as the "**father of algebra**", found solution to quadratic equations of various types, restricted to positive solutions in his book *"Al-Kitab al-mukhtasar fi hisab al-jabrwa'l-muqabala" ("The Compendious Book on Calculation by Completion and Balancing")(825). Al-Khwarizmi* wanted to go from the specific problems considered by the Indians and Greeks to a more general way of analyzing problems, and in doing so he created an abstract mathematical language which is used across the world today. These methods of algebra known to the Arabs were introduced in Italy by the Latin translation of the algebra of *Al-Khwarizmi* by **Gerard of Cremona**, and by the work of **Leonardo da Pisa (Fibonacci).**In around 1225, when *Frederick II* held court in *Sicily*, *Leonardo da Pisa* was presented to the emperor, a local mathematician posed several problems, all of which were solved by *Leonardo*. One of the problems was the solution of the equation $x^3 + 2x^2 + 10x = 20$. The first to solve the general equation $x^3 + px = q$ (restricted to positive coefficients and positive values of x) was **Scipione del Ferro**, professor of U. of Bologna. In his deathbed, *del Ferro* confided the formula to his pupil **Antonio Maria Fiore**. *Fiore*then challenged **Tartaglia** to a mathematical contest and the night before the contest, *Tartaglia* rediscovered the formula and won the contest. *Tartaglia* in turn told the formula (but not the proof) to **Gerolamo Cardano**, who signed an oath to secrecy. From knowledge of the formula, *Cardano* was able to reconstruct the proof. *Cardano* then proceeded to publish the formula in his *Ars Magna* (1545). It is noteworthy that *Cardano*mentioned *del Ferro* as first author, and *Tartaglia* as obtaining the formula later in independent manner. But *Cardano* avoided discussing the difficult case of solving equation $x^3 = px + q$ that hinted in possibility of having the square root of a negative number (the so-called *casus irreducibilis)* in *Ars Magna*.

According to [2], "*Cardano was the first to introduce complex numbers* $a + \sqrt{-b}$ *into algebra, but had misgivings about it."***Rafael Bombelli** authored *l'Algebra* (1572, and 1579), a set of three books. *Bombelli*there introduced a notation for $\sqrt{-1}$, and calls it "*pi´u di meno"*. The discussion of cubics in *l'Algebra*follows Cardano, but now the *casus irreducibilis* is fully discussed. Bombelli considered the equation $x^3 = 15x + 4$for which the Cardan formula gave $x = \sqrt[3]{(2 + \sqrt{(-121)})} + \sqrt[3]{(2 - \sqrt{(-121)})}$. *Bombelli*set $\sqrt[3]{(2 + \sqrt{(-121)})} = a + bi$ from which he deduces $\sqrt[3]{(2 - \sqrt{(-121)})} = a - bi$ and obtained, after algebraic manipulations, $a = 2$ and $b = 1$. Thus $x = a + bi + a - bi = 2a = 4$. After doing this, *Bombelli* commented: "At first, the thing seemed to me to be based more on sophism than on truth, but I searched until I found the proof." **Ren´e Descartes** was a philosopher whose work, *La G´eom´etrie*, included his application of algebra to geometry from which we now have Cartesian geometry in "*Discours de la m´ethod pour bien conduiresa raison et chercher la v´erit´e dans les sciences*". Three appendices to this work were *La Dioptrique*, *Les M´et´eores*, and *La G´eom´etrie*. The treatise was published at *Leiden* in 1637. *Descarte*s associated imaginary numbers with geometric impossibility. This can be seen from the geometric construction he used to solve the equation $z^2 = az - b^2$, with a and b^2 both positive.

According to [1], *Descartes* coined the term *imaginary*: "For any equation one can imagine as many roots [as its degree would suggest], but in many cases no quantity exists which corresponds to what one imagines." *John Wallis* noted in his Algebra that negative numbers, so long viewed with suspicion by mathematicians, had a perfectly good physical explanation, based on a line with a zero mark, and positive numbers being numbers at a distance from the zero point to the right, where negative numbers are a distance to the left of zero. Also, he made some progress at giving a geometric interpretation to $\sqrt{-1}$.

In 1698, **Abraham de Moivre** mentioned that Newton knew, as early as in 1676 of an equivalent expression to what is today known as *de Moivre's theorem*: $(cos(\theta) + isin(\theta))^n = cos(n\theta) + i\, sin(n\theta)$ where n is an integer. Apparently, *Newton* used this formula to compute the cubic roots that appear in Cardan formulas, in the irreducible case. *de Moivre* knew and used the formula that bears his name, as it is clear from his writings - although he did not write it out explicitly.

It was ***L. Euler***who introduced the notation $i = \sqrt{-1}$, and visualized complex numbers as points with rectangular coordinates. Euler used the formula $x + iy = r(cos\,\theta + i\, sin\,\theta)$, and visualized the roots of $z^n = 1$ as vertices of a regular polygon. He defined the complex exponential, and proved the identity $e^{i\theta} = cos\,\theta + i\, sin\,\theta$ in his book "*Introduction in Analysis Infinitorum"(1748).*

William Rowan Hamiltonin an 1831 memoir defined ordered pairs of real numbers (a, b) to be a couple. He defined addition and multiplication of couples: $(a, b) + (c, d) = (a +$

$c, b + d)$ and $(a, b)(c, d) = (ac - bd, bc + ad)$. This is in fact an algebraic definition of complex numbers.

The beginning of modern complex function theory, complex integration, was initiated by the French genius **Augustin-Louis Cauchy** in an 1814 memoir to the *French Acad´emie des Sciences.*

Since then, Complex Analysis has played an extraordinarily important role throughout mathematics, with applications ranging from number theory to geometry to mathematical physics (and almost everything else)!

References:

[1] P. Nahin, An Imaginary Tale, Princeton U. Press, NJ 1998.

[2] B. L. van der Waerden, A History of Algebra, Springer Verlag, NY 1985.

[3] O. Merin, A short history of complex numbers, *University of Rhode Island* 2006.

THE MATHEMATICAL BEAUTY OF SNOWFLAKES

-Rashika Dabas

It is mystical when you step outside on a snowy morning. Snowflakes are swirling around the vast sky and falling and blanketing the ground. If a snowflake lands on you, it is like a winter angel. There are no flowers around, for they cannot survive the cold; yet what lies before your eyes is an incredible beauty. And it's remarkable, you come to realize, that no two snowflakes are alike. It is as if the uniqueness of a snowflake is controlled by a divine force. The individuality of a snowflake's structure draws a parallel to human life. Like snowflakes, everyone has a unique story to tell.

Many mathematicians do ponder about snowflakes. Actually, they think about the *characteristics* of snowflakes because they are particularly important for three basic mathematical principles: pattern, symmetry, and symmetry breaking.

A little-known scientist, Wilson Bentley, a.k.a. *"the Snowflake Man"* took pictures of snowflakes almost every day and observed them until he died.

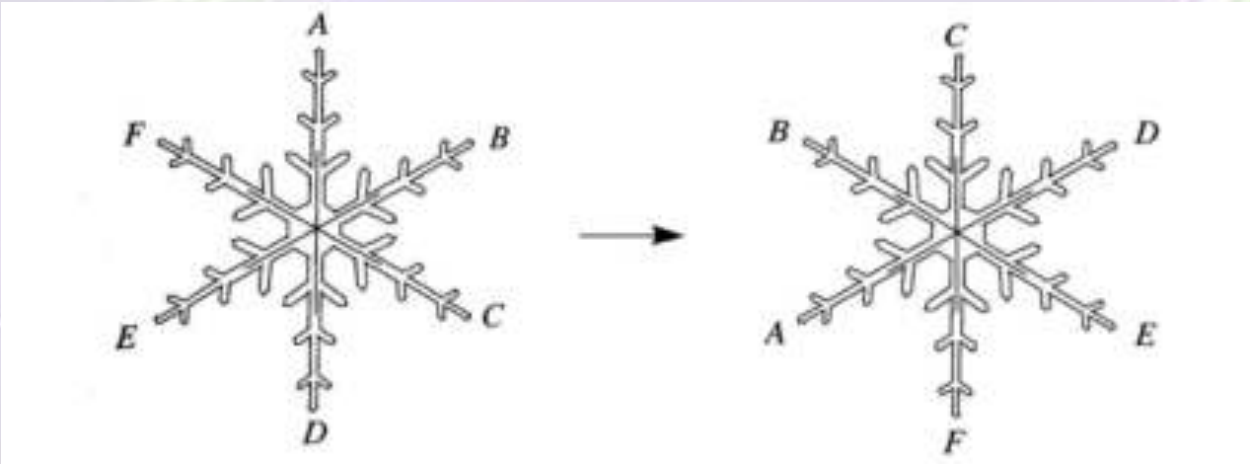
"Under the microscope, I found that snowflakes were miracles of nature; and it seemed a shame that this beauty should not be seen and appreciated by others. Every crystal was a masterpiece of design and no one design was ever repeated. When a snowflake melted, that design was forever lost. That beauty was gone, without leaving any record behind." -Wilson Bentley

When we check the pictures and delve deeper into each snowflake, we will see that the structures of the snowflakes are totally different. However, they have something in common: symmetry and a hexagonal structure.

