Trapezium

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DEPARTMENT OF MATHEMATICS
B. BOROOAH COLLEGE
GUWAHATI - 781 007

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TRAPEZIUM

ANNUAL MAGAZINE

Volume-VII ● 2018-19

Editors :
Trinity Koushik
Hirak Jyoti Sarma

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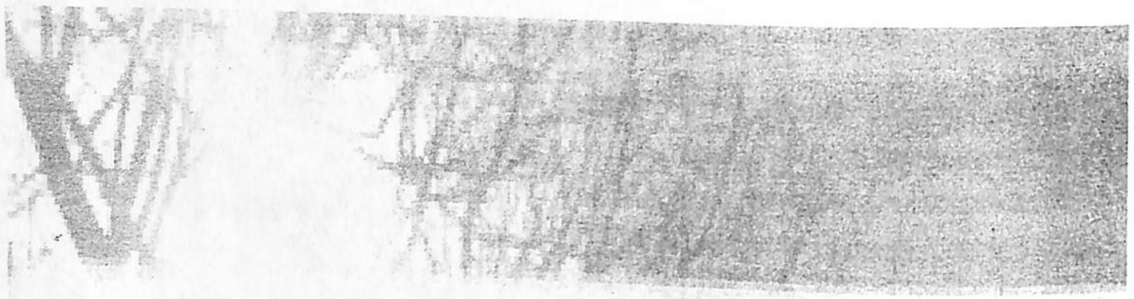

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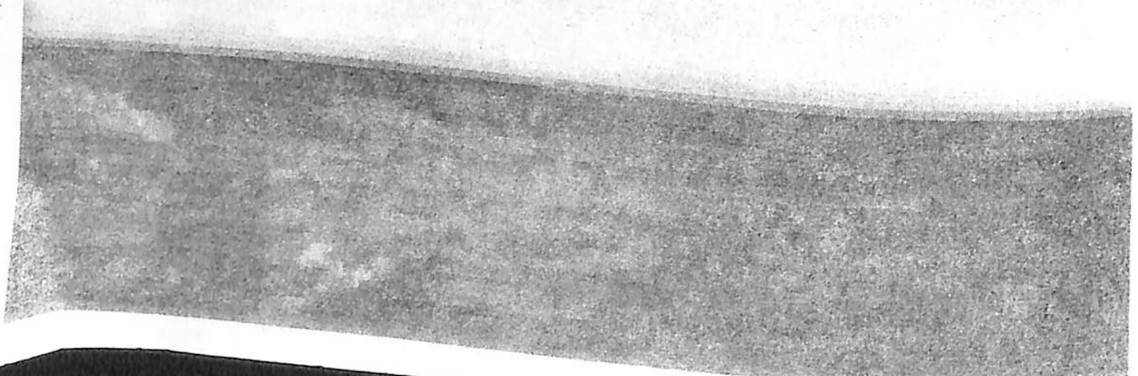

From the Editor's Desk...

TRAPEZIUM is not only an annual magazine of the department of Mathematics but also a platform which provides an opportunity of expressing personal excellence and creativity of our department. As the editors, we really feel very honored and privileged in presenting the 7th edition of our department's annual magazine. TRAPEZIUM has always influenced us throughout the whole journey of BBC and being editors of it is going to be one of the best things ever happened to us till date.

The dictionary defines mathematics as the abstract science of number, quantity, and space, either as abstract concepts (pure mathematics), or as applied to other disciplines such as physics and engineering (applied mathematics). Mathematics being the backbone of all subjects required in every sphere of life. As Galileo has rightly said, "The book of nature is written in the language of mathematics". From the beginning of counting to this new age of satellites, machines, DNA's human civilization has travelled a lot and each step in this journey of development is constituted by mathematics. But a negative attitude or phobia towards mathematics is often seen among students. Because of this agitation one cannot explore the real beauty of mathematics. Relating to this a seminar was held by our department named as "Mathematics Phobia and Measures to Eradicate it". Mathematics is not a child's play. If we make the basement strong, only then we can build a pillar reaching towering height. Mathematics is about beauty. Do fall in love with beauty and precision and everything will take care of themselves.

Amidst the busy schedule of our semester system course we have tried our best to bring out the talent concealed within our student community. In this edition of TRAPEZIUM we are concentrating on some interesting topics of mathematics, uses of math and some facts. We have tried to typify the articles in simple and lucid manner.

This edition of TRAPEZIUM has been made possible by the contribution of valuable writings of guest writers, alumnus and students of our department. We take this opportunity to express our heartiest thanks to each of the authors. We extend our gratitude to the teachers and to all the members of editorial board. We would also like to thank 'Grafix' for printing this magazine. Lastly, apologizing for any mistake unintentionally made in the process of publishing this magazine we present this edition of trapezium.

Trinity Koushik
Hirak Jyoti Sarma
Editors

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গ্ৰহ ধৰিত্ৰীৰ গণিত

ডং কৈলাশ গোস্বামী
প্ৰাক্তন অধ্যাপক, বি. বৰুৱা কলেজ

বিশ্বলোকৰ অফুৰন্ত সত্যৰ ভাণ্ডাৰটোৰ দুৱাৰখন মুকলি কৰিবৰ বাবে আমাক লাগে যুক্তিগত চিন্তা, পদ্ধতি আৰু কৰ্মকুশলতা। ইয়াৰ প্ৰৰোচনাতেই জন্ম গণিত নামৰ সাৰ্থক চমৎকাৰটিৰ। যুক্তিতত্ত্বৰ আধাৰত ডেউকা মেলি এই গণিতেই বিজ্ঞানৰ প্ৰকৃতি আৰু তত্ত্বক সন্তৰণ দিয়ে, কাৰণ প্ৰকৃতিৰ কাৰ্যকলাপ আৰু ত্ৰিলোকক ধৰি অনাদি অনন্তত নিমজ্জিত হৈ থকা নিয়তিৰ নিৰ্ঘাত সত্যবোৰক বুজিবলৈ উপায় মাত্ৰ এটা —সি হ'ল গণিত। দাৰ্শনিক ৰ'জাৰ্চ বেকনৰ মতে 'বিজ্ঞানৰ আটাইবোৰ শাখাৰ দুৱাৰ মুকলি কৰে গণিতে'— অৰ্থাৎ এনে কোনো বিজ্ঞান নাই যি গাণিতিক ধাৰণাৰেই অস্পৃশ্য, অসমৃদ্ধ—যাৰ বাবেই বোলা হয় গণিতক 'বিজ্ঞানৰ ৰাণী'। গেলিলিঅ'ই যথাৰ্থতে কৈছিল—'প্ৰকৃতিৰ বৃহৎ কিতাপখন গণিতৰ ভাষাতহে লিখা'। আন ভাষাত প্ৰকৃতিৰ বিশাল ৰহস্যৰ গোপন দুৱাৰ খুলিবলৈ মানুহৰ চেষ্টাৰ মাধ্যম হ'ব লাগিব গণিত।

প্ৰাকৃতিক বিধি, ঘটনা পৰিঘটনাবোৰক সুক্ষ্মভাৱে পৰ্যবেক্ষণ কৰি সুনিৰ্দ্দিষ্ট পদ্ধতি আৰু কলাকৌশলৰ আয়ত্বলৈ আনি গণিতে সেইবোৰৰ অন্বেষণ নিজে কৰে নাইবা বিজ্ঞানৰ অইন মাধ্যমক কৰিবলৈ উদ্‌গনি যোগায়। বিশ্বৰ নান্দনিক আৰু ভাস্কৰ্যীয় চানেকিৰো ব্যাখ্যা আগবঢ়ায় এই গণিতেই। এয়া গণিতৰ ইতিহাস পৰম্পৰা, মানৱ সভ্যতাৰ অংকুৰণৰ প্ৰথম সাৰথি। প্ৰাকৃতিক পৰ্যবেক্ষণৰ আধাৰ লৈ বাস্তৱিকভাৱে গাণিতিক চিন্তা সূত্ৰবিধিবোৰেই হৈ পৰিছেগৈ বিজ্ঞানৰ ভাষা, চিত্ৰ আৰু জ্ঞান।

কেপলাৰৰ গ্ৰহ-নক্ষত্ৰৰ জ্যোতি-বৈজ্ঞানিক সূত্ৰ, নিউটনৰ মহাকৰ্ষণ সূত্ৰ, আইনষ্টাইনৰ আপেক্ষিকতাবাদ নাইবা হকিঙৰ ব্লেকহোল আদি মহাজাগতিক তত্ত্বসূত্ৰবোৰ প্ৰকৃততেপ্ৰাকৃতিক ৰীতি নিয়ম বুজিবলৈ উদ্ভাৱন কৰা কিছুমান গাণিতিক মডেলহে। বিকল্পভাৱেও, বৈজ্ঞানিক সজাগতা আৰু নতুন পৰিস্থিতিত বিভিন্ন ৰেহৰূপ আৰু চৰিত্ৰৰ জাগতিক ঘটনা পৰিঘটনাবোৰক গাণিতিক মডেলৰ আওঁতালৈ অনাৰ প্ৰয়াসতেই নাইবা আগৰ মডেলবোৰৰ পৰিবৰ্তন আৰু পৰিবৰ্দ্ধন সাধিবলৈ গাণিতিক তত্ত্ববোৰকো আকৌ নতুন ৰূপত সজাই তোলাৰ দায়িত্বও আজিৰ গণিতজ্ঞসকলেই ল'ব লগা হৈছে। ইয়াৰ কেইটামান উদাহৰণ হ'লঃ কোৱান্টাম থিয়ৰি, মেক্সৱেলৰ বিদ্যুৎ-চুম্বকীয় তত্ত্ব, হাৰ্টজৰ বিদ্যুৎ-চুম্বকীয় তৰংগৰ বাস্তৱ সত্তা, ডিৰাকৰ প'জিট্ৰন কণাৰ অস্তিত্ব, প্ৰাকৃতিক সুষমতা, প্ৰতিৰূপতাৰ গভীৰ বুজ (বীজগণিতীয় আৰ্হি) ইত্যাদি। প্ৰাকৃতিক বৈষম্যৰ মাজত সুষমতাৰ বিভংগী (Fractals) পৰিক্ৰমাবোৰৰ ব্যাখ্যাও সম্ভৱ হয় কেৱল নৰূপত আকৃতিকৃত গাণিতিক আৰ্হিৰ যোগেদিয়ে।

বৰ্তমান গণিতে এনে এটা পৰ্যায় পাইছেগৈ যে ইয়াৰ প্ৰয়োগ সাৰ্বজনীন, সৰ্ব্বব্যাপী। ই বৰ্তমান গ্ৰহ ধৰিত্ৰীৰ প্ৰতিটো ক্ষেত্ৰতে সৰ্ব্বসমভাৱে প্ৰযোজ্য হৈ মানুহৰ জীৱন ধাৰণ আৰু উৎকৰ্ষতাৰ অপৰিহাৰ্য অংগ হৈ পৰিছে। গণিতীয় যুক্তি তত্ত্বৰ কলনবিধি (algorithm) অবিহনে বৰ্তমান যুগ ছানি ধৰা কম্পিউটাৰ প্ৰযুক্তি জ্ঞানে পৃথিৱীৰ অভ্যন্তৰৰ ভূতাত্ত্বিক বিশ্লেষণৰ

পৰা আৰম্ভ কৰি হিগছ বচন অনুকণাৰ ব্যাখ্যা সম্ভৱ কৰি তুলিব নোৱাৰিলেহেঁতেন।

এতিয়া আমি আহোঁ আমাৰ গ্ৰহগণিতনো কি বাৰু? ইয়াৰ পৃষ্ঠভূমিয়েই বা কি? আমাৰ পৃথিৱী ব্ৰহ্মাণ্ডৰ চিৰপ্ৰবাহমান প্ৰণালীবোৰৰ এক পটভূমি। আমাৰ বতৰ জলবায়ু আদি বিভিন্ন পৰিস্থিতি নিৰ্দ্ধাৰণ কৰা ভূপৃষ্ঠীয় স্থলভাগ, সাগৰ মহাসাগৰীয় জলভাগ, জীৱ-প্ৰজাতি আৰু এইবোৰৰ অন্তৰ্সংযোগৰ প্ৰণালীবোৰক উদ্বুদ্ধ কৰে প্ৰাকৃতিক প্ৰণালীবোৰে। মন কৰিবলগীয়া যে বিস্তৃত মানৱ সমাজ ইতিমধ্যে সাতশ কোটিৰ সীমা চেৰাই যাওঁ যাওঁ। এই মানৱ বিস্ফোৰণৰ আনুষংগিক ক্ৰিয়াৰূপে খাদ্য, গৃহ, স্বচ্ছ, পানী, শক্তি আদিৰ উৎসত থকা অৰ্থ সম্পদৰ সীমাৱদ্ধতা আৰু অপৰ্য্যাপ্ততাৰ সমস্যাই আমাক জুৰুলা কৰি ৰাখিছে। আনহাতে, প্ৰলয়, দুৰ্যোগ, দুৰ্ঘটনা আদি গোলকীয় প্ৰণালীবোৰ অবাধ্য আৰু অনাহুত। প্ৰাকৃতিক পৰিবেশৰ ওপৰত আমাৰ বৰ্দ্ধিত প্ৰভাৱৰ ফলত নতুন নতুন বহুমুখী সমস্যা বৰ্দ্ধিতৰূপত আগবাঢ়ি আছেই। তদুপৰি মানৱ জাতিৰ ব্যক্তিগত উৎকৰ্ষ বা সুখ সমৃদ্ধিৰ বাবে প্ৰয়োজন হোৱা বিভিন্ন পৰিক্ৰমা, যেনে আৰ্থিক বা বিত্তীয়, জলসম্ভোগ, যাতায়াত, কৃষিকৰ্ম, শক্তিৰ উৎকৰ্ষ, যোগাযোগ ইত্যাদি আটাইবোৰ কাৰ্যৰ বাবে এই ভূপৃষ্ঠকে নিৰ্ভৰ কৰিব লগা হয়। এইবোৰৰ আনুষঙ্গিক সমস্যাৰ সঠিক বুজ আৰু সমাধানৰ বাবে প্ৰাকৃতিক বা অপ্ৰাকৃতিকভাৱে কৰণীয় কাৰ্যকৰ্মৰ বাবে বিশুদ্ধ বৈজ্ঞানিক পদ্ধতিৰ বিকল্প নাই। লগতে মন কৰিবলগীয়া যে আমাৰ সংস্কৃতি সভ্যতাৰ লগে লগে পৃথিৱীয়ে সন্মুখীন হোৱা বহুমুখী বহুধাবিভক্ত বিষয়বোৰৰ পৰিবৰ্তন ইমানেই দ্ৰুত আৰু গতিশীল যে সেইবোৰক যথাৰ্থভাৱে চিনাক্ত কৰি আমাৰ আয়ত্তলৈ আনিবলৈ অতি উচ্চস্তৰৰ বৈজ্ঞানিক তত্ত্ব আৰু কৌশলৰহে প্ৰয়োজন। এই যথাৰ্থবোৰৰ প্ৰকৃত সমল আহিলা যোগান ধৰিব পাৰে প্ৰয়োজনসাপেক্ষে গঢ় দি লোৱা উন্নত তাত্ত্বিক আৰু প্ৰায়োগিক গণিতেহে। উপৰোক্ত ক্ষেত্ৰবোৰৰে পৃথিৱীলৈ আহি পৰা বহুমুখী সমস্যাবোৰৰ সমাধা কৰা আৰু বিজ্ঞানেৰে আবৃত পৃথিৱীৰ সাজৰ লগত মিলাবলৈ গণিতৰ এনে পৰিহাৰ্যতাৰ উদাহৰণ আমাৰ খোজে খোজে প্ৰতিস্তৰতে আছে।

বিশ্বীয় প্ৰভাৱৰ ফলত মানৱ জীৱনে সন্মুখীন হোৱা এনে সমস্যাবোৰক প্ৰত্যাহ্বান জনাবলৈ গণিতক মুখ্য সঁজুলিৰূপে ব্যৱহাৰ কৰাৰ নতুন চিন্তাৰ উদ্ৰেক হয় প্ৰায় ২০১২ চন মানৰ পৰাই। এইক্ষেত্ৰত ইয়াক এটা মিছনত ৰূপ দিবলৈ প্ৰথমেই আগবঢ়া উদ্যোক্তা গৰাকী হ'ল কানাডাৰ মন্ট্ৰিল বিশ্ববিদ্যালয়ৰ গণিতক পদ্ধতি (Dynamical Systems) বিভাগৰ অধ্যাপিকা আৰু কানাডিয়ান গণিত সমাজৰ প্ৰাক্তন সভাপতি (২০০২-০৪) ডঃ খৃষ্টিয়ান ৰুছো। তেওঁ সেই সময়ত গণিত গৱেষণা কেন্দ্ৰৰ সঞ্চালক পদত থাকোতেই উপলব্ধি কৰে যে নতুন গাণিতিক সাজেৰেহে আমাৰ সমস্যাবোৰৰ প্ৰশমনৰ কথা আহিব। গ্ৰহ ধৰিত্ৰীৰ গণিত (Mathematics of the Planet Earth : MPE) তেওঁৰেই মানস সন্তান।

২০১৩ চনৰ খৃষ্টমাৰ্চৰ সময়ৰ কথা। মন্ট্ৰিলত বহিছিল কানাডিয়ান মেথমেটিকেল ছচাইটিৰ বছৰেকীয়া অধিবেশন। ডিচেম্বৰৰ সাত তাৰিখে সভাখনৰ পৰা আনুষ্ঠানিকভাৱে নিৰ্গত হ'ল এই মহান লক্ষ্য, মিছনটো। ইয়াৰ নাম দিয়া হ'ল MPE ২০১৩'। ইউনেস্কোৰ (UNESCO) পৃষ্ঠপোষকতাত এই মিছনে লগে লগে ইমান দ্ৰুতগতিত গোটেই বিশ্বলৈ বিয়পা আৰম্ভ কৰিলে যে বিশ্বৰ কমেও এশ বৈজ্ঞানিক সমিতি, বিভিন্ন গৱেষণা সংস্থাও, অনেক বিশ্ববিদ্যালয় ইয়াৰ লগত জড়িত হৈ পৰিল। উদ্দেশ্যে এটাই যে ২০১৩ বৰ্ষটোক তেওঁলোকে বিশেষভাৱে 'গ্ৰহ **ধৰিত্ৰীৰ গণিতবৰ্ষ**' হিচাপে উৎসৰ্গ কৰিব। ইয়াৰ বাবে MPE ৰ নিজৰ লক্ষ্যত উপনীত হ'বলৈ অনুষ্ঠান বা ব্যক্তিবোৰে গাইগুটীয়াকৈ নাইবা একত্ৰিত হৈ অহোপুৰুষাৰ্থ কৰিব ধৰিলে। ফলত MPE এতিয়া পূৰ্ণবিকাশত ৰূপত এটা গোলকীয় আঁচনিলৈ পৰ্যবসিত হ'ল।

ইউনেস্কোৰ মুখ্য কাৰ্যালয়ত (পেৰিছ) বিভাগীয় ৰূপে ৰাজহুৱাকৈ প্ৰচলন কৰা এই মিছনৰ ঘাই উদ্দেশ্যে হ'ল—

(ক) গ্ৰহ ধৰিত্ৰীৰ মৌলিক সমস্যাৰ প্ৰশ্নবোৰ চিনাক্ত কৰি সমাধানৰ ক্ষেত্ৰত গৱেষণাক উৎসাহিত কৰা,

(খ) গ্ৰহ ধৰিত্ৰীৰ আলোচ্য বিষয়বোৰক সকলো পৰ্যায়ত শিক্ষিতৰ মাজত ভাব-চিন্তাৰ আদান-প্ৰদান কৰাৰ ক্ষেত্ৰত উৎসাহিত কৰা,

(গ) গ্ৰহ ধৰিত্ৰীৰ সন্মুখত আহি পৰা প্ৰত্যাহ্বানবোৰৰ ক্ষেত্ৰত গণিত বিজ্ঞানৰ অত্যাৱশ্যকীয় ভূমিকা সম্বন্ধে জনগণক জ্ঞাত কৰোৱা।

আকৰ্ষণীয় কথা যে আজি প্ৰায় দুবছৰ আগেয়ে শুভাৰম্ভ কৰা এই আঁচনিলৈ নিতৌ ন ন অনুষ্ঠান গৱেষণা প্ৰতিষ্ঠান, বিশ্ববিদ্যালয়, বিজ্ঞান-শিক্ষক অনুষ্ঠান আদিয়ে নিজে নিজে আগ্ৰহ দেখুৱাই অংশ গ্ৰহণ কৰাৰ লগতে ইয়াক এক দীৰ্ঘদিনীয়া আঁচনি হিচাপে লৈও কাৰ্যক্ৰম গ্ৰহণ কৰিছে। এই কাৰ্যক্ৰমবোৰৰ ৰূপায়ণৰ বাবে হাতত লোৱা পন্থাসমূহৰ ভিতৰত আছে—

১। অতি উচ্চ খাপৰ অগ্ৰগণী বাটকটীয়া গৱেষণা কৰা, ২। এই গৱেষণাবোৰৰ সম্পৰ্কত কৰ্মশালা আৰু অধিৱেশন পতা, ৩। জনপ্ৰিয় বক্তৃতা, ৪। বিস্তাৰিত ক্ষেত্ৰত দীৰ্ঘদিনীয়া আন্তৰ্জাতিক কাৰ্যসূচী, ৫। সকলো শিক্ষায়তনিক পৰ্যায়ৰে কাৰ্যক্ৰমণিকাৰ বাবে শিক্ষণ সঁজুলিৰ উন্নয়ন, ৬। বিশেষ জনপ্ৰিয় নমুনা আৰ্হিৰ সৃষ্টিৰ বাবে আন্তৰ্জাতিক প্ৰতিযোগিতা, ৭। ন-গৱেষকৰ বাবে বিভিন্ন আন্তৰ্বিষয়ক গ্ৰীষ্মকালীন শিবিৰ।

MPE ২০১৩ ৰ প্ৰকল্পৰ আওঁতাত পৰা গ্ৰহ-ধৰিত্ৰীৰ গৱেষণাত্মক মুখ্য ক্ষেত্ৰসমূহ চালিজাৰি চাই মুঠ চাৰিটা ক্ষেত্ৰত (উপক্ষেত্ৰ) এনেদৰে ভগোৱা হৈছে—

(ক) **আৱিষ্কাৰৰ ক্ষেত্ৰ** - প্ৰাকৃতিক সম্পদ, জলবায়ু আৰু বতৰ, ভূবিদ্যা (ভূপৃষ্ঠ, ভূকম্পন আদি), সৌৰজগত, জলভাগ (মহাসাগৰ, সাগৰ আদি),

(খ) **জীৱন সমৰ্থক ক্ষেত্ৰ** ঃ পৰিবেশতন্ত্ৰ বিজ্ঞান (ecology), জীৱবৈচিত্ৰ্য (bio-diversity), বিৱৰ্তন (evolution) আদি,

(গ) **দুৰ্যোগ বিপদ ক্ষেত্ৰ** ঃ প্ৰাকৃতিক দুৰ্যোগ, বতৰ পৰিবৰ্তন, সংক্ৰমক জীৱগোষ্ঠী, মহামাৰী ইত্যাদি।

(ঘ) **মানৱ সংগঠনৰ ক্ষেত্ৰ** ঃ শক্তি, সম্পদ পৰিচালনা, ৰাজনীতি, সমাজনীতি, অৰ্থনীতি, বিত্তীয় পদ্ধতি, যাতায়াত, যোগাযোগ (নেটৱৰ্কৰ ব্যৱস্থাপনা) আদি।

MPE মিছনে সহযোগী অনুৰূপ সংস্থাবোৰৰ সৈতে পাৰস্পৰিক সমন্বয়ৰ যোগেদি বিস্তৃত বিষয়ৰ পুংখানুপুংখ আৰু সম্যক জ্ঞান লাভ কৰি গণিত বিজ্ঞানৰ ভূমিকা আৰু দিক্‌দৃষ্টি নিৰ্ণয় কৰাত গুৰুত্ব আৰোপ কৰিছে। লগতে সম্পৰ্কীয় বৈজ্ঞানিক বিষয়বোৰক জড়িত কৰি সহযোগেৰে কাম কৰাৰ বাবে পৰ্যাপ্ত সুবিধাও আগবঢ়োৱা হৈছে। ইয়াৰ ফলত বৈজ্ঞানিক তাত্ত্বিক বিশ্লেষণযুক্ত কাৰ্যক্ৰমবোৰ পাঁচোখন মহাদেশক সাঙুৰি ইউনেস্কোৰ পৃষ্ঠপোষকতাত অতি দ্ৰুতবেগত আগবাঢ়িব পৰা হৈছে।

ওপৰৰ কাৰ্যক্ৰমবোৰে আনি দিয়া অভূতপূৰ্ব সহাৰিয়ে সুনিৰ্দিষ্টকৈ প্ৰমাণ কৰিছে যে জলবায়ু, বতৰ, জনস্বাস্থ্য, প্ৰাকৃতিক দুৰ্যোগ আদি মানৱ জাতিৰ অপৰিহাৰ্য প্ৰতিটো ক্ষেত্ৰতে গাণিতিক আৰ্হিৰ সৃষ্টিয়ে সমাধানৰ প্ৰয়াসত গুৰুত্ব স্থান লাভ কৰিব।

প্ৰথম বছৰতেই বিশ্ববিদ্যালয়, গৱেষণা সংস্থা আদিয়ে নিৰ্দিষ্ট কৰ্মসূচীয়ে গৱেষণা প্ৰকল্প, কৰ্মশালা, বক্তৃতা শিবিৰ আদি পতাৰ উপৰি অনলাইন সম্প্ৰচাৰে ইতিমধ্যে MPE সম্পৰ্কীয় জ্ঞান গৱেষণাৰ দুৱাৰ মুকলি কৰিছে। ইতিমধ্যে এইবোৰৰ লগত জড়িত ভালেকেইটা ৱেবচাইট মুকলি কৰাও হৈছে। ইয়াৰ ভিতৰত প্ৰধান উল্লেখযোগ্য এটা হ'ল, ছাইমন ফাউণ্ডেছনৰ

পৃষ্ঠপোষকতাত খোলা MPE ২০১৩ ৱেবছাইটটো। ইয়াত বিভিন্ন বিষয়ৰ সংবাদ, কথিকা, বক্তৃতা, নিবন্ধ আদিক প্ৰক্ষেপ কৰাৰ উপৰি শিক্ষণ সঁজুলিকে ধৰি বিভিন্ন কাৰ্যক্ৰম আৰু উন্নয়নৰ দিশো প্ৰক্ষেপ কৰা হৈছে। IMAGINARY নামৰ অইন এটা ৱেবছাইট MPE ৰ অনলাইন প্ৰদৰ্শনীৰ নামত স্থায়ীভাৱে উচ্ছৰ্গা কৰা হৈছে। এনে বিভিন্ন ৱেবছাইটৰ উপৰি গৱেষক আৰু জনসমাজৰ মাজত নিৰবচ্ছিন্ন সংযোগ ৰখাৰ বাবে Daily Blog বোৰ আছে। ইয়াৰ প্ৰথম বছৰতেই বিখ্যাত গণিত বিজ্ঞনীৰ প্ৰায় তিনিশ ৰচনা, গৱেষণা প্ৰবন্ধ প্ৰক্ষেপ কৰা হৈছে। ৰচনাৰ বিষয়বোৰত পৃথিৱীৰ অভ্যন্তৰৰ গৱেষণাৰ পৰা আৰম্ভ কৰি সৌৰপ্ৰযুক্তিলৈকে, জলবায়ু পদ্ধতিৰ পৰা জীৱবৈচিত্ৰ্যৰ পৰিক্ৰমালৈ, ছুনামিৰ পৰা সংক্ৰামক বেমাৰলৈ গাণিতিক গৱেষণাৰ দিশবোৰ আলোচনা কৰা আছে। এনে blog বোৰ প্ৰধানকৈ বিভিন্ন আন্তৰ্জাতিক সংস্থা যেনে—আমেৰিকান জিঅ'ফিজিকেল ইউনিয়ন, ইন্টাৰনেছনেল মেথমেটিকেল জিঅ'চাইন্স এচোছিয়েচন, জিঅ'ফিজিক্স ইউনিয়ন, ইন্টাৰনেছনেল ইউনিয়ন অৱ জিঅ'গ্ৰাফী এণ্ড এপ্লাইড মেথমেটিক্ছ, ICSU, ICIAM আদিৰ গৱেষকসকল জড়িত হৈ আছে। ওপৰোক্ত ব্লগ পৰিচালনাত আছে আৰ'গোনা নেছনেল লেবৰেটৰীৰ প্ৰায়োগিক গণিতৰ অধ্যাপক ড০ হান্চ কাপেৰ।

এক উল্লাসজনক আৰম্ভণি আৰু বিশ্বব্যাপী হোৱা সহযোগিতাৰ অভুতপূৰ্ব সঁহাৰিৰে ২০১৩ বৰ্ষটো 'গ্ৰহ ধৰিত্ৰীৰ গণিত বৰ্ষ'ৰূপে প্ৰতিষ্ঠা হ'ল। ৰুছোকে আদি কৰি বিভিন্ন গণিতবিজ্ঞানী আৰু সংস্থাবোৰে অনুভৱ কৰিলে যে ধ্ৰুৱীয় সমস্যাবোৰ ইমানেই প্ৰত্যাহ্বানমূলক যে এতিয়ালৈ এইবোৰ অকল চিনাক্তকৰণতেই প্ৰধানকৈ আৱদ্ধ থাকিবলগীয়া হৈছে আৰু এটা বছৰৰ কাৰ্যক্ৰমে আকাংক্ষিত উদ্দেশ্যৰ সফলতা আনিব নোৱাৰিব। এই বিচাৰতে ২০১৩ চনৰে ডিচেম্বৰৰ ১১ তাৰিখে মণ্ট্ৰিলত বহা এক অধিবেশনত সিদ্ধান্ত গ্ৰহণ কৰা হ'ল যে মিছনটো ২০১৩ৰ পিছলৈকে চলাই ৰখা হ'ব। ২০১৪ ৰ জানুৱাৰীৰ ১ তাৰিখে আৰম্ভ হ'বলগীয়া এই আন্তৰ্জাতিক মিছনটোৰ নতুন নাম কেৱল 'গ্ৰহ ধৰিত্ৰীৰ গণিত' (MPE⁺)।

MPE⁺ ৰ লক্ষ্য MPE ২০১৩ৰ সৈতে একে থাকিব অৰ্থাৎ গ্ৰহ ধৰিত্ৰীৰ বিষয়ত মৌলিক প্ৰশ্নসমূহ চিনাক্ত কৰা আৰু সাধাৰণ জনগণক ইয়াৰ লগত সংপৃক্ত কৰা। ইউনেস্কোৰ সঞ্চালক ড০ ইৰিণা বোকেভৰ মতে 'এই মিছন ইউনেস্কোৰ বিজ্ঞান আৰু বিজ্ঞান শিক্ষাৰ উত্তৰণৰ হকে নিৰ্ধাৰণ কৰা আন্তৰ্জাতিক মৌলিক বৈজ্ঞানিক পৰিক্ৰমাৰ লগত সংগতিপূৰ্ণ। গণিতে মৌলিক গৱেষণাৰ উদগতি সাধন কৰে আৰু দৈনন্দিন জীৱনত ই আমাৰ গুৰুত্বপূৰ্ণ ভূমিকা পালন কৰে। গণিতৰ বিনন্দীয়া জগতখন আৰু ই আগবঢ়োৱা বিশাল সম্ভাৱনাৰ অনুভূতিৰ আনন্দক প্ৰত্যেক বিদ্যাৰ্থীলৈ আমি আগতকৈও বেছিকৈ বিলাব লাগিব, প্ৰাসংগিক লক্ষণ সঁজুলিৰ আমি উন্নতি ঘটাব লাগিব। এই উদ্যমতে আমি ২০১৩ ৰ পৰৱৰ্তী পৰ্যায়লৈকে এই MPE-2013⁺ মিছনৰ ধাৰাবাহিকতা অব্যাহত ৰখাৰ বাবে অনুমোদন জনালো।'

MPE-2013⁺ ভৱিষ্যৎ কাৰ্যক্ৰম MPE-2013 ৰ ভিত্তিতে ৰচনা কৰা হয়। ইয়াৰ ফলস্বৰূপে গণিত আৰু বিজ্ঞানৰ এটা বৃহৎ গোষ্ঠীয়ে এই প্ৰকল্পক আঁকোৱালি ল'লে। পূৰ্বতে মুখ্যতঃ উত্তৰ আমেৰিকাৰ গণিত-বিজ্ঞান সংস্থাসমূহৰ মাজত আৱদ্ধ হৈ থকা এই প্ৰকল্পই গ্ৰহ ধৰিত্ৰীৰ আটাইবোৰ মহাদেশৰ বিজ্ঞানীকে অংশীদাৰ হিচাপে সাঙুৰি ল'লে।

MPE-2013 ৰ যোজনাক পূৰ্বৰ আধাৰত তলত দিশবোৰৰ ওপৰত মুখ্যভাৱে মনোনিৱেশ কৰা হৈছে, যেনে—

(ক) গৱেষণাৰ আশ্ৰয়স্থলৰূপে থকা ভৱিষ্যৎ গৱেষণাৰ প্ৰত্যাহ্বানবোৰক ক্ৰিয়াকলাপ অনুসৰি পাঁচোটা গৱেষণামূলক কৰ্মশালা স্থাপন কৰা।

(খ) প্ৰতিটো কৰ্মশালাত অনুৰূপে একোখন গৱেষণা আৰু শিক্ষায়তন মঞ্চ স্থাপন (Research and Education Forum : REF)ঃ এই মঞ্চই আকৌ কিছুমান শাখা মঞ্চত ভাগ হৈ বিষয়ৰ সমস্যা অনুসৰি সম্ভাৱনাপূৰ্ণ কাৰ্যক্ৰম চিনাক্ত কৰা আৰু সমন্বয়কৰণৰ দায়িত্ব লোৱা।

(গ) একোটা শিক্ষা কৰ্মশালা স্থাপন। ইয়াত গৱেষণা কৰ্মশালাই চিনাক্ত কৰা বিষয়বস্তুবোৰক প্ৰাক্-স্নাতক আৰু স্নাতক মহলাৰ পাঠ্যক্ৰমত সংঘৱদ্ধ কৰি অন্তৰ্ভুক্ত কৰাত সহায় কৰা।

(ঘ) পিছৰ পৰ্যায়ত গৱেষণা প্ৰকল্পবোৰত অধিক গণিত বিজ্ঞানীক ওতঃপ্ৰোতভাৱে জড়িত কৰিবলৈ উপযুক্তভাৱে সাজু কৰাৰ বাবে অধিক গণিত বিজ্ঞানীক চিনাক্ত কৰা।

(ঙ) প্ৰতিটো প্ৰকল্পৰ অনুৰূপে গ্ৰহ ধৰিত্ৰীৰগণিতৰ সবিশেষ তথ্যৰ বহুল প্ৰচাৰৰ বাবে এটা ৱেবচাইট আৰু বিভিন্ন প্ৰচাৰ মাধ্যমৰ সৃষ্টি কৰা।

গৱেষণা আৰু শৈক্ষিক অধ্যয়নৰ বাবে প্ৰকল্পবোৰক পাঁচোটা বিষয়বস্তুৰ আৱেষ্টনীৰ ভিতৰত ৰখা হৈছে। যেনে—

১। প্ৰাকৃতিক উৎসবোৰৰ পৰিচালনা, যেনে—জলসম্পদ, খাদ্য সম্পদ, অৰণ্য আদি, ২। দীৰ্ঘসূত্ৰী মানৱ পৰিৱেশ ঃ যেনে- নিৰাপত্তা, জীৱপৰিৱেশ, ফিটফাট্ (smart) নগৰ। ৩। প্ৰাকৃতিক দুৰ্যোগ ঃ (নিৰীক্ষণ, ব্যৱস্থাপনা, প্ৰশমনকৰণ), ৪। শক্তিৰ সমৃদ্ধিঃ যেনে- বিকল্প শক্তি, বিদ্যুৎবাহন, ফিট্ফাট নিৰ্মাণ।

(চ) গোলকীয় পৰিবৰ্তন ঃ (নিৰীক্ষণ, ব্যৱস্থাপনা, প্ৰশমনকৰণ)

প্ৰতিটো বিষয় সাপেক্ষে কিছুমান কাৰিকৰী গ্ৰুপ গঠন। এই দলবোৰে চিনাক্ত কৰা বিষয়বোৰ কাৰ্যকৰী কৰিবলৈ আৰু সমস্যাবোৰক গাণিতিক বৈজ্ঞানিক দৃষ্টিৰে প্ৰত্যাহ্বান জনাবলৈ আকৌ বিভাগ অনুসৰি প্ৰতিটো দলকে কিছুমান উপদলত ভাগ কৰা হৈছে। উপদলবোৰে গৱেষক, শিক্ষাৰ্থী আৰু অইন সহযোগী বিষয় সংস্থাবোৰৰ পাৰস্পৰিক সমন্বয়ৰ যোগেদি MPE-2013 ৰ একে উদ্যমেৰে নিৰ্দিষ্ট দিক্ নিৰ্ধাৰণৰক আঁচনি হাতত লৈ আগবাঢ়িব। এই আঁচনিৰ বিষয়সমূহে মুঠ আঠোটা অঞ্চল সামৰি ল'ব, যেনে—

১। জ্যোতিপদাৰ্থ বিজ্ঞান, বায়ুমণ্ডল, ২। জীৱবৈচিত্ৰ্য জীৱ ভূ-ৰসায়ন, ৩। জীৱ বিজ্ঞান, জৈৱচিকিৎসা, জৈৱ গোলক, ৪। কাৰ্বন চক্ৰ, জ্যোতিষ্কীয় বলবিজ্ঞান, ৫। জলবায়ু (পৰিবৰ্তন মোডেলিং জলবায়ুৰ জটিল প্ৰণালী), ৬। পৰিগাণনিক বিজ্ঞান, ৭। ক্ৰায়োস্ফিয়াৰ, ৮। সাধাৰণ আলোচনা।

MPE-2013 ৰ একে সংবেগতে শিক্ষা আৰু গৱেষণাক গতি দিয়াৰ উদ্দেশ্যে আৰম্ভ হ'ল প্ৰস্তুতিমূলক কৰ্মশালা আৰু কাৰ্যসূচীবোৰ। উদাহৰণস্বৰূপে ২০১৪ বৰ্ষটো শুভাৰম্ভ কৰা মিছনৰ MPE ঃ প্ৰত্যাহ্বান আৰু সুযোগ" নামৰ কৰ্মশালাখন প্ৰথমেই পাতি আৰিজোনা ষ্টেট ইউনিভাৰ্চিটিয়ে আকৌ 'প্ৰাকৃতিক দুৰ্যোগ', হাওৱাৰ্ড ইউনিভাৰ্চিটিয়ে 'প্ৰাকৃতিক দুৰ্যোগ পৰিচালনা' ৰুট্জাৰ ইউনিভাৰ্চিটিয়ে 'দীৰ্ঘসূত্ৰীয় মানৱ পৰিৱেশ', ইউনিভাৰ্চিটি অৱ কালিফোৰ্নিয়াই (চেন ডিয়েগো) 'তথ্য সজাগন শক্তিৰ ব্যৱহাৰ' আদিৰ ওপৰত শিক্ষা গৱেষণামূলক কৰ্মশালা পৰিচালনা কৰে।

২০১৫ চনৰ MPE যাত্ৰা আৰম্ভ হয় ২০১৪ চনৰ ছেপ্টেম্বৰ মাহত বহা এটা প্ৰৰোচক কেম্পৰ যোগেদিয়ে। এই বছৰতে ইউনিভাৰ্চিটি অৱ কালিৰ্ফোনিয়াই (বাৰ্কলী) 'গোলকীয় পৰিবৰ্তন', ইউনিভাৰ্চিটি অৱ টেনেচীয়ে 'কাইলৈ গ্ৰহ ধৰিত্ৰীৰ বাবে শিক্ষা', পেৰিছ ইউনিভাৰ্চিটিত 'জিঅ'ফিজিক্স আৰু এষ্ট্ৰৈফিজিক্স' (পাঁচ মাহজোৰা) ইত্যাদি গৱেষণা কৰ্মশালাবোৰ চলে।

• ২০১৬ চনত বিভিন্ন বিষয়ত ন ন প্ৰায়োগিক দিশ সামৰি অনবদ্য বৰঙণি যোগাবলৈ আগবাঢ়ি অহা সংস্থাবোৰৰ আটাইতকৈ উল্লেখ্য হ'ল SIAM গ্ৰুপ (Society for Industrial and Applied Mathematics)। আনহাতে DIMACS য়ে (Centre for Discrete Maths. and Theoretical Computer Science)) আগবঢ়োৱা ২০১৫-১৬ বৰ্ষজোৰা

TRAPEZIUM

প্ৰগ্ৰেমত চাইবাৰ চিকিউৰিটি, শক্তি আৰু কলন বিধি, ইনফৰমেশ্যন চেয়াৰিং এণ্ড ডাটা এনালিচিছ, ক্ৰিপ্ট'গ্ৰাফী আদি বিভিন্ন বিষয়ক সাঙুৰি আলোচনা চক্ৰ পাতি আহিছে। পৃথিৱীৰ জলবায়ু প্ৰণালীৰ ওপৰত অভূতপূৰ্ব বৰঙণি আগবঢ়োৱা ব্যক্তিজন হ'ল, জৰ্জটাউন বিশ্ববিদ্যালয়ৰ প্ৰায়োগিক গণিতজ্ঞ হান্স কাপেৰ। ইতিমধ্যে তেওঁ জলবায়ুৰ ওপৰত পাঁচখন অমূল্য গ্ৰন্থ আৰু এশতকৈও অধিক প্ৰবন্ধ আগবঢ়ায়। তেওঁৰ শেহতীয়া গ্ৰন্থ 'Maths and Climate'ৰ বাবে ২০১৩ চনৰ Choice Award বঁটা লাভ কৰিছে।

অনলাইন MPE ডেইলী ব্লগতো ইতিমধ্যে ন ন পোষ্টিং ওলাইয়ে আছে। এনে বিশেষ পোষ্টিংবোৰৰ ভিতৰত 'কোৱাণ্টাম মেকানিক্চ এণ্ড ফিউছাৰ অৱ ডি প্লেনেট' (এমিলি. এ. কাৰ্টাৰ), 'বায়োডাইভাৰ্চিটি এণ্ড ইভ'লুশ্যন (ৰুছো) 'প্ৰছপেক্টছ ফৰ এ গ্ৰীণ মেথমেটিক্চ' (অৰ্থাৎ জৈৱগোলকৰ বুজ আৰু গেটওৱাৰ্ক থিয়ৰিৰ ওপৰত দৃষ্টিপাত), 'নিউমাৰিকেল ৱেডাৰ প্ৰেডিক্চন', 'কেৱ'ছইন এন এট্‌ম'স্ফিয়াৰ', 'মেথমেটিকেল ম'ডেলিং এণ্ড হ্যামোষ্টেটিছ' (জীৱবিজ্ঞান), 'হোৱাইট ইজ চেলেষ্টিয়েল মেকানিকচ পাৰ্ট অৱ MPE-2013 ? ' আদি উল্লেখযোগ্য।

প্ৰশিক্ষণ আৰু গৱেষণাৰ ক্ষেত্ৰখনো সমানেই আগবাঢ়ি আছে। লণ্ডনৰ ইম্পেৰিয়েল কলেজ আৰু ৰিডিং ইউনিভাৰ্চিটিয়ে নিৰ্বাচিত বিষয়ৰ ওপৰত গৱেষণা কৰিবলৈ কোহেৰ্টত এটা ডক্টৰেল ট্ৰেইনিং চেন্টাৰ 'MPE CDT' মুকলি কৰিছে যাতে ইয়াৰ দ্বাৰা Ph.D পৰ্যায়ৰ গৱেষণা চলাব পৰা হয়। MPEৰ বিতং কৰ্মসূচী পৰিচালনাৰ লগে লগে এই প্ৰগ্ৰেমে হাতত লোৱা উল্লেখ্য অইন কেইটামান কৰ্মসূচী হ'ল— ১। ২০১৫-১৬ বৰ্ষৰ বাবে বুধবৰীয়া ছেমিনাৰ শ্ৰেণী, ২। পি জি অপেনিং ডে, ৩। গ্ৰহ ধৰিত্ৰীৰ বৰে ষ্টোকাষ্টিক ম'ডেলিং এনালিচছ, ৪। 'গ্ৰহ ধৰিত্ৰীৰ জ্যামিতি' আদি বিষয়ৰ ওপৰত কৰ্মশালা, ৫। আমন্ত্ৰিত বক্তৃতা আদি।

এইদৰে জীৱবৈচিত্ৰ্যৰ জ্ঞান গৱেষণাৰপৰা গাণিতিক জীৱবিজ্ঞানলৈ, সৌৰ প্ৰযুক্তিৰপৰা শক্তিৰ ব্যৱহাৰ, পৃথৱীত জলবায়ুৰপৰা গ্ৰহ পৃথিৱীৰ আন্তৰ্গাঁথনি, ভূমিকম্প, ছুনামি আদিলৈকে MPE ৰ জ্ঞান গৱেষণাৰ সঞ্চাৰণৰ প্ৰক্ৰিয়া অব্যাহত আছে। ২০১৩ৰ দ মাটিত ইউনেস্কোত আৰম্ভ হোৱা MPE প্ৰদৰ্শনীখনো আকৌ পিছলৈ ২০১৫ চনত লণ্ডন (এসপ্তাহ জুৰি ২০১৩ৰ অক্টোবৰত), হেইডেলবাৰ্গ (৫ জুলাইৰপৰা ২ আগষ্টলৈ), বাৰ্লিন (৭ মে'ৰপৰা ১৩ জুনলৈ) আদিত দীৰ্ঘকালীন ভিত্তিত পৃথিৱীৰ বিভিন্ন ঠাইত পতা হৈছে। ভাৰতবৰ্ষতো এই আঁচনি কাৰ্যকৰীও প্ৰধানকৈ নিমগ্ন হৈছে বাঙ্গালুৰুৰ তাত্ত্বিক বিজ্ঞানৰ আন্তৰ্জাতিক কেন্দ্ৰ।

'গ্ৰহ ধৰিত্ৰীৰ গণিত'ৰ পৰিকল্পনা প্ৰকৃততে গণিত বিজ্ঞান সমাজ আৰু ইয়াৰ সম্বন্ধীয় অইন বিষয়ৰ অংশীদাৰী বৈজ্ঞানিক দল-গোষ্ঠীৰ এটা বৃহৎ অভিযান। ইয়াৰ ধাৰাবাহিকতাই মৌলিক গৱেষণাৰ অভূতপূৰ্ব উদ্‌গতি অনাৰ সুযোগ দিয়াৰ উপৰি দৈনন্দিন জীৱনত ইলৈব পৰা গুৰুত্বপূৰ্ণ ভূমিকাৰ সম্ভাৱনা দুগুণে বঢ়াব। ই প্ৰাসঙ্গিক আন্তৰ্গাঁথনিৰ উন্নয়ন ঘটাই গণিত নামৰ প্ৰমুক্ত এই জ্ঞান জগতখনে MPEৰ যোগেৰে মুদ্ৰিত কৰিবপৰা অপৰিসীম সম্ভাৱনা আছে। এইবোৰক জনসমাজত বিলাই পৰিতৃপ্তি আৰু উপভোগৰ আহিলা যাচিব। গাণিতিক নিৰ্দেশনাৰ আন্তৰ্জাতিক কমিছনৰ প্ৰেছিডেন্ট ড০ ফাৰ্ডিনেণ্ডো আৰ্জাৰেলোৰ ভাষাত 'গ্ৰহ ধৰিত্ৰীৰ গণিতে এটা বিজ্ঞান সংস্কৃতি বিস্তাৰণ কৰিবলৈ আশ্চৰ্যজনক পৰিৱেশ এটাৰ সৃষ্টি কৰাত বৰঙণি যোগাইছে। আমাৰ গ্ৰহই আজি সন্মুখীন হোৱা নাটকীয় প্ৰত্যাহ্বানবোৰক বশ কৰিবলৈ প্ৰয়োজন হোৱা সাধাৰণ সা-সঁজুলিবোৰ লাভ কৰাৰ ক্ষেত্ৰত ই বিস্তৰভাৱে সহায় কৰিব।'

(লেখক ২০১৩ চনৰ ভাৰত চৰকাৰৰ বিজ্ঞান জনপ্ৰিয়কৰণৰ ৰাষ্ট্ৰীয় বিজ্ঞান বঁটা বিজেতা)

The Beauty of Mathematical Equations Which Govern the World

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Mathematics is all around us. From the tiny atom to the biggest Star there is only mathematics. Most of the time we do not realize that we are using mathematics. Everything from the use of toothpaste to the amount of food we eat there is only mathematics. Mathematical equation has the potential to change the world. Without equation we would not have GPS, Computer, Space program, traffic control, Air-craft and so on. Today's computer chip used in different machines is based on mathematical equations.

Here is some of the most amazing mathematical equation that changed the world.

1. Pythagoras Theorem:

Pythagoras theorem is the foundation for understanding geometry. It describes the relationship between the sides of right angled triangle. The equation link algebra with geometry and give us the idea of trigonometry. Without this theorem accurate surveying, map making and navigation is impossible. This equation is used to calculate the epicenter of an earthquake. This theorem plays an important role in GPS system and in telecommunications. One more example of daily use of Pythagoras theorem is triangulation. Cell phone can be traced to their accurate locations using triangulation. Ancient land and sea navigators started with the navigation equations (speed*time = distance). Now a days navigational satellites designed by the engineers use equations that take into account the relative effects of space and time. Since satellites often use Sun's energy to power electrons, engineers calculate the optimal angle to a satellite's solar energy using Pythagorean theorem.

2. Fourier Transform

This equation was developed by mathematician Joseph Fourier. Fourier Transform is used to understand complex wave structure like human speech. Indeed our ear performs Fourier transforms all the time. A messy wave function like recording of a person talking can be broken into a combination of simple waves with the help of Fourier Transform. Fourier Transform is used to compress audio and video images and we are able to watch a You-Tube video efficiently and quickly which otherwise would be so huge that it would create problem on transmitting over to computer. In mp3, jpegs too we use this Fourier Transform equation.

Communication is based on mathematics where it may be digital, wired or wireless. Signal transmission is done through modulation while modulating the information, a high frequency Sinusoidal Carrier Signal is used to transmit the message.

It is received and demodulated using Fourier Transform. Fourier Transform is used in signal processing including seismic data, radio transmission and so on. Our mobile has devices performing Fourier Transform. A Fourier Transform works like a prism which splits white light into a spectrum of colours. Fourier transform is used to clean up a recording if there is a background hum, the Fourier Transform allow to isolate and delete the main frequencies of the hum and preserve. A photograph taken in a dim light might have many disturbances in the form of spots of light, take the Fourier Transform of the image and we can filter them out. This is especially useful in cleaning up astronomical images from space. Fourier Transform is also used to process information in medical imagining, including MRI and CAT scan.

3. Newton's Law of Gravitation

Newton's Law of gravitation describes the force of gravity between two objects. This is the most wonderful equation in scientific history. This equation is used to design orbit for satellites. Newton's formula helps Engineers work out how much energy we need to break the gravitational bonds of Earth. The path of every astronaut and the orbit of every satellite from which we benefit for communications, Earth observation, and research around Earth or other planets is calculated using this simple formula.

Newton's universal law of gravitation successfully explained many phenomena occurring in nature such as the force that binds us to the Earth, the motion of the moon around the Earth, the motion of the planet around the Sun and the tides due to the moon and the Sun.

There are several such equations which contribute in the change of modern technologies to modern society. Future of education will also transform based on different mathematical equations applied in internet technology.

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> *As with everything else, so with a mathematical theory : Beauty can be perceived, but not explained.*
>
> **– Arthur Cayley**

Application of Graph Theory in Electrical Circuit

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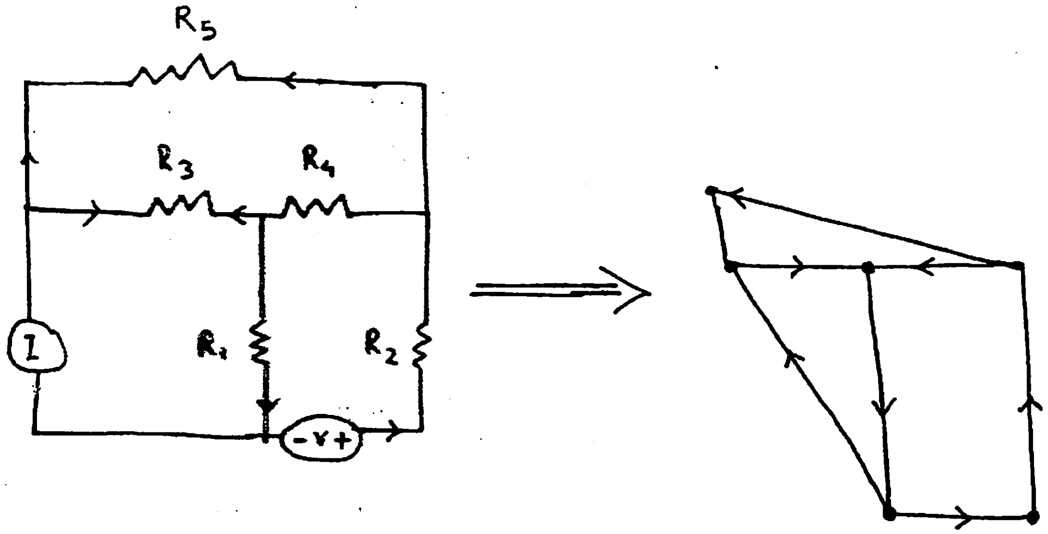
Graph Theory is the branch for the study of proof techniques in discrete mathematics. It has many impacts in different areas of computing, social and natural sciences. It started its journey Konigsberg, (Germany, now a part of Russia). There was a river named pregel completely surrounded the capital part of Konigsberg, dividing it into two islands. These two islands were connected to each other and to the mainland by seven bridges. It was a puzzle for resident of Konigsberg to pick a starting point in the town or in the islands and find a walking route which would take them over each bridge exactly once without swimming across the river. In 1736, the great Swiss Mathematician Leonhard Euler proves that no such route exists and in the process began the study of what was to be called graph theory. He transformed the actual diagram of the city and its bridges into a graph which had vertices and edges. The four vertices represented the land areas (the two island and the two banks of the river) and the seven edges (lines) represented the bridges.

So, A graph is a set of ordered pair G=(V,E) of sets where the elements of v are called vertices(or nodes) of the graph G and the elements of E are called edges or lines or arc.

Nowadays, many researchers have taken graph theory and its impacts on various fields as their areas of research. Application of graph theory in electrical circuit is also a growing trend of research. An electrical circuit consist of internally connected elements such as resistors, capacitors, inductors, diodes, transistors etc. Its behaviour depends upon the characteristics of each of the internally connected elements and the rules by which they are connected together. This characteristic gives a relation between electrical circuits and graph theory. A two terminal electrical element can be represented by an edge. The edge between i-th and j-th vertices can be denoted by {i, j} ignoring the direction. Similarly the rotation (i, j) can be used or oriented edges, where 'i' is the start vertex and 'j' is the end vertex.

So, in network graph all the elements in a circuit are replaced by lines. Circles or dot are given at the end of each line to represent vertices. There are some new terminology used in circuit graph such as branch, nodes, loops, cut-set, tie-set etc. A branch is a line segment representing one network element or a combination of elements connected between two points. It only represents the connections between the two ends but doesn't indicate anything about the



types of the connected element. A node point is the end point of a branch. The number of branches incident into it is called the degree of the node which is some of the degree of a vertex in general graph theory.

A loop is the closed contour selected in a circuit graph. A cut-set is the set of elements or branches of a graph that separates two main parts of the circuit. If a single branch of the cut-set is removed then the circuit becomes disconnected. Similarly a tree in a circuit graph is defined as the interconnected open set of branches which includes all the nodes of the given graph. A branch of a tree is called a twig. That branch that doesn't belong to a particular tree is called tree link or chord. Tie-set is a unique set with respect to a given tree of connected graph containing one chord and all of free branches contained in the free path formed between two vertices of the chord. Also in graph theory different matrices can be obtained from the graph using relationship between vertices and edges in different ways. In circuit theory also, we can obtain different graph in a similar way. There are matrices such as twig matrix, cut-set matrix, branch independence matrix etc. All these matrices can be defined uniquely from the given electrical circuit.

Some well know theorems in electrical circuit analysis such as Thevenin's theorem, Norton's theorem, Superposition theorem can be verified and simplified by using graph theoretic approach with the help of different matrices and network equilibrium equation which are obtained from famous laws of electrical circuit namely Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL).

Thus graph theory has many impacts on electrical circuit analysis which is directly related to the growth of the human civilization. Following this concept one can develop the equivalent circuits from the complicated circuits with the help of graph theory.

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The Story of Math

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Who are we in one word? We are storytellers. We tell stories and our stories take this world to the next level, a better place for us all. Stories on what? Stories of every kind, on Sciences, Humanities, Spiritual believes, Emotions or on Everything that our universe may have in itself. We depend on the truth or the falsehood of some hypotheses of the stories.

And it is time to tell The Story of Math. Like all other disciplines, Mathematics is a name of an infinite collection of unique knowledge that is immutably, incontestably and eternally true. But let us get out of the literacy and ask "**What is Mathematics**?" To figure out this query, we need to go back to the pre-historical time. At that time, it was a science of quantity. Then as time moved on, it accumulated some more terms to be said like the science of quantity, whether of magnitude or of numbers or the generalization of these two fields. Scholars after years had started to see Mathematics in terms as simple as a search for patterns. However, during the decades of nineteenth century, mathematics broadened to encompass mathematical or symbolic logic, and thus came to be regarded increasingly as the science of relations or of drawing necessary conclusions. Now we all agree at the say "Mathematics is the Queen of Science" or we say "Mathematics is the language of the Universe"

So, why or how did Mathematics start once long back? Our world is made up of patterns and sequences. They are all around us. Day becomes night, animals travel across the Earth in ever-changing formations. Landscapes are constantly altering. One of the reason, Mathematics began is that we needed to find a way of making sense of these natural patterns. The most basic concepts of Math are Space and Quantity. And these two are hardwired into our brains. Even animals have a sense of distance and number assessing when their pack is outnumbered and whether to fight or fly away calculating whether their enemy is within the striking distance. Understanding Mathematics is the difference between life and death. But if a man who took these basic concepts and started to build these foundations, at some point humans started to spot patterns to make connections to count and to order the world around them. And with this, a whole new mathematical universe began.

That the number 60 is special can be realized very easily. We talk about time in physics in a very complicated way. But it is time to ask why we defined the minutes of time to contain 60 seconds, the hours of time to contain 60 minutes. It is so much related to the development of number systems in Mathematics in ancient times. The Babylonians found a much more intriguing way to count. They used the twelve knuckles on one hand and five fingers on the other to be able to count 12 times 5 equals 60. So 60 became a base of counting. The idea of 60 base counting system was so successful that much later near in the end of sixteenth century time was mechanically introduced with hours and minutes to have 60 sub-units.

Patterns of our world indicate us to Symmetry, the beauty of nature. The observable universe fascinates us by virtue of symmetry. Having a look at the honeycombs, we see hexagonal symmetry with each circle allowing for maximum storage of honey and this is one out of uncountable number of examples. And looking forward in mystery to explain these mind-boggling observations, hundreds of years back in Greece, developed the idea of geometry. Prior to that, the river Nile has also stories with Mathematics to be told. The flooding of the Nile River repeatedly took away and added soil, altering the configuration of the landscape and hiding the markers that separated one person's land from that of someone else. Measurements had to be made over and over again, and they said that **this was the origin of geometry.** We owe to Pythagoras, or maybe to Pythagoreans. The beauty and harmony that the Pythagoreans found in mathematics was so powerful that Greek Science in general was eventually contaminated with a strong mathematical bias. In other words, the Greeks came to believe that deductive reasoning, which was incredibly successful in mathematics, was the only acceptable way of obtaining knowledge in every other discipline. Observation was undervalued, deduction was made king and it is still ruling in a certain realm of Mathematics we serve in today.

Number systems had by then developed rapidly until the very first mathematical crisis occurred. And the solution to it enlarged the system by addition of irrational numbers. The Pythagoreans knew about the crisis about the square root of 2. If we had a square with each side a unit in length, and we also had a second square with double the area of the first square, how would the side of the second square compare to the side of the first square? This is the origin of the question regarding the square root of 2. The secret of irrational numbers was carefully kept by the Pythagoreans. The reason for this is that the secret created a sort of crisis in the very roots of Pythagorean beliefs. There comes an interesting story about one member of the Pythagoreans who apparently divulged the secret to someone outside their circle. The traitor(?) was thrown into deep waters and drowned. This story is sometimes referred to as the first martyr of Science. After many unsuccessful attempts in finding the value of the square root of 2, the Greeks had no choice but to accept that arithmetic could not be the basis of mathematics. They had to look somewhere else, so they looked into geometry.

Before a few more Para about the old stories make it long for an average reader, it would be proper to arrive at the decades when Europe was at the dawn of becoming the Engine House of Mathematics. It was the period of the golden ages of Mathematics, from Descartes (pronunciation Day-Kart) to Riemann, without which there would be no calculus, no quantum physics, no relativity, none of the technology we use today. I am myself, after a series of information from those centuries, convinced to answer a question such as **"Where is the practical application of Mathematics** like Groups, Rings, Topology

or Differential Equations etc, etc?" as "It is all the same as Physics or Chemistry or every subject. We don't construct some abstract ideas in Mathematics and then try to relate them practically somewhere. We observe the reality and try to answer it mathematically. So the practical mathematics is everywhere."

By the 17th century, Europe had taken over from the Middle East as the world's powerhouse of mathematical ideas. Great strides had been made in the geometry of objects fixed in time and space. In France, Germany, Holland (now The Netherlands) and Britain, the race was then on to understand the mathematics of objects in motion. The pursuit of this new mathematics started in a village in the centre of France. Only the French would name a village after a mathematician. In France, they value their Mathematicians. There was the village of Descartes, renamed after the famous philosopher and mathematician 200 years back. It was him who introduced the idea of Algebra to Mathematics. Each point in two dimensions can be described by two numbers, one giving the horizontal location, the second number giving the point as the vertical location. As the point moves around a circle, these coordinates change, but we can write down an equation that identifies the changing value of these numbers at any point in the figure. Suddenly, Geometry has turned into **Algebra, something new in Mathematics**. Using this transformation from geometry into numbers, we could tell, for example, if the curves on Arch Bridges or Cable-stayed Bridges or Truss bridges were parts of a circle or not. We don't need to use our eyes. Instead, the equations of the curve would reveal its secrets, but it wouldn't stop there. Descartes had unlocked the possibility of navigating geometries of higher dimensions that our eyes will never see but are central to modern technology and physics.

The wonderful thing about mathematics is that we can do it anywhere. Don't have to have a laboratory or not even a library. Fermat (pronunciation fer-mah) used to do much of his work while sitting at the kitchen table or praying in his local church or up on his roof. He might have looked like an amateur, but he took his mathematics very seriously indeed.

And now's time to tell the story of calculus **that will probably hurt you eventually**. Say, something is falling down. Such things, we take for granted so much but No, not this time. Its distance, speed are changing and we want to know how to make sense of these. Call in the calculus. The Newton discovered calculus enables us to really understand the changing world, the orbits of planets, the motions of fluids. Through the power of the calculus, we have a way of describing, with mathematical precision, the complex, ever- changing natural world. Newton himself decided not to publish, but just to circulate his thoughts among friends. But there came the rival, Gottfried Leibniz. He'd worked out the details of the calculus, independent from Newton, although he knew about Newton's work, but unlike Newton, Leibniz published his works. So Mathematics heard about the calculus first from him and not from Newton, and that's when all the trouble started. Like nobody of any time would have wanted to share the credit of discovering calculus, Newton did the same back in London. The final judgement credited Newton and accused Leibniz of plagiarism. Leibniz was hurt, so much that even though he admired Newton, he suffered, never recovered and died in 1716. But the irony is that it is Leibniz discovered calculus that we are using today, and the calculus from Newton lagged behind.

At this moment, I don't have the slightest idea where the story of math is going to end because we have so many of stories to be told. And if you could give me a little more time, I will find a way out to the bottom line Post Leibniz and Victory: It's kind of curious - artists often have children who are artists. Musicians, their children are often musicians, but mathematicians, their children don't tend to be mathematicians. You may agree or disagree at this say. But in both the ways, this is a fact in the society, bearing a contradiction. But the contradiction is at far away from us and also from time. It's the Bernoullis. A discipline needs disciples who take a message, clarify it, realise its implications, and then spread it wide. Two Bernoulli brothers, Johan-I and Jacob who didn't like each other much, but both worshipped Leibniz. They corresponded with him, stood up for him against Newton's allies, and spread his calculus throughout Europe. Leibnitz found two gifted mathematicians outside of his personal circle of friends who mastered his calculus and could distribute it in the scientific community. It would be unfair to tell the Bernoullis to be disciples of Leibniz only. Mathematics was gifted with other Bernoulli classic problem solvers and theorists. The application of the calculus by the Bernoullis became known as **the calculus of variation.** And it's fortunate for us is that a Bernoulli, the last one is still living but more unfortunately he is not a mat hematician. So the great dynasty has already had its end.

In France, they got wonderful mathematicians, like Joseph Fourier, whose work on sound waves introduced us to **Fourier analysis**. The MP3 technology is based on Fourier analysis. But in Germany, they got the Prince of Mathematics, Carl Friedrich Gauss. Gauss questioned one of the central tenets of mathematics - Euclid's geometry. He realised that this geometry, far from universal, depended on the idea of space as flat. It just didn't apply to a universe that was curved. But in the early 19th century, Euclid's geometry was seen as God- given and Gauss didn't want any trouble. So he never published anything. Another mathematician, though, had no such fears. And this was the beginning of another body blow story. Farkas Bolyai of Transylvania realised his son was a mathematical prodigy. So he wrote to his old friend Gauss asking him to tutor son Janos (pronunciation Yaa-nos) Bolyai. Gauss readily declined. Janos joined the Army. Maybe there's something about the air in Transylvania because Bolyai carried on doing his mathematics in his spare time. He started to explore what he called imaginary geometries, where the angles in triangles add up to less than 180 degree. Bolyai's new geometry has become known as **Hyperbolic geometry,** leaving Euclidean Geometry behind.

Bolyai published his work in 1831. His father sent his old friend Gauss a copy. Gauss, this time approved straightaway, but refused to praise the young Bolyai, because he said the person he should be praising was himself. Actually, there is a letter from Gauss to another friend of his where he says, "I regard this young geometer boy as a genius of the first order." But Gauss never thought to tell Bolyai that. And young Janos was completely disheartened. Another body blow soon followed. Somebody else had developed exactly the same idea, but had published two years before him – the Russian mathematician Nicholas Lobachevsky. It was all downhill for Bolyai after that. With no recognition or career, he didn't publish anything else. In

1860, Janos Bolyai died in obscurity, he was erased, forgotten. Gauss, by contrast, was lionised after his death.

And finally we are at the door-step of producing the greatest mind – Einstein. Bernhard Riemann first described what geometry actually was and its relationship with the world. He then sketched out what geometry could be - a mathematics of many different kinds of spaces, only one of which would be the flat Euclidian space in which we appear to live. He was just 26 years old. Was it received well then? Did people recognise the revolution? There was no way that people could actually make these ideas concrete. That only occurred 50-60 years after Riemann, with Einstein. Riemann's mathematics changed how we see the world. Suddenly, higher dimensional geometry appeared. The potential was there from Descartes, but it was Riemann's imagination that made it happen. At only 39 years in 1866, Riemann died. Today, the results of Riemann's mathematics are everywhere. Hyperspace is no longer science fiction, but science fact. **Here is the end of the golden ages of mathematics introducing a treasure hunt, the beginning of the revolution which is going to end with Einstein's relativity in some stories of physics**. And...

And maybe it's time to wrap up. Because I have been realising some stories do not have an end. They just continue to be told while we get in short of time.

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Jokes with Maths

Scientists were playing hide and seek in heaven. Einstein was seeker....
Newton didn't hide and stood in a square of 1 meter.
Einstein : "I found you Newton!! Thappa!!!" Newton : "You are wrong...I am not Newton...
As I am standing in 1 meter square, so, I am Newton per meter square..." hence, I'm Pascal."

Mathematics and the Internet

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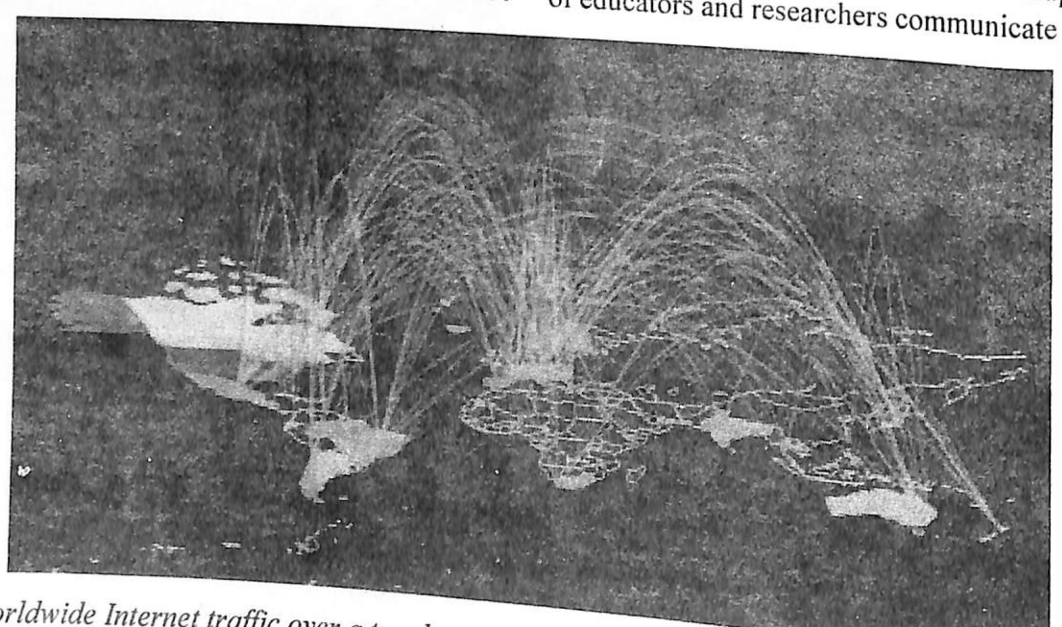
The relationship between mathematics and the Internet is like that between language and the works of Shakespeare: his work could not have been conceived without language, and his poems and plays have contributed to the evolution of language.

Computers were born in the language of mathematics. Binary numbers let computers represent words, music, images and more so that machines can now communicate across the Internet with an alphabet of 0's and 1's. The impartial rules of mathematical logic govern computer operations, Internet addressing and even Web search engines.

Within the Internet, mathematics is at the heart of security for messages and financial transactions. It is the basic tool of data compression, coding, and error correction for transmitting large files. It is the foundation of databases for managing email addresses and for searching the World Wide Web, and it is the agent for routing messages and managing networks.

The Internet is also helping advance mathematical research and education. Groups of educators and researchers communicate



Worldwide Internet traffic over a two-hour period, with the colour and thickness of the lines representing the traffic. Image provided by Bell Laboratories

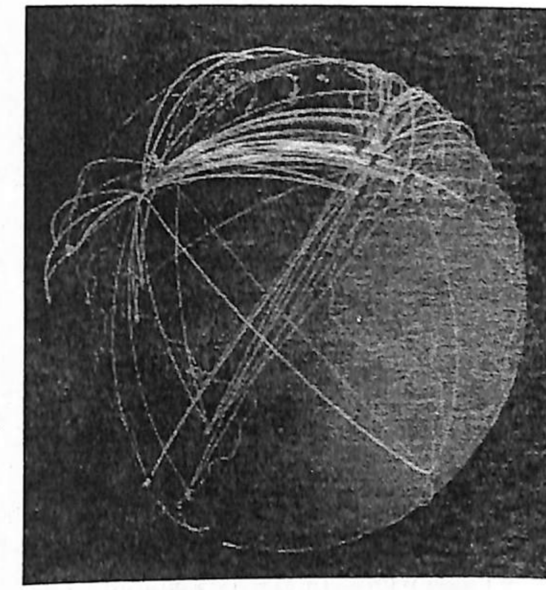
through email, newsgroups, and special World Wide Web sites. The Internet also supports distributed computing such as the recent cooperative effort which linked computers across dozens of countries to crack a code once thought secure for 20 millennia.

Managing Data on the Internet

As most people know, Internet messages — email, graphics, sound, the results of database searches — are transmitted as strings of 0's and 1's.

Mathematics is central to two parts of this digital translation and transmission:

❖ *Global view of the data shown in the arc map. Image provided by Bell laboratories.*



accurately transmitting a text message, say, that has been translated into binary numbers requires codes for detecting and correcting errors (not to be confused with secret codes), and

❖ reducing the volume of data in an image, for example, that must be transmitted and then reconstructed as a reasonable likeness of the original, uses the tools of data compression

When massive strings of 0's and 1's are forced over computer networks, some errors are inevitable, and even small losses of data can be catastrophic. Error detecting codes introduce mathematical tools to detect many of those losses, much like counting the number of pages in a long letter as a way of determining if anything was lost in the mail.

Data compression ideas are shared across a wide range of technologies, including the forthcoming digital television. (One second of high definition, uncompressed video would require more than seven hours to arrive over a conventional home modem!) The challenge of data compression is to reduce by many orders of magnitude the volume of data, and hence the transmission time, while preserving all the visually important parts of the image.

Good data compression schemes help World Wide Web graphics appear quickly and attractively on a computer screen. The same tools bring sound files that please the ear, even though selected parts have been removed or reconstructed. Some of the latest data compression ideas use wavelets, a kind of multiscale analysis tool.

Security on the Internet

Security on the Internet is as important as the security of a bank vault. Security concerns encompass privacy of messages, integrity of computers connected to the Internet, and trust in financial transactions, among many other issues. The rapidly growing Internet marketplace, for example, depends heavily on clever secret codes that combine centuries-old number theory with discoveries of the past two decades.

Moreover, efforts to break such codes use the Internet to distribute the computing burden over a wide array of machines. That distributed computing in turn depends in a crucial way on modern extensions of an old idea of Fermat for methodically searching for prime factors of large numbers.

Internet security can be seen in two complementary parts. One is the problem of sending a message that only the recipient can read, insuring both confidentiality of the message and its fidelity. The other is verifying the identity of the sender of a message. The first amounts to finding a code which is hard to crack while still permitting rapid transmission and decoding. The second is the problem of digital signatures: how can an Internet merchant be sure that the signature on an electronic check is genuine? The solutions to both problems rest squarely on the shoulders of number theory, a deceptively deep branch of mathematics.

Databases and Searching

Powerful Web search engines like AltaVista and Yahoo! let Internet users find specialized nuggets of information hidden all over cyberspace. The heart of most of these search tools is an index of key words; each index entry lists the Web sites that contain that key word. (The entry for "mathematics" in one search index lists 332,966 sites!) Ideally, the search engine returns not just the intersection of all index entries for the given key words but also a priority score reflecting the potential relevance of each listed site to the searcher's needs.

In reality, search engines do not explicitly manipulate matrices with hundreds of thousands of rows and columns. Instead, they rely upon clever computational implementations of databases.

Many databases are built around the mathematical object known as a tree. These trees are like family trees that record relations among parents and children and their ancestors and descendants. An index, for example, might consist of twenty-six family trees, one for each letter of the alphabet. The first level of children would be all legal two letter combinations, and so on; "aardvark" would, for example, be a distant descendant of "aa."

Beyond the parent-child connection, relational databases define additional relationships among their entries. The power of a relational database comes from its ability to manipulate those relations; e.g., performing an intersection operation that can find a common string of letters appearing in two different words. The rules for those manipulations are mathematically defined in a relational algebra or relational calculus specific to that database structure. Mathematics is the framework for describing database constructs, and mathematical tools are the basis for improving their efficiency and reliability.

Internet Timeline

<u>**1630-1750**</u>

P. Fermat and L. Euler lay number theoretic foundations which are now used in public key cryptography, the basis for secure messages on the Internet.

<u>**1944-1945**</u>

J. von Neumann develops methods of translating mathematical procedures into machine-language instructions, and later, designs and constructs a computer.

<u>**1950-1952**</u>

R. Hamming, D. Huffman et al. introduce the basic ideas of error detecting and correcting codes using tools from the algebra of polynomials over finite fields.

<u>**1956-1959**</u>

R. Bellman, L. Ford, and E. Dijkstra develop the first shortest-path algorithms, essential for packet routing on the Internet.

<u>**1962**</u>

P. Baran devises a new kind of communications network that is net or web-like, rather than point-to-point.

<u>**1965**</u>

B. Mandelbrot publishes the first attempt to use a self-similar mathematical model in communications traffic.

<u>**1970**</u>

ARPANET hosts start using Network Control Protocol (NCP).

<u>**1972**</u>

R. Tarjan and J. Hopcroft refine graph search algorithms for finding connected segments of networks and other applications.

<u>**1974**</u>

V. Cerf and R. Kahn develop a protocol for packet network intercommunication which specifies in detail the design of a Transmission Control Program (TCP).

<u>**1976**</u>

W. Diffie and M. Hellman propose notion of public key cryptography based on modular arithmetic and discrete logarithms.

<u>**1978**</u>

R. Rivest, A. Shamir and L. Adelman, devise a method for obtaining digital signatures and public key cryptosystems based on modular arithmetic and properties of prime numbers.

<u>**1982**</u>

D. Anick, D. Mitra and M. Sondhi develop a mathematical model that can be used for a data-handling switch in a computer network.

DCA and ARPA establish the Transmission Control Protocol (TCP) and Internet Protocol (IP), as the protocol suite, commonly known as TCP/IP, for ARPANET.

<u>**1986**</u>

V. Jacobson and M. Karels develop "slow start" proctocols to prevent congestion collapse on ARPANET. NSFNET created (backbone speed of 56Kbps).

<u>**1991**</u>

NSFNET backbone upgraded to T3 (44.736Mbps); traffic passes 1 trillion bytes/month and 10 billion packets/month.

<u>**1994**</u>

NSFNET traffic passes 10 trillion bytes/month.*

W. Leland, M. Taqqu, W. Willinger, and D. Wilson conclude that Internet traffic is fractal in nature and suggest new models.

<u>**1996**</u>

President Clinton proposes next-generation Internet.

Routing and Network Configuration

A local area network of moderate size might have 10,000 pairs of nodes that communicate with one another. The messages they share are like trains running at the speed of light on the tracks of the network. Each car in the train carries part of one message, as if a long letter had been written on a series of postcards, one card per car. Typically, cards from many messages are mixed in one train.

The performance of the network depends on the length of the trains — the size of the message packets — and on the space between the trains. For example, a long message train that arrives at the wrong time can delay many other messages until it passes; short messages properly spaced can be slid in among one another.

The mathematical ideas of queuing theory can predict the behavior of message handling protocols based on information about the size and arrival patterns of these message packets. (The classic application of queuing theory is estimating the waiting time at a bank, given the arrival patterns of customers and the service time of the bank teller.) But investigations of alternate message handling protocols are based on mathematical models of the message traffic. Good models assure that a new protocol will perform as well in practice as queuing theory predicts; bad models can lead a protocol developer to make performance promises that can't be fulfilled.

Mathematics on the Web

Mathematicians take full advantage of the Internet and the World Wide Web. These tools let them share ideas, techniques, and resources across geographic and disciplinary boundaries to advance both teaching and research.

Central hubs for a wide range of mathematical activity, including considerations of the role of mathematics in society, are the Math Forum and the home pages of the three sponsoring societies for Mathematics Awareness Week: the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

Examples of more specialized sites are the Math Archive, which specializes in educational issues, and the Geometry Center, whose focus is computation and visualization of geometric structures. Number theorists interested in the search for so called Mersenne primes pool their resources through the Great Internet Mersenne Prime Search. For many years, computational scientists have shared problems, solutions, and methods through Netlib, where the best public-domain numerical analysis software is available for downloading.

Mathematics and the Internet

Mathematics is the language of Internet operation, from the binary numbers that describe text and images to the complex data structures of search engines for the World Wide Web. Adroit combinations of old and new ideas from fields like number theory have enabled such key Internet technologies as data encryption for secure financial transactions. At the same time, the Internet has given birth to worldwide collaborations among mathematics teachers and researchers, collaborations that are advancing both education from kindergarten through university and our understanding of some of the most difficult problems of pure and applied mathematics.

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Do you know?

- It is impossible to fold a paper more than seven times. Try it!
- 26 is the only number that can be placed between a perfect cube and a perfect square.
- The lifeline of today's time, Google search engine is a term which is derived from word 'googol' which is a mathematical term for the number 1 followed by 100 zeros which reflect infinite amount of search on the internet.

বিশিষ্ট গণিতজ্ঞ ড° কৈলাশ চন্দ্ৰ গোস্বামীৰ সৈতে হোৱা অন্তৰংগ আলাপ

(ভাৰত চৰকাৰৰ বিজ্ঞান আৰু প্ৰৌদ্যোগিকী বিভাগ (Department of Science and Technology, DST) আৰু ৰাষ্ট্ৰীয় বিজ্ঞান প্ৰৌদ্যোগিকী সঞ্চাৰ পৰিষদৰ দ্বাৰা ২০১৩ চনৰ 'বিজ্ঞান জনপ্ৰিয়কৰণ' ৰাষ্ট্ৰীয় পুৰস্কাৰ প্ৰাপ্ত বৰপেটা জিলাৰ পাটাছাৰকুছিৰ ওচৰৰ বেহকুছি গাওঁত জন্ম লাভ কৰা (বৰ্তমান গুৱাহাটীৰ উলুবাৰী নিবাসী) বি. বৰুৱা মহাবিদ্যালয়ৰ অৱসৰপ্ৰাপ্ত উপাধ্যক্ষ তথা বিশিষ্ট গণিতজ্ঞ ড০ কৈলাশ গোস্বামীৰ সৈতে অন্তৰংগ আলাপ।

ড০ গোস্বামীৰ সৈতে অন্তৰংগ আলাপত ভাগ লয় 'ট্ৰেপেজিয়াম'ৰ সম্পাদকদ্বয় ক্ৰমে হীৰকজ্যোতি শৰ্মা আৰু ট্ৰিনিটি কৌশিক)

সম্পাদকদ্বয় ঃ ছাৰ নমস্কাৰ।

ড০ গোস্বামী ঃ নমস্কাৰ আৰু বহুদিনৰ মূৰত মোৰ ওচৰলৈ অহা বাবে বহুত ধন্যবাদ।

১। *সম্পাদকদ্বয় ঃ* ছাৰ। আমি সকলোৱে জানো বিশ্বব্ৰহ্মাণ্ডৰ জ্ঞান বৃক্ষডাল জাতিস্কাৰত গণিত এটা ঘাই উপাদান। কিন্তু এই উপাদানটোৰ স্বৰূপ আৰু ইয়াৰ আঁৰত কি উদ্দেশ্য জড়িত হৈ আছে চমুকৈ ক'বনে?

ড০ গোস্বামী ঃ বিশ্বলোকৰ অফুৰন্ত সত্যৰ ভাণ্ডাৰটোৰ দুৱাৰখন মুকলি কৰিবৰ বাবে আমাক লাগে যুক্তিগত চিন্তা, পদ্ধতি আৰু কৰ্মকুশলতা। ইয়াৰ প্ৰবোচনাতেই জন্ম গণিত নামৰ সাৰ্থক চমৎকাৰটিৰ। যুক্তিতত্ত্বৰ আধাৰত ডেউকা মেলি এই গণিতেই বিজ্ঞানৰ প্ৰকৃতি আৰু তত্ত্বৰ লগতে প্ৰকৃতিৰ কাৰ্যকলাপ আৰু নিয়তিৰ নিৰ্ঘাট সত্যবোৰক বুজিবলৈ উপায় মাত্ৰ এটা সি হ'ল গণিত। দাৰ্শনিক ৰ'জাৰ বেকন (Roger Becon)ৰ মতে 'বিজ্ঞানৰ আটাইবোৰ শাখাৰ দুৱাৰ মুকলি কৰে গণিতে'-অৰ্থাৎ এনে কোনো বিজ্ঞান নাই যি গাণিতিক ধাৰণাতেই অস্পৃশ্য, অসমৃদ্ধ। ইয়াৰ বাবেই গেলিলিওই যথাৰ্থতে কৈছিল-'প্ৰকৃতিৰ বৃহৎ কিতাপখন গণিতৰ ভাষাতহে লিখা।' আনভাষাত প্ৰকৃতিৰ বিশাল ৰহস্যৰ গোপন দুৱাৰ খুলিবলৈ মানুহৰ চেষ্টাৰ মাধ্যম হ'ব লাগিব গণিত।

২। *সম্পাদকদ্বয় ঃ* ছাৰ গণিতক বিজ্ঞানৰ ৰাণী বুলি কোৱাৰ তাৎপৰ্যটো কি? ইয়াৰ সাৰ্বজনীন প্ৰয়োগৰ বিষয়ে অলপ জনাব নেকি?

ড০ গোস্বামী ঃ মই 'গ্ৰহ ধৰিত্ৰীৰ গণিত' নামৰ প্ৰৱন্ধ এটাত উল্লেখ কৰিছোৱেই যে প্ৰাকৃতিক বিধি, ঘটনা-পৰিঘটনাবোৰক সূক্ষ্মভাৱে পৰ্যবেক্ষণ কৰি

সুনিৰ্দিষ্ট পদ্ধতি আৰু কলা-কৌশলৰ আয়ত্বৰে কিদৰে গণিতে সেইবোৰৰ অন্বেষণ নিজে কৰে নাইবা বিজ্ঞানৰ অইন মাধ্যমক কৰিবলৈ উদগনি যোগায়। বিশ্বৰ নান্দনিক আৰু ভাস্কৰ্যীয় চানেকিৰো ব্যাখ্যা আগবঢ়ায় এই গণিতেই। এয়া গণিতৰ ইতিহাস পৰম্পৰা, মানৱ সভ্যতাৰ অংকুৰণৰ প্ৰথম সাৰথি। প্ৰাকৃতিক পৰ্যবেক্ষণৰ আধাৰ লৈ কৰা গাণিতিক চিন্তা, সূত্ৰ বিধিবোৰেই বাস্তৱিক ভাৱে হৈ পৰেগৈ বিজ্ঞানৰ ভাষা, চিন্তা আৰু জ্ঞান।

কেপলাৰৰ দৰে গ্ৰহ, নক্ষত্ৰৰ জ্যোতিবিজ্ঞানিক সূত্ৰ, নিউটনৰ মহাকৰ্ষণ সূত্ৰ, আইনষ্টাইনৰ আপেক্ষিকতাবাদ নাইবা হকিঙৰ ব্লেকহোল আদি মহাজাগতিক প্ৰাকৃতিক ৰীতি নিয়ম বুজিবলৈ উদ্ভাৱন কৰা তত্বসূত্ৰবোৰৰ মডেলবোৰৰ প্ৰকৃততে গণিতেহে যোগান ধৰে। গণিতৰ এই সাৰ্বজনীন প্ৰয়োগতা প্ৰকৃতিৰ ধৰ্মসূত্ৰৰ যোগান আৰু তাত্বিক আৱিষ্কাৰৰ সামৰ্থৰ বাবেই গণিতক বিজ্ঞানৰ ৰাণী বোলা হয়।

৩। *সম্পাদকদ্বয় ঃ* বিষয়টো বুজিলো। ছাৰ গণিত বিষয়টো কিন্তু প্ৰায় ভাগ শিক্ষাৰ্থীয়ে এটা কঠিন বিষয় বুলিহে অনুভৱ কৰে। ইয়াৰ কাৰণ কি?

ড০ গোস্বামী ঃ এইটো এটা স্বাভাৱিক আৰু গুৰুত্বপূৰ্ণ প্ৰশ্ন। সহজ সৰল ভাষাত ক'বলৈ.....

৪। *সম্পাদকদ্বয় ঃ* বহুতে কয় গণিত বিষয়টো এটা টান বিষয়। এই বিষয়টো মুখ্য বিষয় হিচাপে অধ্যয়ন কৰাৰ প্ৰতি আপুনি কেনেকৈ আগ্ৰহী হৈছিল?

ড০ গোস্বামী ঃ এইটো এটা স্বাভাৱিক আৰু গুৰুত্বপূৰ্ণ প্ৰশ্ন। সহজ সৰল ভাষাত ক'বলৈ হ'লে প্ৰকৃতিৰ জগতখনৰ চিনাকি, বুজ, বিচাৰ আৰু অন্বেষণ কৰাৰ প্ৰয়াসতে গণিত নামৰ বিদ্যাটোৰ জন্ম। জাগতিক প্ৰণালীক সু-শৃংখলিত কৰি গাণিতিক পদ্ধতিৰ আয়ত্বলৈ আনি অন্বেষণ কৰাৰ প্ৰচেষ্টা আৰু প্ৰয়োজনৰ ফলতেই এই বিদ্যাৰ বিকাশ ঘটিছে। পদ্ধতি আৰু বিকাশৰ খাতিৰতেই কেতিয়াবা ই বাস্তৱ মূৰ্ত্ত জগতৰ পৰা আঁতৰি থাকিবলগীয়া হয়। সেয়ে বিভিন্ন গাণিতিক ধাৰণাৰ আঁৰত লুকাই থকা আৰ্হি, পদ্ধতি আদি বুজিবলৈ আমাক লাগে যুক্তি, চিন্তা বা কল্পনা, মনোনিৱেশ, চৰ্চা আৰু অধ্যাৱসায়। সৰল আৰু চমুপথ বিচৰা ব্যক্তিৰ মাজত এনে প্ৰচেষ্টাৰ অভাৱ থাকে বাবে তেওঁলোকৰ বাবে গণিত এটা সমস্যা। সেয়ে তেওঁলোকৰ বিষয়টোৰ প্ৰতি অনীহা, বিৰাগ, ভয় আৰু শংকাৰ কাৰণ। এইবোৰৰ অবাৰৰ বাবেই তেওঁলোকৰ বাবে গণিত এক দুৰ্বোধ্য জগতৰ অলংঘনীয় দুৰ্গ। মোৰ ধাৰণাত বেছিভাগ মানুহেই গণিত এটা টান বিষয় বুলি কোৱাৰ মূলতেই এইখিনি।

৫। *সম্পাদকদ্বয় ঃ* এই বিষয়টো মুখ্য বিষয় হিচাপে অধ্যয়ন কৰাৰ প্ৰতি আপুনি কেনেকৈ আগ্ৰহী হৈছিল?

ড০ গোস্বামী ঃ অজস্ৰ মানুহ আছে যাৰ গণিতৰ প্ৰতি দুৰ্বাৰ মমতা, হেঁপাহ আছে। তেওঁলোকৰ এই হেঁপাহ স্বভাৱজনিত, অপ্ৰৰোচিত আৰু যেন গণিত তেওঁলোকৰ এটা সত্বা। এনেলোকৰ বাবে গণিত জীৱনৰ এটা প্ৰবাহ আৰু সুন্দৰতাৰ প্ৰতীক। আন

কিছুমান মানুহ আছে যি প্ৰথমে প্ৰৰোচিতভাৱে গণিতৰ মাজত সোমায় আৰু গণিতৰ মায়াজালত বান্ধ খাই পৰে। তেওঁলোকৰ মনত গাণিতিক বুজ, সৌন্দৰ্য এবাৰ সোমাই পৰাৰ পিছত গণিতহে তেওঁলোকৰ জীৱনৰ মধ্যমণি হৈ থাকে। এই দুয়োপ্ৰকাৰৰ ব্যক্তিয়েই কোনো অসাধাৰণ মেধা, বুদ্ধি বৃত্তি বা প্ৰখৰ তীক্ষ্ণধী প্ৰতিভূ শ্ৰেণীত পৰা ব্যক্তিয়ে যে হ'ব তাৰ কোনো প্ৰয়োজন নাই। এওঁলোক কোনো বিখ্যাত গণিতজ্ঞ হ'বও পাৰে নহ'বও পাৰে। মই কোন বিভাগত পৰো নাজানো, কিন্তু মই পদ্ধতিগত আৰ্হি, যুক্তিসুলভ চিন্তা, প্ৰাকৃতিক প্ৰতিসমতা থকা আৰু বিজ্ঞান কলাৰে সমৃদ্ধ বিষয় হিচাপেই বোধ হয় সৰুৰেপৰা গণিতৰ প্ৰতি আকৰ্ষিত হৈছিলো। সুক্ষ্ম নিৰীক্ষণেৰে ইয়াৰ এনে সৌন্দৰ্যৰ প্ৰতি পিছলৈ বেছি আকৰ্ষিত হোৱা বাবেই মই ইয়াক অধ্যয়ন কৰাৰ ক্ষেত্ৰত এটা মুখ্য বিষয় হিচাপে বাচি ল'লো। পিছলৈ ই মোৰ সত্বাৰ দৰে হৈ পৰিল।

৬। *সম্পাদকদ্বয় ঃ* গণিত বিষয়টোৰ প্ৰতি অনীহা আৰু ভয় ভাৱ আঁতৰাই এজন ছাত্ৰ বা শিশুৰ মনত গণিতৰ প্ৰতি আগ্ৰহ কেনেকৈ জগাই তুলিব পাৰি?

ড০ গোস্বামীঃ ই এটা অতি প্ৰয়োজনীয় আৰু গুৰুত্বপূৰ্ণ প্ৰশ্ন। দৰাচলতে গণিতৰ বিভিন্ন দিশসমূহৰ মৌলিক ধাৰণা। দক্ষতা, কৌশল আৰু প্ৰয়োগৰ চাতুৰ্য্য লাভৰ ক্ষেত্ৰত শিক্ষাৰ্থীয়ে পৰ্যাপ্ত পৰিমাণত অনুশীলনী, অভ্যাস আৰু নিৰ্দিষ্ট কৰ্মসূচী পালন কৰাটো সদায় বাধ্যতামূলক। ইয়াৰ ব্যতিৰেকে ভাল গণিত আয়ত্ব কৰাৰ মসৃণ পথ নাই। কিন্তু এইখিনি কৰিবলৈও শিক্ষাৰ্থীৰ মানসিকভাৱে উপযোগী বিভিন্ন ক্ৰিয়াকলাপ আৰু শিক্ষা বিষয়ত পৰিপূৰক কৰ্মসূচী কিছুমান বান্ধি ল'লেহে শিক্ষাৰ্থী গণিতৰ প্ৰতি আসক্ত হৈ শিকিবলৈ আগ্ৰহী হ'ব। ইয়াৰ বাবে কাৰ্যভিত্তিক শিক্ষা সমলৰ ব্যৱহাৰ আৰু ক্ষেত্ৰভিত্তিক প্ৰকল্প কাৰ্য আদি গ্ৰহণ কৰিব লাগে। হাতে কামে কৰা পৰীক্ষা আৰু অন্বেষণেৰে ছাত্ৰ-ছাত্ৰীয়ে মূৰ্ত্ত পৰিৱেশ এটাৰ জৰিয়তে ধাৰণাৰ বুজনৰ লগতে নিজা যুক্তি চিন্তা আগবঢ়াই সৃষ্টিশীল হ'ব পাৰিব। ইয়াৰ যোগেৰে আনকি শিক্ষকৰ শ্ৰেণীৰ বোজাও বহু পৰিমাণে লাঘৱ হ'ব।

দ্বিতীয়তে গণিতৰ প্ৰতি আকৰ্ষিত কৰাৰ মূল দায়িত্ব শিক্ষকৰ। গণিতