QED

গণিত বিভাগৰ দ্বিভাষিক (অসমীয়া আৰু ইংৰাজী)

বার্ষিক আলোচনী

প্রথম সংখ্যা ঃ জুন ২০১৯

QED : Bilingual (Assamese & English)
Annual Magazine
Published by : Department of Mathematics
Pandu College, Guwahati-781012

Price : ₹ 25

সূচীপত্র

অধ্যক্ষৰ কার্য্যালয়
Office of the Principal

পাণ্ডু মহাবিদ্যালয়, পাণ্ডু
গুৱাহাটী-৭৮১০১২

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MESSAGE

Words fail to express my happiness when I have come to know that the students of the Department of Mathematics are in full preparation for publishing a Magazine. Why I have become so emotional ! Because this is the first initiative of the Department of Mathematics since1962 the year of establishment of the college. It will be a historic event when the Magazine will be opened to the readers. I am grateful to the students and the teachers who are involved with the pain of its birth. A Magazine may be the first platform of expressing the creativity of the students. The guidance of the teachers adds motivation and inspiration and gravity and beauty to the initiative.

I wish long live of the Magazine QED.

10.04.19
(Dr. Jogesh Kakati)
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সম্পাদকীয় ...

প্ৰতিবেদনৰ বুলনিতে যিসকল মহান ব্যক্তিৰ প্ৰচেষ্টাত পাণ্ডু মহাবিদ্যালয় প্ৰতিষ্ঠা হৈছিল সেই মহান ব্যক্তিসকলক শ্ৰদ্ধাৰে সোঁৱৰিছোঁ। লগতে অকালতে নিষ্ঠুৰ নিয়তিৰ সোঁতত আমাৰ মাজৰ পৰা চিৰদিনৰ বাবে আঁতৰি যোৱা সকললৈ অশ্ৰু-অঞ্জলি জ্ঞাপন কৰিছোঁ।

পাণ্ডু মহাবিদ্যালয়ৰ গণিত বিভাগে পাৰ কৰিলে গৌৰৱোজ্জ্বল ৫০ টা বৰ্ষ। গণিত বিভাগৰ এই সোণালী বৰ্ষটিত পোন প্ৰথমবাৰৰ বাবে আমি প্ৰকাশ কৰিবলৈ ওলাইছোঁ বিভাগটিৰ আলোচনী "QED"। মহাবিদ্যালয়ৰ প্ৰায় সকলো কাৰ্যসূচীতেই সক্ৰিয়ভাৱে অংশ গ্ৰহণ কৰা গণিত বিভাগৰ ছাত্ৰ-ছাত্ৰীসকলৰ সাহিত্য প্ৰতিভাৰ লগতে সমসাময়িক ঘটনাৰাজিৰ ওপৰত থকা জ্ঞান সমাজৰ আগত দাঙি ধৰাৰ আশাৰেই আমি এই আলোচনীখন প্ৰকাশ কৰিবলৈ আগবাঢ়িছোঁ।

দৰাচলতে, আলোচনীএখন বাস্তৱধৰ্মী তথা প্ৰাসংগিক হোৱাটো খুবেই জৰুৰী। গণিতৰ দৰে ব্যৱহাৰিক বিষয় এটিৰ আলোচনী এখনত কল্পনাৰ ৰহণ সনা অথবা সাহিত্য বিষয়ক লিখনিয়ে আগস্থান পোৱাটো কিমান গ্ৰহণযোগ্য হ'ব তাৰ প্ৰতি দৃষ্টি ৰাখিয়েই আমি বিভাগৰ ছাত্ৰ-ছাত্ৰীসকলক গণিত বিষয়ক অথবা গণিতৰ সৈতে সম্বন্ধ থকা লিখনিসমূহ জমা দিবলৈ আহ্বান জনাইছিলোঁ। কিন্তু যুগৰ পৰিৱৰ্তনৰ প্ৰভাৱ আমাৰ যুৱ প্ৰজন্মৰ ওপৰত যেন বাৰুকৈয়ে পৰিছে। আজিৰ যুৱক-যুৱতীসকল লিখা-মেলাৰ প্ৰতি আগ্ৰহী নহয় বুলি সততে শুনি অহা প্ৰাপ্তবয়স্কসকলৰ অভিযোগবোৰ আলোচনীৰ কাম কৰিবলৈ আৰম্ভ কৰাৰে পৰা আমিও উপলব্ধি কৰিবলৈ বাধ্য হৈছিলোঁ, যেতিয়া বাৰে বাৰে জাননী দিয়াৰ পিছতো আলোচনী এখন প্ৰকাশ কৰিবলৈ প্ৰয়োজন হোৱা নূন্যতম সংখ্যক লিখনিও আমাৰ হাতত পৰা নাছিলহি। তথাপিও যোৱা তিনিটা বছৰৰ অভিজ্ঞতাসমূহ গোট খুৱাই, সকলোৱে একেলগ হৈ কাম কৰাৰ উদ্যমটি বৰ্তাই ৰাখি কম পৰিসৰত আলোচনী এখন ছপাবলৈ আমি আগবাঢ়িছিলোঁ আৰু সকলোৰে আশাশুধীয়া প্ৰচেষ্টাৰ ফলস্বৰূপে অৱশেষত যোগাত্মক এক আশাৰ ৰেঙণি আমি দেখিবলৈ পাইছোঁ আৰু "QED" ৰ প্ৰথম সংখ্যাটি সফল হ'ব বুলি আশা ৰাখিছোঁ।

ই মানদিনে গণিত বিভাগৰ প্ৰাচীৰ পত্ৰিকা 'Mathematica'ত গণিত বিভাগৰ ছাত্ৰ-ছাত্ৰীসকলৰ লিখা-মেলা অথবা কলাসুলভ মানসিকতাৰ সম্যক আভাস এটা আমি পাই আহিছোঁ। আশা ৰাখিছোঁ "QED" ত আমাৰ বিভাগৰ ছাত্ৰ-ছাত্ৰীসকলে নিজৰ এইসমূহ প্ৰতিভাৰ বিকাশ ঘটাব পাৰিব।

আলোচনীখনৰ প্ৰকাশৰ বাবে সহায় কৰা প্ৰতিগৰাকী ছাত্ৰ-ছাত্ৰীলৈ আমি ধন্যবাদ জ্ঞাপন কৰিছোঁ। দৈনন্দিন পঢ়া-শুনাৰ মাজতো সময় উলিয়াই নিৰন্ধসমূহ লিখি আমাৰ হাতত জমা দিয়া আটাইকেইগৰাকী ছাত্ৰ-ছাত্ৰীলৈ ধন্যবাদ জনোৱাৰ লগতে ভৱিষ্যতৰ বাবে শুভকামনা জনাইছোঁ।

বিভাগীয় আলোচনীখন উলিওৱাৰ পৰিকল্পনা কৰাৰ মূহুৰ্তৰ পৰা ছপা হৈ ওলাই অহালৈকে প্ৰতিটো পদক্ষেপত আমাৰ লগত থাকি সহায় কৰা তথা প্ৰতিমূহুৰ্ততেই দিহা-পৰামৰ্শ দি আমাক উদ্গনি যোগাই থকা আটাইকেইগৰাকী শিক্ষাগুৰুৰ ওচৰত আমি চিৰঋণী। শিক্ষাগুৰুসকলৰ সহায় অবিহনে "QED" ক সাকাৰ ৰূপ দিয়াটো আমাৰ পক্ষে সম্ভৱ হৈ নুঠিলহেঁতেন।

শেষত, পাণ্ডু মহাবিদ্যালয়ৰ গণিত বিভাগৰ বিভাগীয় আলোচনী "QED" সফলতাৰ বাটেৰে আগুৱাই যাওক, তাৰেই কামনাৰে —

সম্পাদনা সমিতি
QED

***QED** is an abbreviation of the Latin words 'Quod Erat Demonstrandum' which loosely translated means 'that which was to be demonstrated'. It is usually placed at the end of a mathematical proof to indicate that the proof is complete.*

A Note on the Role of Mathematics for the 21st Century

Dr. Prasanta Kr. Barman
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Mathematics is not just arithmetic calculations any more. Now, learning mathematics is like learning philosophy. Abstract and logical, it needs a lot of concentration to study. Now that many of the dry spade-work calculations of enormous numbers have been made easy by the application of computers, one

can concentrate on the concepts. Unlike physical or natural sciences, where one can play with experiments, learning the science of mathematics is something like a spiritual exercise, seeking beauty in creative thinking, in the perfection of mathematical relations and relying on logic for verification.

