

THE COMPUTERS AND MATHEMATICS SOCIETY
SHRI RAM COLLEGE OF COMMERCE

10TA

ANNUAL MAGAZINE

VOLUME 1



AND THE
LIMIT TENDS TO INFINITY

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Prof. Simrit Kaur
Principal

Being a premier institute of Commerce and Economics, Shri Ram College of Commerce strives for achieving excellence in academics and extracurricular activities. Bearing testimony to the fact that students of Shri Ram College of Commerce are not just intellectuals in academics but also have multiple shades of uniqueness ingrained in them, the college supports different societies to enrich their proficient skills. Being one among the said societies, The Computers and Mathematics Society has eminently proved its efforts in spreading awareness and creativity in the fields of Computer Science and Mathematics. In today's era of Digitalization, Technology and Mathematics play significant role in all disciplines including Commerce and Economics. The Computers and Mathematics Society is working diligently in making students technologically and mathematically aware and innovative in a College known for its orientation towards Commerce. 'IOTA', the annual magazine of the society, provides an excellent platform for creative minds to express and share their knowledge and opinion on recent developments in the field of Computer Science and Mathematics. The magazine aims at enriching the readers with

the innovative ideas and broaden their horizons of knowledge in the dynamic environment. With the support and assistance of Dr. Pushp Lata Jain, Convenor, they have conducted assorted events ranging from their fests "Enigma" to conducting informative workshops. Heartiest congratulations to the contributors and my best wishes for their future endeavours.

Over the years, The Computers and Mathematics Society has strived hard to create technological as well as mathematical awareness in Shri Ram College of Commerce, a college known for its orientation towards commerce. The society has been successful in taking both technology as well as mathematics to the roots of the college with constant emphasis on learning, be it through their two fests- CMS Week and Enigma or through organising sessions, releasing various series, conducting workshops and what not. Being the convenor of the society, I have tried my best to be helpful and supportive in the implementation of creative ideas the student body comes up with. The first edition of the annual magazine of the society, IOta is an acknowledgement to the fast changing needs of humankind. I feel immensely proud to support the team which worked hard day and night, and made it possible to achieve every possible target and benchmark, thus taking the society to greater heights like never before.



Dr. (Ms.) Misha Govil
Convenor 2018-19



Rahul Gera

**General Secretary
2018-19**

When I stepped in the shoes of General Secretary of CMS, it was the first time in my lifetime that someone had entrusted me with such a huge responsibility. One year later, when I look back, I never felt the burden of this responsibility owing to a lovely set of people who always supported me. As it is rightly said, if you are working with the right people, in this case my family, you don't even realise that you're working. The hospitable and holistic environment of the society is what sets it apart from other societies in the college. The exposure you get while working in a registered society of SRCC, simultaneously making friendships that last for a lifetime is something that only CMS can offer. Working and spending time with the members (I call them family) was a source of happiness for me and I never lost that grin from my face during that time. I feel lucky and will always be thankful to anybody and everybody who played a role in me being a part of this lovely family.

Two years back, when I was selected as a member of The Computers and Mathematics Society, little did I know that I would come this far in my journey and lead the society as the Joint Secretary this year. It was a roller-coaster ride and we underwent many ups and downs but what always remained constant was our dedication and affection towards the society. We have strived hard to make it one of the best societies of the college as well as a popular one amongst the students. To sustain a society related to Computers and Mathematics in commerce college was never an easy task as the interests of students studying in this institution do not match what our society propounds. But over the years we have tried to make it more relatable to them and I'm glad that I have been a small but remarkable part in this process. The society has grown a lot in this span of time and I wish to see it grow even more in future. Today, I not only see myself to be a more responsible person but also a more zealous one who was entrusted the right opportunity at the right time and it won't be wrong to say that I owe a large part of it to CMS.



Shereein Saraf

**Joint Secretary
2018-19**

EDITORS 2018-19



Everytime I hear mathematics or computer, instead of addition, subtraction, 0 or 1, the first thing that comes to my mind is The Computers and Mathematics Society. While it became a regular thing to release the monthly edition of newsletter “Infinity”, it’s quite a thrill and excitement to think about the sensational and amazing leap towards the first magazine of The Computers and Mathematics Society. I am sure it will be no less than a feast for all mathematics lovers and tech enthusiasts. Only once, maybe twice in your life there are times that you get an opportunity to witness the exceptionally talented and most phenomenal brains working together. I believe this is one of those moments and I am grateful to be associated with such great minds. I am sure that candid readers will savour this blissful feast.

Saurabh Rungta

Research and Editorial Head

“Creativity is intelligence having fun”, these words truly define The Computers and Mathematics Society, Shri Ram College of Commerce. I am proud to be a part of CMS which has never ceased to amaze people with its impeccable work. Being the Research and Editorial Head of CMS, I learnt and grew a lot. I found my ‘home away from home’ in CMS. With the help of some amazing juniors, I was able to realise the goals which I only envisioned at the time when I took up this responsibility. Working for CMS has never felt like a burden, owing to my amazing team members who always supported me and had my back. As I already mentioned, the aim of CMS is to make learning fun, not only for its members but for its audience as well. It comes out with challenging and enigmatic fun events in the form of CMS Week and Enigma, not to forget the weekly puzzles, fun facts and tech hacks! Having already come out with monthly newsletters, we are proud to present yet another erudite piece of work- the first edition of our annual magazine. This would not have been possible without our diligent and loving juniors. A number of interesting articles and a lot of learning await you. We hope you enjoy reading it as much as we enjoyed making it.



Vedanshi Gupta

Research and Editorial Head



YEARBOOK

ABOUT CMS

From eruditing minds with the insights of world of numbers and binaries to keeping maths and technology in the list of interesting subjects, CMS does it all for us. With a noteworthy history of more than 50 years, The Computers and Mathematics Society is a registered society of Shri Ram College of Commerce and a one stop destination for all the technology lovers and Math freaks in true sense. Be it finding fun in learning or learning through fun, CMS has been able to deliver wholesome experiences through maximum effort.

The famous CMS Week is the much awaited and sought after event not only among SRites but among other DU students too. CMS Week of 2018 was a huge hit. The technical proficiency imparted through Photoshop sessions was priceless. The kind of adroitness seen in the Shri Ram Cubing Challenge not only amazed everyone with the national records being broken, but also stirred more interest in young minds for the cubical twists and turns of geometry.

Enigma is the annual extravaganza held in the month of February each year where various Tech and Mathematics inspired events take place, which turn imagination into reality. The fest is a perfect blend of intellectual as well as fun events, with events like Math-o-Mania, Outlook, Mad Over Maths and Challenge Accepted testing the participants' ability to think and learn, and events like Zumba and Paper Dance giving the attendees a moment to forget all their worries and enjoy! The fest also includes a grand FIFA tournament and many interactive open events like Numtech Tambola and Game of Shows. Cyber Crime Mystery, a competition based on mathematics and logical reasoning is also organized each year which witnesses participation from numerous students of DU community. It

is a perfect mix of fun, adrenaline and learning.

Leaving no stone unturned in enlightening the students, whether it is a tech hack to keep us updated or the weekly dose of Fun Fact Friday. The quizzes never fail to give an extra reason to hone and sharpen our grey matter. The mind awakening and brilliantly devised tricks being uploaded in the form of series, coming directly from the flips of Vedas seem to connect our heart to the ancient clock of exploration. The flagship weekly series Tech Hacks, that focuses on teaching interesting tricks, proves to be another notch in the belt. The monthly newsletter Infinity has been a hit among the followers for it being an easy and an interesting read. Excel sessions were a great addition to our technical kit. No doubt, the society has been successful in promising the students with the best of opportunities and learning experiences.



The Bit Factorial, handcrafted blogsite of CMS was added to cherish the cuisine of Mathematics and Technology. The website www.cmssrcc.wixsite.com/cmssrcc is a repository of information regarding all activities and functions of the society and has been launched with an aim to give a platform and to empower young minds and thinkers to pen down their views and ideas regarding various contemporary issues. The frequent research sessions are indeed a feast of knowledge for the whole team.

All in all, CMS continues its mission to provide food for thought to young minds and keeps on adding more and more arms and ammunition to its arsenal in the form of teamwork and coordination by pooling a team of talented and aspirational individuals.

CMS WEEK

CMS Week is a mid-term premier fest spread over a period of seven erudite days which witness The Computers and Mathematics Society come alive in engaging sessions, nerve-racking puzzles and innumerable moments of fun and joy. CMS firmly believes in not only finding fun in learning but also in learning through fun. With this in mind, CMS aims to deliver wholesome experiences entailing maximum effort through one of its initiative, CMS Week. Multifarious games, competitions and sessions are organized on all the days of CMS Week. This year, 29th October 2018 marked the beginning of CMS Week. These seven euphoric days which ended on 4th November 2018 witnessed a number of detectives, PUBG lovers, math lovers, photoshoppers and cubers, leading to infinite memories, learning, fun and records! Throughout this week, the participants got a chance to channel their inner Sherlock, convert their worst pictures into their best, twist and turn in order to crack the cube and win prizes for doing one thing they love the most!

221B Hacker Street *a saga of deception*

The CMS Week began with a mind exalting competition. It was an engaging and mysterious mathematical clue hunt which gave the participants a chance to assume the role of their favourite detective, break the codes they know by putting mathemagicians within them to work and deceive the deceit. People participated in huge numbers

and were all perplexed, tired, thrilled and excited till the time they reached the end. Only the best team was able to decode the last clue and win the competition.

Photoshop Session

Having the best technical team, CMS surpasses all expectations when it comes to posters, videos, banner designs and other technical stuff. With a view to pass on some of these skills, a Photoshop session was also organized as a part of CMS Week. It was stretched over a period of four days from 30th October 2018 to 2nd November 2018 and was engaged in teaching some of the basics of Adobe Photoshop. It attracted a mass entry from all over Delhi, who surely learnt the requisite skills to touch up the edges, adjust the tones, blur out the background, focus on themselves and photoshop their lives. It was an enriching and value adding experience and received positive feedback from the attendees.





Shri Ram Cubing Challenge

The highlight of the fest i.e. the Shri Ram Cubing Challenge was conducted in collaboration with World Cube Association and observed participation from various countries such as the US, Indonesia, Bhutan and Afghanistan among others. The competition consisted of several events like 3,4,5,6 & 7 sided cubes, Blindfolded, One-Handed, Fewest moves, Skewb, etc. The participants were to use their adroitness to decode the 3-dimensional treasure trove of geometry in an attempt to make the colour parade as perfect as possible. Watching 4 year olds ace these

challenges in just a matter of seconds was a truly a startling sight. It has witnessed 15 national records being broken and new ones being made in the past 3 years. A total of ten National records were broken and seven Afghanistan records were made in this artefact challenge.

Online Competition

Other than the various offline competitions, an online competition of the most loved online competitions, Player Unknown's Battle Grounds was also conducted for a period of two days starting from 30th October.



Did You Know?

With 6 coloured sides, 21 pieces and 54 outer surfaces there's a combined total of over 43 quintillion different possible configurations.

ENIGMA



Enigma is the annual fest of The Computers and Mathematics Society, Shri Ram College of Commerce, which takes place in the month of February each year, a fest where various Tech and Mathematics inspired events take place, which turn imagination into reality.

Enigma'19 was successfully organised on 11th, 12th & 13th February and comprised of many events, which included fun activities and competitions for college as well as school students.

This year's Enigma **Day 1** kicked off with two events based on Mathematics. One was 'Math-o-Mania', a 2 day Maths Quiz for school students from XIth and XIIth standard and the other was 'Mad Over Maths', a one day Mathematics quiz for undergraduate level students. After this, Enigma gave a chance to the students to forget stress and dance to the rhythm of Zumba Music at Co-op Area, which was open for all.

Day 2 started with the final rounds of 'Math-o-Mania'. Then it was the time for an Avengers themed Cryptic Puzzle, The Cyber Crime Mystery, which involved many logical reasoning based clues. Day 2 was not over yet as CMS presented the students an opportunity to participate in an altogether different version of Tambola, called the 'Numtech Tambola' to successfully end Day 2 of the fest.

Day 3 started with an Intellectual Presentation based event, Outlook, where the finalists presented their research papers through presentations and were judged on different parameters by a panel of judges. The attention moved towards fun activity again, as a Paper Dance competition took place in the college premises, which tested the participants on their balance and rhythm. It was not the end yet, as the Final event of Enigma'19 was next.

Game of Shows, an event based on popular TV series included a Clue based round and a Quiz consisting of two sub rounds.

This was not all, as CMS organised many other events as well, like Ubiquitous Mathematics, MathComp and Challenge Accepted. Moreover, Enigma also had fun stalls to play dart games and Guess the Object. FIFA Championship 2.0 was also organised on all 3 days of Enigma'19, which saw participants enjoy playing FIFA on PlayStation with a competitive spirit.

All in all, Enigma'19 was an appreciation of the excitement and enthusiasm in students as well as members as it ended up being a grand success.

TECH HACKS

We, while working for The Computers and Mathematics Society, always try to make people's lives better, with the use of knowledge, information and awareness in the fields of technology and mathematics.

Keeping that in mind, we rolled out a series named **TECH HACKS** on our social media handles where we explained some amazing tricks to solve problems people face while using technological devices.

SEASON 1 HIGHLIGHTS

#1 How to find phone using PC/Laptop

You may come across a situation where you just forgot where you put your phone and now you need it urgently but are unable to find it.

We will not let your important work get away from you.

Presenting to you the trick, using which you can find your phone using PC/Laptop.



Steps to be followed:

- Sign into your PC with the same Google ID as your phone
- Search **"find my device"** on google.
- You will find an option to "ring your phone"

You can also use this feature to:

- Locate your device
- Lock your device
- Erase data from your device

#2 How to recover unsaved word document

When you started using PCs, no one really taught you the tricks to tackle some problems you may come across while using it.

One of the most common of them is not saving your word document.

You may suddenly freak out that you just lost all your important research work. Not to worry, we have a trick for this as well.

Steps:

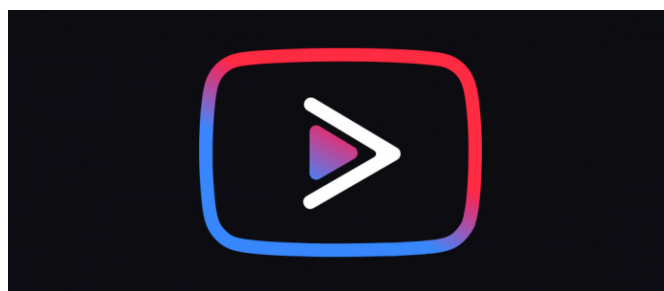
- Open a **blank document** in Microsoft Word
- Then go to File>Open
- Then select the recover "unsaved documents" option
- A window will open showing the unsaved documents
- Select the latest file and click open
- Now save this document and you will be good to go



Alternative method:

- Open **"This PC"**
- Go to **search box** on to right corner
- Then type **'.asd'** and press enter
- Double click on the latest file and you will be good to go

#3 How to remove advertisements from YouTube



While watching a video, ads create a hindrance in your entertainment. Well to tackle this, we present to you the trick to remove this bothering permanently to enable you binge watch your favourite TV shows. This can be done using feature of an online application named **YoutubeVanced**.

Steps:

- Search **"youtubevanced.com/non-root"** in your web browser.
- Download the latest version apk on the following:
 1. YoutubeVanced
 2. MicroG APK

To install these apps, you must change the setting of **"Installation from Other Sources"** in your phone settings.

The season 1 got you covered with these amazing tricks.

Check out SEASON 2 on
Our YouTube Channel



VEDIC MATHS

by Anushi Agarwal, Rajsi Sah and Anustha Puniyani

As the name of our society suggests, we bring out the mathematicians in people. In the month of November, we started a new online series known as 'Vedic Maths'. It consisted of 5 episodes teaching some basic yet useful ways to solve problems in just a matter of seconds. Some of the tricks covered included finding the square of any number ending with 5, finding the square of a number close to power of 10 etc.

Now we bring to you this article that focuses on how this traditional method of mathematics originated, its characteristic features and much more!

The "Vedic Mathematics" is called so because of its origin from Vedas. To be more specific, it has originated from "Atharva Veda", the fourth Veda. "Atharva Veda" deals with the branches like Engineering, Mathematics, Sculptures, Medicine and all other sciences with which we are today aware of. The Sanskrit word Veda is derived from the root Vid, meaning "to know without limit". The word Veda covers all Veda-Sakhas known to humanity. The Veda is a repository of all kinds of knowledge, fathomless, ever-revealing as it is delved deeper.

What does it include?

This subject was revived largely due to the efforts of Jagadguru Swami Bharati Krishna Tirtha Ji of Govardhan Peeth, Puri Jaganath (1884-1960). Having researched about the subject for years in the period between A.D. 1911 and 1918, even his efforts would have gone in vain but for the enterprise of some disciples who took down notes during his last days. The basis of Vedic maths, are the 16 sutras, which attribute a set of qualities to a number or a group of numbers. The ancient Hindu scientists (Rishis) of Bharat in 16 Sutras (Phrases) and 120 words laid down simple steps for solving all mathematical

problems in easy to follow 2 or 3 steps. Vedic Mental or one or two line methods can be used effectively for solving divisions, reciprocals, factorisation, HCF, squares and square roots, cubes and cube roots, algebraic equations, multiple simultaneous equations, quadratic equations, cubic equations, biquadratic equations, higher degree equations, differential calculus, Partial fractions, Integrations, Pythagoras Theorem, Apollonius Theorem, Analytical Conics and so on.

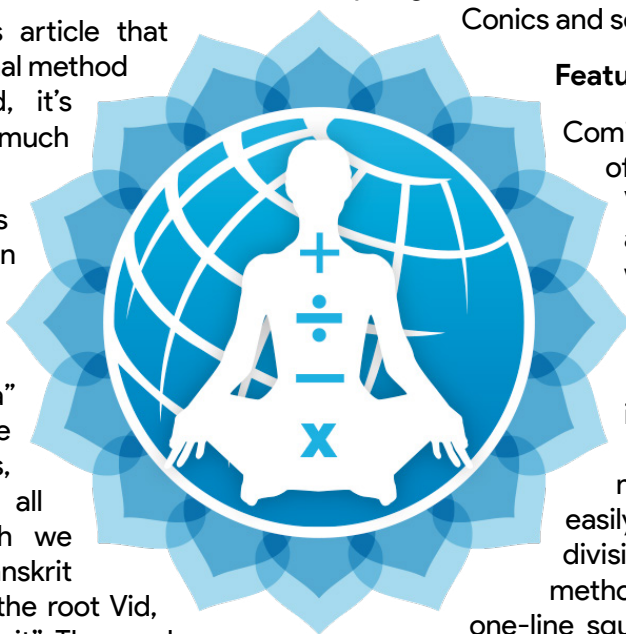
Features

Coming back to the present, one of the striking features of Vedic maths is its coherence and flexibility. Instead of a web of complicated and not-so-easy-to-understand techniques the whole system is beautifully interrelated and unified. For example, the general multiplication method is easily reversed to allow one-line divisions and the simple squaring method can be reversed to give one-line square roots. And these are all easily understood. This unifying quality makes mathematics easy, enjoyable and encourages innovation.

The simplicity of Vedic Mathematics means that calculations can be carried out mentally (though the methods can also be written down). There are many advantages of using a flexible, mental system. Students can invent their own methods; they are not limited to one 'correct' method. This leads to more curiosity and interest amongst the students and also leads to them enjoying rather than fearing the subject.

How could it help an average student, for whom maths is not a likeable subject?

- It helps a person to solve mathematical problems 10-15 times faster. More than 1700% times faster



than normal way sometimes, making it the world's fastest.

- It helps in intelligent guessing.
- It reduces burden as you need to learn tables up to 9 only, making it easy to master and apply.
- It is a magical tool to reduce scratch work and finger counting. It increases your speed and accuracy. You could become a Mental Calculator yourself.
- It increases concentration. It sharpens your mind, increases mental agility and intelligence.
- It helps in reducing silly mistakes.
- Experts suggest that it could be a handy tool for those who need to solve mathematical problems faster by the day. How fast you can solve a problem is very important. There is a race against time in all the competitions like CAT, GMAT, CET, SAT, Banking Exams, etc. Only those people having fast calculation ability will be able to win the race. Time saved can be used to solve more problems or used for difficult problems.
- Eradicates fear of Math completely. So if your child has Maths-Phobia (Arithmophobia), high speed Vedic Math is a fun-filled way to do mathematics and raises interest in your child. Much improved academic performance in school and instant results.
- Improves memory and boosts self-confidence.
- Cultivates an interest in you for numbers and develops your left and right sides of your brain, hence using intuition and innovation. It has been noted that geniuses have been using the right side of the brain to achieve exceptional results.

Vedic Math provides answer in one line whereas conventional method requires several. Even recurring decimals and auxiliary fractions can be handled by Vedic Mathematics.

Vedic Mathematics forms part of Jyotish Shastra which is one of the six parts of Vedangas. The Jyotish Shastra or Astronomy is made up of three parts called Skandas. A Skanda means the big branch of a tree shooting out of the trunk.

In Vedic Maths System a manual approach is preferred. The simplicity of Vedic Mathematics encourages most

calculations to be carried out without the use of paper and pen. Methods like Shudh method, are applicable in statistics. This mental approach sharpens the mind, improves memory and concentration and also encourages innovation.

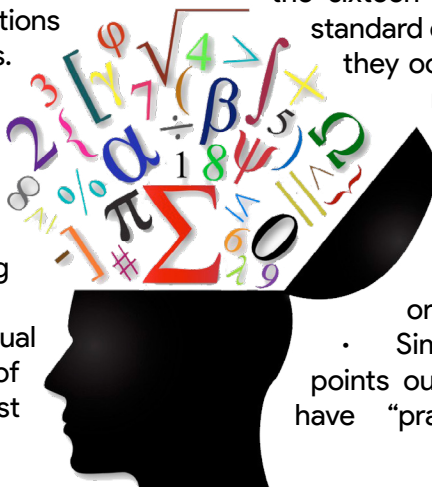
Some glimpses

- Using Vedic Maths tricks, you can multiply 962 and 998 in mind in couple of seconds.
- Multiply a no. by 11. Shift the number by one unit and add to same number
- For this method you should remember square of all numbers till 25.
- Multiply 2 different two-digit numbers
- Multiply a no. by 9
- If you're wondering whether you can do that easily, then see this-
- How would calculate Square Root of 20736.893? Using Vedic Mathematics its 4 step method.
- How much time will you take to calculate square of 1221? Using DvandaYog of Vedic Mathematics, it is just 2 step answer.

Are there any criticisms as well?

- Tirthaji claimed that he found the sutras after years of studying the Vedas, a set of sacred ancient Hindu scriptures. However, the Vedas do not contain any of the “Vedic mathematics” sutras. First, Tirthaji’s description of the mathematics as Vedic is most commonly criticised on the basis that, thus far, none of the sutras can be found in any extant Vedic literature.
- When challenged by Professor K.S. Shukla to point out the sutras in question in the Parishishta of the Atharvaveda, Shukla reported that the Tirthaji said the sixteen sutras were not included in the standard editions of the Parishishta and that they occurred in his own Parishishta and not any other.

- Professor Vasudeva Saran Agrawala, the editor of the first edition of Tirthaji's book, notes that there is no evidence that the sutras are "Vedic", as such, in their origin.
- Similarly, S. G. Dani of IIT Bombay points out that the contents of the book have "practically nothing in common"



with the mathematics of the Vedic period or even with subsequent developments in Indian mathematics. For example, multiple techniques in the book involves the use of decimal fractions, which were not known during the Vedic times: even the works of later mathematicians such as Aryabhata, Brahmagupta and Bhaskara do not contain any decimal fractions. He contends that Tirthaji liberally interpreted three-word Sanskrit phrases to associate them with arithmetic.

- Tirthaji's claim that the sutras are relevant to advanced mathematical techniques such as successive differentiation or analytical conics have also been dismissed by Dani. He terms 'ludicrous' Tirthaji's claim that "There is no part of mathematics, pure or applied, which is beyond their jurisdiction". He also points out that while Tirthaji's methods were not unique, they may have been invented by him independently, as Tirthaji held an MA in Mathematics. Similar systems include the Trachtenberg system or the techniques mentioned in Lester Meyers's 1947 book "High-speed Mathematics". Alex Bellos points out that several calculation tricks can also be found in certain European treatises on calculation from the early Modern period.

Use in schools-not free from bias

The book was previously included in the school syllabus of Madhya Pradesh and Uttar Pradesh. Some schools and organizations run by Hindu nationalist groups, including those outside India, have also included Tirthaji's techniques in their curriculum. They have also made several attempts to have Tirthaji's 'Vedic mathematics' system included in the Indian school curriculum via the NCERT books.

A number of academics and mathematicians have opposed these attempts on the basis that the techniques mentioned in the book are simply arithmetic tricks, and not mathematics. They also pointed out that the term "Vedic" mathematics is incorrect, and there are other texts that can be used to teach a correct account of the Indian mathematics during the Vedic period. They also criticized the move as saffronisation with an attempt to promote religious majoritarianism.

Dani points out that while Tirthaji's system could be used as a teaching aid, there was a need to prevent the use of "public money and energy on its propagation, beyond the limited extent".

Scope

The future Vedic Math seems to be great with many schools, colleges and universities seeing their efforts to incorporate this branch of mathematics in their daily

life problems. A great deal of research is also being done on how to develop a more powerful and easy application of the Vedic sutras in geometry, calculations and computing. Statistics reveal that around the world, about 20 universities including London School of Economics, Sydney, Birmingham, Zurich, Heidelberg etc., have already introduced Vedic Maths in their curriculum.

Epilogue

Proponents of Vedic Mathematics however argue that the methods are not merely mathematical tricks and that there is an underlying psychology because the aphorisms describe personal approaches to problem-solving. As pedagogical tools, the methods are useful because they invite students to deal with strategies.

Once the mind of the student develops an understanding of system of mental mathematics, it begins to work more closely with the numbers and becomes more creative. The students understand the numbers better. Vedic Mathematics is very flexible and creative, thus an appealing medium to all groups of people. It is very easy to understand and practice.

It will be of interest to everyone but more so to younger students, keen to make their mark in competitive entrance exams. India's past could well help them make it in today's world. It is amazing how with the help of 16 Sutras & 13 sub-sutras, the Vedic seers were able to mentally calculate complex mathematical problems.

In conclusion, the real beauty and effectiveness of the subject cannot be fully appreciated without practising it. One can then see why its enthusiasts claim that it is the most refined and efficient calculating system known.



CROOKED

The interesting thing about cybercrime and the whole cyber world is that many of the people that are most proficient in it are young people, really young people.

~ Patricia Arquette

Well, to start with, doesn't this quote sound bitter? With increase in number of cases related to cyber attacking we are heading towards a future where criminals do not hold a real identity! Maybe the next is YOU! Hence to make you aware of the new crimes that are going on in this new era of technology, THE COMPUTERS AND MATHEMATICS SOCIETY, SRCC came out with a new series named **CROOKED** which included latest cases of cybercrimes.

The series consisted of 5 episodes, the first episode being the '**Cyberattack on Cosmos Bank**'. A daring cyberattack was carried in August 2018 having its place of impact at Cosmos bank, Pune branch, India. The extent of damage as reported amounted to Rs 94.2 crores. The hackers wiped out money and transferred it to a Hong Kong situated bank by hacking the server of Cosmos Bank.

Likewise, it covered a variety of major cybercrimes which affected a million people in and around the world such as the **2011 PlayStation network outage** (affecting 77 million users), **Nyetra ransomware attack** (costed Ukraine more than \$10 billions), **Data breach of LinkedIn and E-Harmony** (7 million accounts hacked) and the **hacking of Associated Press' twitter account**.

Below we present you two conspiracies which shook the entire world.

THE SPYEYE

- The SpyEye is a malware program designed by the Russian nationalist Aleksandr Andreevich Panin. This malware program attacks user's running google chrome, firefox, internet browser and opera web

browsers on the Microsoft windows operating system. The SpyEye emanated from Russia in 2009 and was sold in underground forums for \$500+.

- The SpyEye has the ability to insert fields in the websites asking for credit card numbers, username and passwords helping the hackers to steal money from the people without the notice of account holders.
- From 2009 to 2011, Panin conspired with others, including co-defendant Hamza Bendelladj (charged and extradited to the U.S. last year), to advertise and develop various versions of SpyEye in online criminal forums.
- **It affected almost 1.4 million computer systems.** It obtained victims' financial and personally identifiable information stored on those computers and used it to transfer money out of victims' bank accounts and into the accounts controlled by criminals.
- Panin sold the SpyEye malware to more than 150 "clients" who paid anywhere from \$1,000 to \$8,500 for various versions of it. Once in their hands, these cyber criminals used the malware for their own nefarious purposes, infecting victim computers and creating botnets (armies of hijacked computers) that collected large amounts of financial and personal information and sent it back to servers under the control of the criminals.
 - Ultimately, after Panin sold his malware online to the wrong customer—an undercover FBI employee and after an investigation involving



international law enforcement, a dangerous cyber threat was neutralized.

- **The investigation of the SpyEye was carried under Operation Clean Slate.** The operation focuses on a broad public/private effort recently undertaken to eliminate the most significant botnets affecting U.S. interests by targeting the criminal coders who create them and other key individuals who provide their criminal services to anyone who'll pay for them.

OPERATION GHOST CLICK

- In an international Cyber Ring that is being called the biggest cybercriminal takedown in history, the FBI has arrested six Estonians accused of running a botnet that controlled more than 4 million computers in 100 countries. But as nefarious and far-reaching as that sounds, the scheme itself brings the story to something of an anti-climax. The botnet was simply diverting browsers to sites that served up advertising and then collecting referral fees.
- **When:** Beginning of 2007, the cyber ring used a class of malware called DNSChanger to infect approximately 4 million computers in more than 100 countries.
- There were about 500,000 infections in the U.S., including computers belonging to individuals, businesses, and government agencies such as NASA. The thieves were able to manipulate Internet advertising to generate at least \$14 million in illicit fees. In some cases, the malware had the additional effect of preventing users' anti-virus software and operating systems from updating, thereby exposing infected machines to even more malicious software.
- DNS—Domain Name System—is a critical Internet service that converts user-friendly domain names, such as www.fbi.gov, into numerical addresses that allow computers to talk to each other. Without DNS and the DNS servers operated by Internet service providers, computer users would not be able to browse websites or send e-mail.
- DNSChanger was used to redirect unsuspecting users to rogue servers controlled by the cyber thieves, allowing them to manipulate users' web activity. When users of infected computers clicked on the link for the official website of iTunes, for example, they were instead taken to a website for a business unaffiliated with Apple Inc. that purported to sell Apple software. Not only did the cyber thieves make money from these schemes, they deprived legitimate website operators and advertisers of substantial revenue.
- But when DNSChanger was detected in the NASA computer network, the Estonian IT company that served as a front for the operation found themselves at the wrong end of an FBI investigation dubbed "**Operation Ghost Click.**"



BLOCKCHAIN BUZZ

by Rushil Gupta

People all around the world are talking about blockchain and its wonderful advantages. But is the technology ready for usage? Should we accept it? The answer is Yes and No.

Let's start with **what exactly is Block-chain?**

By 'block', we refer to digital information stored in a public database (the 'chain'). The technology at the heart of bit coin and other virtual currencies, block-chain is an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way.

Block-chain is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value.

Just like the saying "Rome wasn't built in a day", Blockchain too will take deeper work to perfect it for usage of the masses. However, many companies are using it. Take Maersk for example, one of the leading logistics firm in the world, that is using Blockchain for organizational success. With Blockchain, they are creating a network of connected containers that log their data for the organization, available anytime, anywhere. They are also automating their Invoice creation, trade receipts and other important documentation, built right into a Blockchain for robust processing and security.

But the real benefit of Blockchain is collaboration, and Maersk's solution is to create a Blockchain of not only internal stakeholders but also external like competitors and governments to make shipping processes leaner, smarter and efficient. Why is this a great idea because the parties trust each other, know each other (in Blockchain) and hence the

Blockchain acts as a private network of individual entities participating in trade.

Contrast this with the consumer model of Blockchain where thousands or millions of people are involved. A person wouldn't know who is on the other side of the transaction unless they meet face to face or know each other already, and this is the biggest flaw in the current Blockchain model, that normal consumers prefer privacy than security in communication. The reason is simple – the use case for Blockchain for normal consumers is financial.

Since most data people own is not as sensitive and critical as Organizational data, they tend to use email, messaging and other simple modes of communication for documents and other things. Cryptography is not necessary for them. But when it comes to financials as well as commodity trading, they want secure means, where privacy is a requirement for operation and security. Therefore, crypto-currency has seen a boom in recent past, bitcoin being the leader. However, what kind of transactions are taking place, and more importantly, who is doing them remains unknown.

This is the reason why the Indian government has placed a ban on bitcoin for being accepted as legal tender.

Meaning that people cannot purchase bitcoins or sell them using Indian banks.

Since it is extremely hard to control peer to peer Blockchain transactions, the Indian government wants to ensure they are as minimal as possible. This would help them keep in control drug mafias, money launderers and terrorists from having smooth operations.

Consider an alternate universe where Bitcoin was accepted as legal tender



in India. Normal consumers would flock to buy it and thereby increase Bitcoin's prices. This would have helped dark organizations, who mine Bitcoins, exchange more commodities for less and less bitcoin, upscaling their drug or terror operations.

What makes it secure?

After a block has been added to the block-chain, it is really difficult to go back and alter its contents; that's because each block contains its own hash, along with the hash of the block before it.

Now let's say you tamper with the second block. This alters the hash of that block as well. That will make block three and all the consequent blocks invalid because it no longer stores the correct hash of the previous block.

(Hash codes are created by a math function or algorithm that turns/converts digital information into a string of numbers and letters. If that information is edited in any way, the hash code changes as well.)

Instead of using a central entity to manage chains, it uses a decentralized peer to peer network. The node can use this to verify that everything is still in order and verify that it has not been tampered with. And if everything checks out, each node adds this block to his/her own block-chain. That is, all the nodes in the block chain create consensus.

So, to successfully tamper with a block-chain, one needs to tamper with all the blocks on the chain, redo the proof of work for each block and take control of more than 50% of the peer to peer network, which is impossible to do because in order to change a single block, a hacker would need to change every single block after it on the block-chain. Recalculating all those hashes would take an enormous and in appropriate amount of computing power.

Conclusion

The argument is simple – Blockchain technology is successful only when the use case deems it so. Blockchain in Finance has failed (in India) or will crash in future (shutdown of websites like Silk Road marked the beginning). Hence companies must find more ways for people to use Blockchain, other than Finance, that are compelling, or modify the technology to allow for monitoring and approval of an incoming transaction by an authority. But then, that would defeat the reason why Blockchain was developed.

Just like thepiratebay.org (the peer to peer sharing website), Blockchain too will fall if not modified for normal consumers.



FRACTALS

by MD Sehal Hasan

Fractals represent a branch in Mathematics which tends to abolish the barrier between mathematics and art. They may be defined as a broken geometrical shape that can be split into parts which are scaled down versions of the original shape, such a shape when zoomed upon, closely provides us the same figure. Fractal geometry has been described as “a collection of examples, linked by a common point of view, and not an organized theory”. In this article we have covered 2 properties, self-similarity and similarity dimensions.

Self-Similarity

An object is considered self-similar if a part of the object, when scaled by a factor of $k > 0$ is equivalent to the object itself. For example, each floret of a broccoli when zoomed looks like the broccoli itself. Same is with fractals, we can scale them up many times and after every step we will encounter

the same shape with which we started. Consider a square and highlight a portion of it, a scaled down version of the original, by $\frac{1}{2}$.

When we magnify the same by 2 times we obtain the original square. Take

a circle, the closer we magnify the circle the flatter its curve tends to get, hence a circle is not a self-similar shape. This same concept can be applied to any differentiable curve, i.e., no differentiable curve is self-similar (except a line). A self-similar set is one which would be invariant under more than one similarity transformations. The dimension of a self-similar object is called as similarity dimension. Now take 3 figures, having known dimensions, line ①, square ②, cube ③. Break the line into 4 equal parts, where each part is $\frac{1}{4}$ th the original, now let length = 1, so to obtain the original line we take the no. of broken lines ($N=4$) and multiply it by the amount with which we scaled it down ($\frac{1}{4}$) to the power 1, i.e., $4 * (\frac{1}{4})^1$ would give us 1. The one which is in the higher power is defined as the

dimension of an object. Mathematically the formula can be defined as $d = \frac{\log(N)}{\log(1/r)}$. Applying this formula to that of a square, 4 subdivisions and scaled down twice, then $d = \frac{\log 4}{\log 2} = 2$. Now, one of the properties of dimensions is that each whole dimension has a specific lebesgue measure attached to it. Lebesgue measure is a method of assigning measures to n -dimension Euclidean space (for $n=1, 2$ and 3 its length, area and volume respectively). Each n th dimension also gets the measures of all values of n preceding it (a square has both a perimeter and an area). Now consider a triangle ABC with P,Q,R being the midpoints of the segments respectively. A new triangle PQR can be formed within ABC, now remove it. Now the remaining 3 triangles also have their respective segment midpoints so we form another triangle within them and remove them, we keep on doing these to obtain a self-similar figure which when

scaled up provides us the original figure,

i.e., each sub triangle when scaled

up by 3 gives us ABC and

each sub-sub triangle

when scaled up by

3 gives us the sub

triangle and so

on. This is an

example of

a sierpinski

triangle. As

we keep on

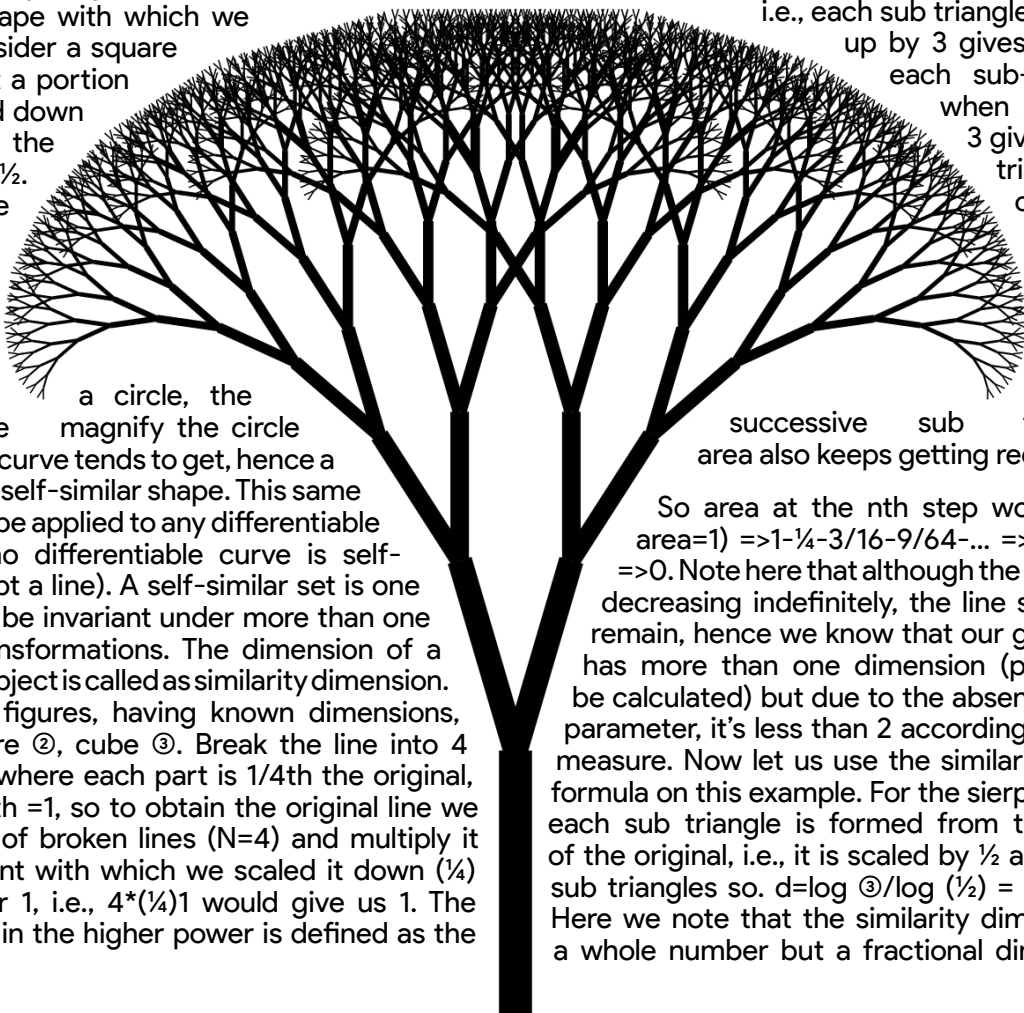
removing

the

successive sub triangles our

area also keeps getting reduced.

So area at the n th step would be (Take area=1) $\Rightarrow 1 - \frac{1}{4} - \frac{3}{16} - \frac{9}{64} - \dots \Rightarrow 1 - \frac{1}{4} \sum (\frac{3}{4})^k \Rightarrow 0$. Note here that although the area keeps on decreasing indefinitely, the line segments still remain, hence we know that our given example has more than one dimension (perimeter can be calculated) but due to the absence of an area parameter, it's less than 2 according to Lebesgue measure. Now let us use the similarity dimension formula on this example. For the sierpinski triangle, each sub triangle is formed from the midpoints of the original, i.e., it is scaled by $\frac{1}{2}$ and we have 3 sub triangles so. $d = \frac{\log 3}{\log (\frac{1}{2})} = 1.585$ approx. Here we note that the similarity dimension is not a whole number but a fractional dimension. This



was an important aspect in Mandelbrot's study of natural phenomena and he coined the term fractals in his book "Fractals: form, chance and dimension". From this book we received the first defined fractal. Fractals had been drawn before Mandelbrot gave his definition. Back in the 1800s, Weierstrass gave the equation for the Weierstrass curve; which is everywhere continuous and nowhere differentiable and when zoomed upon, indefinitely, keeps on giving the original curve.

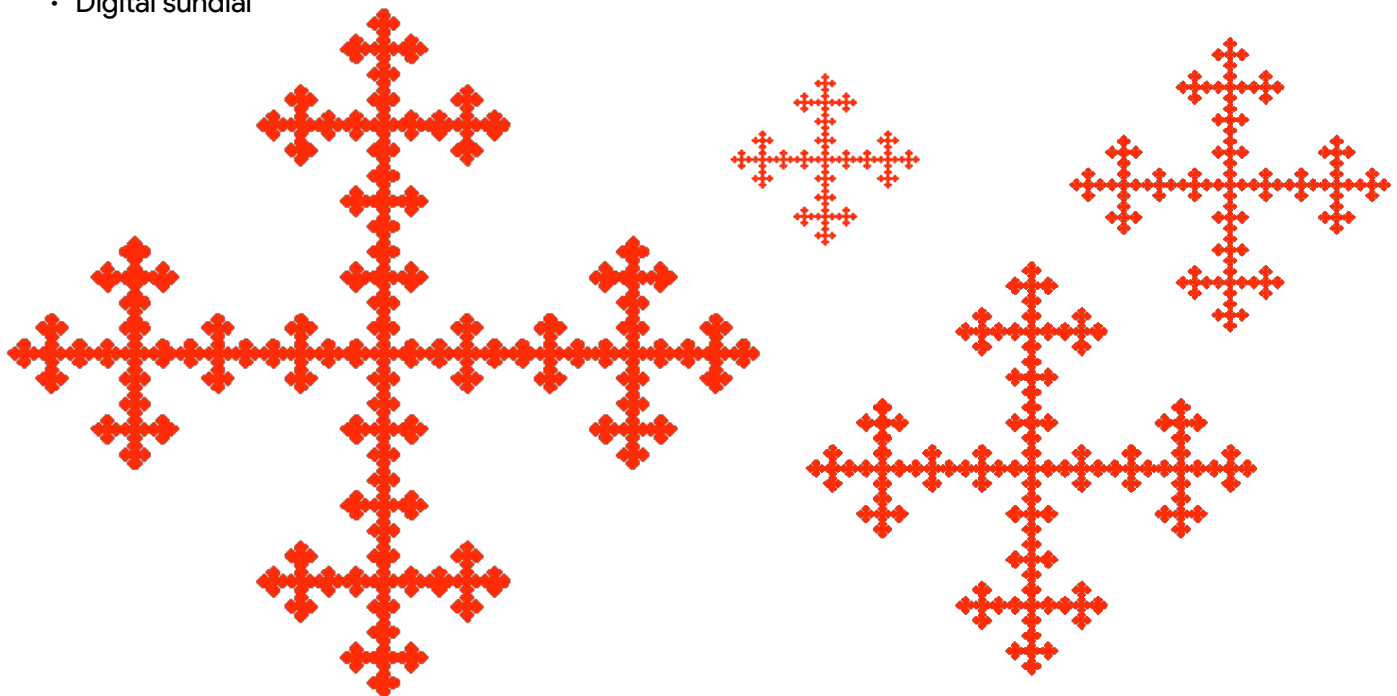
APPLICATIONS OF FRACTALS

Fractals have many uses and applications which include the following broad categories:

- Medical Classification
- Various forms of Music are generated.
- Various forms of art are generated.
- Signal and image compression
- Seismology
- Computer and video game designing, which predominately includes computer graphics for organic environments
- Fractography and fracture mechanics
- Fractal antennas — Small size antennas using fractal shapes
- Fashion in the form of Neo-Hippie T-shirts.
- Generation of patterns for camouflage, such as MARPAT
- Digital sundial

CONCLUSION

We learnt that Fractals are a unique blend of mathematics and art. They tend to showcase several different properties in its vast multitude of examples. They have infinitely repeating patterns which is the reason they are so useful. Why? Because, it allows fractals to store infinite amount of data. We see how infinitely complex patterns arise in the Mandelbrot and Julia sets with only a single equation and the application of such a property in the modern world is immense. It ranges from the technical fields of computer graphic imagery to the world of biological sciences and so many more. Just to give an example of its practicality, earlier biologists used traditional objects and series, under Euclidean representations, to model different aspects of nature. Such as sine waves for heart rates, cell membranes as curves or simple surfaces, conifer trees as cones etc. These figures were useful but were limited to the amount of specification. As I mentioned earlier, fractals have the property of being able to hold infinite amounts of data. Now since Biological structures have been found to portray multiple levels of substructures with the same general pattern repeating indefinitely, Fractals looked like the right way of representation. As mentioned by Kenkel and Walker in 1993, Fractal proved to be a unifying theme in biology as it allowed for us to generalize the fundamental concepts of dimension and length measurement. Many scientists agree that fractal geometry is a powerful tool for uncovering the secrets of the universe. The list of known fractals systems is quite long and still continues to grow.





by Shivani Joshi

The developments in digital technology have revolutionized the way we used to define communication. Packet switching has made it possible for globally connected systems to exchange data in a matter of seconds. Wi-Fi (Wireless Fidelity) has made it possible to connect multiple devices over a network which can communicate without cables. But due to its extensive use, radio wave spectrum available is getting reduced. With advancements in Internet of Things, a large number of devices are getting connected on the network. It is estimated that around 50 billion devices will be connected to the internet by 2020. The capacity of Wi-Fi is on a downward scale. To overcome this, a new technology known as Li-Fi has been developed recently. Li-Fi (Light Fidelity) is high speed bi-directional networked communication technology which uses light as source of data transmission. It is comprised of multiple light bulbs that are used to form a wireless network. Li-Fi is capable of providing functionalities similar to that of Wi-Fi. This technology was proposed by Harald Haas, who is a professor of Mobile Communication at University of Edinburgh. Li-Fi is claimed to produce data at rates much higher than Wi-Fi.

Working of Li-Fi

Li-Fi uses light as medium of data transmission because gamma rays, X-rays, UV rays and Infrared rays pose some or the other potential threat to human body. Radio waves have the capability to penetrate through walls, that raises safety concerns. Thus, visible light is the only option which can be practically used. The bandwidth available is 360 nanometers, which is quite large as compared to radio waves. An added advantage is that visible light is available in abundance in our immediate vicinity most of the times. So, no extra will be incurred in infrastructure. Li-Fi uses LED bulbs which can perform rapid data transmission.

When current passes through LED bulb, it emits photons. By modulating the light at different

rates, intensity of photons can be changed. This modulation allows us to send different data. At sender's end, it uses signal processing element to send data. On the receiving end, signals are received by photo-receptors which interpret the variation in intensity to convert it to data that is eventually visible on electronic devices. The intensity modulation is so high that it is not noticeable to the human eyes. A Li-Fi enabled smart device will have a light emitter to send data and a photo detector that will work as receiver. The device will re-establish its connectivity every time it moves from one light source to another.

The Two Sides

Li-Fi has numerous advantages over Wi-Fi. Some of which are mentioned below-

- **Speed:** Li-Fi technology can develop signals at a high rate which can be used to send data by small changes in amplitude. It is claimed that Li-Fi is about 100 times faster than Wi-Fi.
- **Bandwidth:** The radio frequency spectrum that is extensively used by Wi-Fi, might create a spectrum shortage. Due to limited bandwidth availability, Wi-Fi gets more congested and the spectrum of radio waves will reach its saturation if used at such high rates. Li-Fi resolves this issue by providing a long range of bandwidth of the visible light for usage.
- **Infrastructure:** Since most of the rooms at homes and workplace have LED lights, they can be used as sources for data transmission. The infrastructure can provide access to high data rate. This makes deployment of Li-Fi implementable at a large scale.
- **Wider Applications:** Other than conventional usages, Li-Fi can also be used in areas which are otherwise restricted for Wi-Fi. Radio waves cannot be used in airplanes, power plants and hospitals as they can create electromagnetic interference. At such places, Li-Fi can be used instead. Solar cells can be integrated with vehicles and roofs by using sunlight as the source there.

However, there are some downsides as well-

- **Availability of light source:** Li-Fi needs light for data transmission. Thus, it cannot be used in places where there is no light source.
- **Limited Range:** Li-Fi is a line of sight

communication technology. Since light cannot penetrate through walls, the range of the signals is restricted by the physical barriers. Thus, any opaque obstacle would cease the data transmission.

- Interference from other light sources: Although light waves do not interfere with radio waves, yet it might interfere with other sources of light.
- Compatibility of devices: Electronic devices such as cell phones and laptops are equipped with hardware required for connecting to Wi-Fi. But they do not have necessary specifications to connect to Lifi. So, it cannot be directly used with currently available devices in the market.

CONCLUSION

Li-Fi has the potential to bring revolution in wireless communication stream wherein we can

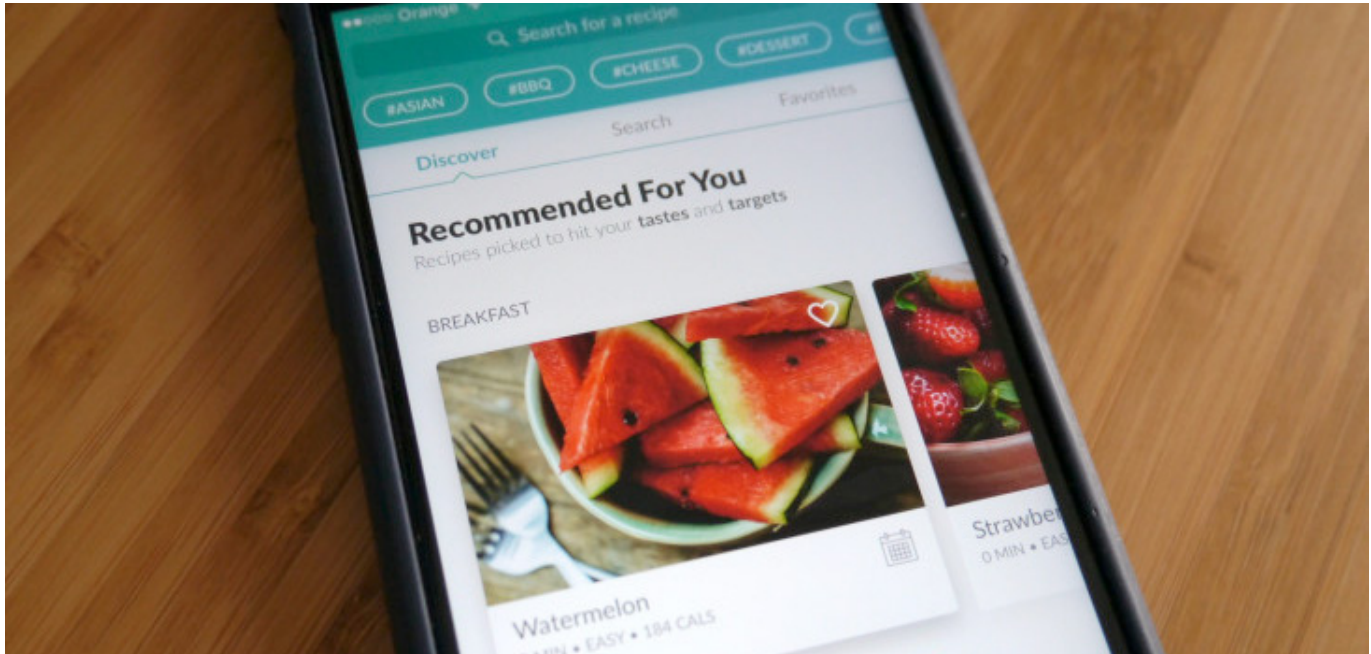
leverage on a source that is available in abundance in our immediate vicinity- light. Some of the top players of the world have already started thinking in the direction of incorporating this technology in products and services. Microsoft has started the work to implement Lifi solution at its innovation Centre in France. The iOS 9.1 is known to find mentioning of 'Lifi Capability' in its library cache. It is also working on hardware implementations for wireless light communication. However, Li-Fi will not replace Wi-Fi completely. Public area networks are best supported by Wi-Fi. Lifi cannot be used to transmit data beyond physical barriers. Devices need to be redesigned in order to make them Li-Fi compatible. Hence, Li-Fi will not entirely eradicate the usage of Wi-Fi, but will be a complementary technology to be used in closed areas for data transmission in order to save the bandwidth of radio waves.





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AI AND NUTRITION



by Akshat Goyal

In 2050, there will be nine billion people on Earth which implies that we need to produce 70% extra food, which is a lot of food as compared to now. The bizarre thing is that 50% of food production, which is full of nutritional value, is thrown away before it reaches the plates.

Owing to this fact, around 85% of the organisations have planned to adopt digital technology (AI) in their food production lately.

Artificial Intelligence usage was very limited before, but now it's slowly becoming a part of our daily lives. In the last few years, it was incorporated into multiple sectors including media, education, transportation, healthcare, gaming, finance, marketing, and now food.

The food industry is getting involved in AI technology rapidly. From selecting the products for the cooking process to analysing food's freshness to detecting the level of cleanliness of the cooking space, Artificial Intelligence brings a lot of benefits to this industry as well.

It can help to optimize operations, improve offerings, deliver a better customer experience

and better products. That obviously will increase customers' expectations for food to be always healthy and fresh even more. Besides that, the usage of Artificial Intelligence should stop the battle of finding the perfect mix of cost, taste, appearance and of course, healthiness of the food. That's the main reason why food companies are investing a lot in safety and quality controls, as well as in storage, distribution, raw materials and ingredients.

Recently, the government has committed to double the farmers' income by 2022. The Chief Minister of Maharashtra, Devendra Fadnavis, has launched 'Maha Agritech', a project in which area under cultivation from sowing to harvesting, climate and disease on crops will be monitored digitally using satellite and drone technology. Around 1.5 crore farmers will be brought on digital platform under this program.

Did You Know?

IBM Watson has a 90% success rate in diagnosing cancer as compared to 50% success rate of Human doctors.

VR AND GAMING

by Sparsh Chandra

Put on those goggles, go nowhere and be transported anywhere. Virtual Reality is basically an organic experience at its core. It's man meets machine, literally, but when the magic unfolds, it's strictly within the mind.

The definition of Virtual Reality comes, naturally, from the definitions of both 'virtual' and 'reality'. The word 'virtual' is described as near and 'reality' is what we experience as human beings. So, the term 'virtual reality' basically means 'near-reality'. This could, of course, mean anything but it usually refers to a specific type of reality emulation. Virtual Reality (VR) literally makes it possible to experience anything, anywhere, anytime. It is the most immersive type of reality technology and can convince the human brain that it is somewhere it is really not.

The exact origins of virtual reality are disputed, partly because of how difficult it has been to formulate a definition for the concept of an alternative existence. The promise of the idea was shrouded, concealed under clunky visuals. But the concept was worth pursuing, and others did (especially the military, who have used virtual reality technology for war simulation for years). The utopian ideals of a VR universe were revisited by a small crew of inventors in the late '80s and early '90s.

The vision simply did not match the means. In the mid-'90s, VR as an industry, was basically closed up. Though still used in the sciences, those eager to bring VR to the masses found themselves overshadowed by a glitzier, more promising technological revolution: the Internet.

Then come 2011, Palmer Luckey, a kid born during the waning days of VR's late-20th-century golden era, put the pieces together using improved technology. He raised some money and soon developed the Oculus Rift, his own version of a clunky headset. The graphics were still basic but the experience was, surprisingly, lifelike. For the first time ever, one could casually wander through a comically realistic



rendering of Monica Gellar's apartment or hack a zombie to death. It didn't really matter what you did inside the goggles, really, just the act of immersion was awing. In 2014, someone at Facebook got the memo, and they purchased Oculus wholesale for \$2 billion, signalling a promising, if unclear, future for virtual reality.

VR is best understood by first defining what it aims to achieve - total immersion. Total immersion means that the sensory experience feels so real, that we forget it is a virtual-artificial environment and begin to interact with it as we would naturally in the real world (e.g. walking around the streets of Hogwarts or shooting space aliens on a foreign gravity less planet).

Key Elements of a Virtual Reality Experience:

- ① Virtual World
- ② Immersion
- ③ Sensory Feedback
- ④ Interactivity

But how many of us would have a complex brain operation carried out by a surgeon trained in VR? How many of us would rather practice our driving on a car simulator before we set foot on the road? Or sit back and relax in a Jumbo Jet, confident that our pilot practiced landing at this very airport, dozens of times, in a VR simulator before she ever set foot in a real cockpit? This is still a big question mark.

As virtual reality continues to boom, it also opens

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new doors in the gaming industry. Gaming has come a long way since its early days when Atari introduced the home version of pong in 1972. Although 2D and 3D games continue to hold a fair share of the gaming industry, the future of gaming fits in snugly with the new breed of VR platforms. Advances in hardware, as well as software refinement is taking VR gaming to increasingly practical levels. The conventional 2D and 3D games pale in comparison to the interactive and immersive experiences offered by VR gaming platforms.

Integration of virtual reality has revolutionized the gaming industry. Many of latest video games are driven by VR technology, creating a much more realistic game play. Most importantly, VR has enhanced the user experience, bringing closer the virtual and real world. With the help of VR, it is now possible to create hyper-realistic gaming environment. Over the years, gaming consoles have also evolved, VR games require special gloves, glasses and head mounted displays that make for a superior gaming experience. Some of the gaming environment are completely inspired by real time environment, making them highly pragmatic in nature. The aforementioned factors are prompting game developers to integrate VR in their products.

Gamers, a group that consistently demonstrates an affinity for anything cutting-edge that promises to transform the gaming experience, are more than eager to jump on the virtual reality train and revisit their favourite pastime with the help of a VR headset. Virtual reality gives gamers what they have long been looking for: an experience more immersive than ever. A significant aspect of the gaming culture is about reinventing yourself and experiencing challenges and situations you would never have the chance to in real life. The added level of being able to actually act within this world via hand controls only further improves how “real” it can feel for the user. With VR gaming reaching more users more easily, video game development companies are taking advantage of the opportunity to experiment

with new possibilities. At their core, video games are stories, and when developing technology is introduced, stories evolve. This means there are whole new ways for games to be enjoyed.

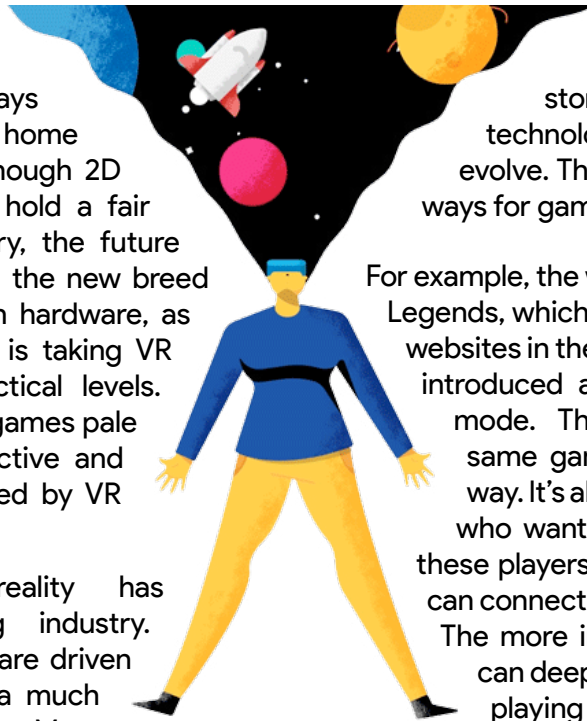
For example, the wildly popular game League of Legends, which has one of the best-designed websites in the gaming industry, has recently introduced a 360-degree view VR arena mode. This allows players to enjoy the same game they love in a whole new way. It's also a huge draw for new players who want to explore VR gaming. As all these players join VR games together, they can connect with one another in new ways. The more immersive gaming experience can deepen player connections. People playing video games across the world, feel as if they're standing right next to each other.

VR gaming is still in its early stages and is still building for the future. As developers continue to push VR forward and new games come out, we'll get closer to seeing VR's full potential in games. 2018 wasn't the best showcase of that, but developers are still investing the time into VR platforms, and we're hoping that comes to light in 2019.

The promise of VR has loomed large over the world of computing for at least the last quarter century—but remains largely unfulfilled. The 2014 acquisition of VR company Oculus, by Facebook, greatly renewed interest in the area and could change everything. Facebook's basic idea is to let people share things with their friends using the Internet and the Web.

What if you could share not simply a photo or a link to a Web article but an entire experience? Instead of sharing photos of your wedding with your friends, what if you could make it possible for people to attend your wedding remotely, in virtual reality? What if we could record historical events in such a way that people could experience them again and again, forever more?

If so, the future of virtual reality looks very bright indeed!



SELF DRIVEN CARS

by Garima Sobti

A self-driving automotive, conjointly called a mechanism automotive, autonomous automotive, or driverless automotive, could be a vehicle that's capable of sensing its atmosphere and moving with very little or no human input.

The pros of autonomous cars are many. The sensors in a self-driving car are always observing, remain unaffected by the state of the driver, and can scan in multiple directions simultaneously. Potential benefits include reduced costs, increased safety, increased mobility, increased customer satisfaction and reduced crime. Safety benefits include a reduction in traffic collisions, resulting injuries and related costs, including insurance. Automated cars are predicted to:

- Increase traffic flow
- Provide increased mobility for youngsters, the old, disabled, and the poor
- Relieve travellers from driving and navigation chores
- Increase fuel efficiency of vehicle
- Significantly reduce needs for parking space
- Reduce crime and facilitate business models for transportation as a service, especially via the sharing economy.

While technologies and science continue to evolve toward making self-driven vehicles a reality, there are some hurdles. Right now, autonomous cars are in use only in a few U.S. states, as regulators weigh how to best guarantee their safe interaction with customary human-driven vehicles. Self-driving capability



will add benefits to our whole society, such as providing transportation for people who are otherwise not able to drive because of age or physical impairment.

While design and external details may vary, most self-driving systems create and maintain an internal map of their surroundings, based on a wide array of sensors, like radar. Software then processes those inputs, plots a path, and sends instructions to the vehicle's "actuators" which control acceleration, braking, and steering. Hard-coded rules, obstacle avoidance algorithms, predictive modelling, and "smart" object discrimination help the software follow traffic rules and navigate obstacles.

Driverless cars used to be the sort of thing you'd see in sci-fi films - but in 2018 they're becoming a reality. Autonomous car technology is already being developed by the likes of Lexus, BMW and Mercedes, and we've even tested Tesla's driverless Autopilot system on UK roads. Across the Atlantic, Google is developing its automated technology in the wild, and Apple is rumoured to be working with BMW on its own - probably automated - car. With so much investment and interest in driverless technology, it's easy to assume that self-operating cars are imminent, but they're much further away than we might think. Before our roads are flooded with driverless vehicles, manufacturers must tackle a range of technical and ethical challenges, and combat the biggest threat to autonomous technology: human.

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Environmental impacts are a serious concern, and a major uncertainty. Accessible, affordable, and convenient self-driving cars could increase the total number of miles driven each year. If those vehicles are powered by gasoline, then transportation-related climate emissions could skyrocket. If, however, the vehicles are electrified—and paired with a clean electricity grid—then transportation emissions could drop, perhaps significantly. Self-driving cars are already exploring the difficulties of determining the intentions of pedestrians, bicyclists, and animals, and models of behaviour must be programmed into driving algorithms. Human road users also have the challenge of determining the intentions of autonomous vehicles. Possible technological obstacles for automated cars are:

- Artificial Intelligence is still not able to function properly in chaotic inner-city environment.
- A car's computer could potentially be compromised, as could a communication system between cars.
- Susceptibility of the car's sensing and navigation systems to different types of weather (such as snow) or deliberate interference, including jamming and spoofing.
- Avoidance of large animals requires recognition and tracking, and Volvo found that software were suited to few animals and not for all of them.
- Autonomous cars may require very high-quality specialised maps to operate properly. Where these maps may be out of date, they would need to be able to fall back to reasonable behaviour.
- Field programmability for the systems will require careful evaluation of product development and the component supply chain.
- Current road infrastructure may need changes for automated cars to function optimally.

Automation levels in driverless cars

The U.S. National Highway Traffic Safety Administration lays out six levels of automation, beginning with humans doing the driving through driver assistance technologies up to fully autonomous cars.



LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
The human driver does all the driving.	An advanced driver assistance system (ADAS) on the vehicle assists the human driver.	The vehicle's ADAS can control both steering and braking/accelerating simultaneously under some circumstances. The human driver must continue to pay full attention and perform all other driving tasks.	An automated driving system (ADS) on the vehicle can perform all driving tasks under some circumstances. In those circumstances, the human driver must be ready to take the wheel and drive outside of those set circumstances.	An ADS on the vehicle can perform all driving tasks and monitor the road in certain circumstances. The human doesn't have to pay attention in those circumstances.	An ADS on the vehicle does all the driving in all circumstances. The human occupants are just passengers and are never involved in driving.

QUANTUM COMPUTING

by Palak Jain & Samriddhi Saxena

Our current “classical” computers can solve simple problems pretty quickly but when it comes to large and much more complex optimization problems which require exponentially stronger computational power, even our supercomputers fail miserably. These problems, which could essentially take billions of years to be solved on our classical computers, can be solved in a matter of few minutes, hours or days through Quantum Computers.

Quantum Computers have the potential to conquer the world’s toughest challenges. These quantum computers can revolutionize healthcare, energy sector, aviation sector and much more.

WHAT IS QUANTUM COMPUTING?

Quantum Computing is an area of study focused on harnessing quantum mechanics properties of “superposition” and “entanglement” to process information. In simple words, it can perform certain kinds of computation more efficiently than a classical computer.

WORKING

A classical computer refers to any non- quantum computer which stores information in the form of long strings of ‘bits’ i.e. the binary digits 0 and 1. A classical bit holds the data either as a 0 or 1 at a time.

A quantum computer, on the other hand, stores and processes data through quantum bits or ‘qubits’. These qubits are basically subatomic particles such as photons or electrons capable of holding positions not only as 0 or 1 but also as 0 and 1.

A quantum computer works on the principle of superposition and entanglement which form the basics of quantum mechanics.

SUPERPOSITION

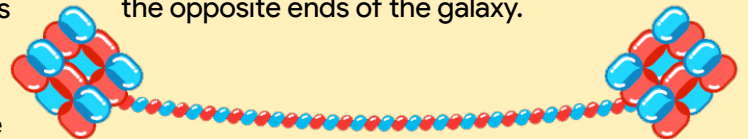
The ability of qubits to exist in two states simultaneously is known as superposition. Therefore, each qubit, when in superposition, can exist as 0 and 1 at the same time. This helps in processing multiple options simultaneously. A

quantum computer can do 2^n computations at a time in a single operation, where n is the number of qubits present. So, when a quantum computer works with several qubits in a superposition, it can process the information in a fraction of the time that even the fastest supercomputer in the world would take to solve that problem. We get the final result of the computation when the qubits are “measured” which results in the collapsing of the quantum state to either a 0 or 1. These qubits can be put in a superposition using microwave beams.

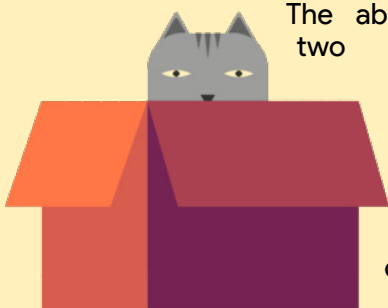
This can be understood with the famous example of Schrodinger’s Cat. In this case, a living cat is first placed inside a thick lead box. At this point, there is no doubt that the cat is indeed alive. Then we throw a vial of cyanide in the box and seal it. Now, we do not know whether the cat is alive or it has broken the vial of cyanide and died. Hence, at this stage, the cat is both alive and dead i.e. it is in a superposition of states. It is only when we “measure” the result and open the box, we get to see whether the cat is alive or not. This is the collapse of superposition state.

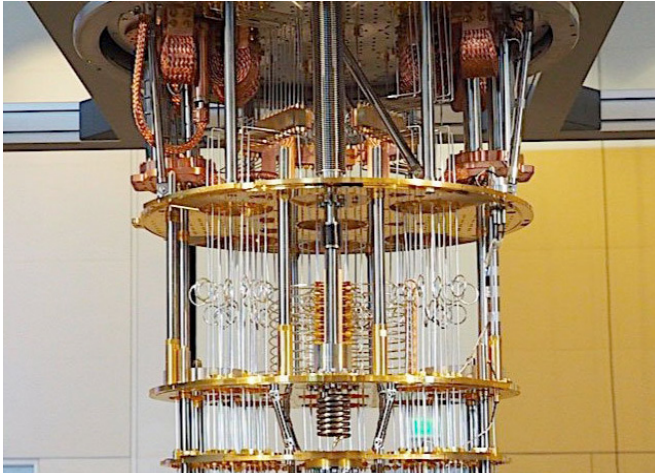
ENTANGLEMENT

Another property of qubits is that of entanglement, wherein, two qubits on physical interaction get tied together in such a manner that they remain intimately connected even after being separated by great distances. So, if the state of one of the qubits changes, it will automatically change the state of the other qubit as well in a predictable way. Hence, a perfect correlation exists between the particles even at the opposite ends of the galaxy.



So, using the properties of superposition and entanglement, quantum computers compute the data on the basis of algorithms (a basic set of instructions representing a problem solving approach). These algorithms are significantly different from that of a classical computer and make use of quantum properties to find the solution to the problems which are beyond the computational capability of a classical computer.





THE CHALLENGE

The qubits, in their quantum state, are extremely fragile. Even the slightest disturbances in the quantum system such as vibrations or changes in temperature (called “noise”) can cause the quantum computation to collapse even before the job is properly done. This is known as de-coherence. This is why the qubits are placed in super-cool fridges and vacuum chambers (at temperatures colder than intergalactic space) to isolate them from any external interference during computation phase.

Despite all the efforts, noise still disturbs the calculations sometimes. Since isolating a quantum system is so difficult, error correcting algorithms are being developed for quantum computations.

POTENTIAL APPLICATIONS

While classical or conventional computers could take tens of billions of years to solve the world's most complex problems, quantum computers would be able to do so in a matter of minutes, hours or days. They can spur the development of significant breakthroughs in various fields:

- **Cryptography**

The very basis of present day encryption including RSA encryption and the method used to encrypt our credit cards is the factorization of a number into very large prime numbers (300+ integers) which is very difficult (though not impossible) for even the best classical computers to do. Hence, our bank accounts remain protected.

With quantum computers, this factorization and decryption would become trivial, somewhat jeopardising some aspects of classical cryptography. However, it would also lead to the development of much stronger forms of encryption such as “private keys” used for

encrypting messages sent from one location to another.

Quantum computing poses a dire threat to the blockchain technology. Blockchain technology uses asymmetric cryptography as a security mechanism which is based on prime numbers and factors. Since quantum computers, using their superposition properties, can factorize large numbers, they can easily crack this cryptography, thereby shaking the very foundation of blockchains.

- **Tackling World Hunger**

By 2050, the population of our planet will reach 9.5 Billion. Hunger is already a big challenge in many of the developing and underdeveloped nations. And in the coming years, feeding the global population might become the biggest challenge we come across.

To improve the fertilizers and make the chemical reaction work, we need a catalyst along with high pressure and temperature. But, there are just too many possibilities of experimenting with different catalysts. Finding the best catalyst would take centuries on our fastest computers. With the assistance of quantum computers, chemists can identify the best catalyst that would help in increasing the food production. This solution requires the ability to model molecular interactions, something the classical computers are not capable of handling.

- **Aviation**

Quantum computing could enable complex computer modelling like aeronautical scenarios, to speed up the design of aircrafts and debug millions of lines of software codes. Airbus is actively researching and investing in this technology to compute the most fuel conserving ascent and descent paths.

- **Forecasting**

According to statistics, nearly 30% of US GDP is directly or indirectly affected by weather. The ability to predict weather would prove extremely beneficial to many fields such as food production and transportation and help in disaster management as well.

Scientists have long been working to develop equations which can help predict weather. But such equations contain many variables which make the calculations too complex for classical

computers. However, running these equations on a quantum computer can enable us to develop better and more accurate climate models.

- **Medical Research**

The drug market today is an industry worth billions of dollars. It often takes 10+ years and billions of dollars for pharmaceutical companies to discover new drugs and bring them to the market. Using quantum computing, we can analyse and compare the compounds to create new drugs. It will also help in dramatically cutting the costs.

Quantum Computing can also result in more effective radiotherapy. By taking all the variables into account, it can find the best possible treatment for a given patient, leading to a much faster and precise result.

Proteins are usually present in the folded structure. Our understanding of the physical structure of proteins, which can lead to better understanding of human life and development of new drugs, is very less. A quantum computer can simultaneously test various possible fold structures and identify the most promising ones much faster than a classical computer.

- **Self-Driving Cars**

Self-Driving cars are the future. They not only cut pollution, reduce congestion, but also raise the standard of living of most of the people. At present, Google and Volkswagen are using quantum computers to develop self-driving technology. The performance of electric-vehicle batteries can also be improved by simulating their chemical composition through quantum computers.

- **Reducing Energy Loss**

Standard conductors like copper, are resistive and thus lead to loss of energy, as heat, during transmission. Quantum computers can help to look for materials which can be used to develop high temperature superconductors which can conduct electrical energy without any loss during transmission. This is beyond the powers of the computers we use today due to the high level of complexity involved.

- **Optimisation Problems in Machine Learning**

Machines know whatever information is fed to them in the form of codes. But at times, it is difficult to define the 'essence' of certain objects in computer code. This is where machine learning comes in. Machine learning refers to the ability

of computers to learn and improve from past experiences without any explicit instructions or programming. Quantum computing can help accelerate the progress in machine learning by helping to recognise the 'essence' of objects by detecting the recurring patterns in huge amounts of data. This is very difficult for classical computers as the process involves study of enormous amount of data and potential combinations of data, which far exceeds the computational capabilities of a classical computer.

Quantum computing is still at an infant stage and predicting its application decades from now is limited only by our imagination. This revolutionizing technology has a potential which cannot even be properly comprehended at this stage. It can do wonders in various sectors of our life. The possibilities that lie ahead are limitless.

HOW FAR HAVE WE COME AND WHAT DOES THE FUTURE HOLD?

In the early 1980s, Richard Feynman (a Nobel Prize-winning physicist) and Yuri Manin came up with the idea of 'Quantum Computers' i.e. a computer based on quantum mechanics, with the potential to stimulate things that a classical computer couldn't. This idea remained mainly theoretical until Peter Shor, in 1994, invented an algorithm to factor large numbers on a quantum computer, which could be used for decryption of secure communications in a matter of seconds.

In 1998, at the Oxford University, the first quantum computer with only 2 qubits was developed by Jonathan Jones along with theoretical input from Michele Mosca.

Several companies like IBM, Intel, Google, Microsoft and other tech heavyweights have tirelessly been investing on the R&D of quantum computers.

In March 2017, Google announced its plan to achieve 'quantum supremacy' with a 49-qubit computer by the end of 2017. In November 2017, IBM announced that they have built a 50-qubit quantum chip prototype. In January 2018, Intel joined the race by unveiling a 49-qubit quantum chip.

In March 2018, Google blew IBM's 50-qubit processor, out of the water, by presenting the world's largest 72-qubit processor quantum computer.

This being said, a future where we have quantum computers to make complex calculations, which are far beyond the reach of today's computers, possible is still at least a decade away.

ONLINE GAMBLING

by Gurleen Kaur Gandhi

"Gambling is the sure way of getting nothing for something."

Gambling is the wagering of money or something of value often referred to as "the stakes" on an event with an uncertain outcome with the primary intent of winning money or material goods. A startling fact is that gambling is not at all a new concept, but has been a part of human activities since they lived in caves. The first ever physical casino was built in 1638 in Italy!

But let's fast forward to around 300 years, when the world gave birth to Online Gambling in 1994. Online gambling, more commonly known as **Internet gambling**, is typically betting on casino or sports type games over the Internet. This illegal practice began in the United States and is running in full-force till date not only in the U.S. but has also spread its roots to various countries including India. Majorly these Internet gambling sites are operated by small virtual companies which are located in remote countries where there is little or no government intervention so that they don't have to pay any taxes.

Thanks to the Internet, online gambling takes many forms, some of which are listed below:

- **Poker:** The game of poker simply played over the Internet becomes Online Poker.

- **Casinos:** Online casinos, also known as virtual casinos or Internet casinos are online versions of traditional ("brick and mortar") casinos. Online casinos enable gamblers to play and wager on casino games through the Internet. It is a prolific form of online gambling.

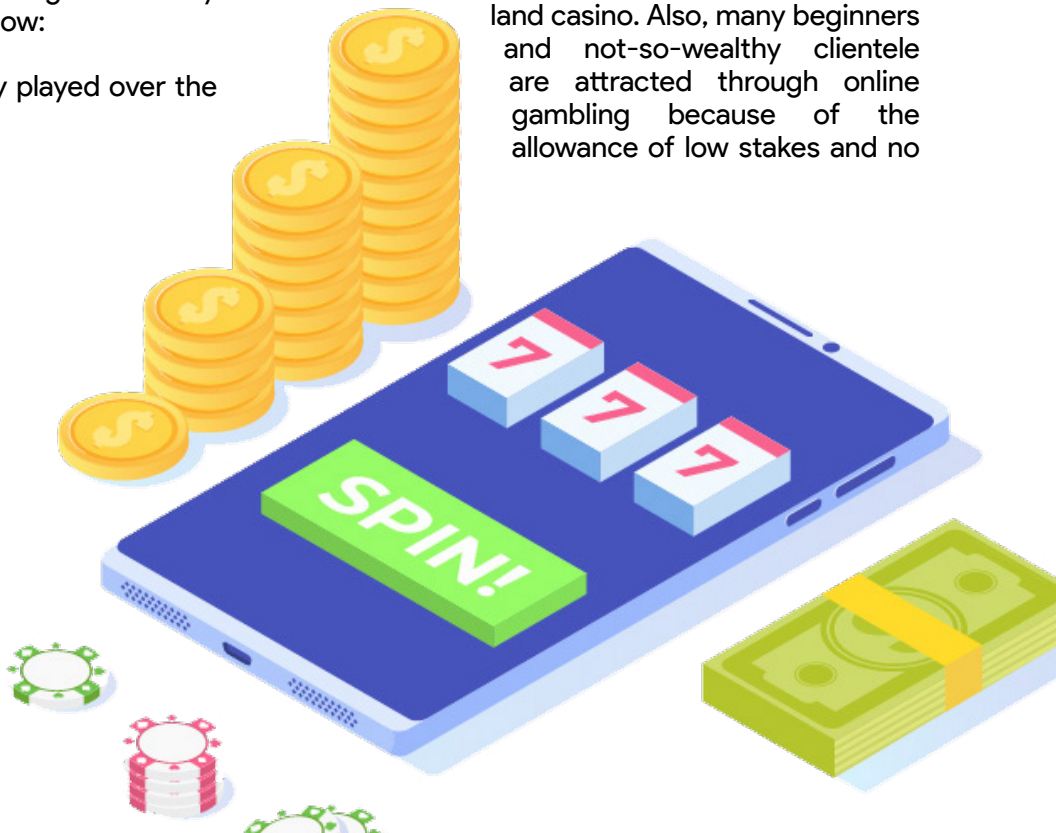
- **Bingo:** Online bingo is the game of bingo played on the Internet and it was launched in 1996. Unlike balls used in regular bingo halls, online bingo sites use a random number generator. Most bingo halls also offer links to online poker and casino offerings as the patrons are often in the target market.

The reasons for rise in online gambling can be attributed to the traditional casinos being quite unnerving, especially for amateur players. Moreover, the locations of casinos can be quite geographically unapproachable. Yet another reason for the surge in Internet gambling is the high opportunity costs that tag along with traditional gambling, not to mention the high time charges.

In contrast, online gambling is quite cheaper mainly because of low overhead costs, for example, setting an extra table on online avenues does not take valuable space like it would for a land casino. Also, many beginners and not-so-wealthy clientele are attracted through online gambling because of the allowance of low stakes and no

Did You Know?

90% players choose to play online slots while only 10% of all the players have remained faithful to land-based and offline casinos.



entry fee.

But the question that arises is that, 'How can an illegal activity as such be practiced on such a large scale?'

The answer to this is that that online gambling falls into a legal grey area. Technically, online gambling is illegal, but accountability of individual players is very difficult as they are playing from different locations. While within the U.S., it is illegal for gambling sites to operate, there are many countries who allow setting up shops there, like Australia, Denmark, Finland, Germany etc.

When we talk about India, only three states allow casinos - Goa, Daman and Sikkim. Critics of gambling claim that it leads to crime, corruption and money laundering, while proponents of regulated gambling argue that it can be a huge source of revenue for the state. For example, casinos in Goa contributed Rs. 135 crores to the state revenue in 2013.

Online gambling is in its infancy in India, but Sikkim planned to offer three online gambling licenses in 2010. This failed despite India being the most sought out country for online gambling. Sikkim also permits an online lottery, which takes bets from players throughout India. It was expected that other states would follow Sikkim, thereby opening up a major online gambling market throughout India.

Talking about markets, it is evident that the companies do not let themselves miss on even a single opportunity! During the recent years, there has been a rise in Mergers and Acquisitions in the online gambling industry. The factors causing this change include saturation of the market, consolidation in fragmented markets and a greater desire for economies of scale. Examples of these M&As are FanDuel acquired by Paddy Power Betfair, Yoyo Games acquired by Playtech, PartyGaming merged with Bwin (to create Bwin.Party) and the list goes on and on.

But there is an urgent need to address the widespread presence of online gambling as it is quite riskier than it seems. With online gambling, access to one's bank account is always only a click away - which makes the likelihood of impulse betting and "chasing losses" much greater compared to locations where one must physically withdraw money from a bank machine. This encourages the player to bet more and more money which increases his/her risk of losing even more. One of the common tricks used by online casinos is to offer a demo version of their games. This is done with the objective to introduce new players to the game and make them feel comfortable placing real bets with real money after they have had some success with the demo version. The success of new players is ensured by inflating the odds to favor the player and making him win when he is gambling with play money, so that he assumes that he'll be successful with real money as well. But of course, the odds are changed as soon as real money is involved.

Another danger that lies in online gambling is that it is very difficult to remember that electronic money is still real money. Many a time, various deceptive opponent practices turn the players into a victim. For example, it is possible that several players are together in a particular location and sharing information, so that they have an edge over other players. It is quite commonly seen that many unaware players might provide personal

information or credit card details to fraud gambling websites and make themselves vulnerable to a high risk of identity theft and credit card fraud.

All in all, gambling, whether online or offline is an addiction. It destroys homes, marriages and relationships. It can lead to depression, bankruptcy, blackmail and what not.

Let's remember that the safest way to double your money is not gambling, but folding it and putting it back in your pocket!



HOW NOKIA LOST THE SMARTPHONE BATTLE

by Anustha Puniyani

Nokia's agreement in 2013 to sell its handset business to Microsoft for \$7.2 billion demonstrates just how far, and fast Nokia has fallen in recent years.

It is not that long ago, when it was the world's dominant and pace-setting mobile-phone maker. In October 1998, Nokia became the best-selling mobile phone brand in the world; to losing it all by 2013, the story of its dramatic downfall has become a case study for business management classes. The statistics show that despite being the world's leading brand, accounting for more than 50% back in the 1990s and early 2000s, it got drastically reduced to as little as 3% of the global smartphone market, and its market cap is one-fifth of what it was in 2007.

While its journey to the top was swift, and its decline being equally so, it seems quite tempting to put the blame for Nokia's demise at the doors of Apple, Google and Samsung. But is it really like that? While we all keep note of our existing competition, we should not forget to observe the upcoming threats in the market. The failure to analyze the market correctly, only led to Nokia's own failure in the market. Ignorance isn't bliss at all, when ignoring the million-dollar rival Apple proved as fatal to its health.

Consumer is and will always be the pivot point of the market of a product, whether it is the market of a safety pin or an airplane. Nokia took for granted, the change in demand pattern of consumers from traditional to touch, app based phones, thus clearing the way to its downfall. It did spend money on R&D, but failed to convert it into phones, that people want to buy.

Obsolescence of Symbian system, the launch of iOS was like an attack on the roots of the company, the attack which it couldn't sustain and gave up at completely. Also, Nokia gave more importance to its hardware domain, than to its engineers. The lack of market savviness proved as a blind spot.

It is always the human resource that makes the company what it is. If the top management is afraid to take action, mismanages and is reluctant to take actions on technological inferiority, out of organizational fear, how can one expect anyone, whether insider or outsider, to save it on a rainy day?

Until 2015, Nokia had released enough disappointing phones in the market, making people critically denounce its existence as well as rebirth (in 2013). The truth is, brands today aren't as resilient as they used to be.

Late and inadequate: for Nokia, it was a deadly combination.





MATHEMATICS

ARE DIFFERENTIAL EQUATIONS APPLICABLE IN REAL LIFE?

by Vedant Gupta

Ever wondered while studying Differential Equations, or for that matter, any other topic included under Calculus like Trigonometry, Limits, Integration and many more, that will these complex mathematical equations and formulae really help me in real life? Will they really aid me in day-to-day activities or am I just studying them just for the heck of it, to get good grades? Yes, you must have wondered this for sure. Every student who studies these topics in higher mathematics faces these questions. This article aims to answer many such questions by explaining the real life applications of Differential Equations.

What are Differential Equations?

A differential equation may be defined as an equation consisting of a function and one or more of its derivatives. But in a layman's language, they can be explained differently. In this world, things change, and how they change often ends up as a differential equation.

Differential equations have a remarkable ability to predict the world around us. It might not be easily identifiable but differential equations are all around us. In fact, they are so vital in some fields that their presence is almost indispensable. Although you may not sit down and solve problems of differential equations on a daily basis, but their understanding really helps us in the understanding of how the world functions.

Some applications of Differential Equations

Differential Equations, as discussed above, have applications all around us. We do not use them in our day-to-day life, unlike addition, subtraction etc., but they find usage in a wide variety of disciplines

ranging from medicine & physics to economics and many more. They can describe exponential growth and decay, the population growth of species or the change in investment return over time. Some of their most prominent applications are listed below:

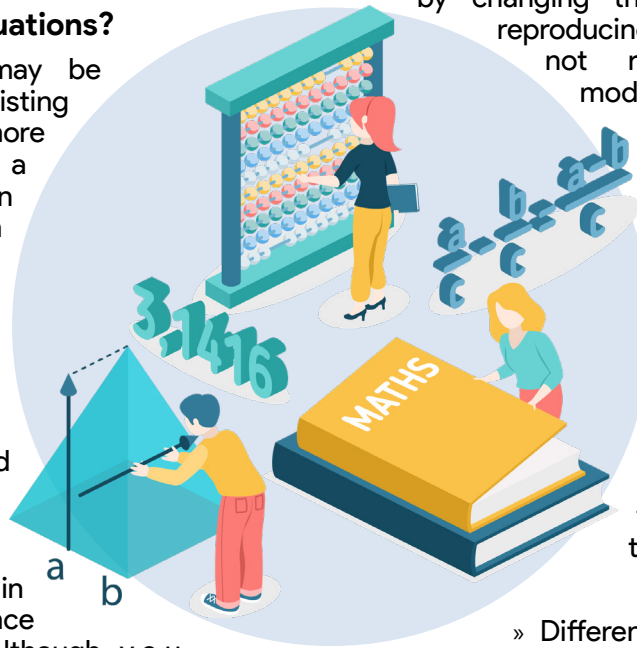
1. **Medicine:** In medicine, differential equations are used for modelling cancer growth or the spread of a disease. The modelling for tumour growth can be divided into two different categories: probabilistic and deterministic. Probabilistic model describes a set of measurement to evaluate the behaviour of individual cells, and deterministic model explains the behaviour of large populations of cells and their growth by changing the state from an actively reproducing cell to a cell that is not reproducing. Mathematical modelling is an essential tool that provides the way of comprehending tumour growth and response to chemotherapy in both these categories and the mathematical models are created, in turn, through ordinary and partial differential equations.
2. **Engineering:** Differential equations find a number of applications in the field of engineering. Some of them have been listed below:

» Differential Equations are used to understand computer hardware. This comes under electrical engineering.

» A constraint logic programme is an essential component in civil engineering. It is a logic which contains constraints in the body of clauses. It is designed through differential equations.

» Ordinary and partial differential equations help to provide shape to interior and exterior designs of machines, which comes under mechanical engineering.

» Space flight engineers frequently use differential



equations when planning for long missions. To launch an exploratory probe, they consider the different orbiting velocities of the Earth and the planet the probe is targeted for, as well as other gravitational influences like the sun and the moon.

3. **Chemistry:** Chemical kinetics refers to the study of rates of chemical reactions. Differential equations play a central role in the mathematical treatment of chemical kinesis. The rates of change are measured by using differential equations. Moreover, computing radioactive half-life is also done through differential equations. A radioactive half-life refers to the amount of time it takes for half of the original isotope to decay. For example, if the half-life of a 100.0 grams sample is 4 years, then in 4 years, only 50 grams would remain. During the next 4 years, 25 grams would remain and so on. This calculation of ascertaining the value of decaying isotope comes under differential equations.
4. **Economics:** Differential equations find their application in the study of consumer preferences from the differentiable point of view. The consumer's preferences are denoted by the marginal rate of substitution. From this well-defined variable, we solve a first order ordinary differential equation in order to determine the indifference map for consumer's preferences. Differential equations are also used by investors to find optimum investment strategies.
5. **Physics:** In the field of physics, differential equations find application in explaining various laws, which includes the factor of rate of change of some commodity.
 - » **Newton's Law of Cooling:** From experimental observations it is known that the surface temperature of an object changes at a rate proportional to its relative temperature. That is, the difference between its temperature and the temperature of the surrounding environment. This is known as Newton's Law of Cooling. Differential Equations are applied to calculate the rate so mentioned.
 - » **Newton's Second Law of Motion:** Through this law, motion of a body is described by its position and velocity as the time varies. This law allows one to relate the position, velocity, acceleration and various forces acting on the body and state this relation as a differential equation for the

unknown position of the body as a function of time.

- » Moreover, differential equations can also be used to describe the motion of waves and pendulums.

6. Some more common applications:

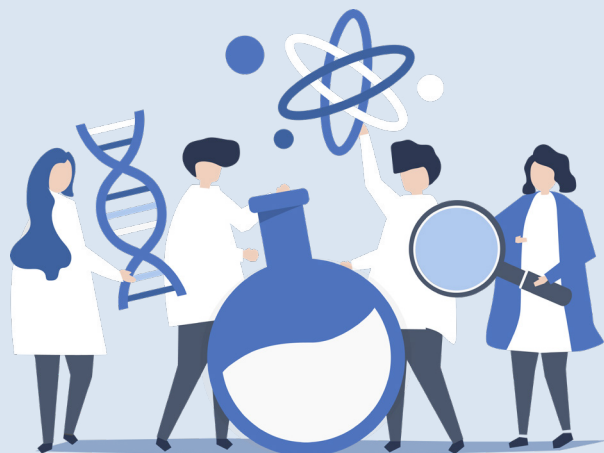
Differential equations also find some applications in everyday objects that we use. The electrical equipment we use is designed by using differential equations. So is the case with cars, bikes, and for that matter any vehicle we use.

Another important application of differential equations is in determining population growth. They help in answering questions like what the population of a town will be in 10 years, or when is the human race likely to face extinction? Moreover, keeping a track on money flow or circulation in the economy comes under its purview.

Conclusion

Considering the fact that so many applications of differential equations have been listed in this article, the question that mainly arises is whether it is really worth studying the topic of differential equations, as almost all of its applications are in highly technical fields, and are not in the scope of a common man. Differential equations might not be used in our day-to-day activities but they surely are used in the making of objects, directly or indirectly, which are used in our day-to-day activities.

As a result, it can be said that a proper understanding of them does no harm, even if we do not intend to pursue a career in that field. It is only a small step towards understanding the proper functioning of the world at grass root level, as it gives us useful insights into how things are actually done.



ALGEBRAIC TOPOLOGY

by Alish Dhaked

Algebraic topology is a very unique branch of mathematics that includes the study of shapes and uses tools from abstract algebra like vector algebra, to study topological spaces. Topological spaces throw a different meaning that makes circle and ellipse similar. This is because it includes the process of deformation to change the shape but not cutting. Thus a circle is equivalent to a square, rectangle, ellipse or any other similar shapes that makes this equivalent through reshaping the objects. One of the main ideas of algebraic topology is to consider two spaces to be equivalent if they have 'the same shape'. We define Algebraic topology as the study of techniques for forming algebraic images of topological spaces. More often, these algebraic images are groups but more elaborate structures such as rings, modules, and algebras also arise.

The algebraic topology consists of many fields that include Homotopy, Cohomology etc. Homotopy groups are used in algebraic topology to classify topological spaces. The first and simplest homotopy group is the fundamental group, which records information about loops in space. Intuitively, homotopy groups record information about the basic shape, or holes, of a topological space.

Cohomology is defined as the abstract study of cochains & cocycles. Cohomology can be viewed as a method of assigning algebraic invariants to a topological space that has a more refined algebraic structure than homology which consists of basic shapes.

TOPOLOGY AND GEOMETRY

Often geometry and topology are considered a bit similar. However, they do have differences. Geometry deals with shapes, relative positions, sizes of figures and properties of space such as curvature while topology studies the properties of space that are preserved under continuous deformations, this means stretching and bending but not cutting or gluing.

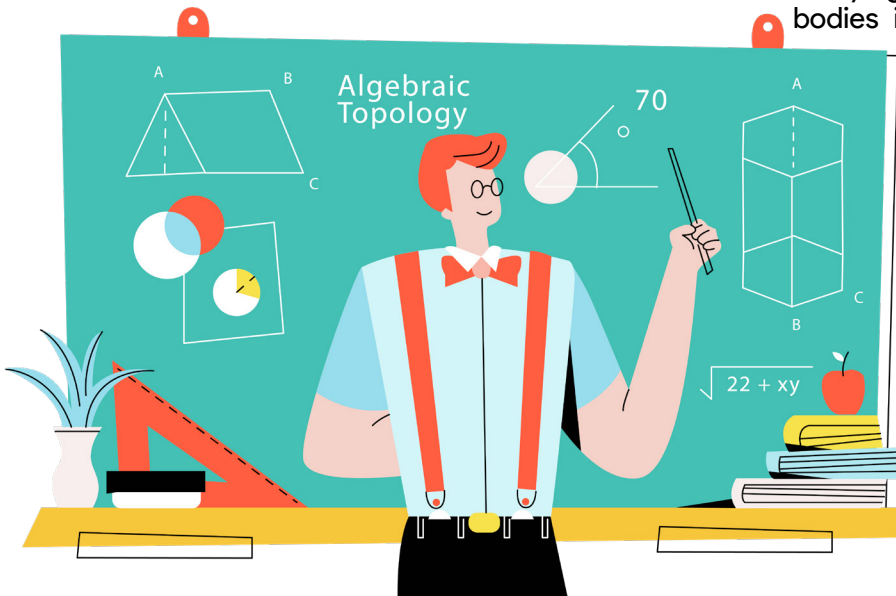
For example, for a topologist, a sphere and a bowl are the same, since you can deform one into the other. A coffee cup and a donut are also equivalent; they both have one hole. But a sphere and a donut are not the same since you can't deform continuously one into the other.

For a geometer, a sphere and a bowl are definitely not the same, since curvature changes and so does the metric and so on.

Thus, Geometry is the study of length, angle, area, and volume. Topology is the study of connection. Geometry will tell you how long and what direction a path between two points will be whereas topology tells you whether there is a path between two points!

SIGNIFICANCE

One of the strengths of algebraic topology has always been its wide degree of applicability to other fields. Topology has seen its applications even in geology, geography and astronomy, especially for studying the fabric of the space-time and heavenly bodies in relation to it. Recently, a paper named 'Black Hole' disproved the conjecture that has been made to save black holes. The paper was completely topological. Knot theory, another subfield of topology apart from homotopy and cohomology, is used to study the DNA and the enzymes that take part in the genetic processes. In various engineering fields like mechanical, electrical etc., topology of a conducting surface is necessary to study its behaviour. Thus, topology has its relevance in various fields and has abundant scope of research in the field of mathematics.



MÖBIUS KALEIDOCYCLES

by Garima Sobti

The simplest kaleidocycle is a ring of an even number of tetrahedron. Tetrahedrons are pyramids with equal edges and equilateral triangles as sides. The Tetrahedron are connected on perpendicular edges. A similar kaleidocycle can be constructed from eight triangular pyramids, but there's a catch: rather than rotating in one distinct way, such an eightfold kaleidocycle can move in various ways. These additional "degrees of freedom" make the object move in a wobbly fashion, rendering it less useful in application. Schönke and Fried wondered if they could create a new kaleidocycle with seven, eight, nine or more elements that still retained the classic single degree of freedom.

What makes it special is that you can continually twist it inwards or outwards while it shows different sides of each tetrahedron. Kaleidocycles represent a class of mechanisms which have potential in applications of engineering design due to their unique combination of characteristics: they are continuously rotatable mechanisms, they have the ability to possess multiple stable equilibrium states with a variety of characteristics, and they can be designed as compliant mechanisms. An understanding of kaleidocycle behaviour, especially the ability to characterize their stable equilibrium properties, has the potential of leading to new compact devices not previously possible. This can be particularly useful in applications, such as switches, relays, and autonomous sensors. They also stand as a way of improving durability in applications where detents are currently used to achieve multiple stable states.

Kaleidocycles are found where science, math, and art meet. The objects resemble geometric sculptures that might be found in a modern art museum, but it is the motions they can undergo that really capture

the imagination. The mesmerizing objects inspire wonder in all those who see them — including curious engineers and mathematicians.

Researchers at the Okinawa Institute of Science and Technology Graduate University (OIST) have now unveiled a new class of kaleidocycles. They could spur advances in fundamental research, synthetic chemistry, and even robotics. They published a paper describing the objects, called Möbius Kaleidocycles, on December 19, 2018, in the Proceedings of the National Academy of Sciences of the United States of America. Dr. Johannes Schönke and Professor Eliot Fried created a variety of Möbius Kaleidocycles with different numbers of hinges from folded paper and 3D printed materials. They call them Möbius

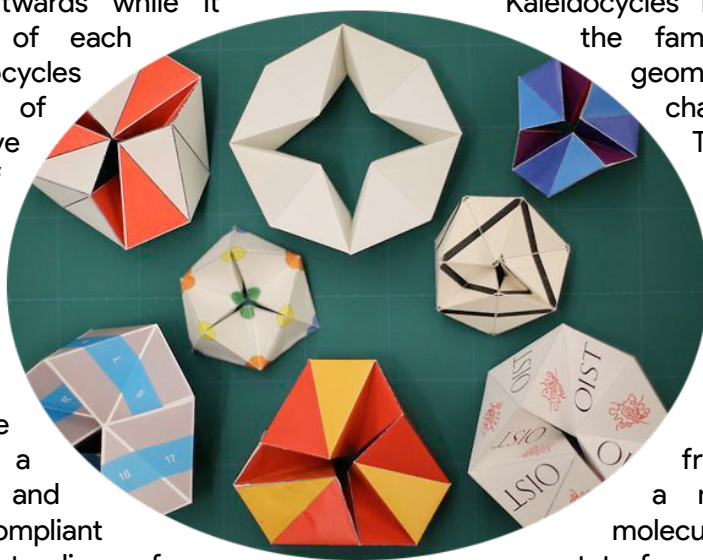
Kaleidocycles because they resemble the famous Möbius band, a geometrical object with a characteristic topology.

These mystifying objects can be turned inside-out continuously and have unique mathematical properties. A chemist could potentially synthesize molecules based on Möbius Kaleidocycles because friction is negligible on a molecular scale, those molecules could essentially rotate forever and would likely have

an extremely high heat capacity.

Due to their unique properties, Möbius Kaleidocycles could be used for a diverse range of applications. The researchers propose that the objects might form the basis for designing new mixing machines, energy transmitting devices, or robotic arms. A classical kaleidocycle made from six triangular pyramids can be moved in only one specific way, so researchers were interested in finding other ring linkages with that property but they weren't sure if such objects could be constructed.

Based on this research, Schönke designed an





interactive visualization tool to further explore the movements of Möbius Kaleidocycles. With a few precise folds and some glue, a flat sheet of paper can be transformed into a classical kaleidocycle. The realized object consists of six identical triangular pyramids joined together by hinges like those of a revolving door. When the two ends of this chain of pyramids are linked, the angle between neighbouring hinges is exactly 90 degrees. This precise relationship makes it possible for classical kaleidocycles to turn inside-out with perfect threefold symmetry.

Individual Möbius Kaleidocycles could be designed to function as self-propelling submarines, capable of collecting water samples or monitoring marine life. The objects can also be joined together to create new deployable devices – objects that function by changing shape, such as umbrellas or solar panels on spaceships.



P vs NP PROBLEM

by Manan Surana

The P vs NP problem is one of the seven Millennium Prize Problems selected by the Clay Mathematics Institute, each of which carries a US \$1,000,000 prize for the first correct solution.

Polynomial Time

Time complexity is the computational complexity that describes the amount of time it takes to run an algorithm. Since an algorithm's running time may vary among inputs of different sizes, the worst-case time complexity is commonly considered, which is the maximum amount of time required for inputs of a given size. An algorithm is said to be of polynomial time if its running time is upper bounded by a polynomial expression in the size of the input for the algorithm, i.e., $T(n) = O(n^k)$ for some positive constant k . Cobham's thesis states that polynomial time is a synonym for 'tractable', 'feasible', 'efficient' or 'fast'.

The selection sort algorithm is an example of polynomial time algorithm. It performs n^2 operations on n integers for some constant A .

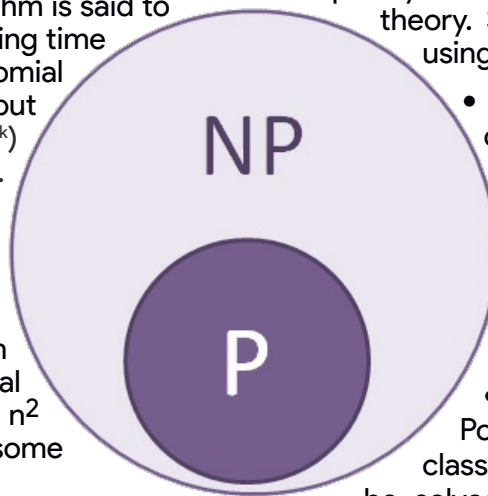
In some contexts, especially in optimization, polynomial time is differentiated between **strongly polynomial time** and **weakly polynomial time** algorithms. These two concepts are only relevant if the inputs to the algorithms consist of integers.

An algorithm is said to run in **strong polynomial time** if:

1. The number of operations in the arithmetic model of computation is bound by a polynomial in the number of integers in the input instance; and
2. The space used by the algorithm is bound by a polynomial in the size of the input. Strongly polynomial time is defined in the arithmetic model of computation. In this model of computation, the basic arithmetic operations

(addition, subtraction, multiplication, division, and comparison) take a unit time step to perform, regardless of the size of the operands. An algorithm which runs in polynomial time but which is not strongly polynomial is said to run in **weakly polynomial time**. A well-known example of a problem for which a weakly polynomial-time algorithm is known, but is not known to admit a strongly polynomial-time algorithm, is linear programming.

The concept of polynomial time leads to several complexity classes in computational complexity theory. Some important classes defined using polynomial time are the following.



- **P** (polynomial time)- The complexity class of decision problems that can be solved on a deterministic Turing machine in polynomial time. In other words, problems for which a deterministic polynomial time exists.
- **NP** (Nondeterministic Polynomial Time)- The complexity class of decision problems that can be solved on a non-deterministic Turing machine in polynomial time or the problems for which it is quick to check the solution but not quick to solve the problem.
- **ZPP** (Zero-error Probabilistic Polynomial Time)- The complexity class of decision problems that can be solved with zero error on a probabilistic Turing machine in polynomial time.
- **RP** (Randomized Polynomial Time)- The complexity class of decision problems that can be solved with 1-sided error on a probabilistic Turing machine in polynomial time.
- **BPP** (Bounded-Error Probabilistic Polynomial Time)- The complexity class of decision problems that can be solved with 2-sided error on a probabilistic Turing machine in polynomial time.

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As seen in the above list, there are other complexity classes apart from P and NP but these two are seemingly the major ones.