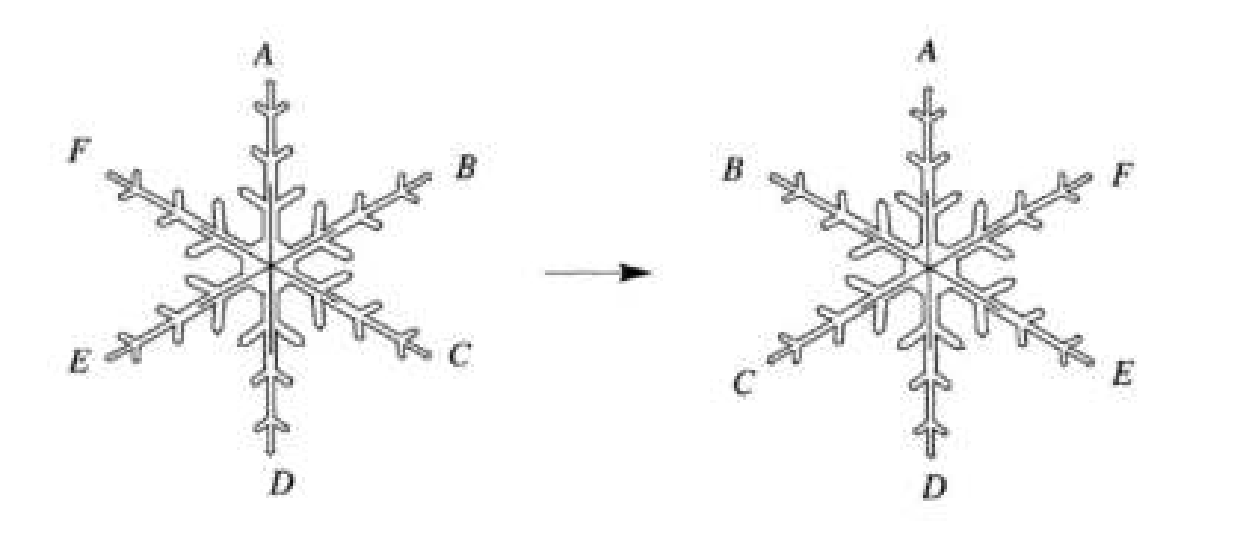
These perfect ice crystals are genuine, even though it is hard to believe they are not fake. Whenwe take a close look at a snowflake, the beauty of the combination of ice molecules fascinates people every time. Each flake is unique. However, uniqueness is not the point here. The things that make snowflakes important objects for mathematicians are their symmetry and their hexagonal structure. Math-loving people have a lot of interest in transformations. They love moving objects. And, surprisingly, if an object is symmetric, transformations are not even noticed by many.

To be more precise, when you have a hexagonal symmetric snowflake, or any other symmetrical object, when you rotate it in any direction, 60°, 120°, 180°, 240°, 300°, or 360°, people watching you wouldn't realize it. If you check the images below, you will see rotated shapes but no difference. It appears to be the same shape in exactly the same place.

Counterclockwise rotation by 120°



Reflection through a vertical axis



Snowflakes also possess reflectional symmetry. If we stand in front of a mirror, our reflection looks exactly the same. Hence, if we put a mirror in the middle of a snowflake, there will be a reflection. For a snowflake, we can put a mirror 6 different ways. Thus, we can say that a snowflake has 12 symmetries: 6 from reflections, and 6 from rotations.

Now we can define symmetry as a transformation that leaves things unchanged. We can also claim that a combination of any of the transformations will give us exactly the same shape. For instance, we can rotate our snowflake 60° two or three times in a row and flip it over, and it will remain unchanged.

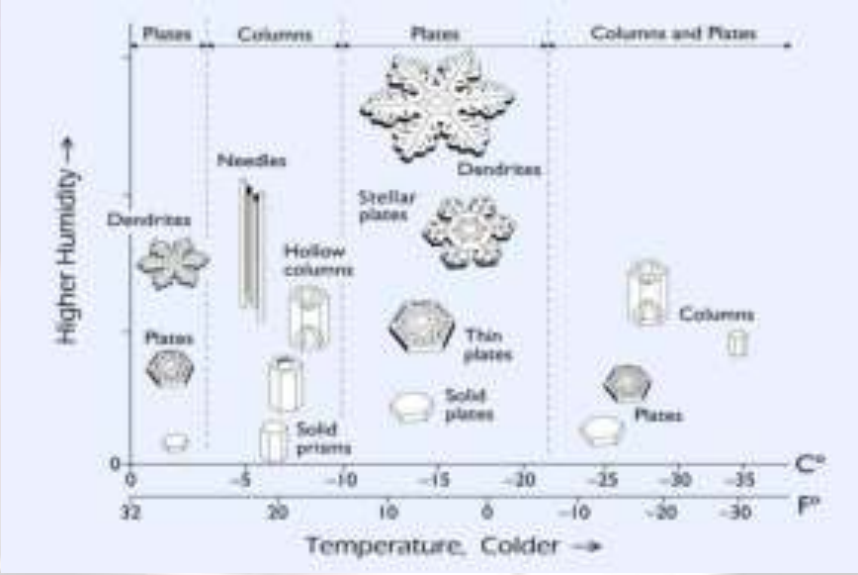
At this point, you might ask the question: *"You have all these fancy symmetries for a particular snowflake. But, does every snowflake possess the same symmetries?"*

Snow is a molecular structure of an ice crystal. And ice is a structured substance. It is a different form of water. When the water cools down, the molecules move more slowly, and this begins to impact how the molecules line up. Hydrogen atoms of one water molecule bond with two oxygen atoms. As the water freezes, the molecules arrange into hexagonal patterns.

When we examine an ice crystal carefully under normal conditions, we always see a combination of molecules with six-fold symmetry. Snowflake molecules make a honeycomb structure. This results in an inordinate amount of hexagonal symmetry in these molecular three-dimensional structures.

Okay, we saw the structure of a snowflake under normal conditions. Butwhat if we changed those conditions? Johannes Kepler answered this question after his experiments and wrote a book about snowflakes, particularly *The Six-Cornered Snowflake*.

There are two key elements which affect the structure of a snowflake: *temperature and moisture.* Each time the temperature or the amount of moisture change, the structure of a snowflake changes. If you check the snow crystal morphology diagram below, you will see that when the temperature nears 0° and humidity is high, the structure of a snowflake will be flowery. Flowery structures are called dendrites. When you make it a little bit colder, the structure will be fancy hexagonal plates. We can apply many combinations and get varying structures.



In the end, although the structure of (almost) all snowflakes are the same, some of them are not *completely* hexagonal. For instance, there are some snowflakes that have tree structures. Some snowflakes have branches, and each branch has tiny branches.

But, why is the structure of some snowflakes not hexagonal?

So far, we have talked about pictures which were taken at a particular instant. We have seen the pictures of the motion of the snowflakes for the smallest amount of time that can be measured. However, a snowflake never stops spinning in the air. They tend to oscillate. That means the shape of the snowflake is changing all the time. But how? When you see a snowflake in the air, it changes its place after a second because it would be whirled about, and it will be under different conditions at that time. This process will occur up until the snowflake lands on the ground. We know from the snow crystal morphology diagram that the temperature and amount of moisture always affect the shape of a snowflake. While small-scale conditions are almost the same, on a larger-time scale, conditions will differ. And these differences will change every corner of a hexagonal snowflake, resulting in a different structure. This is the main reason behind the variety of snowflake structures and uniqueness.

In conclusion, we can say that a snowflake can preserve its six-fold symmetry at all times. I think we have another reason to love mathematics! I want to finish my piece with Hermann Hankel's words:

"In most sciences one generation tears down what another has built, and what one has established another undoes. In mathematics alone, each generation adds a new story to the old structure."

So, the next time it snows, take a few minutes to admire the individual snowflakes.

DO YOU HAVE A MATH BRAIN?

