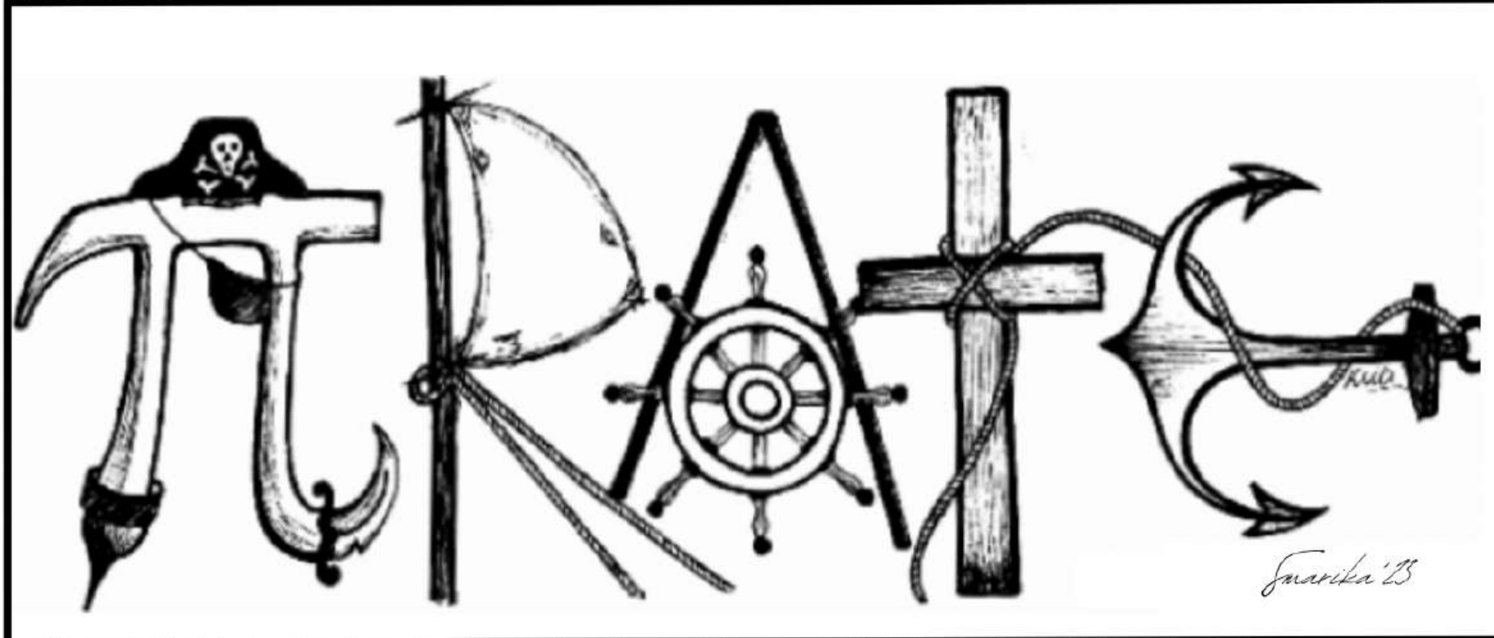


"Leave behind the passive dreaming of a rose-tinted future. The energy of happiness exists in living today with roots sunk firmly in reality's soil."

-Daisaku Ikeda

Dear Readers,

I once wrote a poem for a magazine entitled, "You are the Potter and I am the Clay." It was a poem of appreciation for the teachers who helped me grow to be the person I am today. It was about how we students are the clay and our teachers mould us.

As an immature seven-year-old, I never understood the importance and significance of what I wrote but now it hits me that my passion for Mathematics is a pure result of the hard work my teachers put in for me. These are the teachers who encourage us to write impactful and informative articles. The theme of the *Pi-rate* for the April Edition revolves around the various aspects of the world and how math is deeply rooted in all of them. The excitement of suggesting an article to calculate the rate of spread of rumours and then to see the said-article take shape was immense. A write-up with suitable illustrations on Data Science, Data Analytics and Statistical Computing adds variety to the publication.

The junior school contributors have been constantly solving questionnaires as a part of the Math Club and have been trying to get their foot in the Ed-Board, clearly portraying their interest in Mathematics and its applications beyond the classroom. The effort has been to make Pi-rate a very expressive mathematical platform for all who have the zeal, passion and drive for the subject.