A simple example for P and NP problem can be - Suppose that you are organizing housing accommodations for a group of four hundred university students. Space is limited and only one hundred of the students will receive places in the dormitory. To complicate matters, the Dean has provided you with a list of pairs of incompatible students, and requested that no pair from this list appear in your final choice. This is an example of what computer scientists call an NP-problem, since it is easy to check if a given choice of one hundred students proposed by a co-worker is satisfactory (i.e., no pair taken from your co-worker's list also appears on the list from the Dean's office), however the task of generating such a list from scratch seems to be so hard that it becomes nearly impractical. Indeed, the total number of ways of choosing one hundred students from the four hundred applicants is greater than the number of atoms in the known universe! Thus no future civilization could ever hope to build a supercomputer capable of solving

the problem by brute force; that is, by checking every possible combination of 100 students. However, this apparent difficulty may only reflect the lack of ingenuity of your programmer. In fact, one of the outstanding problems in computer science is determining whether questions exist whose answer can be quickly checked, but which require an impossibly long time to solve by any direct procedure. Problems like the one listed above certainly seem to be of this kind, but so far no one has managed to prove that any of them really are so hard as they appear, i.e., that there really is no feasible way to generate an answer with the help of a computer. Stephen Cook and Leonid Levin formulated the P (i.e., easy to find) versus NP (i.e., easy to check) problem independently in 1971.

*Cobham's thesis asserts that computational problems can be feasibly computed on some computational device only if they can be computed in polynomial time.

**a mathematical model of a hypothetical computing machine which can use a predefined set of rules to determine a result from a set of input variables.



VISUAL MATHEMATICS

by Gurleen Kaur Gandhi

Mathematics, as a subject, turns out to be quite a phobia for a lot of students. When the numbers begin to combine with alphabetical letters, the fear reaches its pinnacle. But with mathematics being present in our daily lives from calculating the expenditure on oranges to calculating the angles for a craft exercise, we can't undermine its importance. So the question is, how to understand Maths easily? Luckily, we have a solution: Visual Mathematics.

What is Visual Mathematics?

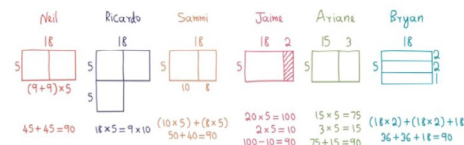
Mathematics is a subject that allows for precise thinking, but when that precise thinking is combined with creativity, openness, visualization, and flexibility, then the mathematics comes alive. Visual representation in mathematics involves creating and forming models that reflect mathematical information. Visual mathematics is an important part of mathematics for its own sake and new brain research tells us that visual mathematics even helps students learn numerical mathematics.

Applications

As explained ahead, it is often assumed that solving problems visually is a thing that is taught and used only in primary classes but that is not at all true! Visual mathematics can be used to solve all levels of problems as explained below:

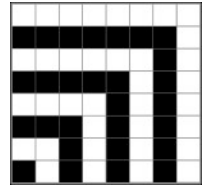
Primary level:

Consider the problem 18×5 . There can be many ways in which the question can be interpreted as given in the picture below.



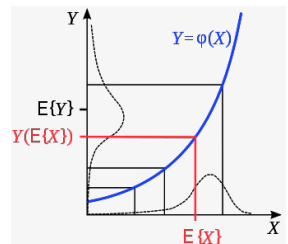
Secondary level:

We all have learnt that **sum** of any set of consecutive **odd numbers** starting with 1 is always equal to the square of the **number** of digits that were added together. But visual mathematics can give a proof of this statement without using words! As it can be seen in the picture, that the first black square is formed by 1 block, and 1 is the first square. Similarly, next strip of white squares shows how adding 3 more blocks make the next square, i.e., four.



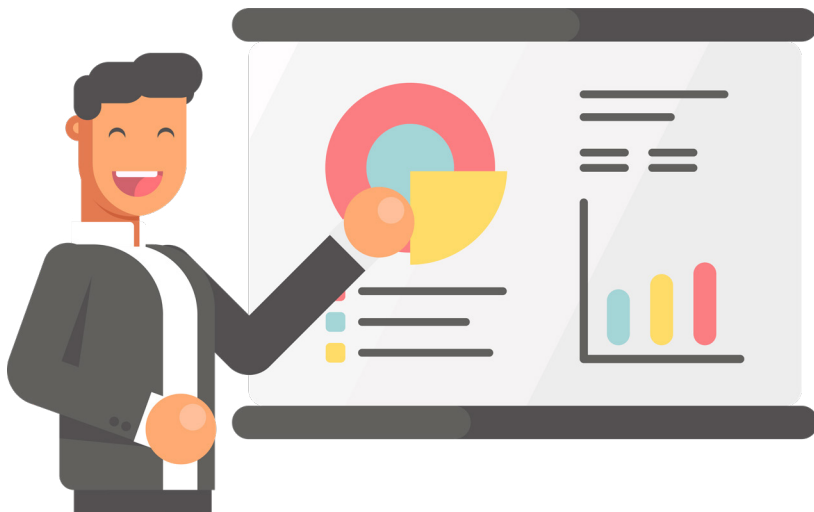
High level:

Even Jensen's inequality can be proved using visual proof. As seen in the figure, the dashed curve along the X axis is the hypothetical distribution of X, while the dashed curve along the Y axis is the corresponding distribution of Y values. It is evident that the convex mapping $Y(X)$ increasingly "stretches" the distribution for increasing values of X.



Scope

Visual mathematics should be gaining more importance, especially in schools, due to the nature of the knowledge needed for today's high-tech world. Years ago workplace knowledge was based on words and numbers, but the new knowledge of the world is based largely on images, that are 'rich in content and information'. Most companies now have large amounts of data, known as "big data" and the largest growing job of the future is the



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task of making sense of the data, including seeing data patterns, visually. Such activities not only offer deep engagement, new understandings, and visual brain activity, but they also show students that, mathematics can be an open and a beautiful subject, rather than a fixed, closed and impenetrable subject. Visual mathematics is not important only for some students - struggling or so called “visual” thinkers, nor is it only a prelude for abstract mathematics - visual mathematics is important for everyone, at all levels of mathematics.

It is hardly surprising that students feel that mathematics is inaccessible and uninteresting when they are plunged into a world of abstraction and numbers. The problem of mathematics in schools is it has been presented, for decades, as a subject of numbers and symbols, ignoring the potential of visual mathematics for transforming students’ mathematical experiences and developing important brain pathways.

Why not take the example of two geniuses, Albert Einstein and Thomas Edison who were constantly being written off by teachers and being labelled as “stupid”? Einstein often shared that all of his thinking was visual and he struggled, later, to turn his visual ideas into words and symbols. Visual mathematics is widely thought of as being appropriate for younger or struggling students and as a prelude to the “more important” abstract mathematics. It is true that abstract ideas can come from and be aided by visual mathematics, but visual ideas can also come from abstract mathematics and extend them to much higher levels. They can also inspire students and teachers, to see mathematics differently, to see the creativity and beauty in mathematics and to understand mathematical ideas.

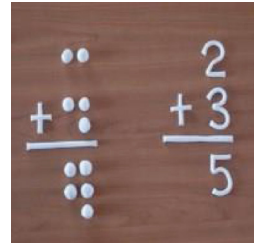
Words: A Barrier to Dyslexics

Almost all of us are familiar with Ishaan Awasthi’s problem in the famous Bollywood movie ‘Taare Zameen Par’. But are we working on it? Are we making the lives of other such Ishaan Awasthis easier?

Children with dyslexia have difficulty using and understanding symbols and

words, especially small function words of language which do not have a meaning that can be easily pictured, or which have multiple meanings depending on concepts. Concepts of time, sequence and order may seem like French to them. In even simple math problems, the numbers might be transposed, like 36 is seen as 63 by the child but word problems involving a set of variables wreaks havoc on them. The letters of the words might be seen in the reverse order or they might miss vowels in the problem. But it has been observed that most dyslexic students have strong visual and spatial reasoning skills so learning maths visually becomes quite easy for them.

Instead of asking $2+3$, children should be given beads to calculate the answer. This minimises the risk of numbers being transposed or vowels being missed in the words, and ensures the proper learning of the concept.

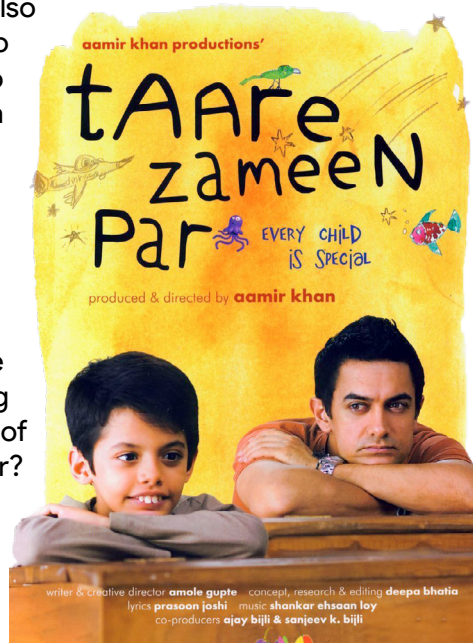


Facts and Figures

- Researchers found that after four 15-minute sessions of playing a game with a number line, differences in knowledge between students from low-income backgrounds and those from middle-income backgrounds were eliminated.
- One yet-to-be published study from Stanford, with children between the ages of 8 and 14, showed that, as children get older, they develop part of the ventral visual pathway. The study also showed an important and increased interaction between the two visual pathways.

This indicates that as children learn and develop, the brain becomes more interactive, connecting the visual processing of symbolic number forms, such as the number 10, with visuo-spatial knowledge of quantity, such as an array of dots or another visual representation.

Considering the Brain Science as well, the scientists have developed a more nuanced understanding of the ways through which our brain works when we study and learn mathematics. They highlighted the importance of



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student learning numerical knowledge through linear representation and visuals. All the studies show that these visuals help students raise their ability to achieve.

It's high time now and there is a requirement of modification in the way the education is imparted and at the same time, the learner's approach and attitude towards the subject. Teachers are to play a big role in this Visual mathematical learning. When they use more of pictures, models, cartoons, graphs and doodles to represent mathematical ideas, it will actually make a big difference.

Various upcoming educational apps such as BYJU'S are actually helping things to turn around by making maths more interesting and appealing in visual form.

The BYJU'S Raveendran says that "Use of technology can help make mathematics visual and contextual, which will help students understand not just the 'what' of learning, but the 'why and how' as well."

The importance of improving mathematics education in India is crucial, as in every field the core is based upon the fundamentals of mathematics. Therefore, it is very important to establish mathematical concepts right from the formative years of a student. Students should have a deep and solid understanding of the subject and ability to utilize it in routine problems.

The speed of solving a mathematical problem is not what should be considered but how creative solution is brought up by the students is upon what they should be judged. Strong mathematics learners are those who think deeply, make connections and visualise the things.

If the students are encouraged to look at maths more visually, it could actually make them smarter! Whether we like it or not but the fact is that the brain processes number of images representing the space and quantity. And for understanding the immense impact that this multidimensional subject creates, we need to change the approach towards Mathematics.

Conclusion

Mathematics learning needs to become more visual - there is not a single idea or concept that cannot be illustrated or thought about visually. Elementary school is often obsessively numerical, ironically more than higher-grade levels. Students are made to memorize mathematical facts, and plough through worksheets of numbers, with few visual or creative representations of mathematics or invitations to work visually, often because of policy directives and faulty curriculum guides. By the time most students leave elementary school, they have developed the idea that visuals and manipulates are babyish, fingers should never be used, and mathematical success is about memorizing numerical methods. Some scholars note that it will be those who have developed visual thinking who will be 'at the top of the class' in new high-tech workplaces that increasingly draw upon information visualization technologies and techniques. It is important not to prioritize any 'one type of learner' over others or even to give the idea that it is productive to take one learning approach and focus upon it. We need to encourage this broad development in mathematics now and we urgently need to expand the ways we think about mathematics, and to learn it as the visual and multidimensional subject that it is.



Did You Know?

1 out of 5 people suffer from dyslexia.





COMMERCE

E-GOVERNANCE



by Akshat Goyal and Garima Sobti

The technology has its roots spread everywhere, even the government cannot resist to take advantage of it. The last decade has witnessed popular use of technological services by the government to provide a bundle of services through the internet. E-governance is getting a boost in the convoluted business world. Government to Citizen, Government to Business, Government to Government, Government to Employees, are the components of basic framework of e-governance that is currently in work. Distinguished management scholars have described the concept of e-governance as an emerging and an important activity in the business field.

The first term of the NDA government coming out with GST roll-out is a classic example of Government to Business model of E-Governance. It simplified the taxation system by replacing all the different types of taxes earlier levied in the business transactions. The governments in the last two decades have thrived hard to implement the e-governance models to every sphere of the economy. With success in most of their efforts, the government is looking forward to make every government activity online with high speed and great efficiency.

The newest reform of the government is the scrapping of the charges levied earlier on the NEFT and RTGS transactions. This move aims at boosting the number of RTGS and NEFT transactions. Increase in the RTGS and NEFT transactions will generate more transparency in the business transactions and will bring more tax to the government treasury. Out of the bundle of government services, the key area is that of the railways. Even now, it is the most

convenient and cheapest mode of transport. To make that more convenient, the government rolled out an application named IRCTC (Indian Railways Catering and Tourism Corporation). This application provides services like instant ticket booking, PNR checking, ticket confirmation probability and many more.

Here are some of the major applications developed by the government to facilitate the working of the economy of the country.

PayGov facilitates online payment to all Public Sector Undertakings (PSUs) and major private banks. The facilities of digital signatures, which are treated at par with physical signatures have been provided for taking advantage of E-Aadhaar and PAN services. E-registration for companies have been allowed through a simple and efficient online process.

E-TAAL (Electronic Transaction Aggregation and Analysis Layer) provides real time status on delivery of electronic services.

NOFN (National Optical Fibre network) provides services such as providing birth certificates, death certificates, educational, health as well as insurance and pension schemes specifically covering gram panchayats.

AGRIMARKET app has been developed for farmers to keep them updated with the current crop prices and discourage them to carry out distress sales.

BHIM app has been developed for instant payments which can work even without internet.

E-Sampark is an effort of the government

to connect directly with citizens across India by running mailer, outbound dialing and SMS campaigns. The platform is used for sharing informational and public service messages. MCA21 has been initiated by the Ministry of Corporate Affairs which provides easy and secure access to MCA services for various corporate entities and professional firms.

National Voters Service Portal (NVSP) has been developed to help citizens access voters list, apply for voter IDs online or any corrections thereof.

Passport Seva Projects (PSP) are launched for providing convenience to citizens for successful delivery of passports as well as making identification and verification more accurate.

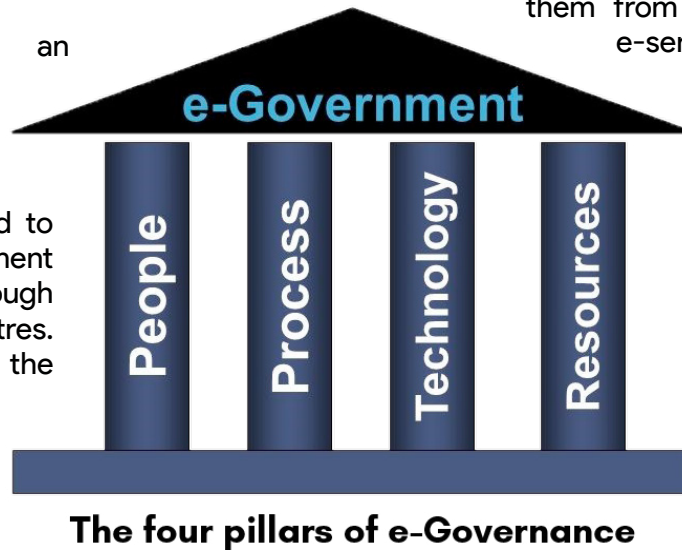
E-Mitra: E-Mitra is an integrated project to facilitate the urban and the rural masses with maximum possible services related to different state government departments through government run centres. The importance of the e-governance lies in the fact that every aspect of the economy has government's role to play in it. This very thing has put a tremendous pressure on the government to deliver, and it left no stone unturned to deliver the same to the public.

Whether the e-governance is a boon or a bane, is still unanswered. But there is no doubt in saying that there has been a great revolution in the workings of the modern governments which has seen mushrooming growth in the usage of internet and technology to its fullest potential. The use of internet and technology not only delivers faster services but also brings more transparency between the government and the citizens. The government will have a better control and administration on the transactions affected by citizens through e-governance websites which

usually require payments through online channels promoting digitalization as well as reducing the scope of corruption leading to fair revenue estimation for tax computation.

Looking on the other side, e-governance has its own failures: One of the key factors in implementing the e-governance is the cost of implementing it which is huge in its initial stages. Due to this, many governments have failed to implement the e-governance framework properly. The government feared that the framework will not yield much output or it can be said that they feared their own implementation. Another major difficulty in implementing such e-governance policies is illiteracy and lack of technical knowledge among citizens which prevent them from gaining benefit of such e-services being provided by the government.

Other than this, Cybercrime has become a barrier in implementing e-governance in many areas and fields of activity as there might be a fear of loss of information due to which the citizens may even lose their confidence in the efficiency and working of government.



For E-governance to be fully operational in India the government just needs to fill the loopholes and India is all set to be a full digitally operated country in terms of government services.

Also, the government needs to form a regulatory body to act as regulator over the information and technology department of the government. In a nutshell, the future looks good for e-governance in India.

Did You Know?

As of 2018, there are 140 countries which offer digital payment for utilities.

FINTECH

by Harshita Jaiswal and Dimpy Rajora



The most recent buzzword in the business domain is 'Fintech' or simply put 'Financial Technology'. In brief, Fintech refers to any technology designed to improve financial activities. Many people may think about fintech as an app which helps them send money to someone without them ever moving out or an app which helps them raise money for their startup easily but fintech is actually greater than that. Technology has always played a key role in the financial sector and without this innovation and evolution, financial sector wouldn't be what it is today. This evolution started way back in 1950s when credit cards were introduced or 1960s when ATMs were launched or where 1970s saw the beginning of electronic stock trading, 1990s was a year for e-commerce businesses. These years of development have revolutionized the financial sector and built a fintech infrastructure so strong which most people never think of but use almost every day.

Despite the critical presence of technology in the financial sector over the years, fintech as an industry is a recent phenomenon and still in its infant stage. The total fintech software and services market in

India was valued around \$8 billion in 2016 and is likely to grow 1.7 times by 2020, according to a NASSCOM-KPMG report. Fintech has brought in a wave of disruption in the financial services and products market which can be loosely categorized into four main segments: 'Financing', 'Asset Management', 'Payments' and 'Others'.

- **Financing** – The most benefitted by this wave are the startups. With apps providing instant loans in seconds, it has become easier than ever to borrow money. Not just taking loans but raising funds too; that is where crowdfunding comes into picture, which is the practice of raising small amounts of money from a large number of people typically via the internet.
- **Asset management** – Investment advisors are undergoing changes and the most momentous change is the growth of 'Robo-Advisors'. They are a class of financial advisors which provide financial advice based on algorithms and assist the investors in reaching at the most suitable and tailor-made decision. They have definitely made the work more transparent and lent a value addition for the smart investors.

- **Payments** - “Fintech is banking’s cooler cousin”
-David Brear

Credit cards, mobile banking, RTGS (Real Time Gross Settlement), etc. have made our life literally heaven but this is not just it; Blockchain technology has taken this revolution to greater heights. Earlier, transactions needed a third party validation but now blockchain has done away with this by providing a cryptographic security. With blockchain comes cryptocurrency, a digital asset which uses blockchain technology. Though India may not accept cryptocurrency as a legal tender, there is no denying the fact that it has brought a disruption and has a very promising future ahead.

- **Others** – Fintech is also used in various other sectors such as insurance for helping customers compare different policies and take a prudent decision.

RISE OF FINTECH IN INDIA

The post demonetization era finally saw a rapid rise in the fintech industry with the strong governmental push for a digital shift. PM Narendra Modi has also pointed towards the significance of digitalization and leading India towards a cashless economy. Government initiatives like digitalized consumer transactions (UPI), mandatory E-KYC for bank accounts, advocating digital platforms like social media and apps have made India strong in its fintech infrastructure and also increased the ease for new startups to flourish. RBI has also been instrumental in enabling the fintech sector. As aptly stated in ‘Fintech in India’, “the objective has always been towards creating an environment for unhindered innovation, expanding the reach of banking services and regulating efficient electronic payment system.” India is leading the charts in the fintech industry as well with 87% adoption in 2019 along with China, as per EY Global Fintech Adoption Index 2019. Moreover in 2015-16, India had more number of new Fintech startups being founded than any other country except China.

David Brear once said:

“Technological innovation will be the heart and blood for the banking industry for many years to come and if big banks do not make the most of it, the new players from fintech and large technology companies surely will.”

Seems like he couldn’t be more right and that too not just for the banking sector.



David Brear

CHALLENGES IN INDIA

- **Financial Ecosystem** - The relationship between Fintech startup and traditional Financial Institutions has changed from contest to cooperation. However, the collaboration rate is quite less. Traditional Financial Institution can’t afford to be left out, else it’s a matter of time before they become Nokia of Finance industry.
- **Regulatory Landscape** - Transparency of regulatory issues and hiring of tech personnel are the key challenges of Indian Fintech space.
- **Consumer Confidence** - Acceptance of various cashless mode of payments were seen after demonetization, still there is a long way to go for the Fintech startups to gain confidence among Indian customers. Moreover, mass awareness is a major roadblock.
- **Cash Market** - Despite the rise in digital transactions by 22% in India post demonetization, India remains a highly cash intensive country. It therefore becomes difficult for the Fintech companies to get data about customers and transactions which are off the book and involve cash.
- **Data security** - It is yet another issue which regulators are concerned about because of the threat of hacking as well as the need to protect consumer’s and corporate financial data. Integration of many other techniques like blockchain management and cryptocurrency is still at a niche stage in India.

PUBLIC OPINION

In a recent study conducted by us, the data revealed things quite differently. When asked about whether blockchain technology has a promising future in India, people made an ambiguous choice. Most of them weren't sure about the future of blockchain technology in India. About 65% believed that online mode of payment is more convenient as compared to cash. However, they weren't sure about their data being safe while making transactions online! When asked if they were aware about the automated financial advisory tools like Robo-Advisors, the facts were quite astonishing. About 55% of people were not aware about Robo-Advisors, 44% were still not sure whether they knew about it or not. The question next in line was regarding the sector which will be most affected by the financial advisory tools. Here, Banking topped the numbers, followed by Asset Management, Securities and Insurance. Next, we asked "To what extent do you think automated financial advice will replace engagement with human advisors for the following types of investors in a time frame of 5 years?" The options were Mass Affluent Investors, High Net Worth Investors, Ultra-High Net Worth Investors and Institutional Investors.

We got the following response :

- About 36% think that it is most likely that automated financial advice will replace human advice.
- 32.3% think it is likely that automated financial advice will replace human advice.
- A small fraction of about 4% believe it will entirely replace human advice.

- A mere 3% think it will not replace human advice in the upcoming 5 years.

As a result, it is very difficult to say whether in a time frame of 5 years financial advice will be fully automated or not since human engagement has always topped the numbers when it comes to advice.

As a result it is very difficult to say that in a time frame of 5 years whether financial advice will be fully automated or not since human engagement has always topped the numbers when it comes to advise.

AN AFTERTHOUGHT

"Would you like to see it one more time? You may have blinked and missed it"

- Tim Cook while launching Apple Pay

Fintech is no doubt the largest emerging industry of the world which is bringing all the technology of the world in one complex environment. Blockchain and Cryptocurrency will surely add the finishing touch to the finance sector and bring the consumers, financial institutions and technology in one loop. Even the traditionally cash-driven Indian economy has responded well to the fintech opportunities which are primarily triggered by a surge in e-commerce and smartphone penetration. As per NASSCOM, Indian fintech software market is forecasted to touch USD 2.4 billion by 2020. Whatever be the future of Fintech, it is definitely worth looking forward to!



MATHS IN COMMERCE

by Aman Srivastava

We all wonder about implications of mathematical knowledge in normal day to day life. We couldn't figure out how proving that "sum of squares of sine and cosine of any angle is equal to one" was ever going to help fetch us a good deal in the marketplace. If the reader is from commerce background, he will find it more relatable since the dreaded trigonometric concepts might have helped others but may not have helped him much. On this note, prioritising Mathematics and scoring must seem a bit dubious and dumb to the readers, but is it so? It is important to note that it is true that Mathematics is everywhere. It also holds an important place in the career of commerce students. How? That's what we are going to discuss through this article.

Thales, a mathematician who introduced the predictive capacity of the subject, through the use of options, did so with respect to harvested crops. He used to predict price hike and calculated the profit he wanted to earn and thus went on to take long position on the harvested crops before harvest. When gambling peaked in 15th-16th Century A.D., mathematicians presented a way to make gambling fair which was not effective enough to ensure victory. This way is known as Probability. Probability, Speculation and Finance go hand in hand and it proves the prima facie worth

of knowledge in Mathematics subject matter in the field of commerce.

Let's start by discussing use of Mathematics in Business Analytics first. Constant monitoring and proper analysis of every component of business leads to the success of business. On that note, we have accounting ratios helping us out with the following aspects of business:-

1. **Profit and Earning Ratios:** Key ratios like EBITDA, Earning Per Share, Gross Profit Ratio, and Operating Profit Ratio and so on, include the use of Mathematics for calculation of the resultants. Not just the basic calculative mind, the use of Mathematics to calculate the risk and reward for any investment also comes out on one tap!
2. **Inventory Turnover Ratios:** There are few ratios which help to optimise the use of inventory resources with the help of proper statistics, like Inventory Turnover Ratio and other measures for Inventory Management including storage cost – benefit analysis.
3. **Debt/Credit Management:** For growth of an enterprise, leverage and credit are very important factors. Now, credit management



could be a subjective concept if it were not for quantitative analysis. Ratios like Debt Coverage/ Servicing Ratios and other risk measures to be discussed later help in optimum credit risk management. Moreover, time taken to charge back the amount of debt given also becomes very important and there comes the concept of Debt Turnover Ratio which again requires use of quantitative measures and analysis.

4. **Risk Measures:** The core finance is structured on the concept of risk. Managing risk is essential for any form of business, fund or enterprise. Thus, it becomes necessary for an enterprise to take quantitative approach towards such management. Ratios and Analysis which help in debt management automatically affects risk profile of an entity, but it becomes more important with the introduction of Quantitative Analysis of Finance. Terms like Sharpe Ratio, Treynor Ratio and Beta might sound greek to you, but all of them are in fact peculiarly assimilated in lives of our financial experts and analysts. All these ratios require the use of Maths. Sometimes, much more than basic.
5. **Performance:** Profit is not the only performance variable. There are other variables like equity returns and interest rates as well. This includes the use of Alpha ratio, which measures the performance of any fund or so against market benchmark, XIRR and IRR among many more things. Everything boils down to the use of Mathematics.

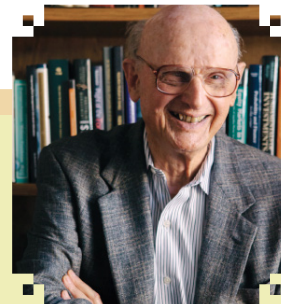
With all these advantages, the use of Mathematics has created a separate field of Finance, Quantitative Analysis which may be called more important than Fundamental or Technical Finance. Thus it becomes important to learn about few important techniques/ components of the model, which are as follows:

1. **Regression:** Regression helps in derivation of relation and correlation between two variables. A certain increase in the cost of labour would do certain harm to market share, which can be measured by regression analysis and thus a quant based model of solution can be laid out accordingly.
2. **Linear Programming:** Much associated with an advantage of Quantitative Analysis, the concept of Linear Programming is based on the efficiency model, seeking development of plans, procedures and models, through which optimum combinations can be targeted. Basic charting Mathematics is used to get to the combinations.

3. **Data Mining:** If there were no data, there would have been no Morningstar. The quantitative analysis research hub is based on the model of data, loads of data and data mining for those loads. Data mining is the process of churning out data from credible sources through credible mechanism and using that for research purposes, which is objectified in targets of quantitative analysis.

4. **Software:** Perhaps the most important components of Mathematical Symphony's importance in Finance world are its softwares. Softwares based on mathematics model like excel and numbers have been the staple ingredient of industry's success. The softwares like R, Excel, Numbers and so on. Not only these softwares but certain websites combining the use of Mathematics and technology also prove to be helpful, which includes, as quoted, "Morningstar".

The scope of development and practice of this field of Mathematics is certainly infinite and thus it is best to assume that quantitative analysis is here to stay. This way Mathematics has presented us with technical work coupled with data, unlike fundamental or technical strategies. Mathematics has proved to be not only a subject and has worked in the best way to generate results to drive career avenues. It is again estimated that another George Soros would rise the way he rose mathematically strong during Asian Financial Crisis. Remember Big players run the markets and mathematical efficiency and strength is what overpowers a non maths financier.



Did You Know?

Harry Markowitz is generally credited with beginning the quantitative investment movement when he published a "Portfolio Selection" in the *Journal of Finance* in March of 1952.

THE POWER OF DIGITAL IN MARKETING

by Atishay Jain

If you are talking to your friend on Facebook, there are 3 people who know about the conversation- you, your friend, and Mark Zuckerberg.

Yes, you laughed harder on this than you should have. (And if you didn't, you'll get the joke by the end).

The average 'screen-on time' on my mobile showed 10 hours 11 minutes, a few days ago. Yes, I spend nearly 42% of my day conversing with people, creating and consuming content on social media and what not.

But is this just me? No.

According to a recent report (<https://wearesocial.com/blog/2019/01/digital-2019-global-internet-use-accelerates>), an average internet user spends 6 hours and 42 minutes online each day. It's not just about mobile phone, but all devices that exist in the digital space- televisions, radios, computers take up a reasonable fraction of our day.

Such strong usage of 'Digital Media' is seen by businesses as a golden opportunity to market the right products to the right customer in the right place at the right time. This is nothing but the essence of digital marketing.

Why Digital Marketing?

I won't be answering this question since I'll allow you to find the answer to this question yourself, which I am pretty sure you'll be able to do by the end of this article.

For now, let's have a brief look at the important components of Digital Marketing.

1. Social Media Marketing (SMM)

An interesting study by IDC research reveals that **4 out of 5 smartphone owners use their mobile within first 15 minutes of waking up**. This is one of the reasons why many businesses apprehend 'Social Media Marketing' to be very effective for lead

generation. Some of the major social media platforms are Facebook, Twitter, Instagram, YouTube, LinkedIn and Pinterest.

[1.1] Content on Social Media can be pushed forward to the users through 2 ways:

a) Organic Reach/Impressions:

A business posts/shares content on its timeline/feed that reaches people **without any form of paid advertising**. The algorithms of the social media platform, kind of page audience and relevance of content play a crucial role here. However, thousands of other businesses are also publishing content on social media due to which not all of a business' followers are able to see the content that it posts. For example:

Organic Reach on Facebook is generally 10%-15% of the number of followers on a page. This means that for every 20 of a business' followers on Facebook, Only 2-3 people actually see the post.

However, there is a way around this which is paid advertising.



b) Paid Reach/Impressions:

A business has the option to create and run **paid campaigns** on its social media handles by allocating a total as well as a daily budget. It also has a lot of **advanced targeting metrics** such as age, gender, region, interests, hobbies, purchase behaviour etc.

Social media advertising not only helps a business to **reach a greater part of its target audience** but also **more relevant people** by tracking the user behaviour on other websites, and internet through **tracking pixels**. In layman's language, a **tracking pixel** is a tracking device (a snippet of code) that every business can include in their website. Let me run you through an example:

You want to buy shoes, so you browse through different websites such as Amazon, Nike, Puma and Reebok. You might also use Google Search for the same. The Facebook pixel on these websites tracks and understands that you want to buy shoes. You expressed an **intent** to buy shoes. Now, while browsing through Facebook or Instagram later, you'd be shown ads not only from the sites that you visited but even other brands which are selling shoes and targeted people who are buying shoes online, including you.

[1.2] Another important feature of social media is that it provides a **platform for consumers** as well to get in touch with the businesses to share their feedback or grievances, if any.

This is enough to understand the basics of SMM. Now, it's important to point out a common misconception among beginners that Digital Marketing is majorly Social Media Marketing. However, that is far from reality. The actual 'Search' hasn't even started yet. (Pun Intended)

2. Search Engine Marketing (SEM)

Marketing efforts made under SEM are dedicated towards increasing the visibility of a business on Search Engines like Google, Bing, Yahoo etc.

Like SMM, SEM can also take up 2 routes:

[2.1] Search Engine Optimisation (SEO): It is an

unpaid route where businesses optimise their websites with the ultimate aim of **improving their visibility in search engines**. This is done by making some technical changes in the code of the website as well as including **relevant 'keywords/keyphrases'** in the content; so that the Web Crawlers of the search engine can easily navigate through it, find relevant content and show their website in the search results.

Ah, too much to take, isn't it? Let me break down in simpler words using an example: -

Business: Footwear Showroom located in Delhi

Target Audience: People who currently live in Delhi

SEO Strategy: Let's say one keyphrase used by potential shoe buyers is 'Buy Best Shoes in Delhi'. When a person enters this keyphrase on Google, Google's Web Crawler, which is an internet bot will browse the World Wide Web and go through all the websites which have any or all of the words in the given keyphrase.

Now, I won't talk about the technical part because it might get a bit overwhelming for a few readers. But the thing that the businesses do is including the keywords in its website content so that the Web Crawler considers it as a relevant result. This can be done very smartly by writing 'If you are looking to **buy the best pair of shoes in Delhi**, do visit XYZ Business located at ABC'. The type of SEO where a business optimises its own website is called **On-Site SEO**.

There is another kind of SEO known as **Off-Site SEO** in which a business may request another website owner to include the relevant keyphrase/keywords in their own website and link back that particular portion of text to the business's website. This is also known as **backlinking**.

[2.2] Paid Search Advertising (PSA):

In PSA, **Businesses** run ads on search engines to improve their search visibility. They basically **pay the search engine to rank their website on the top**. You might have often noticed that the first 3-4 results on Google search have 'Ad' written on them. Similar to social media advertising, Search Advertising gives you ample of targeting options and metrics.

Google offers this service to businesses through a service known as Google Ads.

3. Display Advertising

Display Advertising works on the same framework as Search Ads, the main difference being that Search Ads are just shown on search engines while display ads are displayed on other websites which have allocated some website space to earn revenue from ads. Such ads contain visual media and a **'call to action'** (text/buttons meant to make the user perform a desired action) which redirect the user to a certain page on the business's website known as the **landing page**.

Another difference between Display Ads and Search Ads is that Search Ads are shown on the basis of the keywords/keyphrase entered by the user whereas Display Ads are targeted to the potential consumers on the basis of different targeting parameters such as demographics, interests, purchase behaviour etc.

4. Video Advertising

Video Advertising has a similar framework as



Display Ads but with video ad formats, designed to encourage people to express interest and take action. You'll generally come across these ads **when you are watching a video on YouTube** or other platforms on web.

5. Content Marketing:

Content Marketing allows a business to **communicate with its target audience** while aiding them in their quest to search for information, thus building credibility so that the business becomes a go-to place to purchase any product/service. In content marketing, rather than directly promoting their product or services, a business generally **provides relevant content in the form of blogs, videos, creatives etc.** For example: Taking forward

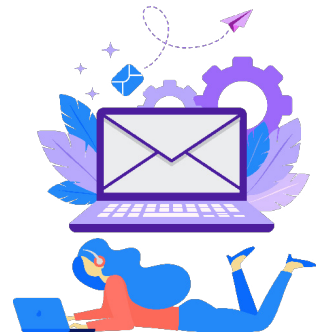
the previous example of the showroom, the business may write blogs on topics like 'Which shoes to wear on which occasion?' which answers questions that the target audience may have.

Just like Harvey Specter said in Suits, **"It's a win-win situation!"**

6. Affiliate Marketing

In Affiliate Marketing, a business ties up with 'affiliates' who basically redirect traffic from their own websites, blogs or applications to a business's website through self-initiated digital marketing techniques and they receive a **commission for every purchase which is a result of this affiliate relationship**.

Example: YouTubers putting Amazon links in the description earn commission for every purchase made using their links. (Amazon Affiliate Program)



7. Email Marketing

It involves the use of email campaigns to urge the customers to perform a certain Call-to-action. It may sound simple, but on the contrary, Email Marketing offers a lot of opportunities for **Customer Relationship Management, Customer Retargeting, Promotions, Personalised Experiences** etc. A business may include 'Sign-up Forms' on its website and social media handles, collect users' email addresses and email them relevant stuff.

8. Analytics

Every action performed by an online user is tracked. What you talk about, what you browse, what you try to buy, everything! **The availability of such detailed consumer insights to the businesses in the form of 'Analytics'** allows them to measure the performance of their online campaigns. Once a business knows what works and what does not, and what kind of people are showing interest in its products, it can **make relevant changes in its online marketing plan to maximise the return on investment**. Analytics give online marketing a significant edge over traditional marketing.

Okay, so are we done with all the components of Digital Marketing yet?

For common use, the answer is yes. But technically, no.

There is still one concept left, although some people may not agree with me, but I'll present my case so you can decide for yourself. The last point is

9. Offline Marketing

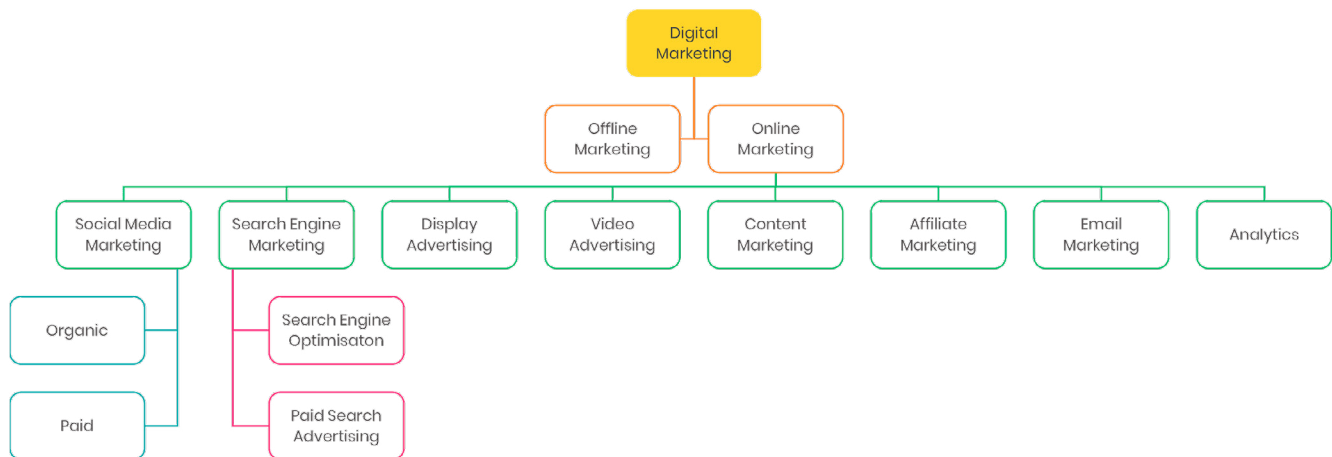
You might be thinking, is he crazy? Or **is this some kind of a joke?** Actually, No. Some part of offline marketing exists in Digital Marketing as well. Digital, in literal sense, refers to any electronic device. So, I consider it fair enough to include non-internet electronic technologies such as SMS, MMS, radio and television in Digital Marketing. It's just that technologies like Radio and Television are so big & cater to a mass audience without any specific targeting that they have come to be considered a

whole other category, in general use.

All the aforementioned points are the major components of Digital Marketing. However, please note that all of the above points may not form an exhaustive list because digital world is ever-changing with technological advancements and discoveries being made with every passing second. Trying to sum up all of that in a few points would be an act of sheer disregard to the essence and beauty of the dynamic nature of technology.

Having got a beginner-level insight into the world of Digital Marketing, I am sure you now understand the power it beholds.

Infinity Gauntlet, step aside!



Did You Know?

20% visitors read text on your page, 80% will watch a video

58% of people will stop watching a video within the first 90 seconds

Posts with 10-18 word titles receive more likes



MISCELLANEOUS

TECH IN 2019

by Gurleen Kaur Gandhi

“Somewhere, something incredible is waiting to be known.”

~Carl Sagan

Well, technology fits into this quote perfectly, doesn't it? In a world where even a birthday song is being sung by an artificial intelligence software like Alexa to a gadget like Drowse Buster, that stimulates you to be awake while driving, we are truly on the right path to discover some new incredible things waiting to be unfolded.

But as we know, all things have their pluses and minuses. Technology is no different.

Creating a human organ using 3-D printing techniques, to a robot performing a full-fledged surgery, it seems as if we are reaching towards God. Today, technology is literally present in all sectors—communication, healthcare, transport and the list goes on and on.

But the same technology is invading your life more than you know. Your right to privacy is being compromised with each social account you are making. And if that was not enough, technology is feeding on your employment opportunities as well.

Thus, technology is a useful servant, but a dangerous master.

Having talked about technology in general, let's see how 2019 specifically was different for technology. This year we are seeing the breakthrough innovations that are expected to radically impact the global, social and economic order. This includes DNA-based data storage, as a low-energy alternative to computer hard drives, with huge capacity. According to one estimate, all the world's data for a year could be stored on a cube of DNA measuring just a square meter! Another emerging technology that has found its application even in advanced food tracking and packaging is Blockchain. What used to take days or even weeks to trace can now be tracked in minutes, using blockchain

technology to monitor every step of a food item's progress through the supply chain. Meanwhile, sensors in packaging can indicate when food is about to spoil, reducing the need to waste whole batches once an expiry date is reached.

Who would have thought that a traditional occupation like agriculture and artificial intelligence could also be amalgamated? The Indian Council of Agricultural Research (ICAR) has been instrumental in developing over 100 easy-to-use and farmers-friendly mobile apps covering different areas of agriculture and its allied activities. The “Kisan Suvidha” mobile app is a comprehensive portal comprising of information related to weather, dealers of inputs like seeds, pesticides, cold stores and warehouses etc. Another app called “mKisan” conveys agriculture-related counsel to the registered farmers through SMS and voice messages in local languages. Even the Indian Budget 2019 has given a boost to the technological sector by announcing a few policies in favour of electric vehicles. The GST rate on electric vehicles has been reduced from the current 12 per cent to five per cent in a bid to push the sale of EVs in the country. In addition, there will be an income tax deduction of ₹1.5 lakh on the interest paid on the loans taken to purchase electric vehicles. Advances in Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR), all of which can be summarized in R+, will continue to be at the forefront of attention. R+, which once was only found in video gaming, has been quickly advancing to become a useful tool in industries such as engineering design, manufacturing, healthcare etc.

In a nutshell, 2019 has been a promising year for technology so far. But it remains to be seen what more the year has in store. It seems that time isn't far where ocean water will become drinkable, humans will have bionic arms, human jetpacks will become common and what not!



INFOTAINMENT

THE SOCIAL NETWORK



The Social Network is a 2010 American biographical drama film directed by David Fincher and written by Aaron Sorkin. Adapted from Ben Mezrich's 2009 book, the film portrays the founding of social networking website Facebook and the resulting lawsuits. It stars Jesse Eisenberg as founder Mark Zuckerberg, along with Andrew Garfield as Eduardo Saverin, Justin Timberlake as Sean Parker, and Armie Hammer as Cameron and Tyler Winklevoss. The film was released in the United States by Columbia Pictures on October 1, 2010.

The Social Network garnered considerable acclaim, with critics praising its direction, screenplay, acting, editing and score. The film appeared on 78 critics' Top 10 lists for 2010; of those, 22 had the film in their number-one spot, the most of any film in its year. The film was also chosen by the National Board of Review as the best film of 2010.

At the 83rd Academy Awards, the film received eight nominations, including for Best Picture, Best Director, and Best Actor for Eisenberg, and won three: Best Adapted Screenplay, Best Original Score, and Best Film Editing. The film also received awards for Best Motion Picture – Drama, Best Director, Best Screenplay, and Best Original Score at the 68th Golden Globe Awards. In 2016, it was voted 27th among 100 films considered the best of the 21st century by 117 film critics from around the world.

N IS A NUMBER: A PORTRAIT OF PAUL

ERDÖS

A man with no home and no job, Paul Erdos was the most prolific mathematician who ever lived. Born in Hungary in 1913, Erdos wrote and co-authored over 1,500 papers and pioneered several fields in theoretical mathematics. At the age of 83, he still spent most of his time on the road, going from math meeting to math meeting, continually working on problems. He died on September 20, 1996 while attending such a meeting in Warsaw, Poland. N is a Number: A Portrait of Paul Erdos was filmed between 1988 and 1991.



In an age dominated by technical wizardry and high tech communications, Erdos was an unusual human link connecting hundreds of people. As he travelled from country to country, Erdos carried with him the latest in mathematical thinking, inspiring others to develop new ideas and, sometimes, entire new fields. In turn, the mathematical community supported this repository of centuries of mathematical knowledge and lore. Every mathematician in the world has an "Erdos Number"-a number that describes the collaborative distance between mathematician Paul Erdős and another person, as measured by authorship of mathematical papers.

Erdos established himself as a serious mathematician at the age of 20 when he devised a more elegant proof for Chebyshev's theorem, i.e., that there is always a prime number between any number and its double. He was at the center of an informal clique of gifted young mathematicians in Hungary, known as the Anonymous Group, because they would meet in a Budapest park under the statue of a medieval historian named Anonymous.

MISCELLANEOUS

ENIGMA

The cryptanalysts at Bletchley Park, Buckinghamshire, have a problem: the Nazi U-boats have changed one of their code reference books used for Enigma machine ciphers, leading to a blackout in the flow of vital naval signals intelligence. The British cryptanalysts have cracked the “Shark” cipher once before, and they need to do it again in order to keep track of U-boat locations.

The film begins with Tom Jericho returning to Bletchley after a month, recovering from a nervous breakdown brought on by his failed love affair with a coworker named Claire Romilly.

Jericho immediately seeks to see her again and finds that she mysteriously disappeared a few days



earlier. He enlists the help of Claire’s housemate, Hester Wallace, to follow the trail of clues and learn what has happened to Claire. Mr. Jericho and Miss Wallace, as they formally address each other, work to decipher intercepts stolen by Claire and determine why she took them. Jericho is closely watched by an MI5 agent, Wigram (Jeremy Northam), who plays cat and mouse with him throughout the film. Meanwhile, U-boats are closing in on a convoy of thirty seven ships from America, giving the code-breakers less than four days to find a solution to changed Shark cipher. But someone else at Bletchley has a personal interest in the stolen intercepts, and may be responsible for Claire’s disappearance.



CUBE - FILM SERIES

Cube is a Canadian psychological horror thriller film series. All three films; Cube, Cube 2: Hypercube and Cube Zero; are centered, with slight variations, on the same science-fictional setting: a gigantic, mechanized cubical structure of unknown purpose and origin, made up of numerous smaller cubical rooms, in which most or all of the principal characters inexplicably awaken in the opening scenes. Each of these rooms has six heavy vault doors, one on each face of the cube, which lead into adjacent, largely identical rooms, differing occasionally by colour of lighting. Some of these rooms are “safe”, while others are equipped with deadly booby traps such as flamethrowers and razorwire.

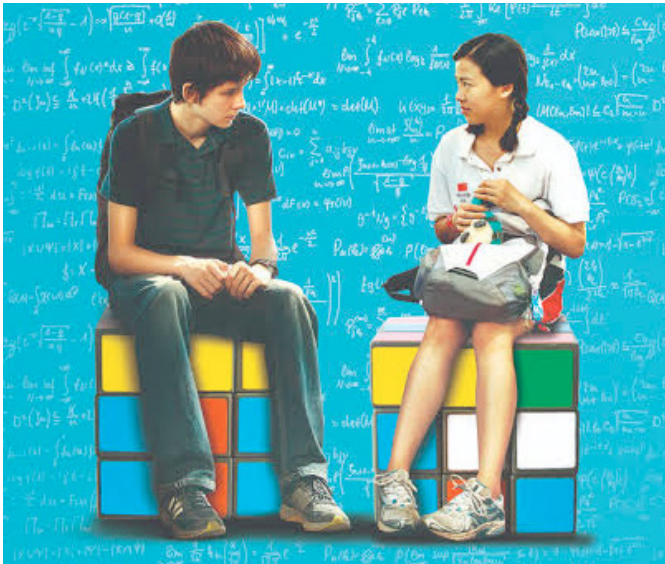
In each case, a group of strangers awakens in this mysterious structure, without any knowledge of how or why they are there. In order to escape from the prison, they must band together and use their combined skills and talents to avoid the traps and navigate out of the maze, while also trying to solve the mystery of what the cube is and why they are in it. A fourth film was rumored in March 2011, and a remake of the first film was announced in April 2015.

MISCELLANEOUS

A BRILLIANT YOUNG MIND

X+Y, released in the US as *A Brilliant Young Mind*, is a 2014 British drama film directed by Morgan Matthews starring Asa Butterfield, Rafe Spall and Sally Hawkins.

The film, inspired by the documentary, *Beautiful Young Minds*, focuses on a teenage English mathematics prodigy named Nathan (Asa Butterfield) who has difficulty understanding people, but finds comfort in numbers. When he is chosen to represent the United Kingdom at the International Mathematical Olympiad (IMO), Nathan embarks on a journey in which he faces unexpected challenges, such as understanding the nature of love. The character of Nathan was based on Daniel Lightwing who won a silver medal at the 2006 IMO. The film heavily features previously recorded songs by Keaton Henson.



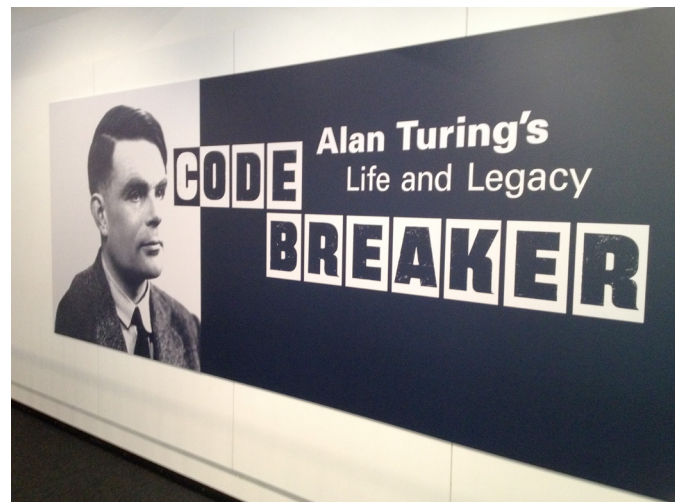
HACKERS

Super-hacker Dade Murphy (Jonny Lee Miller), infamous for his creation of a destructive virus at age eleven, has just moved to New York City. A high school senior, Dade wins the respect of a group of teenage hackers and struggles to start a romance with Kate (Angelina Jolie). When a member of the crowd hacks into a corporate computer system, Dade and his friends draw the attention of the FBI and of "Plague," a former hacker turned corporate security officer. Plague launches a virus designed to create oil spills and frames kids while covering up his own multi-million dollar scam. The teens (with help

from hackers everywhere) must dash to stop the virus, unmask Plague's villainy, and keep themselves out of jail.

CODE BREAKER

The highs and lows of Alan Turing's life, tracking his extraordinary accomplishments, his government persecution through to his tragic death in 1954. In the last 18 months of his short life, Turing visited a psychiatrist, Dr. Franz Greenbaum, who tried to help him. Each therapy session in this drama documentary is based on real events. The conversations between Turing and Greenbaum explore the pivotal moments in his controversial life and examine the pressures that may have contributed to his early death. The film also includes the testimony of people who actually knew and remember Turing. Plus, this film features interviews with contemporary experts from the world of technology and high science including Apple co-founder Steve Wozniak. These contributors bring Turing's exciting impact up to the present day, explaining why, in many ways, modern technology has only just begun to explore the potential of Turing's ideas.



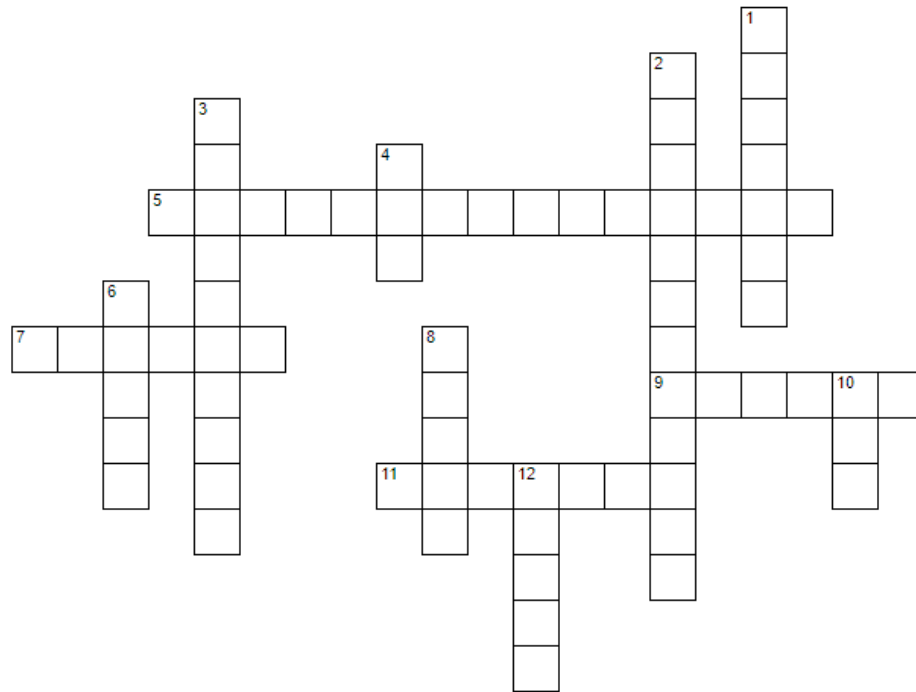
CROSSWORD

ACROSS

5. CEO ADOBE
7. A FRIENDLY MALWARE
9. FIRST SEARCH ENGINE ON THE INTERNET
11. PERSONAL INFORMATION MANAGER OF MICROSOFT

DOWN

1. FACILITATES DATA MOVEMENT
2. FATHER OF INDIAN SUPER COMPUTING
3. INVENTOR OF LOGARITHMIC TABLE
4. LOCATION OF FILES ON THE DISK
6. A DATABASE MANAGEMENT SOFTWARE
8. FIRST WEB BROWSER INVENTED IN 1990
10. INTRODUCED COMPUTER HARD DISK
12. FIRST FULLY SUPPORTED 64 BIT OPERATING SOFTWARE



ANSWERS:

- ARCHIE / FIRST SEARCH ENGINE ON THE INTERNET
- NEXUS / FIRST WEB BROWSER INVENTED IN 1990
- COBOL / A DATABASE MANAGEMENT SOFTWARE
- LINUX / FIRST FULLY SUPPORTED 64 BIT OPERATING SOFTWARE
- IBM / INTRODUCED COMPUTER HARD DISK
- TROJAN / A FRIENDLY MALWARE
- VIJAY BHATKAR / FATHER OF INDIAN SUPER COMPUTING
- SHANTANU NARAYEN / CEO ADOBE
- OUTLOOK / PERSONAL INFORMATION MANAGER OF MICROSOFT
- FAT / LOCATION OF FILES ON THE DISK
- PACKETS / FACILITATES DATA MOVEMENT
- JOHN NAPIER / INVENTOR OF LOGARITHMIC TABLE

KEYBOARD SHORTCUTS

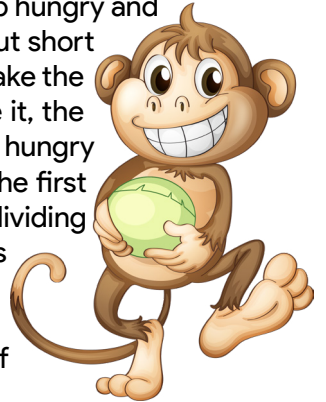
MICROSOFT EXCEL



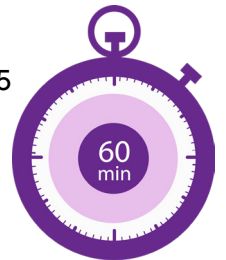
1. F12	Displays the (file> Save As) dialog box
2. Ctrl + F2	Print Preview
3. Alt + F1	Creates a chart (on a chart sheet) using the highlighted range
4. Shift + Tab	Moves from right to left within a selection (opposite direction to tab)
5. =	Starts a formula
6. Ctrl + Insert	Copies the current selection to clipboard
7. Ctrl + 6	Hides Toggles between hiding, displaying
8. Ctrl + 8	Toggles the display of outline symbols on the active worksheet
9. Ctrl + 9	Hides the rows in the current selection (Format > Row > Hide)
10. Ctrl + A	Displays formula palette given a function name or selects the whole worksheet or current date
11. Ctrl + F	Displays the Find dialog box
12. Ctrl + Shift + Spacebar	Selects all the objects on the worksheet when an object is selected or selects the whole worksheet
13. Tab	Shortcut for selecting a formula when you type the initials
14. Ctrl + E	Flash Fill
15. Ctrl + 2	Typing in the cell
16. Shift + Enter	Enters the content of the active cell and moves to the cell above (by default)
17. Shift + Insert	Enters the data from the clipboard
18. Alt + =	Enters the SUM function (AutoSum) to sum the adjacent blocks of cell
19. Ctrl + Delete	Deletes text to the end of the line
20. Ctrl + Shift + =	Display the cells dialog box

PUZZLES

1 Ten people land on a deserted island. There, they find lots of coconuts and a monkey. During their first day, they gather coconuts and put them all in a community pile. After working all day, they decide to sleep and divide them into ten equal piles the next morning. That night, one castaway wakes up hungry and decides to take his share early. After dividing up the coconuts, he finds he is one coconut short of ten equal piles. He also notices the monkey holding one more coconut. So he tries to take the monkey's coconut to have a total evenly divisible by 10. However, when he tries to take it, the monkey conks him on the head with it and kills him. Later, another castaway wakes up hungry and decides to take his share early. On the way to the coconuts, he finds the body of the first castaway, which pleases him because he will now be entitled to $\frac{1}{9}$ of the total pile. After dividing them up into nine piles, he is again one coconut short and tries to take the monkey's slightly bloodied coconut. The monkey conks the second man on the head and kills him. One by one, each of the remaining castaways goes through the same process, until the 10th person to wake up gets the entire pile for himself. What is the smallest number of possible coconuts in the pile, not counting the monkeys?



2 Mr. John has 25 horses, and he wants to pick the fastest 3 horses out of them. He has only 5 tracks which means only 5 horses can run at a time. He doesn't have a stopwatch. What is the minimum number of races required to find the 3 fastest horses?



3

ONLY 2% STUDENTS SOLVED THIS QUESTION!

$$5+3+2 = 151022$$

$$9+2+4 = 183652$$

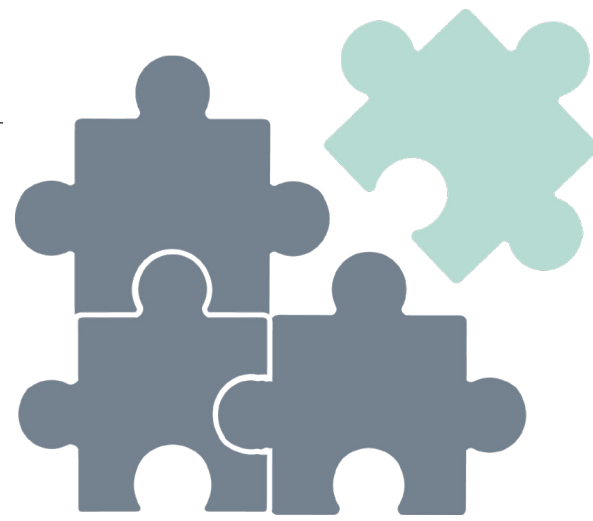
$$8+6+3 = 482466$$

$$5+4+5 = 202541$$

THEN...

$$7+2+5 = ??????$$

Turn to the next page for solutions!



PUZZLE SOLUTIONS

1. 2519

Logic:

LCM (Lowest Common Multiple) of 10, 9, 8, 7, 6, 5, 4, 3, 2, and 1 - 1. LCM would give the least number which is divisible by all of these number and subtracting one would give us the number of coconuts which were initially there.

2. We will have 5 races with all 25 horses

Logic:

Let the results be

a1, a2, a3, a4, a5

b1, b2, b3, b4, b5

c1, c2, c3, c4, c5

d1, d2, d3, d4, d5

e1, e2, e3, e4, e5

Where a1 faster than a2, a2 faster than a3 etc.

We need to consider only the following set of horses:

a1, a2, a3,

b1, b2, b3,

c1, c2, c3,

d1, d2, d3,

e1, e2, e3,

Race 6

We race a1, b1, c1, d1 and e1

Let

$\text{Speed}(a1) > \text{speed}(b1) > \text{speed}(c1) > \text{speed}(d1) > \text{speed}(e1)$

We get a1 as the fastest horse, We can ignore d1, d2,

d3, e1, e2 and e3

a2, a3,

b1, b2, b3,

c1, c2, c3,

Race 7

Race a2, a3, b1, b2 and c1

The first and second will be second and third of the whole set of 25 horses.

3. 143547

Logic:

Consider the number as: $A + B + C$

Now, they are following this pattern: $A + B + C =$

$[A \times B] [A \times C] [(A \times B) + (A \times C) - (B)]$ where:

$[A \times B]$ = First two digits

$[A \times C]$ = Further two digits

$[(A \times B) + (A \times C) - (B)]$ = Last two digits

E.g.: In case of $5 + 3 + 2$:-

First two digits: $5 \times 3 = 15$

Further two digits: $5 \times 2 = 10$

Last two Digits: $(15 + 10) - 3 = 25 - 3$ (middle number from question) = 22

So, we get $5 + 3 + 2 = 151022$

Similarly, $7 + 2 + 5 = 143547$



CABINET 2019-20



**Aman
Srivastava**
General Secretary



**Palak
Jain**
Joint Secretary



**Samriddhi
Saxena**
Chief Coordinator



**Gaurav
Bansal**
Treasurer



**Shubh
Pallav**
Technical Head



**Sristi
Bhimrajka**
Technical Head



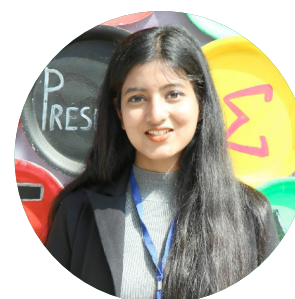
**Anu Shalini
Ekka**
Creative Head



**Ekta
Bareja**
Creative Head



**Madhav
Kaushal**
Organising and
Marketing Head



**Kanak
Kumar**
Organising and
Marketing Head



**Garima
Sobti**

Research and
Editorial head



**Anustha
Puniyani**

Research and
Editorial head



**Anshul
Kumar**

Corporate
Communications
Head



**Amisha
Diwan**

Corporate
Communications
Head



**Gurleen Kaur
Gandhi**

Coordinator



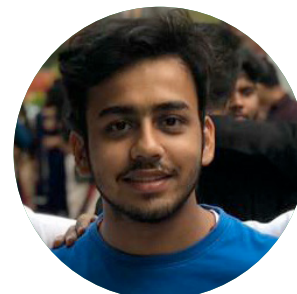
**Harshita
Jaiswal**

Coordinator



**Ayushi
Kalra**

Senior Executive
Member



**Harsh
Somani**

Senior Executive
Member



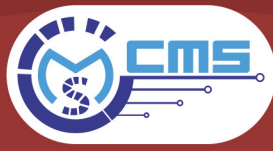
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Goyal**

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Member



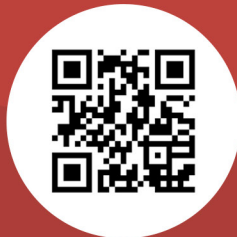
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