A mathematician makes dreams beyond the imagination of man. It is for the scientists and technologists to use them. Blind use of formulae should be discouraged. It should be used like a surgical knife to solve the problems which cannot be settled by experimentation alone. When Napier got a dream of a number e with special properties nobody expected that the growth and decay of materials in nature such as radioactive materials follow Napierean logarithmic functions. Every branch of science ultimately has to fit into the larger picture of nature.

At present, we have plenty of excellent mathematicians, what we need today is to take whatever is valid and better from the past and delve deeply into the modern literature of the mathematics. We need an army of mathematics of the modern era, who read, write and lecture on mathematics to show how exciting it is as a subject and show its applications to non-mathematics student too.

In the fifties, economics was taken by the non science students. In seventies, nobody is even admitted to economics stream unless the person is good in mathematics. The turning point was econometrics.

Economic science is based on models,

analyzed by statistics. Differential equations are used for predictions and weightage is given to various factors mathematically. The best way of learning the concepts in mathematics is to study mathematics written for economics students. Dr. Amartya Sen got the Nobel prize in 1999 for welfare economics. Within every one of the Nobel Prize winners is lurking a mathematician.

Analysis of the development of a country is pure application of mathematics. This is only to tell our mathematics students that if only they push the borders of mathematics, they will be including so many application ranging from modern physics, chemistry, biology, economics and archeology to commerce. The formula is to study mathematics and to study any applied area of their linking with open eyes to where one can perform a totally innovative or deeper application.

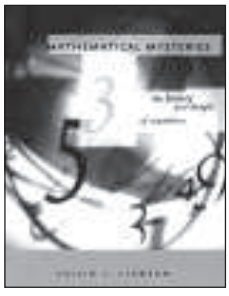
The field is vast; we need more harvesters. Students! You are not late. Join the game of working for excellence for the sake of perfection.●

The mathematicians' patterns, like the painter's or the poet's, must be beautiful; the ideas, like the colours or the words, must fit together in a harmonious way. Beauty is the first test; there is no permanent place in the world for ugly mathematics.

–G.H. Hardy, A Mathematician's Apology

"We now know that there exist true propositions which we can never formally prove. What about propositions whose proofs reqire arguments beyond our capabilities? What about propositions whose proofs require millions of pages? Or a million, million pages? Are there proofs that are possible, but beyond us?"

– Calvin Clawson
Mathematical Mysteries, 1999



Recent Trends in Mathematical Research and Applications

Dipjyoti Barman
Assistant Professor

In recent years Mathematics has evolved considerably to extend its applicability to real problems. Math is present in day to day life and is being used even when people don't realize that they are using mathematical reasoning. Almost all areas of human activities make more and more use of mathematics. They use all branches of mathematics, not just traditional applied mathematics. Mathematical activities like research, applications, education, exposition, has changed a lot in the last some years. Many new forms of mathematical activity like algorithms and programming, modeling, conjecturing, expository writing and lecturing, are getting significance. Following are some of the emerging fields where a large numbers of research works are going on today for their applications in various branches of Physical Science, Life Science and also Social Sciences.

Biomathematics

Biomathematics is the branch of Mathematics in which mathematical models are used to understand phenomena in biology.

Mathematical and theoretical biology is an interdisciplinary scientific research field with a range of applications in biology, medicines and bio-technology. The field may be referred to as Mathematical Biology or Biomathematics to stress the mathematical side, or as the theoretical biology to stress the biological side. It includes at least four major sub-fields: Biological Mathematical Modeling, Relational Biology, Complex Systems Biology (CSB), Bioinformatics and Computational Bio-modeling. It is also very similar to the new field of Algebraic Biology. Mathematical Biology aims at the mathematical representation, treatment and modeling of biological process, using a variety of mathematical techniques and tools. It has both theoretical and practical applications in biological, biomedical and biotechnical research.

The mathematical areas of calculus, progability theory, statistics, linear algebra, abstract algebra, graph theory, combinatorics, algebraic geometry, topology, dynamical system, differential equations and coding theory are now being applied in biology. Some mathematical areas like statistics are developed as tools during the conduct of research into mathematical biology.

Mathematics For Environmental Studies

Applied mathematics has gained growing importance in order to analyze and estimate mathematical models for environmental problems in recent times. Various fields such as Optimization

Theory, Combinatorics, algebra, topology and various equations, and the theory of mathematical systems, including linear and nonlinear programming, give effective theory for solving problems related to environmental pollution and destruction of the ecological systems.

In order to solve our enviromental problems, it is effective to quantify and to analyze these ecological systems as mathematical models. For this, it is very inportant to develop techniques to construct, apply and estimate the mathematical models. Researches on mathematical models of environmental problems and their analysis by using the theory of mathematical science and computer simulation has become of great importance now a days.

Prediction Analysis

Predictive modeling is a technique that uses mathematical and computational methods to predict an event or outcome. A mathematical approach uses an equation-based model that describes the phenomenon under consideration. The model is used to forecast an outcome at some future state or time based upon changes to the model inputs. The model parameters help explain how model inputs influence the outcome

Safety and Precautions

Mathematical modeling can also be used to predict behavior. In these studies data are collected and the set of data thus collected is run through a proper mathematical model and then predications can be made what kind of crimes are most likely to happen and where. There is a phenomenon called "Broken Window Affect". It describes the tendency of thieves to target areas where they were previously successful, where they already know the escape routes. With the help of predictive mathematical models police can concentrate their efforts on those areas where these crimes likely to happen.

Another application of mathematical modeling is to understand how our bodies function and how our bodies respond to drugs for treatments of various diseases. In order to treat systemic illnesses, such as diabetes or hypertension, we must consider what effects a drug might have on our bodies. Mathematical modeling can be used to run different combinations to predict side effects and to identify which scenarios are the safest and most promising.

Mathematics of DNA

In the study of genefics two most important sub sections of mathematics that play a major role are statistics and probability. Through probability, its formula and applications, people working in the field of genetics understand the mechanism of meiosis, forming eggs cells and sperm, and the process of inheritance. They also get an understanding of how phenotypes (observable disease) and genotypes (the DNA of sequences) are related to each other through the study of probability distribution. They also conduct the analysis and study of genetics determinants through the application of statistics and its methods and principles.

Numerical Analysis, statistics and modeling plays a significant role in mapping and sequencing our DNA-the blueprint for genetic information. Researchers predict that this fusion of mathematics and biology will result a new era of molecular medicines, where diagnosis, treatment and prevention of disease will be individual specific and this will be more powerful.

Mathematics in Voting

A Voting system or a voting scheme is a way for a group of people to select on from among several possibilities. If there are only two alternatives between which we have to choose one, then it is easy. It is when several people have to choose among from more than two alternatives then things become trickier.

The scientific and statistical study of voting

and elections, which began around the time of the French Revolution, is called Psephology, which was derived from the Greek word psephos means ballot.

In the 1950s, the mathematical theory of games, devised by John von Neumann, was used to analyze voting systems.

Modern research focuses on devising new criteria and new methods of fulfilling the benefifts and weaknesses of a voting system in mathematical terms. With high-power computers, it is feasible to simulate elections and to study the practical implications of modifications in voting and counting procedures.

Mathematics in Actuary Science

Actuarial science became a formal mathematical discipline in the late 17th century with the increased demand for long-term insurance coverage such as life insurance and health insurance.

An Actuary is a business professional who analyzes the financial consequences of risk. Actuaries use mathmatics, statistics, and financial theory to study these uncertain future events based on insurance and investment. Actuaries may work for insurance companies, consulting firms, government, hospitals, banks and investment firms, or, more generally, in businesses that need to manage financial risk. A career as an Actuary is basically a business career with a mathematical background. The field of Actuarial Science is slowly gaining popularity and recognition in India, but ouside India there is a huge demand for Actuaries both in the developed as well as emerging countries.

Mathematics at the heart of Biometrics

When looking at a Personal Computer, we just see some physical components that make up a complete PC-CPU, Motherboard, Screen, Hard Disk Drives, Keyboard and Mouse, the essential hardware components which are necessary to able to use the PC. But we hardly think of the Operating System which is the heart of a PC which makes these components work together. An Operating System is a very complex set of logical mathematical equations.

The same principle applies to biometric devices. On a Biometric Device we see different hardware components. For instance, on a Fingerprint Biometric Device, we see a fingerprint scanner lens where we place our finger, a screen that informs us if access is granted or denied.

But we give very little thought to what makes a biometric device functions and how it verifies who we are. Mathematical equations are used to verify or identify the physical biometric attributes of an individual and compare it to what is stored in the systems database.