It has been a constant endeavour of the school to promote the knowledge of numbers and to uncover the innumerable hidden mysteries which lie within the universe of numbers and beyond it. Our relationship with calculations depicts the dynamicity which the numbers bring in to our lives. The aim has been to connect, collaborate and interact.

Someone asked what the humorous catch for this year's editions will be. We can safely say, "3.14% of sailors are Pi-rates."

Vaishnavi Agarwal
Editor-in-Chief

CONTENTS

THE SPREAD OF rumours

Endless gossip, drama, and rumour mongering - every reader of the Pi-rate has, in some form or the other, indulged in it. As a species, humans are proven to be scientifically incapable of resisting the urge to talk about and spread stories of uncertain origin among themselves. But when we wondered how fast a rumour can really spread, we found that there was no concrete answer. So, we embarked upon an adventurous quest over the internet, followed by a small experiment which we conducted ourselves within our batch (sorry everyone), and came upon some intriguing methods to mathematically devise the rate at which a rumour spreads.

Before proceeding, one must remember that human behaviour and psychology plays an important role in the spread of a rumour, and so no equation can precisely predict the transmission rate, but can only give an approximate.

The spread of rumours can be studied Mathematically through epidemic models. These models are based on epidemiology or the study of how diseases spread in various populations using math. One such model is the SI model- Susceptible and Infected model, first developed for modelling the transmission of infectious diseases, originally concocted by Kermack and McKendrick.

TO BE NOTED
While devising the rumour many assumptions were made and as all those variables could not be accommodated in the final equation, only very broad and generalised variables were taken in order to devise a relatively simple differential equation.

Taking inspiration from and applying the basics from the aforementioned methods, we created our own equation to determine the transmission rate of a rumour in our school.

$$\left\{\frac{N-I}{d*3600}\right\} *100 = R$$

'N' is the total (constant) population

Population 'I' who help propagate it

'D' is the time taken in hours

'R' is the transmission rate

To confirm our theory, we did our experiment and tricked our batch into believing a rumour pertaining to us. We set a 48 hour window to see how fast the rumour transmits in a batch of 79. 15 people were a part of the group (shoutout to Fly Pre SCs and Manya Kohli) who helped us spread the rumour and the remaining 62 were a part of the susceptible group. On the first day, 30 believed the rumour and by the end of the second day the remaining 32 people were also made aware. At the end of the 48 hour period, the rumour spread throughout the batch, even plaguing a few at the hospital as well as making its rounds around the Pre SC batch.

$$\left\{\frac{79-17}{48*3600}\right\} *100 = 0.0358$$

R (transmission rate) is 0.0358 people per hour

Even today, we face taunts from a certain few and are often told we were perfect examples of the story 'The Boy Who Cried Wolf.' To sum up, spreading rumours is absolutely futile, and who knows someone might just be using you as a guinea pig for their next experiment?

-Aarisha Jain and Tvisha Mahajan
Pre SCs

10 FEET HIGH

On a court, 28 meters long and 15 meters wide, with an orange ring 10 feet above the ground, 12 members in a team and 5 play at once with a basketball of 74.9 cm circumference, yet there is only one heartbeat.

Basketball and Mathematics, usually one does not hear of them together. Mathematics does not just consume and surround the game closely but surprisingly, it is as crucial as a 6th player or an assistant coach. It is extremely significant both in terms of strategy and physical performance.

Carefully combining mathematical concepts with a sport like basketball, we would arrive at shooting percentages, statistical strategies, every player's individual game analysis, geometry and the trajectory involved in shooting, passing, and rebounding the ball. It also concerns the spontaneous and basic calculations of estimated speed, distance and time.

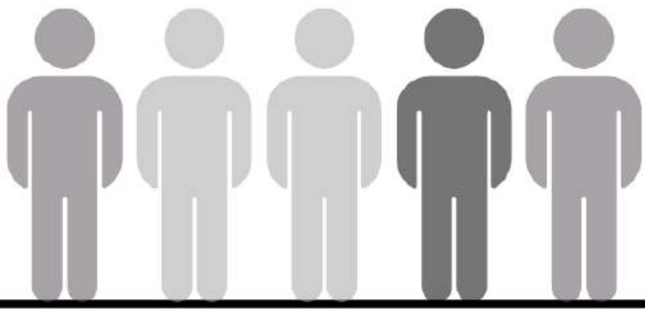
The spectators had a simple and obvious question, "What's the best free throw? Should the shooter aim towards the front of the hoop or the back of it? Does it depend on the height of the shooter?"