-Sheenu Teotia

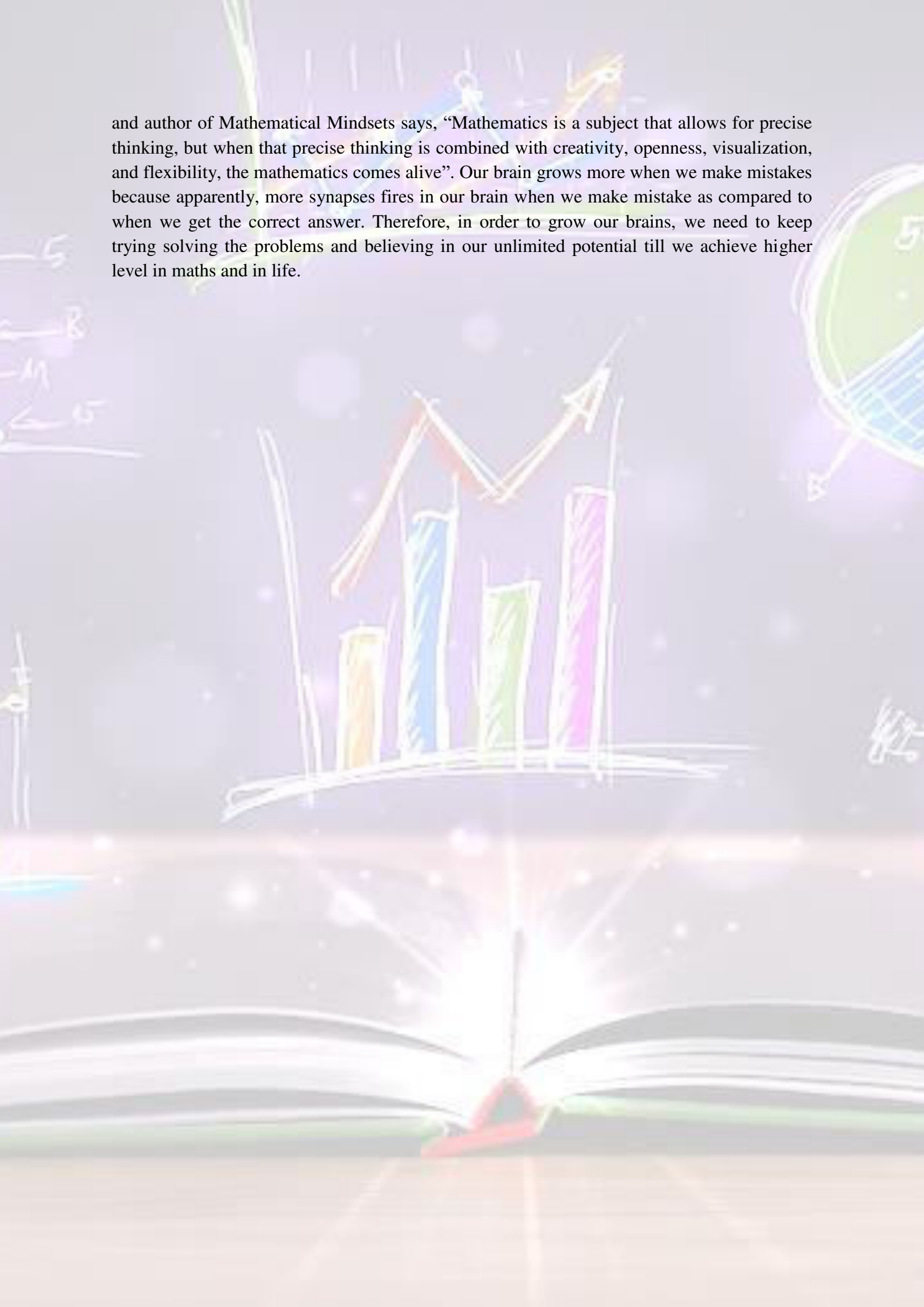
Many of us have been given the idea that we are not a math person or we don't have the brains for it? Is there such a thing called "a math brain"? Did you know Albert Einstein was dyslexic? He said, "The words or the language as they are written or spoken don't play any role in my mechanism of idea". Incredible, isn't it? That means words are not needed for great science or maths, which implies that may be words are not even needed for great science or maths teaching, but the vast majority of teaching is done through words and hence we need to change the current teaching methods. In early age, when human being didn't know any language, he used to understand everything through visuals. Visual mathematics is the key to unlock the brains of those who believe that they are not a maths person.

Mathematics is a subject that deals with abstract ideas in order to solve problems. Visual representation is an important skill because **higher-level math and science courses** increasingly draw on visualization and spatial reasoning skills to solve problems .Visual representation have different types. Graphic organizer is a type of external visual representation that is often used in mathematics. They help in **enhancing conceptual understanding** in mathematics. Graphic organizers may be a great support for students with learning disabilities because they **take some of the organizational pressure off** these individuals who may have difficulty sorting through information and seeing the relationships between different mathematical objects or concepts.

There are many types of graphic organizers too and each have situations that they are best used for. A **visual display** is a type of graphic organizer that can be used in mathematics for **displaying spatial relationships** very clearly. Visual displays can be used for a number of different purposes. One might make comparisons between objects or concepts using a **Venn diagram**, or display information temporally using a **timeline** to compute the answer to a word problem. Certain new applications like BYJU's and YouTube make the learning of typical concepts through the visuals a way easier than it was before. The introduction of software like Mathematica and others plays an important role in understanding concepts like continuity, differentiability etc.

But there is still a long way to go till we completely vanish the myth of "a math brain". Many researchers have already developed several games and applications through which concepts of figures like rectangle, triangle etc to number lines to parabolic equations to higher typical problems can be taught. We need to get research out to teachers so that a revolution can be brought to the mathematics teaching world. Jo Boaler, the Stanford professor of Mathematics

and author of Mathematical Mindsets says, “Mathematics is a subject that allows for precise thinking, but when that precise thinking is combined with creativity, openness, visualization, and flexibility, the mathematics comes alive”. Our brain grows more when we make mistakes because apparently, more synapses fires in our brain when we make mistake as compared to when we get the correct answer. Therefore, in order to grow our brains, we need to keep trying solving the problems and believing in our unlimited potential till we achieve higher level in maths and in life.



MANIPULATING RAMANUJANS' INFINITE NESTED RADICAL

-Hitika Narang

As $3 = \sqrt{3^2} = \sqrt{3^2 + 2^2 - 2^2}$

$$= \sqrt{2^2 + (3-2)\sqrt{(3+2)^2 + 3^2 - 3^2}}$$

$$= \sqrt{4 + 1\sqrt{9 + (5-3)\sqrt{(5+3)^2 + 4^2 - 4^2}}}$$

$$= \sqrt{4 + 1\sqrt{9 + 2\sqrt{16 + (8-4)\sqrt{(8+4)^2 + 5^2 - 5^2}}}}$$

$$= \sqrt{4 + 1\sqrt{9 + 2\sqrt{16 + 4\sqrt{25 + (12-5)\sqrt{(12+5)^2 + 6^2 - 6^2}}}}}$$

$$= \sqrt{4 + 1\sqrt{9 + 2\sqrt{16 + 4\sqrt{25 + 7\sqrt{36 + (17-6)\sqrt{(17+6)^2 + 7^2 - 7^2}}}}}}$$

$$= \sqrt{4 + 1\sqrt{9 + 2\sqrt{16 + 4\sqrt{25 + 7\sqrt{36 + 11\sqrt{49 + (23-7)\sqrt{(23+7)^2 + 8^2 - 8^2}}}}}}}$$

$$= \sqrt{4 + 1\sqrt{9 + 2\sqrt{16 + 4\sqrt{25 + 7\sqrt{36 + 11\sqrt{49 + 16\sqrt{64 + \cdots\cdots}}}}}}}$$

Difference

$4 + 1 = 5$

$9 + 2 = 11$

$16 + 4 = 20$

$25 + 7 = 32$

$36 + 11 = 47$

$49 + 16 = 65$

] 9

] 12

] 15

] 18

MULTIPLES OF 3 (OR AP WITH d=3)

Difference

$4 - 1 = 4$

$9 - 2 = 7$

$16 - 4 = 12$

$25 - 7 = 18$

$36 - 11 = 25$

$49 - 16 = 33$

] 4

] 5

] 6

] 7

] 8

NATURAL NUMBERS (OR AP WITH d=1)

JUST PRESS A SHIFT+DELETE. HOW CONVENIENT….

-Dr.Rashmi Verma

For certain remembrances in life, I wish we could behave like computers. The folder of those memories that hurt us a lot but are meaningless to be remembered and most of the times most difficult to be forgotten would have been erased permanently so easily by just pressing shift+delete.

There are many emotional moments in life which are worth forgetting. There is no lesson of life in them. There is pain, humiliation and so many unanswered questions that have no answer. Even if there is any answer, it's too late to be meaningful. Often it leads to anger, frustration, sadness, depression and whatever ...a negative emotion that is definitely of no good to the bearer. So much of energy and time gets wasted in overcoming the stress. It needs courage to keep smiling and behave as if nothing has happened. The work gets affected...professionally as well as personally. But its all futile. Certain facts cannot be changed. They have to be accepted. Life has to move on. One day we feel we have forgotten. But perhaps the pain has taken the back seat with passage of time. Who knows in which coming moment, what might trigger the futile memories bringing back all those emotions. Once again we will strive to get back to normal life. An endless process...We could have saved ourselves from all this nuisance by just pressing a shift+delete. How convenient. Alas! we are not computers...