In biometrics we call this mathematical equation an algorithm. The biometric features of an individual are converted to a mathematical string or template by using this algorithm. This template is stored in some sort of database and when the user places his or her finger on the fingerprint scanner the algorithm compares the template from the fingerprint scanner to the template stored in the database.

There are two functions involved in verifying a template. The first is the extraction function and the second is the comparison function. The extraction function takes the image presented to it from the scanning device and converts it to a mathematical string or template. The second function then compares the extracted template with the template saved on the database and if enough points of comparison correspond the system will verify or identify an individual.

Biometric algorithms are extremely complex logical mathematical equations and the complexity of the algorithm ultimately determines the success of the biometric device.●

Is It Solved?

Devajit Nath
B.Sc. 6th Semester

Do not worry about your difficulties in Mathematics I can assure you mine are still greater.

— Albert Einstein

Mathematics may not teach us how to inhale Oxygen and exhale Carbon dioxide or how to love a friend and forgive an enemy. But it gives us every reason to hope that every problem has a solution. The essence of mathematics is not to make simple things complicated, but to make complicated thinks simple. Though sometimes mathematics can get pretty complicated. There are some problems in the world of mathematics which remained unsolved untill now. These problems can easily be understood by anyone, but nobody has been able to Solve it till date. Here I present some problems which were never solved.

Collatz Conjecture

The conjecture is named after Lothar Collatz. He introduced this conjecture in 1937 two years after his doctorate. This problem is also known as "3n + 1" Conjecture. The problem says -

Pick any number. If that number is even divide it by 2. If it is odd, multiply it by 3 and add 1. Now repeat the process with your new number. If you keep going you will eventually end up at 1.

Illustration

Let us consider a number n = 12, then since 'n' is even we divide it by 2 and get 6 which is again even so the successor is 3. Since 3 is odd we multiply it by 3 and add 1 to it. So the sequence becomes....

12, 6, 3, 10, 5, 16, 8, 4, 2, 1.

Mathematicians have tried millions of number and they have never found a single number which didn't end up at '1' eventually. They could never prove that there isn't a special number out there that never leads to 1. It is possible there is some really big number that goes to infinity instead. Or a number that gets stuck in a loop and never reaches1. But no one is able to prove it till date.

Perfect Cuboid Problem

Everyone knows the Pythagorean theorem $A^2 + B^2 = C^2$? The three letters A. B. and C. represents three sides of a right angled triangle.

Now extending this idea into three dimensions there will be four whole numbers A, B, C and G. The first three are the dimensions of the box and G is the diagonal running from one of the top corners to opposite bottom corner.

The problem is to find a box where $A^2 + B^2 + C^2 = G^2$, and where all the seven numbers are integers. This is called a perfect cuboid. Mathematicians have tried many different possibilities and have yet to find a single one that works. But they also haven't been able to prove that such box doesn't exists. which is irony in the problem.

The Beal Conjecture

The Beal Conjecture was introduced in 1993 by Andrew Beal, after whom the name is derived. He discovered this while he was generalizing the Fermat's last theoren.

Statement :

If $A^x + B^y = C^z$ *and A, B, C, X, Y, Z are all positive integers (whole numbers greater than 0) then A, B and C should have a common prime factor.*

Goldbach's Conjecture

Goldbach's Conjecture was discovered by Christian Goldbach. He wrote a letter to Leonard Euler on 7 th June 1742 where he proposed the following conjecture.

Statement : Every integer which can be written as the sum of two primes, can be also written as the sum of as many primes as one wishes, untill all terms are unit.

He again proposed another conjecture in the Margin of the letter.

Every integer greater than 2 can be written as the sum of three primes. (He consider 1 as a prime number, which was abondoned. The two Conjectures are now equivalent.)

'Every integer greater than 5 can be written as the sum of three primes.'

And also *: 'Every even integer greater than 2 can be written as the sum of two primes.'*

As we continue to calculate larger and larger number, we may find one such number that is not the sum of two primes, But till date no one is able to find such a number.●

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

–Karl Weierstrass

"It is impossible to be a mathematician without being a poet in soul."

–Sofia Kovalevskaya
Recollections of Childhood, 1895

ϕ = Phi $\approx$ 1.618
The Golden Ratio

Sanchita Talukder
B.Sc. 6th Semester

Golden Ratio is a special number which is approximately equal to 1.618033988 ..... . The digits just keep on going, with no pattern. Golden ratio is also known as golden section, golden mean, golden number, divine proportion, divine section and golden proportion. It is denoted by ϕ (phi). The Golden Ratio is an irrational number which is a solution of the quadratic equation $x^2 - x - 1 = 0$, with a value of :

$$1.618... = 1 + \frac{1}{1.618....} \quad \phi = \frac{1+\sqrt{5}}{2} = 1.618033988....$$

Calculation

We find golden ratio when we divide a line into two parts such that :

The whole length by the long part is also equal to the long part divided by the short part.

Golden ratio is given by,

$$\frac{a+b}{a} = \frac{a}{b} = 1.618... = \phi$$

Let us consider a golden rectangle with longer side a and shorter side b. The rectangle is placed adjacent to a square of length a, which will produce a similar golden rectangle with longer side a + b and shorter side a.

Therefore, $\frac{a+b}{a} = \frac{a}{b} = 1.618... = \phi$

We can also determine ϕ in other methods too.

Like, $\phi = 1 + \frac{1}{\phi}$;

In numbers :

That can be expanded into the fraction which goes on for ever,

$$\phi = 1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1+.....}}}$$

Fibonacci Numbers And Golden Ratio

Fibonacci numbers are a sequence of integers with pattern.

The Fibonacci sequence is given by,

0, 1, 1, 2, 3, 5, 8, 13, 21, 34 ...

The next number is calculated by adding up the two numbers before it.

When we take any two successive fibonacci Numbers, their ratio is very close to the Golden Ratio. Bigger the Fibonacci numbers, closer will be the approximation.

Interesting Facts And Example

1. The human face is based on Phi and Golden Ratio proportions. Several studies have observed that humans are most attracted to faces that has Golden Ratio proportions. For example : The head forms a golden rectangle with the eyes at its midpoint, etc.

2. Sunflower and makeup of honeybee colony are good examples of golden ratio in nature.

3. The shape of our own galaxy, the Milky way is similar to the Golden spiral and we can easily draw a Golden rectangle and therefore, this is another example of golden ratio proportion.

4. Seed heads, pods of the pine cone, fruits and vegetables like pineapple, red cabbage etc. are examples of golden ratio.

5. Branching pattern in trees, outer calearous shell of snails, the movement of air and wind in hurricanes reveals the usage of golden ratio.

6. Our bodies have golden ratio proportions. For example : measurement from navel to the floor and top of the head to the navel is golden ratio. Even, animal bodies have golden ratio proportions.

Golden Ratio In Art Composition And Design

Some artists and architects believe that with the help of Golden ratio, beautiful shape can be prepared, which created beauty in the nature. Many buildings, monuments and paintings are made based on Golden Ratio. For example :

● Design of Parthenon in Athens is based on golden ratio.

● Another interesting example is, Leonardo da Vinci's Monalisa. Also, Leonardo da Vinci's " The Last Supper" is also based on Golden Ratio proportion.

Likewise, there are more Real life examples which are based on Golden Ratio.

The Golden Ratio is a very interesting number whose interest is not limited to mathematicians only. Biologists, artists, musicians, architects, historians, everyone studied this particular ratio, so as to explore the subject. Even, the greatest mathematicians of all time tried harder to study this simple ratio and its properties. Probably, this ordinary ratio inspired thinkers to think over it and created some extraordinary works throughout, like no other number in the history of Mathematics.●

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

–Hermann Hankel

The Development of Mathematics in the last few centuries, 1869

Mathematics and Literature

Hiramoni Das
B.Sc. 6th Semester

If some one look generally he or she can not find any relation between mathematics and literature but if we think deeply we can find a lots of relation between maths and literature. The relations between maths and literature are discussed below.

Both require finding and elegant solution to a problem. In math, the beauty lies in showing an elegant solution or constructing a model to represent a problem while in literature, you find the most elegant way to tell a story or construct a silence. Hence both require alot of creativity. (Einstein : "Logic will get you from A to B; imagination will get you every where.") Because of the amount of Creativity thinking involved, both can be very painful endeavors. Hemingway : "There is nothing to writing. All you do is sit down at a type writen and bleed."

What's interesting is that both endeavors they to tell a truth about the world we live in. A mathematical model and dramatic conflict in literature both sort of occur in a vacuum; they are separate entities from reality because they both selectively isolate parts of reality to achieve: their goal. For example, the solow growth model attempts to explain economic growth by choosing variables such as capital (k) and Labor (L) that are belived to affect economic growth. The model plays around with these variables to see what happens to the result when you increase or decrease, a variable. The production function is directly correlated with the output a country produces, and the model attempts to explain this law. This mathematical model helps a country create more output because it tells us the country how capital, labor and technology are related. But there are also things it doesn't tell us: like how bad climate can really affect K and L. The model ignores parts of reality in order to irolate what it is trying to tell us.

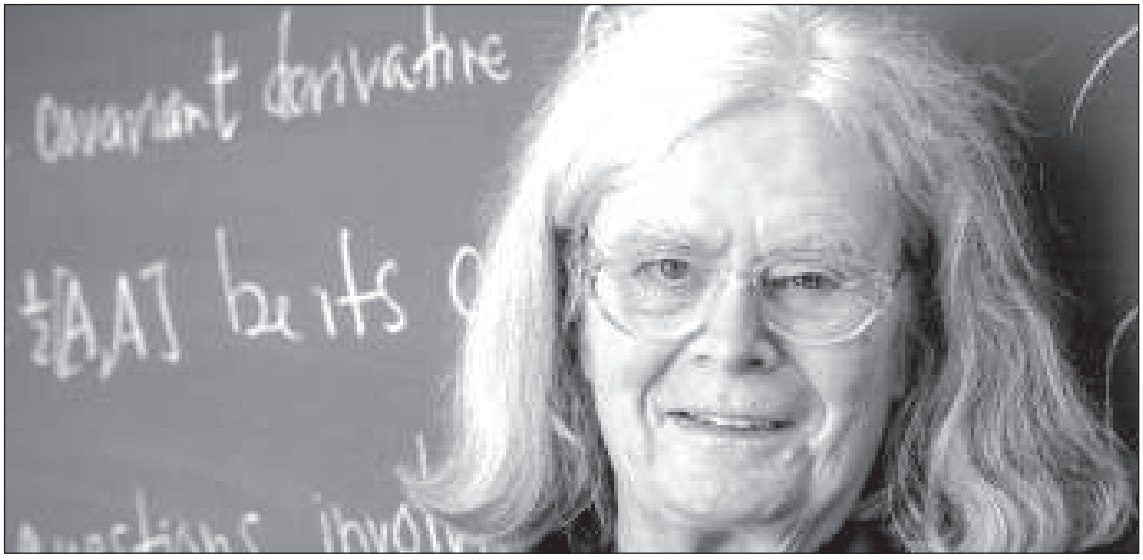
Literature in a way does the same. For example, George Orwell's 1984 shows us what could happen to citizens living in a totalitarian society. In the world of 1984, the government with absolute power watches every one and uses technology to manipulate every one's thoughts. This sort of setting causes our main characters. who are supposed to be lovers, to betray each other. Orwell uses this reality that he has created to show us the importance, of free speech, democracy, etc. His book has also allowed us to improve our society and stay away from the dangers that he has envisioned.

Both maths and literature have thus constructed an alternate reality where the creator can play with the variables. Yet the beauty of it is that in the end, they tell us truths about our own reality.●

এবেল বঁটা

হুমায়ুন কবিৰ
স্নাতক (বিজ্ঞান) ষষ্ঠ যান্মাসিক

গণিতৰ জগতখনৰ শীর্ষবঁটা 'এবেল প্রাইজ'। এইবঁটা এইবাৰ লাভ কৰে আমেৰিকাৰ গণিতজ্ঞ কেৰেন উলেনবেকে (Karen Uhlenbeck)। তেওঁ হৈছে এবেল বঁটা লাভ কৰা বিশ্বৰ প্রথমগৰাকী মহিলা। জ্যামিতিৰ ব্যাখ্যা আৰু গজ (gauge) থিয়ৰীৰ বাবে তেওঁলৈ আগবঢ়োৱা হৈছে এইবঁটা। ৭৬ বছৰীয়া উলেনবেক হৈছে প্রিন্স বিশ্ববিদ্যালয়ৰ জ্যেষ্ঠ গৱেষক শিক্ষাবিদ। আমেৰিকাৰে ইনষ্টিটিউট অৱ এডভান্সড ষ্টাডিৰ সৈতেও তেওঁ জড়িত। উল্লেখ্য যে ১৯ শতিকাৰ নৰৱেৰ গণিতজ্ঞ নীলছ হেৰিক এবেলৰ স্মৃতিত প্রদান কৰা হয় এবেল বঁটা। ১৮০২ চনত জন্মগ্রহণ কৰা নীলছ এবেলৰ ১৮২৯ চনত দেহাৱসান ঘটিছিল। তেওঁৰ মৃত্যুৰ পিছতেই এইবঁটা প্রদানৰ প্রস্তাৱ লোৱা হৈছিল যদিও সেয়া হৈ উঠা নাছিল। ২০০৩ চনৰ পৰাহে এবেল বঁটাৰ আর্হিত এইবঁটা প্রদান কৰা হয়। নৰৱেৰ চৰকাৰে প্রদান কৰা এবেল বঁটাক বহুতেই গণিতৰ ন'বেল বঁটা বুলিও অভিহিত কৰে। ২০০২ চনত এটলে ছেলবার্গক সন্মানীয় এবেল বঁটা আগবঢ়োৱা হৈছিল যদিও ২০০৩ চনৰ পৰাহে বর্তমানৰ প্রচলিত এবেল বঁটা প্রদান কৰা হয়। নৰৱেৰ প্রখ্যাত গণিতজ্ঞ গৰাকীৰ দুশ বছৰীয়া জয়ন্তীৰ সৈতে সংগতি ৰাখি এবেল বঁটা প্রদানৰ পৰম্পৰা আৰম্ভ হয়। নৰৱেয়ান একাডেমী অৱ ছায়েন্স এণ্ড লেটার্ছে এবেল বঁটা বিজয়ীৰ নাম ঘোষণা কৰে। ২০০৩ চনত ফ্রান্সৰ জাঁ-পীয়েৰ ছেৰেই লাভ কৰিছিল এই বিশিষ্ট বঁটা। তেওঁৰ লগতে বৃটেইনৰ গণিতজ্ঞ মাইকেল আটায়াকো যুটীয়াভাৱে এবেল বঁটা প্রদান কৰা হৈছিল প্রথম বর্ষত। ২০০৭ চনত ভাৰতীয় মূলৰ মার্কিন গণিতজ্ঞ এছ আৰ শ্রীনিৱাসবর্দ্ধনে লাভ কৰিছিল এবেল বঁটা।●

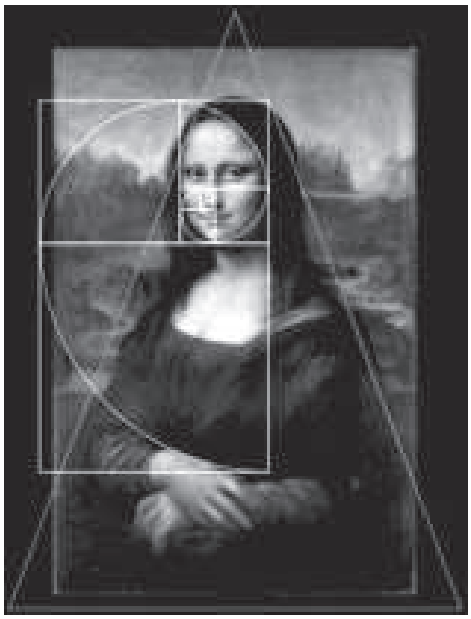


Mathematics and Monalisa

Kingsmita Borah
B.Sc. 4th Semester

"Where the spirit does not work with the hand, there is no art."
—— Leonardo da Vinci.

Monalisa, the most mysterical painting by the great painter, in rentor. sculptor Leonardo da Vinci. It is a portrait of Lisa Gheradini and was painted during the period 1503 and 1506. It is considered as one of the most mysterical painting in which, Vinci reveals many mystery and some mysteries are yet to be discovered. The painting has been currently preserved at the Louvre Museum in Paris since 1797. There is a mathematical ratio commonly found in nature, the ratio of 1 to 618. The Monalisa was drawn according to the golden ratio.



The golden ratio is 1: 0.618 and has been coined golden because it is said to be aesthetically pleasing. The golden proportion can be bound throughout the human body. A golden rectangle is simply a rectangle with dimensions that reflect the golden ratio. The Monalisa has many golden rectangles throughout the painting. By drawing a rectangle around her face. We can see that it is indeed golden. If we divide that rectangle with a line drawn across her eyes, we get another golden rectangle, meaning that the proportion of her head length to her eyes is golden. There are other golden rectangles that can be drawn on the rest of her body, like from her neck to the top of her hands.

Da Vinci created other pieces that were also drawn according to the golden ratio such as the last supper, old Man, and the Vitruvian Man. The Vitruvia Man (Or Man in Action) in the drawing of a man inscribed in a circle. The height of the man is in golden proportion from the top of his head to his navel and from his navel to the bottom of his feed. The Vitruvian Man illustrates all of the divine. proportions within then human being.●

17 Equations that Changed the World

Pooja Biswas
B.Sc. 6th Semester

One of the masters of writing mathematician Ian Stewart wrote about 17 equations that he belives have changed the world. In his book,

In Pursuit of the Unknown: 17 Equations that changed the world, he discusses each equation in an engaging and practical manner, and he gives a number of illustrations of how those equations have and are impacting our lives.

Pythagorean Theorem

$a^2+b^2= c^2$

Pythagorean theorem helped us create better maps. We use theorem to find the shortest distance. Pythagorean Theorem is a useful technique for architecture, woodworking, or other physical construction projects.

$\log_b (a.c) = \log_b a + \log_b c$

Logarithms helped as perform todious calculations before there were calculators. They are especially evident in science and measurement. When we talk about tiny and gigantic things, we always use. logarithms such as; our sensitivity to light, earthquake magnitudes, noise levels in decibels, acidity (pH) momey growing with a fixed interest rate, bacteria growing in a petri dish, radioactive decay.

Calculus

Calculus appears everywhere in modern science and technology whether we are modelling the rise in the fall of the stock market or determining exactly when a space rocket will arrive into Earth's orbit, and basically created the modern world. Calculus holds incredible power over the physical worlds by modelling and controlling systems. It's the language of medical experts, scientists, engineers, statisticians, physicists and economists.

If a quantity on a system is changing we can use mathematical modelling of calculus to analuze a system fund an optimal solution and predict the future.

Newton's law of gravity

$$F_{grav} = \frac{Gm_1m_2}{r^2}$$

Helped us understand the movement of the

stars and planets. It's actually a key to understand the divine force, momentum and many other laws.

Complex Numbers

$i^2 = -1$

The square root of minus 1 was invented by people in order to solve equations. Most of our modern tech depends on them.

i^2 was a great discovery and had a lot to do with the development of quantum mechanics. Many people hated this. It brought up ideas that turned out to be very important.

Euler's Formula for Polyhedra

$V+F = E+2$

Helped us send rockets throughout space and understand DNA replication. Euler's formula is an essential ingredient in finding solutions for network information. Euler's invention is a new way of thinking about shape and space.

It also provides a clear connection between geometry and the knot structure of a DNA.

$$\rho\left(\frac{D\vec{v}}{Dt}\right) = -\nabla p + \nabla \cdot T + f \qquad \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-\mu)^2/2\sigma^2}$$

Normal Distribution

It transformed how we understand medical trials and how we gamble. It also changed almost all psychological and educational aplications of our modern world. Statisticians and scientists use the normal distribution to measure reading ability, job satisfaction, surveys, IQ scores, blood pressure, measurement errors , etc.

Wave Equation

$$\frac{\partial^2 u}{\partial t^2} = c^2 \nabla^2 u$$

It tells us what the earth is made of and helps us find oil easier. It plays an essential role in electromagnetism, optics, fluid dynamics and heat transfer. It helps us perdict the future dynamic properties such as energy and impulse.

Fourier Transform

$$\pi(s) = \int e^{-2\pi ist}\, \pi(t)dt$$

Thanks to these algorithms, because the interned, wifi, smart phones, computers, routers, almost everything that has a computer inside uses Fourier transform algorithms. Fourier transforms are important in signal processing. We can now compress thousands of information into a tiny dongle.

Navier -Stokes Equation

The Navier-stoked equations are significant in terms of pure science and mathematics. The equation represents the governing equations of one model of fluid flow. The equation also tells us all the fast things in life can go even faster.

Maxwell's Equations

$$\nabla . E = \rho / \mathrm{E}_0$$
$$\nabla . B = 0$$
$$\nabla \times E = -\partial_t B$$
$$\nabla \times B = \mu_0 (j - E_0 \partial_t E)$$

All modern wireless communications as we know it today because Maxwell's equations are the mathematical summary of electromagnetism. The equations show the relationship between electromagnetism.

Second law of thermodynamics

$$\Delta s \geq 0$$

It literally drove the industrial revolution and gives us efficient power generators. It also

represents the relationships between heat and energy. For instance, it explains what happens to our cup of tea if we don't drink it for 5 minutes.

Relativity

$E = mc^2$

The relativity theorem is very important because it answered previously almost all the questions that remained unanswered. It changed the way we look time, space and gravity. It is everything for black holes, the big bang, nuclear power but also GPS on our phones.

Schrodinger's Equation

$$i\hbar\frac{\partial\psi}{\partial t} = \hbar w\psi = E\psi$$

This theorem changed the field of quantum physics. It made possible to work on quantum and calculate what would happen next. It is also essential for modern computer chips and lasers and cats.

Information Theory

$$H(x) = -\sum_{x\in s} P\times(x)\log P_x(x)$$

Information theory means the entire internet. It literally models the human machine communication process. This theory is now more important than communication itself.

Chaos Theory

Predicting the weather better. It's the butterfly's fault for flapping its wings. The equation also predicts the growth rate of the butterfly population.

Black-Scholes Equation

The massive growth and profits of the financial sector in the 2000 s and the financial crisis of 2008-2009.●

You teach best what you most need to learn.

–Richard Bach, Illusions

"Each generation has its few great mathematicians, and mathematics would not even notice the absence of the others. They are useful as teachers, and their research harms no one, but it is of no importance at all. A mathematician is great or he is nothing."

–Alfred Adler

Mathematics and Creativity, The New Yorker, 1972

The Beauty of Mathematics

Ankrita Sarma
B.Sc. 2nd Semester

Mathematics, the Qucen of all sciences, itself reveals the beauty of the subject.

The word “Perfect” means, it cannot get better than this and we know “Nothing is perfect”. But we can contradict the statement by citing the two most perfect things in the world. One is the Mother Nature and the other is Mathematics.

Mother Nature is the reason for life as well as death. So, we should protect our mother nature instead of using the resources vigorously. On the other hand, Mathematics is man-made and whether it was invented or discovered but either way, it is still perfect. also, the new and upcoming discoveries in our day to day life that are made in nature and maths as well, are very informative and keeps us aware of the truth throughout.

Maths is founded on simple yet powerful element– numbers. Numbers, just like the element of nature, share a complex relationship with every other element in the set. This relationship is universally valid. Now, if we consider the equation, $(a+b)^2 = a^2+2ab+b^2$, then it is obvious that, the equation stands true on Earth, anywhere and everywhere in the nature, either planets or stars Hence, the equation would never change. Because math doesn't exist in this physical dimension. It exists in the human mind and is a mental concept, which is one of the most beautiful concept created by human mind and so, the subject and human beings are always co-dependent to aid each others growth.

Maths is full of creativity and varies from element to element, shape to shape and relation to ralation. Maths is an abstract representation of nature and this fundamental reason suggest that maths is not different from the nature. Hence, any real world problem can be solved in maths and any maths solution is effective in the real world.

The Human mind always strikes with several questions, like, what is the largest number our mind can conceive? What is the size of the universe? There is one and only one answer to the two questions. We basically think it is infinite but its not. The answer to both the question is similar and it is zero. The size of the universe is zero and so is the largest number. We all know, for every positive number, there exists a negative

in maths. For every matter there exists anti-matter in nature.Therefore, when we put everything together, the size of the universe is zero. Zero is thus simultaneously everything as well as nothing. This is how we put our explanation on this fact. That's why, it is called a whole number. We can add or remove anything from this whole, it still remains a whole.

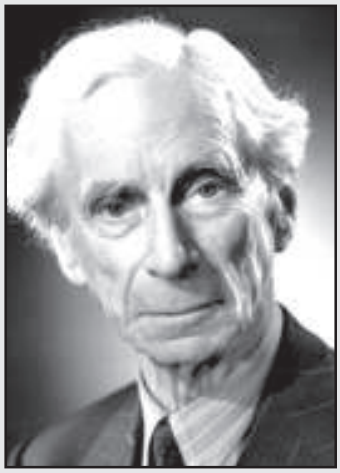
It is indeed a beautiful concept which was made in ancient India, at a time, when the rest of the world was busy figuring out whether the earth is flat or round.

It's really amazing and makes me feel proud of the ancient India, which was effective for such outstanding creativity and is still effective for more impressive innovation in the near future, so as to change and nourish the human thought process throughout.●

Russell's Paradox

Aman Kumar
B.Sc. 6th Semester

The concept of set is most basic in Mathematics. Set theory is a branch of mathematical logic that studies sets, which informally are collections of objects. The language of set theory can be used to define nearly all mathematical objects.



The modern study of set theory was initiated by Georg Cantor and Richard Dedekind in the 1870s. After the discovery of paradoxes in naive set theory, such as Russell's paradox, numerous axiom systems were proposed in the early twentieth century. Bertrand Russell and Ernst Zermelo independently found the simplest and best known paradox, now called Russell's paradox: Consider 'the set of all sets that are not members of themselves', which leads to a contradiction.

According to the naive set theory, any definable collection is a set. Let R be the set of all sets that are not members of themselves. If R is not a member of itself, then its definition dictates that it must contain itself, and if it contains itself, then it contradicts its own definition as the set of all sets that are not members of themselves. This contradiction is Russell's paradox.

In 1908, two ways of avoiding the paradox were proposed, Russell's type theory and the Zermelo set theory, the first constructed axiomatic set theory. The essential difference between Russell's and Zermelo's solution to the paradox is that Zermelo altered the axioms of set theory while preserving the logical language in which they are expressed while Russell altered the logical language itself.●

Indian Mathematics and Discovery of Zero

Dibyajyoti Dutta
B.Sc. 6th Semester

The Golden bird country India was not only rich in history and trade but it also played a prominent role in the discovery and development of Modern Mathematics. Indian Mathematics emerged in the Indian sub continent from around 1200 BC untill the end of 18th century. In the classical period of Indian Mathematics important contributions were made by the scholars like Aryabhatta, Brahmagupta, Bhaskara II. The Decimal Number system in use today was first recorded in Indian Mathematics. Indian mathematicians made early contributions to the study of the concept of Zero (Sunya) as number.

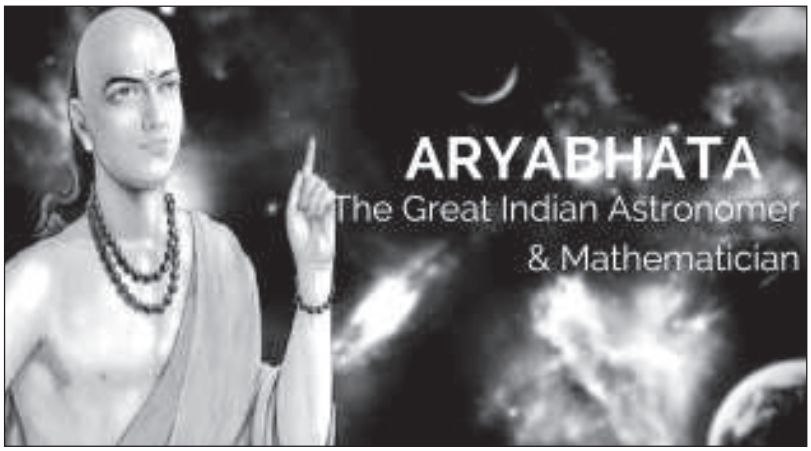
Ancient and Medieval Indian mathematical works were composed in Sanskrit, usually consisted of sections of sutras. All Mathematical works were orally transmitted until 500 BC, after which manuscript were introduced.

The excavations on the early civilizations of India the Harappa, MohenjoDaro and the Indus Valley civilisation uncovered evidences of practical mathematics.

The discovery of zero and decimal number system played a significant role in the advancement of mathematics. The concept of zero was first given by Babylonians, Mayans and Indians. Despite being very skilled mathematicians the Mayans and Babylonians never used zero in equations. India was the first country to accept zero in their number system.

India : The Place Where Zero Became A Number

The concept of zero was first appeared in India around 458 AD. In 628 AD an Indian mathematician Brahmagupta developed a symbol



for zero- a dot underneath the numbers. He also developed rules for reaching zero through addition and subtraction. This was the first time the world accepted zero as a number. Zero signifies nothing, null and current definition calls it as 'additive identity'.

Mathematically, x + 0 = x, i.e. zero is a number which, when added with any number gives the same number.

Around 500 AD Aryabhatta, an Indian Mathematician, devised a numbers system and symbol he used for the number zero was also the number used to represent unknown number (say x). This system was confusing but the improvements continued and by 876 AD, the concept of zero was mostly understood and the symbol for it was ascertained.

The Mathematician Bhaskara, Mahavira later worked on this new number and tried to explain the properties of the number. one example is –

$0^2 = 0$ and $0^{1/2} = 0$

Also, according to them any number divided by zero is uncertain and = infinity (n /0 = infinity) which was wrong as if it was possible then 1 = 2= 3 ..... must also be possible. The reason of this was that the Indian Mathematicians could not conclude that no number can be divided by zero.

Thus, invention of zero was not a result of a single person. Though invention of zero was carried out by various theories, Aryabhatta was most significant in the discovery of zero. So he is often referred or known as the inventor of ZERO.

Rather than this Indian Mathematics also contributed in various field of mathematics. The Decimal Number System, contribution in various field of calculus, series expansions, trigonometric functions are some prominent works of Indian mathematics. Among the mathematicians the works of Aryabhatta, Bhaskara II, Brahmagupta and Ramanujan are significant in the development of mathematics. ●

একোটা তথ্য আহিছে, দুদিন প্ৰতিষ্ঠা লাভ কৰিছে, তাৰ পিছত বিদায় লৈছে। পূৰ্বপুৰুষসকলক ভুল প্ৰতিপন্ন কৰিছে নিউটনে, নিউটনক ভুল প্ৰতিপন্ন কৰিছে কুৰি শকিতাই। ইউক্লিড-ডেকার্ট-পাইথাগোৰাচৰ পাছত ৰীমান্ আৰু আইনষ্ঠাইন্। ফ্লেট পৃথিৱীৰ ইউক্লিডীয় জ্যামিতিৰ ভিত্তি কম্পিত কৰি বক্ৰজ্যামিতিৰ পিঠিত আঁউজি আইন্ষ্টাইনে কৈছে— 'সৰলৰেখা এটা বিৰাট ভুৱা..... হয়তো আইন্ষ্টাইনো এদিন মিছা হৈ যাব। কোনো স্থিৰতা নাই, কোনো কথাই লাষ্ট-ৰৰ্ড্ নহয়, কোনো উপপাদ্যই চৰম সত্য নহয়— One thing is certain, and rest all lies; that time flies.....

কই নিজ মনেই ভাবে ঃ তথাপি, আমাৰ ফ্লেট পৃথিৱীত সেই চিৰন্তনৰেই নিত্য পুনৰাভিনয় চলে, সেই পুৰণি জ্যামিতিৰ নিয়মেৰেই ককাদেউতাৰ ত্ৰিভুজ নাতিল'ৰাই পুনৰ্নিৰ্মাণ কৰে। স্থানৰ বুকুত গ্ৰহ-উপগ্ৰহই জ্যামিতি ৰচনা কৰে, ফুলৰ পাহিয়ে কার্টেচীয় জ্যামিতিৰ সমীকৰণৰ লগত সুৰ মিলায়, মুগ্ধ হৈ জীনচে কয়, ভগবান এজন বিদগ্ধ গণিতজ্ঞ। দিনটোৰ অফিচৰ কামৰ শেষত ৰাতি 'ক' যায় 'গ'ৰ ঘৰলৈ তাচ খেলিবলৈ— ক খ গ পথেৰে নহয়, সংক্ষিপ্ত ক গ ৰেখাৰেই যায় লৰা-লৰিকৈ। কথাটো মনত নপৰে সদায় যদিও, 'ক'ই জানে— (Euclid 1.20) — ত্ৰিভুজৰ যিকোনো দুই বাহুৰ সমষ্টি তৃতীয় বাহুতকৈ ডাঙৰ।

—জ্যামিতি/ সৌৰভ কুমাৰ চলিহা

Fibonacci Sequence

Nabanita Kalita
B.Sc. 4th Semester

Mathematics is a huge and interesting subject comprising of various numbers, sequences and their amazing facts. So, here we take a glance on Fibonacci numbers, Fibonacci sequence and their applications.

Fibonacci numbers is basically denoted by F_n. Fibonacci numbers, when arranged in a systematic manner gives rise to fibonacci sequence. Each number in the sequence is the sum of the two numbers that precede it. So, the sequence is : 0, 1, 1, 2, 3, 5, 8,13, 21, 34 .... From the sequence, we describe the mathematical equation $X_{n+2} = X_{n+1} + X_n$. The name "Fibonacci sequence" was first used by the 19th century number theorist Edouard Lucas.

The Fibonacci Sequence was invented by the Italian Leonardo Pisano Bigollo (1180 – 1250). Who is known in mathematical history by several names : Leonardo of Pisa (Pisano means " from pisa") and Fibonacci was his nickname which means "Son of Bonacci".

Fibonacci, the son of an Italian Businessman from the city of Pisa, grew up in a trading colony in North Africa during the middle ages. Italians were some most proficient traders and merchants during the middle ages, so they needed arithmetic for commercial purposes. At that period of time, mathematical calculations were made by using the Roman numerical system (I, II, III, IV, etc.), which was quite tough. With the help of the Fibonacci sequence, he did spread Hindu – Arabic numeral system (0, 1, 2, 3 .....) for all sorts of calculations which was far better and helpful than the Roman numeral system, for the merchants and traders for commercial transactions.

Applications

i) The Fibonacci numbers are important in the Computational run-time analysis of Euclid's algorithim to determine the greatest common divisor of two integers.

ii) Fibonacci numbers are used by some pseudorandom number generators.

iii) They are also used in planning poker, which is a step in estimating in software development projects that use the scrum methodology.

iv) Fibonacci numbers arise in the analysis of the Fibonacci heap data structure.

v) A One-dimensional optimization method, Called the Fibonacci search technique, uses. Fibnacci numbers.

vi) The Fibonacci numbers are also an example of Complete sequence. This means that every positive integer can be written as a sum of Fibonacci numbers, where any one number is used once atmost.

vii) The Fibonacci cube is an undirected graph with a Fibonacci number of nodes that has been proposed as a network topology for parallel computing.●

Field Medal

Rajib Chetry
B.Sc. 6th Semester.

The "Field Medal" is a prize. awarded to two, three or four mathematicians under 40 years of age at the International congress of the International Mathematics Union (IMU), a meeting that takes place every four years. The Fields Medal is with the Abel Prize, viewed as the highest honour, a mathematician can receive. The Field Medal is equivalent to nobel prize in physics and chemistry.

Some Field Medalists

• In 1954, Jean Pierre Serre became the youngest winner of the Fields Medal at 27.

• In 1990, Edward Witten became the first physicist to win this award.

• In 2006, Grigori Perelman, who proved the Poincare conjecture, refused his Fields Medal and did not attend the congress.●

Mathematical Thinking and Importance

Himan Das
B.Sc. 6th Semester

Mathematical thinking supports science, technology. economic life and development in an economy. Being able to use mathematical thinking in solving problems is one of the most fundamental goals of teaching mathematics. It is an ultimate goal of teaching that students will be able to conduct mathematical investigations by themselves and that they will be able to identify where the mathematics they have learned is applicable in real world situations.

Mathematical thinking is important in three ways

● Mathematical thinking is an important goal of schooling.

● Mathematical thinking is important as a way of learning mathematics.

● Mathematical thinking is important for teaching mathematics. Mathematical thinking is a highly complex activity and a great deal has been written and studied about it.●

The Large Number

Jyotismita Goswami
B.Sc. 4th Semester

'GOOGOL', the term which was coined in 1920 by Edward Kasner's nine-year old nephew, Milton Sirotta which is 10^{100} and then proposed the further term "googolplex" to be " one, followed by writing Zeroes until you get tired." Kasner decided to adopt a more formal definition as 'different people get tired at different times and it would never do to have earnera a better mathe matician than Dr. Einstin, simply because he had more endurance and could write for longer. If thus became standardized to $10^{10^{100}}$. In other words, a 'googolplex' is the number 10 googol or equivalently $10(10^{100})$. Writen out in ordinary decimal notation, it is 1 followed by 10^{100} zeroes, that is, a 1 followed by a googol zeroes. In pure mathematics, there are several national methods for representing large numbers by which the magnitude of a googolplex could be represented such as titration, hyperoperation, Kasner's up-arrow notation.

Considering the physical universe, in the PBS science program cosmos: A personal voyage; astromomus and television personality 'Carl Sagan' estimated that writing a googolplex in full decimal form (ie. "10,000,000,000....") would be physically impossible, since doing so would require more space than is available in the known universe. Basically, a typical book can be printed with 10^6 zeroes (around 400 pages with 50 lines per page and 50 zeroes perline) which finally requires 10^{94} such books to print all the zeroes of a googol plex.

One googol is presumed to be greater than the number of atoms in the observable universe which has been extimated to be appronimately 10=78. Thus in the physical world, it-is difficult to give example of numbers that compare to the vastly greater googolplex. Further sources says that writing the number would take an extreme amount of time; as if a person can write two digits persecond, then writing a googolplex would take about 1.51×10^{92} years, which is about 1.1×10^{82} times the accepted age of the universe. Thus googolplex is so enormous that there are more zeroes in a googol plex than there are particles in the observable universe. A common estimate of the number of particles in the observable universe is 10 to the power of so-less than a googol and less than the member of zeroes in a googolplex (this estimate does not include photons to dark matter). The last but net the least, the residues (Modn) of a googolplex are : 0, 0, 1, 0, 0, 4, 4, 0, 1, 0, 1, 4, 3, 4, 10, 0, 1, 10, 9, 0, 4, 12, 13, 16, 0, 16, 10, 4, 24, 10, 5, 0, 1, 18, 25, 28, 10, 28, 16, 0, 1, 4, 24, 12, 10, ... (sequence A067007 in the OEIS).●

The Importance of Maths in Everyday Life

Nitul Bharali
B.Sc. 6th Semester

In today's world, where we come across several issues that sometime disorder the balance in our life, mathematics is a well ordered application of matter that gets connected to our daily life, for our own benefit, Because, this subject makes a man well organised or systematic. This beautiful subject makes our life orderly and prevent. chaos. The qualities that are nurtured by mathematics are power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem solving ability. and even effective communication skills.

Mathematics is the origin of all creations, without which the world can not move an inch. Be it a cook, or a farmer, a carpenter or a mechanic, a shopkeeper or a doctor, an engineer or a scientist, a musicians everyone needs mathematics in their day-to-day life. Even insects use mathematics in their everyday life for existence. Snails make their shells, spiders designs their web and bees build hexagonal combs. There are countinus example of mathematical patterns in nature's febrics. Anyone can be a mathematician if one is given proper guidance and training in the formative periods of one's life. A good curriculum of mathematics is helpful in effective teaching and learning of the subject.

Experience says learning mathematics can be made easier and enjoyable if our curriculum includes mathematical activities and game. Maths puzzles and riddles encourage and attract an alert and open minded attitude among youngsters and help them develop clarity in their thinking.

Emphasis should be laid on development of clear concept in mathematics in a child, right from the primary classes. If a teacher fails here, then the child will develop a phobia for the subject as he moves on the higher classes. for explaning a topic in mathematics, a teacher should take help of pictures, sketches, diagrams and models as far as possible. As it is believed that the process of learning is complete if our sense of hearing is accompanied by our sense of sight. Open-ended questions should be given to the child to answer and he/she should be encouraged to think about the solution in all possible manners. The child should be appreciated for every correct attempt. And the mistake must be immediately corrected without any criticism.

The greatest hurdle in the process of learning mathematics is lack of practise. Students should daily work out atleast 10 problems from different area in order to master

the concept and develop speed and accuracy in solving a problem.

The present age is of skill-development and innovations. The more mathematical we are in our approach, the successful we will. Mathematics offers rationality to our thoughts. It is a tool in our hand to make our life simpler and easier. Let us realize and appreciate the beauty of the subject and embrace with all our heart.●

Few Problems of Mathematics Recently Solved

Aakash Deka
B.Sc. 6th Semester

Mathematics is a creative and highly interconnected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. Problem solving is interpreted as working through a series of related and predictable questions in order to acquire a particular skill. Here, we have listed below some problems recently solved in the field of Mathematics:

◆ **Seventeen Sudoku Clues:** Sudoku is a popular logic-based puzzle where numbers are placed into a 9×9 grid so that each column, each row and each of the nine 3×3 sub-grids contain just one of the digits between 1 and 9. In 2012, Mc Guire, Jugermann and Civario proved that the smallest number of clues which determine a sudoku puzzle is 17.

◆ **Partition Numbers :** In number theory and combinatorics, a partition of a positive integer is also called integer partition. In the year 2011, Ken One and Jan Bruinier provided the answer to the question, how many ways we can write a positive number as a sum of smaller integers. Partitions can be graphically visualized with Young diagrams or Ferrers diagrams.

◆ **Bounded gaps between primes :** In the year 2013, Yitang Zhang found a wonderful result that there is some number n, below 70 million, such that there are infinitely many pairs of consecutive primes. The subsequent flurry of activity saw James Maynald and a Polymath project by Terence Tao.

◆ **Completion of the Flyspeck project:** The aim of this project is a complete formal verification of the Kepler conjecture. In 1611, Johannes Kepler asserted that the maximum density of a sphere packing in a three dimensional space is achieved by the familiar cannonball arrangement. To eliminate any uncertainties about the correctness of the proof, Thomas Hales launched the Flyspeck project in the beginning of 2003.

◆ **Largest Prime Discovered :** The Great Internet Mersenne Prime Search (GIMPS) has discovered the largest known prime number, $2^{77,232,917}-1$ having 23,249,425 digits on 4th January, 2018. It is a special class of extremely rare prime numbers known as Mersenne primes. It is only the 50th known Mersenne prime ever discovered.●

অনুভৱৰ দলিচাত...

1. Name : Devajit Nath

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Hobby : Watching movies and listening music.

The past 5 years have been years of great experience and self development. I am fortunate enough to be a part of the mathematics family. It provided me good lessons and nurtured my skills that would help me in the long run. Gathering warm thoughts and experience throughout, I wish the department a better future.

2. Name : Sanchita Talukder

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The department, itself is the cradle of knowledge, experience and interest. A Family to me, comprising of worthy teachers and incredible students. Hope, the department strengthen up in the near future.

3. Name : Akash Deka

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তিনি বছৰীয়া ৰহনীয়া স্মৃতি তথা অভিজ্ঞতাবোৰ দুশৰীয়া দফা এটাত আৱদ্ধ কৰাটো একেবাৰেই কঠিন। যোৱা তিনিটা বছৰে আমি বিভাগটোৰ পৰা তথা শিক্ষাগুৰুসকলৰ পৰা মাত্ৰ কেইটামান অংক অথবা এখন 'মার্কশ্বিটেই' লাভ কৰা নাই, সীমাহীন মৰম, অশেষ যত্ন আৰু আশীৰ্বাদমিশ্ৰিত পথ নিৰ্দেশনাৰ অনেক উপচাৰো গোটোৱাৰ সুযোগো পাইছো। বিভাগটোৰ প্ৰতি শুভাশা আৰু শ্ৰদ্ধা পৰিমাপহীন। থকাখিনিৰ উন্নতি আৰু নথকাখিনিৰ সংযোজনেৰে বিভাগটো সদায় দীপ্ত হৈ ৰওঁক বুলি কামনা কৰিছোঁ।

4. Name : Humayan Kobir.

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Hobby : Watching movie.

The department taught me how to study and love this subject. I am very grateful to be a part of this department.

5. Name : Sangita Barua

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Hobby : Cooking and reading novels.

My experience in college has given me a chance to sharpen my skills in my choice of field which I am truely thankful.

6. Name : Dibyajyoti Dutta

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বিগত ৩ বছৰ গণিত বিভাগৰ অধীনত পঢ়ি খুৰেই সুখী আৰু গৌৰৱ অনুভৱ কৰিছোঁ। লগতে আগন্তুক সময়ত বিভাগটোৰ শ্ৰীবৃদ্ধি আৰু উত্তৰোত্তৰ কামনা কৰিলো।

7. Name : Manisha Kathar

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Hobby : listening music and painting

My experience in my college : Entered with white paper , going out with full of colours.

8. Name : Barnali Das

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Hobby : Listening music

বিগত ৩ বছৰ গণিত বিভাগৰ অধীনত পঢ়ি খুৰেই সুখী অনুভৱ কৰিছো। গণিত বিভাগত বহুত কথা জানিব পাৰিছো।

9. Name : Rajib Chetry

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বিগত ৩ বছৰ গণিত বিভাগৰ পৰিয়ালৰ অংশীদাৰ হ'বলৈ পাই সৌভাগ্যৱান অনুভৱ কৰিছোঁ। শিক্ষাগুৰুসকলৰ মৰম, সহায়-সহযোগ লাভ কৰি নিজকে ধন্য মানিছোঁ। লগতে অনাগত দিনত বিভাগটোৰ উজ্জ্বল ভৱিষ্যত কামনা কৰিলোঁ।

10. Name : Dhananjay Debnath

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I had a fairly positive experience in College– The professors are quite supportive and caring. I owe them for all the efforts they have put into us, in shaping our future.

11. Name : Pooja Biswas

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Hobby : Drawing scenery and reading biographies.

It's hard to describe the wonderful experience of almost 3 years in this department in few lines. I would like to thank respected teacher for their immense support. The teachers helped not only in excelling the academics but also inspired us in taking part in co-curricular activities. To sum up in one line : I am very grateful to the teachers of our department for their measureless contribution.

12. Name : Hira Moni Das

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বিগত তিনিটা বসন্তত গণিত বিভাগক মই কি দিলোঁ নাজানো কিন্তু গণিত বিভাগে মোক মোৰ পৰিচয় দিলে আৰু মোৰ জীৱনত এক নতুন সপোনৰ অগোচৰ যাত্রা দিলে। জ্ঞানৰ সাগৰত যেন এই গণিত বিভাগ কেৱল এটি নাম নহয় এটি চিৰ যুগমীয়া অমিয় জোৱাৰ হৈ বৈ থাকক।

13. Name : Aman Kumar

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Our department taught me the way of studying and lots of things. I am truely thankful to our department.

14. Name : Nitul Bharali

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I Feel very happy to be a part of Mathematics department. It taught me lot of good things and gives me some never forgettable memories. I am very thankful and grateful to be a part of this department.

15. Name : Rituparna Borah

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পাণ্ডু মহাবিদ্যালয়ৰ গণিত বিভাগত যোৱা তিনিটা বছৰে লাভ কৰা অভিজ্ঞতা সমূহ ৰং-বিৰঙী পখিলা সদৃশ। মনৰ গহনত যোৱা তিনিটা বছৰৰ প্ৰত্যেকটো পলেই সোঁৱৰণি হিচাপে সিঁচৰিত হৈ ৰ'ব। গণিতৰ ৰসাল তত্ত্বসমূহ, শিক্ষাগুৰু সকলৰ মৰম বুজনি, বন্ধু-বান্ধৱীসকলৰ সহায় এই সকলোবোৰেই হৃদয়ৰ মণিকোঠাত আজীৱন জিলিকি ৰ'ব। আশা কৰোঁ, ভৱিষ্যতে বিভাগটিয়ে কেৱল বিদ্যায়তনিক দিশতেই নহয়, সকলো দিশতেই জাকত-জিলিকা হৈ ছাত্ৰ-ছাত্ৰীসকলক পোহৰৰ দিশলৈ লৈ যাব।

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Hobby : Meeting new person/ friend, reading books, listening song.

বহুত বস্তু শিকিলো। সকলোৰে লগত মিলি হাঁহি ধেমালি কৰি বহুত স্মৃতি লগত লৈ যাম।

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পাণ্ডু মহাবিদ্যালয়ৰ গণিত বিভাগৰ ছাত্ৰ হৈ ৩ বছৰ অধ্যয়ন কৰি নিজকে সুখী যেন অনুভৱ কৰিছো। গণিত বিভাগটোৱে শিক্ষাৰ লগত বিভিন্ন দিশত আগবাঢ়ি যাবলৈ অনুপ্ৰেৰণা জগাইছে। এই উৎসাহ অনুপ্ৰেৰণা অনাগত দিনত অটুট থকাৰ আশাৰে বিভাগটোৰ উজ্জ্বল ভৱিষ্যৎ কামনা কৰিছো।

18. Name : Sandeep Das

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Hobby : cooking, Music

Feel very lucky to meet everyone, learnt a lot, still I am hungry.

19. Name : Swrjima Hainary

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Hobby : Dancing

The department has given me the confidence that I needed from very long time. Thank you to all the teachers. I am very thankful to be a part of Mathematics Department.

20. Name : Bishal Ghosh

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Hobby: Playing Guitar.

It’s been nice studying in Pandu College. I feel grateful to study in that college.

21. Name : Uday Bhanu Debnath

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