Physical attributions seem important, and many believe are crucial for a person's performance, but speaking as the shortest basketball captain and player in my team, a lot of math is involved in it. Shooting accuracy heavily depends on the angle at which the ball is released from the player's hand. The optimal angle for a successful shot when the player aims at the front part of the hoop is 45 degrees. The player must also consider the range i.e. distance from which they are shooting, and note the spring action of the bend in their knees, along with jump height, parabola, and power.

Teams use statistics to analyse their individual performance and make strategic decisions about which game-plays to perform using tabular comprehension. Basketball analytics involves the usage of statistical methods and data analysis to gain insights into the game and identify the strengths and weaknesses of their opponent teams in order to optimize their plans.

The game clocks a 40 minute match. The division of time in four quarters, addition of consequent baskets scored, subtraction of the energy and fouls received, multiplication of the crowd energy with cheers and hoorays, the clock turns 00:00 and the one heartbeat which started the match, finally breathes again. If it wasn't for math, maybe we would have never known to play harder as well as smarter.

-Varija Manglik
SCs



EVOLUTION OF
Data Science

"The best thing about being a statistician is that you get to play in everyone's backyard."
-John Tukey

Data science is a field that has rapidly evolved over the past few decades, driven by advancements in technology and mathematics. From its humble beginnings as a way to analyze data sets, data science has now become a powerful tool for making predictions and extracting insights from complex data.

The field of statistics began to merge with the emerging field of computer science which led to the development of new mathematical tools and techniques that could be used to analyze large, complex data sets. The invention of the computer allowed for the processing and analysis of large amounts of data. As computers became more powerful and affordable, data scientists were able to develop increasingly sophisticated algorithms and models for analysis. These algorithms relied heavily on mathematical concepts such as linear algebra, calculus, and probability theory.

Linear algebra, for example, is used to represent and manipulate large matrices of data. This is particularly useful in machine learning, where algorithms need to be trained on large data sets. Calculus is used to optimize these algorithms by finding the best set of parameters that minimize the error between the predicted outcomes and the actual outcomes. Probability theory is used to model and make predictions about uncertain events, such as the likelihood of a customer buying a product or the probability of a medical test result being accurate.

Another important development in data science is the use of Bayesian statistics, which is a method for updating probabilities based on new evidence. Bayesian statistics is particularly useful in situations where data is scarce or uncertain, such as in medical diagnosis or financial forecasting.

In conclusion, data science is driven by advancements in technology and mathematics. From statistical analysis to deep learning and Bayesian statistics, data scientists have a wide variety of mathematical tools and techniques at their disposal. However, the key to success in data science is not just about mastering these tools, but about applying them creatively to solve real-world problems. As the field continues to evolve, it will be exciting to see what new mathematical strategies emerge to help data scientists tackle even more complex problems.

-Arshiya Sharma
SCs

AN HONEST LIE

'More than 80% of dentists recommend Colgate.'

What does this statement mean to you? To a layman, Colgate would be the star toothpaste. After all, most dentists are recommending it over others. Well, using this advertising statement, Colgate tells an honest lie. Instead of being considered better than the rest, dentists were asked to recommend several brands of toothpaste and 8 out of 10 happened to mention it amongst others.

The above example speaks the 'truth'. The numbers and data support their claim, but the presentation is more than often misleading. On 18th October 1995, the Committee on Safety of Medicines warned that seven brands of the contraceptive pill (containing a 'new generation' progestogens) posed a relatively higher risk of thrombosis (blood clots). This number was calculated as a 100% increase over the previous safer pill. Diving deeper into the data, we realized that the earlier birth control caused 1 in 7000 women to suffer from blood clots, while the new pill increased it to a mere 2 in 7000.

The probability only went up from 0.14% to 0.28%. The apparent 100% increase was just 1 in 7000, proving that this was simply a scare, and the pill was not as harmful as it seemed. This pill scare was responsible for 13000 unwanted pregnancies.

This misuse of data can often lead to misjudgment at the judicial level. Let's examine the case of Sally Clark, a woman who was accused of murdering her infant children despite being innocent. Her children died of SIDS (Sudden Infant Death Syndrome). The probability of 2 children dying due to said disease by chance was calculated as 1 in 73 million. She was labelled as a child-killing mother due to the minuscule probability and was put up for life imprisonment. When the case was examined again, the prosecutors realized that they had presented an incorrect probability by taking the death of the children as two independent variables and hence simply multiplied the probability (take it this way, on multiplying, a 1 in 1,000 probability becomes a 1 in 1,000,000). Later, they realized their folly as genetic factors played a major role. Hence, the two deaths were not independent. Therefore, the calculation of the probability was incorrect, and the number was greater than what seemed to be.

To put the story in perspective: A woman lost her two children, was wrongly persecuted, brutally defamed by the media, and was traumatised to the extent that she died after being released. The root cause: An Honest Lie. The misinterpretation of the situation, the brutal use of large numbers to misguide the jury and the misuse of the power of statistics.

Think for yourself. When you look at advertisements, read the news or buy health products, have you ever questioned the favorable numbers and asked - do they show the complete picture?

-Bhavya Sangal and Keya Aggarwal
SCs

MATH-A-GENIUS

Sofia Kovalevskaya

As we were talking about Sir Isaac Newton in class today, I had the sudden urge to know about female mathematicians. Upon asking around in my class, I got only one answer, Shakuntala Devi. One of my classmates offered to search it up for me and it got me thinking about why they hadn't already.

The world is dominated by men and their achievements in every field. The society often forgets to recognise the women who have made equally good, rather better contributions to the world.

Sofia Kovalevskaya was one of the most remarkable female mathematicians who overcame gender inequality and drastically influenced the field of mathematics. She was born in Russia, on 15th January 1850. She pursued mathematics at the University of Göttingen where she received her doctorate. She also taught at Stockholm University as the world's first female professor of mathematics. She was significantly important because of her ground-breaking contribution to the theory of partial differential equations. She was the first one to join the editorial board of a scientific journal and she published many research papers.

Not being allowed to study in Berlin, she convinced Karl Weierstrass, one of the most renowned German mathematicians, to tutor her. After her husband's death, it was really difficult for her as a single mother to secure a job. Eventually, she found a position as a private lecturer at a newly-founded University in Stockholm. She has left behind the legacy of being the first woman to have been awarded a doctorate.

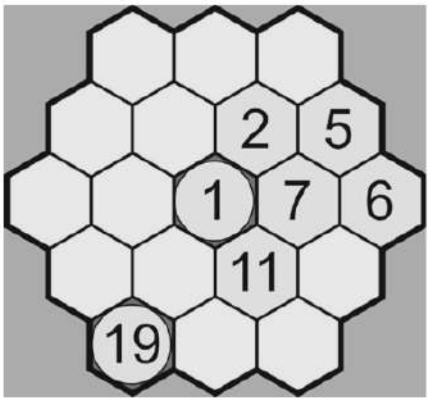
What is really fascinating about her is that she showed women that they can do anything. She made a name for herself using her own talents and most importantly, she was self-sufficient and independent in a rime where education was prohibited for women. She mastered a subject which was considered as a man's domain.

"It seems to me that the poet has only to perceive that which others do not perceive, to look deeper than others look. And the mathematician must do the same thing."

-Nitya Rathi
AIIIs

MATH MIRTH

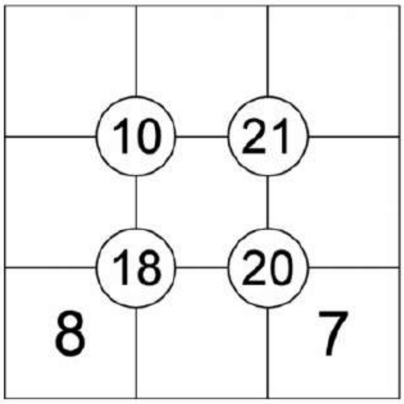
HIDATO



The aim of Hidato is to fill the cells with consecutive numbers from 1 to the highest number (both of which are circled) so that consecutive numbers connect. In other words, 1 must be next to 2, which must be next to 3, which must be next to 4, and so on.

SUKO SUJIKO

The puzzle takes place on a 3x3 grid with four circled number clues at the centre of each quadrant which indicate the sum of the four numbers in that quadrant. The numbers 1-9 must be placed in the grid, in accordance with the circled clues, to complete the puzzle.



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