STATISTICS

STATISTICS IN NETFLIX

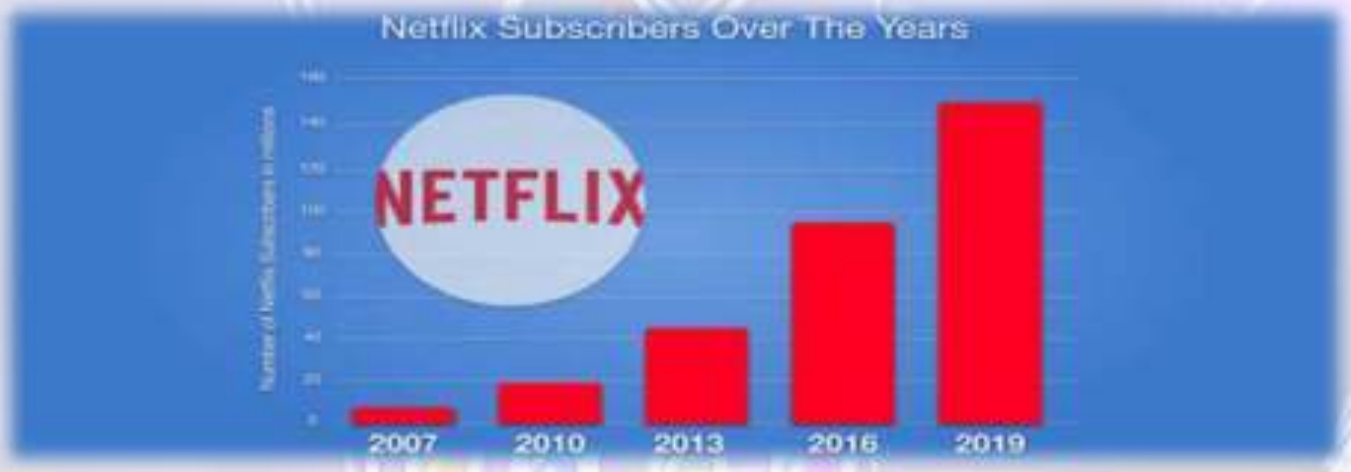
-Shreya Wahi

Today nobody is a big fan of daily soap operas. Being so busy with our hectic schedules, nobody has enough time to actually keep up with the time table of the television shows. So more than 70% of the population streams online shows whenever and wherever they get time. But how do these live streaming companies engage people towards them?

The answer to this question is very simple- STATISTICS.

Under this article, let's carry on with the example of NETFLIX.

Today, Netflix is the second most used video streaming service with 72.9 million viewers and is streamed in over 190 countries. Over 30% of the adult users stream Netflix on daily basis.



Isn't it so interesting? I bet that you are one of those users as well.

According to researches, an average human spends about 10 hours a week on Netflix. Whereas an average American watches about 19.6 hours of Netflix a week, i.e. about 2.8 hours daily. These amounts of hours spent on Netflix can grow into a bigger number if the content quantity and quality rises with time.

But the question is how does Netflix know want each one of us wants to watch? Netflix makers can be considered as very good stalkers and make use of Statistics in a very wild way. They know when, what and for how long we are streaming; they know everything.

This is the point where Netflix uses Statistics in most important way. They collect the data about: for how many hours an individual streams for a day, what kind of genres are streamed more, what kind of lead roles people like to watch, at what time of the day people stream the most, what age group uses Netflix the most. They also keep track of in what amount of time a user finishes with a particular series, when you pause or rewind, what device you use, the ratings you give, searches, browsing and scrolling behaviour. All of these account in the DEMOGRAPHIC STUDY OF THE DATA. A concept which makes statistics relate to the public hence, making it vital!

With all this data generated they analyse what all kind of web series is engaging people and what kinds are not. Through this they launch the shows likely to be loved by the people and keep them engaged.

For example, if we consider a particular series *Arrested Development.* Netflix can know how many users who started this series finished it to end of season 3, where is common cut off point of users, what did other 30% users do, how big of a 'time gap' was there between when consumers watch one episode until they watched the next. With this data they try to understand engagement of users at deep level of this show. If Netflix saw that 70% of users watched all the seasons available of a cancelled show, they may provoke some interest in restarting *Arrested Development*. They know there's a good chance users will watch the new season.

Today Netflix has about 700 original movies and shows.

With $7.99 - $13.99 subscription cost per month per individual, with so much of engaged users Netflix makes about $950 million per month. It also earns about $30 million per month through DVD rentals. And this is by making quality contents by use of simply statistics.

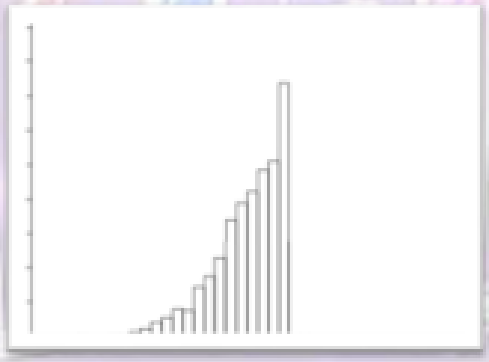
This makes us think, how the study of population and demographics makes Netflix gross close to a whopping billion dollars and makes it user interface more and more likeable for the population. And as George Bernard Shaw once said, "it is the mark of a truly intelligent person to be moved by statistics", we see that Netflix is minting all those dollars by using its study of Statistics and making sure that those numbers attract more users as well and being an online platform, their data is all they need and more!

PARAMETRIC TESTS

-Dr. Meenu Goel

Nonparametric tests refer to statistical methods often used to analyze ordinal or nominal data with small sample sizes. Unlike parametric models, nonparametric models do not require making any assumptions about the distribution of the population, and so are sometimes referred to as a **distribution-free** methods.

Also this method is used when the data is quantitative but has an unknown distribution, is non-normal, or has a sample size so small that the central limit theorem can't be applied.



A skewed distribution is one reason to run a nonparametric test.

Difference between non-parametric and distribution-free

Distribution-free test procedures are broadly defined as:

1. Those whose test statistic does not depend on the form of the underlying population distribution from which the sample data were drawn, or
2. Those for which the data are nominally or ordinally scaled.

Nonparametric test procedures are defined as those that are not concerned with the parameters of a distribution.

Equivalent Tests

PARAMETRIC TEST	NON-PARAMETRIC TEST
Parametric tests of means	Nonparametric tests of medians
1-sample t-test	1-sample Sign, 1-sample Wilcoxon
2-sample t-test	Mann-Whitney test
One-Way ANOVA	Kruskal-Wallis, Mood's median test
Factorial DOE with a factor and a blocking variable	Friedman test

The main nonparametric tests are:

- **1-sample sign test**. Use this test to estimate the median of a population and compare it to a reference value or target value.
- **1-sample Wilcoxon signed rank test**. With this test, you also estimate the population median and compare it to a reference/target value. However, the test assumes your data comes from a symmetric distribution (like the Cauchy distribution or uniform distribution).
- **Friedman test**. This test is used to test for differences between groups with ordinal dependent variables. It can also be used for continuous data if the one-way ANOVA with repeated measures is inappropriate (i.e. some assumption has been violated).
- **Goodman Kruska's Gamma**: a test of association for ranked variables.
- **Kruskal-Wallis test**. Use this test instead of a one-way ANOVA to find out if two or more medians are different. Ranks of the data points are used for the calculations, rather than the data points themselves.
- The **Mann-Kendall Trend Test** looks for trends in time-series data.
- **Mann-Whitney test**. Use this test to compare differences between two independent groups when dependent variables are either ordinal or continuous.
- **Mood's Median test**. Use this test instead of the sign test when you have two independent samples.
- **Spearman Rank Correlation.** Use when you want to find a correlation between two sets of data.

When the word "parametric" is used in stats, it usually means tests like ANOVA or a t test. Those tests both assume that the population data has a normal distribution. Non parametric do **not** assume that the data is normally distributed. The only non parametric test you are likely to come across in elementary stats is the chi-square test. However, there are several others. For example: the Kruskal Willis test is the non parametric alternative to the One way ANOVA and the Mann Whitney is the non parametric alternative to the two sample t test.

IMPORTANCE OF THE READINESS OF THE SPARES IN COLD STANDBY SYSTEM

-Dr. Komaldeep Kaur

The growing expectations of society always demand for the rapid advancements in technology. As a result of this, various types of systems have come into existence. The easy functioning of any system more or less depends on its failure free operations. Though for relatively less discriminative systems the consumers may allow failures within certain limits but on the other hand, there are systems of hazardous nature, such as nuclear power plants etc., in case of which even a small failure can result in serious consequences may be in terms of huge economic loss, threats to human life or serious damage to the environment. Therefore, the failures can't be permitted at any cost in such cases. This fact makes the theme of reliability theory much-more essential and brings it at forefront for extensive research in order to minimize such system failures.

The reliability of a system can be defined in many ways but most commonly it is characterized as the probability that the system will perform its required function for given time interval under stated conditions. Therefore, the system failures are inherent and inevitable so the occurrence of failures can neither be stopped nor be ignored completely but their effects can be minimized by incorporating the techniques of reliability theory i.e. either by using various redundancy methods or by employing different maintenances, repairs, replacements and inspection strategies.

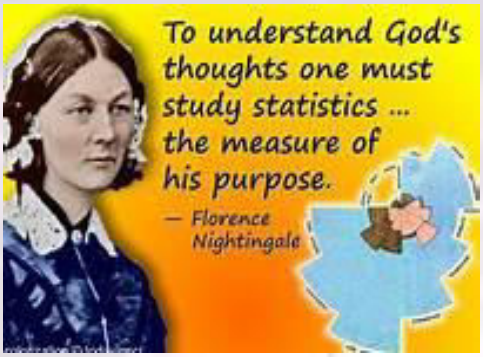
There are mainly two types of redundancies used for system designs namely warm and cold standby. In a cold standby system the redundant unit must be found operable when the main unit fails. Otherwise the system would reach in down-state. But always it is not possible for the standby unit to be in operation able state. Some factors like corrosion-rust or external environment may cause the standby failure, which leads to the system to down state. So the analysis of failure of unit in standby mode is essentially important for maintaining a high level of the system performance. For example, the electricity inverter or generator together with the main power supply forms a cold-standby system in operation theatre of a hospital. If the main supply discontinues, the standby inverter or generator is expected to resume electricity immediately. The readiness of the standby source (inverter/ generator) is certainly required to avoid any annoying eventuality.

POWER OF STATISTICS

-Jessica Kaur Sidhu

Statistics are everywhere today. You'll run across them in your everyday life. Four out of five dentists prefer this toothbrush! On the news. This scientific poll used random sampling and has a margin of error of 3%. In school, your grades were averages of scores. Then, you took the , CGPAs, SAT, ACT, or GRE received your results with percentiles. You'll find statistics in almost every aspect of life: Nielsen TV ratings, surveys, political polls, insurance rates, and so on. And then, of course, there are the ubiquitous sports statistics, batting averages, third-down conversions, and countless more!

Also, the subject Statistics, as it seems, is not a new discipline but it is as old as the human society, itself. It has been used right from the existence of life on this earth. The lady with the lamp, was also the lady who conducted pioneering and brave work as a statistician during a time when women were a rare presence in such fields. Florence Nightingale, one of the most prominent statisticians in history, used her passion for statistics to save lives of soldiers during the Crimean war, and did groundbreaking work in data visualization that continues to be influential to this day. She very well understood the influential role of statistics and used them to support her convictions and saved many lives.Nightingale proposed a form of religion in which human beings patterns in the world around us, had the power to reveal God's providential plan: "**to understand God's thoughts, we must study statistics for these are the measure of His purpose**".



When Florence Nightingale arrived at the British military hospital in Turkey in 1856, the scene was pretty grim. The mortality rate was high, and the hospital was chaotic—even the number of deaths was not recorded correctly. Florence Nightingale established much needed order and method within the hospital's statistical records.

She also collected a lot of new data. In doing so, Nightingale learned that poor sanitary practices were the main culprit of high mortality in hospitals. She was determined to curb such avoidable deaths. By using applied statistical methods, she made a case for eliminating the practices that contributed to the unsafe and unhealthy environment. Her work in statistics saved lives.

Tables and diagrams fill the pages of Nightingale's notes and records. Hundreds of years before the Adobe Creative Cloud hit the market and "infographics" were something we all needed, Nightingale made data beautiful.

	Zymotic Diseases.	Wounds and Injuries.	All other Causes.	Total
APRIL 1854	1.4	..	7.0	8.4
MAY	6.2	..	4.6	10.8
JUNE	4.7	..	2.5	7.2
JULY	150.0	..	9.6	159.6
AUGUST	328.5	.4	11.9	342.8
SEPTEMBER	312.2	32.1	27.7	372
OCTOBER	197.0	51.7	50.1	298.8
NOVEMBER	340.6	115.8	42.8	499.2
DECEMBER	631.5	41.7	48.0	721.2
JANUARY 1855	1022.8	30.7	120.0	1173.5
FEBRUARY	822.8	16.3	140.1	979.2
MARCH	480.3	12.8	68.6	561.7

Her most famous design, which we use in varying forms today, was the "coxcomb." The coxcomb is similar to a pie chart, but more intricate. In a pie chart the size of the 'slices' represent a proportion of data, while in a coxcomb the length, which the slice extends radially from the center-point, represents the first layer of data.

The specific organization of Nightingale's chart allowed her to represent more complex information layered in a single space. In her coxcomb during the Crimean War, the chart was divided evenly into 12 slices representing months of the year, with the shaded area of each month's slice proportional to the death rate that month. Her color-coding shading indicated the cause of death in each area of the diagram i.e. in these sections, parts were coloured depending on the percentages of deaths due to wounds, infections, or other causes. This meant that even those who did not know how to interpret statistical data could look at the graphs and easily see what was happening.

Nightingale is an enduring role model for women in the field of statistics; she paved the road in so many ways. Today we know statistics careers are growing in nearly every type of industry, but Florence Nightingale probably didn't have many female statisticians to serve as role models in the **1850s**. She was the "lady with the lamp" who will long be remembered for her trailblazing work in statistics.

Hence, statistics is an exciting field about the thrill of discovery, learning, and challenging your assumptions. Statistics facilitates the creation of new knowledge. Bit by bit, we push back the frontier of what is known. The field of statistics is the science of learning from data. Statistical knowledge helps you use the proper methods to collect the data, employ the correct analyses, and effectively present the results. It is a crucial process behind how we make discoveries in science, make decisions based on data, and make predictions. Statistics allows you to understand a subject much more deeply. Statisticians offer critical guidance in producing trustworthy analyses and predictions. Along the way, statisticians can help investigators avoid a wide variety of analytical traps. John Tukey very well said : **"The best thing about being a statistician is that you get to play in everyone else's backyard."**

So never ever underestimate the power of statistics!

SUDOKU SQUARES: A SPECIAL CASE OF LATIN SQUARES

-Dr. Archana Verma

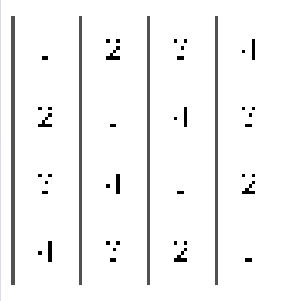
There's no mathematics involved. Use logic and reasoning to solve the puzzle.

Instructions in ***The Independent***

If you see anyone with newspaper and pen in hand, he is in all likelihood solving Sudoku!! Sudoku is a very popular puzzle and pastime. Sudoku or Su Dokuhas a very interesting structure. It is a 9-by-9 grid or square of numbers from 1 to 9 where every row and column has all nine numbers. It is further split into 9 smaller 3-by-3 boxes which also has all the nine numbers. The aim of the game is to fill every cell with one of the numbers from 1 to 9, so that each number appears exactly once in each row, each column and in each 3-by-3 boxes. Few numbers are already given as clues to help in completing the puzzle. There are approximately 6,670,903,752,021,072,936,960(approx. 6.67 x 10^{21}) completed Sudoku squares of order 9.Sudoku squares of any other order are also similarly defined. It was invented by Howard Garns in 1979, who named this puzzle as 'Number Place'. In 1980s, the puzzle gain popularity in Japan by the name of Sudoku, meaning single number. In 1997, Wayne Gould, a retired chief district judge from Hong Kong, discovered this puzzle while visiting Japan. He wrote computer program generating Sudoku puzzles and send it for publication to 'The times' in London who first published it in 2004. By 2005, Sudoku became popular all over the world and today it has become a regular feature in many magazines and newspapers.

Every Sudoku square is a special kind of Latin Square. Infact, Latin squares are true ancestors of Sudoku. The examples of Latin Squares can be seen in Arabic literature over 700 years old. They were discovered by Euler. Latin squares are used as statistical experimental designs that study the effect of three explanatory variables, rows, columns and treatments.

A Latin square of order n is an n-by-n array or grid containing the symbols (treatments) 1, . . ,n such that each symbol occurs once in each row and once in each column.



This is an example of Latin Square of order 4. We can see that the number 1 to 4 appears once and only once in every row and column. There are only 4 distinct Latin Squares of order 4 but the number increases rapidly as the number of treatments or order of array increases. For instance, there are 5.525 x 10^{27}Latin Squares of order 9. One example of Latin Square of order 9 is

I have colored nine smaller 3-by-3 cells, each of which also contains all nine numbers. We can see that it is similar to Sudoku square of order 9. So we say, Sudoku squares are a very special case of Latin Square designs. Wherever we can use a Latin square, we can use a Sudoku square of the same order as an experimental design. This gives an advantage of further incorporating a fourth explanatory variable without increasing the number of experimental units and thereby providing an additional benefit.

Rows	c1	c2	c3	c4	c5	c6	c7	c8	c9
r1	4	8	3	7	9	2	6	1	5
r2	6	1	5	4	3	8	2	7	9
r3	2	9	7	6	1	5	8	4	3
r4	9	5	8	3	2	4	7	6	1
r5	3	6	1	8	7	9	4	5	2
r6	7	4	2	1	5	6	9	3	8
r7	8	3	6	9	4	1	5	2	7
r8	1	2	4	5	8	7	3	9	6
r9	5	7	9	2	6	3	1	8	4

Ronald Fisher invented these designs in the 1930s for agricultural experiments. Suppose that we want to test nine different treatments on some crop to see which one results in the best yield. A Latin Square design of order 9 allows the experimenter to independently estimate the row effect, the column effect, and the treatment effect. For this we divide a large square field into a 9-by-9 grid of smaller plots and allocate these 9 treatments to these plots according to one of the possible Latin Square design of order 9. This is done so that the row and column effects can adjust the treatment effect estimate for any fertility gradient effect present across the field.

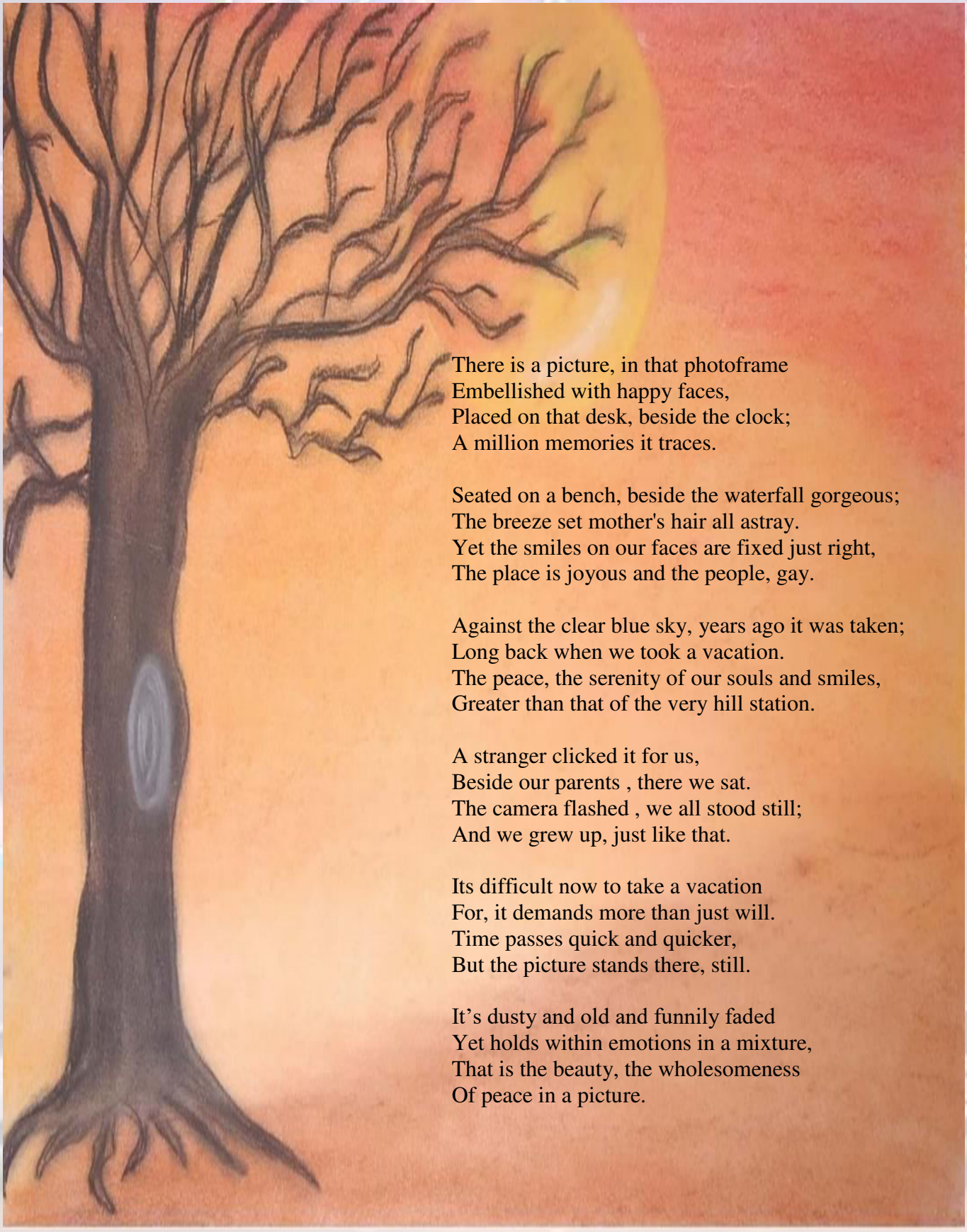
Now what is the need for further dividing the 9-by-9 array into 9 inner 3-by-3 blocks !!! Now let us suppose that the northeast corner of the large field (colored light green above) had some unique damage so that the yield in that whole 3-by-3 grid was zero. Losing that 3-by-3 square would still leave eight squares, each employing all nine treatments. In a standard Latin Square design, the result of losing this square generally would be some lack of balance in the number of replications of each treatment.

Another example of using a Sudoku square as an experimental design is in the context of a manufacturing in which the Rows can represents the suppliers of raw material, the Columns representing the days of operation, the Treatment representing Machines used in the operation and the Internal Block can be identified with Operators.

WHEN IN DOUBT, TRAVEL AND DO SUDOKU !

PEACE IN A PICTURE

-Suhani Vadhera



There is a picture, in that photoframe
Embellished with happy faces,
Placed on that desk, beside the clock;
A million memories it traces.

Seated on a bench, beside the waterfall gorgeous;
The breeze set mother's hair all astray.
Yet the smiles on our faces are fixed just right,
The place is joyous and the people, gay.

Against the clear blue sky, years ago it was taken;
Long back when we took a vacation.
The peace, the serenity of our souls and smiles,
Greater than that of the very hill station.

A stranger clicked it for us,
Beside our parents , there we sat.
The camera flashed , we all stood still;
And we grew up, just like that.

Its difficult now to take a vacation
For, it demands more than just will.
Time passes quick and quicker,
But the picture stands there, still.

It’s dusty and old and funnily faded
Yet holds within emotions in a mixture,
That is the beauty, the wholesomeness
Of peace in a picture.

HOW I STARTED MY INVESTMENT JOURNEY?

-Sampada Kapur

During my childhood days I always saw my parents sitting outside in the verandah at 6.30 - 7.00 in the morning enjoying their morning tea and getting engrossed in the daily newspaper.

Since I had a joint family there were two sets of newspapers that we got-both the largest selling ones- The Times of India and The Hindustan times. And there were 4-5 people reading them. I used to sleep in the room facing the front side of the verandah and often used to get woken up by their chitchatting. That was I think my daily news bulletin. Often the conversations were so interesting that I used to wake up from my bed and go outside, pick up the advertisement newspaper as all the other ones were taken up and start reading it. The ads were with car loans, house loans, mutual funds, movies etc. I understood most of the ads except the mutual funds and investment ones.

Then I would get the magazine like the HT City to read as one of the family members left it on the tea table. The last news paper that I used to get to read was the Business standard or the economic times. These yellow coloured papers seemed quite fancy and of high standard as their names. I felt that these contain the business news of the whole world and was filled with the stock market tables that showed graphs up and down. With either a bull shows its muscles and strong body with a green index and graph going up. Other times there were tensed people's faces blaming the government and global cues for the steep red line that showed the graph going down.

I never really understood these lines or their meaning at that time but observed them daily and dived into their conversation that today the market has gone up by certain points, gold is up, gas in down, dollar is good, euro is strong, etc. hoping that they would explain stuff to me

but they said you should go past the first page and read why it happened, which was too boring and quite an exercise to do at 7 in the morning, I'd rather go to bed.

Until one fine day I heard them reading a letter in the morning that had arrived by post, surprisingly it was a letter stating the till date investment and how had it fared over the months we had invested in that particular stock. I was overjoyed and almost sprung out of the bed and rushed outside to the tea table asked my mom to pour me some tea and started listening to the conversation while snacking on to the rusk which I hated. Though most of it went above my head, it caught everyone's attention that I was interested in the stock market. I read the news the market was roughly at 8000 points at that time and we had invested in a mid cap bank the HDFC. I began asking questions as what was a share, how does the price goes up and down, how does one decide that its three hundred rupees or fifty rupees or twenty thousand rupees. To my surprise I learnt that the base price for any share listed on the stock exchange in 10 rupees. That burst my cloud of thought and I came to know that there's a lot more, in fact, there's a lifetime of stuff that I had no idea about. Later that day I got introduced to the meaning of words like the NASDAQ, the NYSE, the SGX and our very own BSE and NSE. I felt I had attended nirvana that day as I got a new direction to think in, to look forward to.

As I read it deeply and spent some time understanding it by watching the news etc I realised that its quite boring and one needs to have a bank account to invest, one needs to be 18 years and earn and have a regular supply of income as there was a risk factor involved if the money invested goes up or down.

I stepped down as I had no regular source of income and was far from 18 years of age. One fine day I came across a magazine at home that had a bold caption I married my daughter just by investing in shares. Well now that sounds quirky, it had a picture of an auto driver in his khakhi uniform, with stacks of coins displayed on either side of him and pictures of the our BSE, NYSE in the background. Well I thought this guy got to be a master. I ran up to my grandfather and asked him is this even possible to accumulate so much wealth that you could actually become well off just by putting small amounts of money in that red and green index !! His answer in his calm and composed manner was- "anything is possible only if you think big and work towards it with sheer discipline". My first lesson of investment came from him.


COMPUTER SCIENCE

DEEP-FAKE

-Paridhi Shah

The camera never lies! Okay some who are aware of how Photoshop works will say it does!

In the world where most of things are fake from identity proof to personality how to know what's real? What about videos? Are they sacred? Can they be considered as backup for any idea or quote?
Answer of these questions would be 'yes' but only if these were asked before 2017 but thanks to the rise of DEEP FAKES the answer has changed!

What are deep fakes? These are the altered videos usually of famous people produced by neuro networks, it could be super-imposing a face onto a body so it looks like they are doing something they never did or you can take a speech and then alter the content making the face match the new audio that you have put in, like the popular forged videos of Facebook CEO Mark Zuckerberg and US House Speaker Nancy Pelosi that went viral recently.

Hollywood has transposed real or fictional faces onto other actors, for example, bringing Peter Cushing back to life in 2016's Rogue One: A Star Wars Story, but the technique used complex, expensive pipelines and face-mounted cameras. Simple software tools such as FakeApp and DeepFaceLab have since made a comparable effect available to all. The technology offers interesting possibilities that range from dubbing, improving and repairing video to solving the uncanny valley effect in video games, avoiding actors having to repeat fluffed line, the creation of apps that allow us to try on clothes or hairstyles, and even to train doctors, but many fear it being used for nefarious ends. These are the fakes that have scared people the most so far. There's growing concern over the potential abuse of increasingly realistic doctored videos.

Deep fakes exploit this human tendency using generative adversarial networks (GANs), in which two machine learning (ML) models duke it out. One ML model trains on a data set and

then creates video forgeries, while the other attempts to detect the forgeries. The forger creates fakes until the other ML model can't detect the forgery. The larger the set of training data, the easier it is for the forger to create a believable deepfake. This is why videos of former presidents and Hollywood celebrities have been frequently used in this early, first generation of deep fakes — there's a ton of publicly available video footage to train the forger.

The researcher revealed that the deepfake phenomenon is growing rapidly online, with the number of deepfake videos almost doubling over the last seven months to 14,678. As the tech firms scramble to tackle the spread of deepfake videos online, a new research has claimed 96% of such videos contain pornographic material targeting female celebrities.

The researcher from Deeptrace, a Netherland-based cyber security company, also found that top four websites dedicated to deepfake pornography received more than 134 million views on videos.

The other sector where deep fakes are very destructive is Politics. Altered videos are not exactly new. The most famous recent example is an edit of a slowed Nancy Pelosi speech from earlier this year. The video spread across conservative media as critics of the Speaker of the House of Representatives declared it evidence of her senility, alcoholism or a mental health problem.

Amazon web services (AWS) is joining deep fake detection challenge (DFDC), driven by the companies like Facebook and Microsoft, to fight deep fakes. Amazon will provide machine learning experts and offer $1 million AWS credits to teams that need cloud services. Facebook is also releasing 5,000 sample videos to help researchers create detection tools. DFDC will release the full dataset in December.

“The rise of synthetic media and deep fakes is forcing us towards an important and unsettling realization: our historical belief that video and audio are reliable records of reality is no longer tenable” – Giorgio Patrini (CEO and Chief Scientist at Deeptrace). Fake news and similar deceptions are already common problems for many and it’s going to get worse as the technology advances. Even if a deepfake video can be spotted as a fake, it can still be spread across social networks in a matter of minutes before anyone has had the chance to verify it, potentially changing the course of elections or destroying careers.

BIOINFORMATICS

-Kavita

On **June 26, 2000**, the sciences of medicine and biology changed forever. Prime Minister of United Kingdom, Tony Blair and President of United States, Bill Clinton, held a joint press conference, linked via satellite, to announce the completion of the draft of Human Genome. New York Times ran a banner headline **"Genetic Code of Human Life is Cracked By Scientists."** The **Human Genome** is fundamentally about information, and computers were essential both for determination of the sequence and for the applications to biology and medicine.

Bioinformatics is an interdisciplinary field that develops method and software tools for understanding biological data .As an interdisciplinary field of science, bioinformatics combines biology, computer science, information engineering, mathematics, and statistics to analyze and interpret biological data. Today, Bioinformatics is an Applied Science. Computers have been an essential component of the projects that determine sequences, structures, and other types of data. We use computer programs to make inferences from the data archives of molecular biology and medicine. *As languages,* ***PERL, PYTHON and RUBY*** *are used for computation and detection of sequences.*

As languages, ***PERL, PYTHON and RUBY*** *are used for computation and detection of sequences.*

To understand the patterns, the field has moved towards combining information into networks, and analyzing these structures and dynamics. Many tools are now available for storing, visualizing, analyzing, and comparing networks. Contemporary bioinformatics could not do without them.

Biomedical scientists are not required expertise in programming but they must have *developing skills* in using these programs, and *intelligent interpretation* of the results that they produce.

Where will this lead? We can study the present as thoroughly as possible, and the past as extensively as we can and now we have the ability, and the challenge, of direct control over living things, including but not limited to ourselves. *A gratifying consequence of this program is its contributions to* ***Medicine****,* ***Agriculture,*** *and* ***Technology****.*

A better understanding of life processes empowers us to deal with them when they go wrong, and even to improve them when they do not.

ENVIRONMENT MONITORING WITH IoT

-Aradhana Dang

Pollution contributes to 9 million deaths each year, that is, roughly one in six people. With growth in population and increasing pollution severe floods, droughts and cyclones are becoming more and more common.

One way to deal with the problem is by using IoT devices or Internet of Things devices. These devices collect data from our physical environment using sensors and send this data to central servers where machine learning algorithms are applied to them and thus, we can know the exact source of pollution so that we can control it or prevent exposure to it.

Environmental Monitoring is collection of measurements from the surroundings and using it to influence policy, draw attention of the people to environment sustainability and development. It provides a way for businesses to save money and while contributing to a greener and safer planet at the same time.

At present the Environment Monitoring efforts are spare and inconsistent at best. Very few countries in Europe are only making efforts to improve this technology. This technology can help us save the resources of our planet like never before and thus, we need more and more development of the technology.

IoT uses internet-connected sensor solutions that can provide:

- Real-time insights and environment condition of a place at a given time.
- Predictability via machine learning algorithms.
- Alerts to people via SMS/E-mails.
- Data sharing

These sensors or “nodes” can be spread out in an area to collect data and are connected via mesh topology. The data is shared between the nodes and all the nodes send their data to the central server.

By installing a mesh network of environmental monitoring sensors, continuous and periodic data collection and recordings can be made available to stakeholders – be it to management, public authorities, and the general public. With a mesh network, the data would become immediate, helping the environmental consultant make quicker recommendations. As a result, citizens would be aware of their surroundings, and city leaders would be able to make evidence-based decisions as soon as possible.

Types of information these sensors can collect:

- Air quality index and the level of harmful gases in the surroundings
- Acidity of water
- Disease causing bacteria and viruses in the air and water.
- Soil sampling
- Waste Management
- Extreme weather
- Energy efficiency
- Healthcare
- And many more

With the right set of technology, we can help and solve the problems that have been caused by pollution and reduce the deaths and diseases it can cause.

SMART HEALTHCARE

-Chakshita Gupta

In our lives, do we care about our health? All the time, we are glued to technology. We are neglecting the most valuable treasure of human life- HEALTH. Going for monthly checkups seems like a task in today's time.

If we are that connected to technology, then why not put a thought into using it for human health monitoring? The solution here is IoT based health monitoring systems. These systems digitally monitor our health on regular basis and send the data collected to the doctor for analysis for research and monitoring. This system helps in connecting people with medical resources and healthcare services.

An appropriate health monitoring system can recognize abnormalities of health in time and make treatments according to the compiled data and the monitoring is made possible only due to the high performance of wireless solutions. The connectivity enables health practitioners to store patient's data and apply complex algorithms for health data analysis. The technique is widely used to diagnose heart diseases.ECG monitoring uses this technique to accumulate cardiogram information, supported by Internet-of-Things (IoT) techniques. The data is collected using a wearable monitoring node and are broadcasted directly to the IoT cloud using Wi-Fi. The HTTP and MQTT protocols are utilized within the IoT cloud so as to supply visual and timely cardiogram information to users.

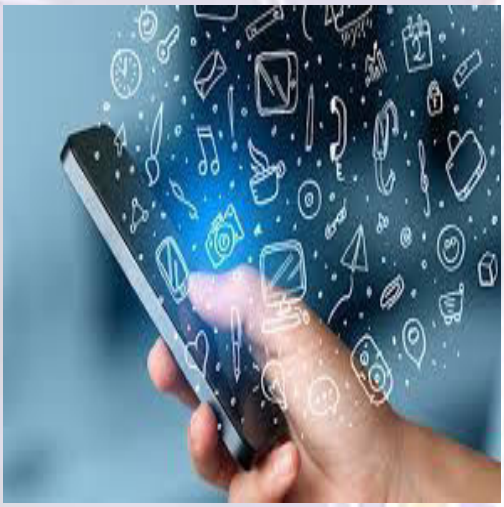
Almost all terminals with an internet browser will acquire information handily, that has greatly relieved the cross-platform issues. With this paper, I would like to throw light on how, in today's world of technology, we have such systems that will even take care of our health needs.

BEAT THE STRESS WITH TECH

-Nida Khan

Today world is ruled by technology. Techie people have been playing with technology so well that no sector is left untouched with technical advancement. Whether it is technical or it is non technical. Technical world is taking away all big issue in just one go. Computer science have played vital role in dealing medical, agricultural, defence, entertainment and almost all field of development. Today world is blown by impact of IT in all sectors.

Medical Advancement is getting peek due to technical meddling. In recent time with growth in physical sector world is someway or what moving towards harsh mentality of competition. Massive shift of people in urban areas makes them get into fight of promotion, some height in salary. Somewhere in down line "stress" is taking over everyone. It doesn't even matter whether what your age is or in what sector you are working strength of stress can get over you. Continuous stress often leads to various medical issues which affect individual badly. Today's world is similar to cat race. We all have to understand to counter balance our work with our personal life as if there is health, there is everything. Stress touches all social groups and all age categories; affects differently depending on their personal, psychosocial, professional and health background; comes from various sources of a different nature, such as physical, psychological, emotional, social, etc. no one can truly escape it.



Here comes beauty of technical advancement intersecting with medical field. Various medical records of people suffering from stress leads to depression which badly affect everyone. Now there are certain problems which matter always that are growing stress level among youth. To handle stress medical is using technology. Technology is supporting variety of medical needs. Technical features can understand medical needs more widely and most important thing it benefits in providing ease.

Life is more beautiful with healthy body and peaceful mind. It becomes more easy and progressive when connected with technology.

In recent couple of years, the first line of meditation apps has done much for the mindfulness practice. These days, more and more people are growing interested in this practice, apps like Headspace, Calm, conscious and similar is gaining huge traction. The ease of installing and downloading is making people more inclined toward these apps. Altogether, this has made

the services of yoga centre accessible to everyone. Indeed, this is a wonderful thing, though there is much more that a meditation app can do.

If you own a Fit Bit or Apple Watch, try the breathing exercise features to relieve stress. The way you live your life is till what time you live in life. Life is more beautiful with healthy body and peace mind it becomes more easy and progressive when connected with technology. Thanks to the latest technology used today, more and more people have been able to track and improve their health and now people can also burst there stress with use of technology.

SMART CITY

-Kanwalpreet Kaur Dhingra

Internet of Things (IoT) is a new technology that is booming up these days and is going to be seen everywhere, in every appliance, in the upcoming future. IoT is basically a complete system inside which, all the devices are connected with each other, emitting and receiving the data and all these combined together, are linked to a big data warehouse where the collected data is analysed. It's more like an admin staff that collects all the necessary information of students and then analyses it for various purposes.

Big tech companies like **Tech Mahindra** are investing on plans in which IoT can be used to convert our normal city into a smart one. IoT is being used in many scenarios these days. Of course, we need a proper planning and plotting for this, because many small-small applications combined together would lead to a successful mission.

Following are some of the areas where companies are planning and have even started to apply IoT.

1. **Public transport:**

Again this is a big domain inside which, I can quote many sub domains. For example, Smart traffic lights , they are different from the normal lights as they are real-time or dynamic, means, they adjust themselves acc. to the current traffic and thus avoid congestion and wastage of time on the road.Then come the Smart vehicles, which are embedded with a GPS tracker to track driver's location, vehicle number and it's speed. Also plans are about to be implemented for the Smart public transportation services. In the process, the operators would fetch the data through CCTV footages, movement sensors and ticket sales and according to that would predict the number of passengers that are going to board the train.

2. Home Utilities:

These days' citizens are given the authority to send their utility meter readings by themselves directly to the organization in-charge, avoiding the third-person frauds regarding the bills. Smart metering allows utilities companies to bill accurately for the amount of water, energy and gas consumed by each household. Some major examples of the apps that even I personally use are DJB mSeva, BSES mobile app and IGL.

3. Public Safety:

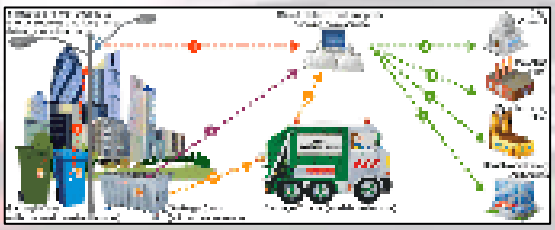
Public's safety especially women's safety is matter of concern these days especially in a country like India. It's actually a matter to laugh, that in a country where people are confused about which new product can be launched in market or what new topic can be taken to blog upon, in such a situation, there are products focussing on women's safety and are becoming extremely trendy. Want to have some examples? The anti-rape pantie and Optisafe by MyHero are some anti-rape devices that are becoming trendy these days because, after all every women desires to be safe. These products basically use IoT as their fundamental. These security devices use a simple pull mechanism for activation, making it fast and convenient to notify an emergency to your family members. Just pull out the device from the cover to activate a loud distress siren on the device, your smartphone and your pre-defined contacts, also the device sends SOS message to 3 pre-defined contacts with your live location and link for videos. The videos are recorded from your mobile devices front camera in spy mode. The location link opens up a live location tracker that the recipient can use to navigate to your location.

4. Environment

A city can deploy a network of sensors across the water grid and connect them to a cloud management platform. Sensors measure pH level, the amount of dissolved oxygen and dissolved ions. If leakage occurs and the chemical composition of water changes, the cloud platform triggers an output defined by the users. A network of sensors is deployed along busy roads and around plants. Sensors gather data on the amount of CO, nitrogen, and sulphur oxides, while the central cloud platform analyses and visualizes sensor readings, so that platform users can view the map of air quality and use this data to point out areas where air pollution is critical and work out recommendations for citizens.

5. Waste Management

IoT-enabled smart city solutions help to optimize waste collecting schedules by tracking waste levels, as well as providing route optimization and operational analytics.



HOW GOOGLE CONTROLS THE LIFE OF A PERSON?

-Diya Garg

The answer to this question is the statement that follows it. The foremost idea that crossed my mind was to 'google this answer'. This is the control of Google in our lives. From a simple home assignment to writing research papers, we are largely dependent on Google.

Love it or loathe it, Google affects almost everything we do today and it also influences most of our plans for the future. Call it innovation, call it the tech evolution, or the Internet of Things, Google is taking over our lives.

Google offers a plethora of services to help people and businesses. You may be using numerous conveniences while others might not be exercised by you. The more commonly known services include Gmail, Chrome, Maps and YouTube. But here are several others: Google Trends, Find Your Android, Google Dashboard, Google Photos, Google Reverse Image Search, Google Flights, Google Arts & Culture, Google Alerts etc. Google keeps a record of all your personal information. Be it your name, address, or contact number. Wondering how? While you sign in for any application of Google, you fill your personal details which are then remembered by Google.

Google knows you and understands your choice and preferences better than anybody else. It controls what appears on your screen without being at the frontier. Be it the advertisements that pop-up while you are surfing the internet, or the promotional e-mails Google is all behind it. It knows your exact location, bank transactions, payment schedules, gallery, routes followed, workplace, how you analyze information, your areas of interests, favorite destination, hotels, cuisine and what not. Our overdependence on Google for all types of services allows Google to control us.

TECH INTELLECT

-Kanwalpreet Kaur Dhingra

1. Typing speed is measured in _____ per minute.

2. Bitcoin transactions are recorded using what technology?

3. IBM is a well-known computer and information technology company, what does IBM stand for?

4. The technologically advanced humanoid robot ASIMO is made by which car company?

5. What is NASA's internet speed?

6. The first computer virus was called as.....

7. Password of the computers in charge of controlling the nuclear missiles of the United States Army for years was.....

8. The "Pixel" is the name of what type of device made by Google?

9. Contactless payments are typically made using which wireless technology?

10. Which programming language was developed by Apple?

Answers

1. Keystrokes
2. Blockchain
3. International Business Machines
4. Honda
5. 91 GB per second.
6. Creeper system
7. 0000000000
8. Chrome book
9. Near Field Communication(NFC)
10. Swift

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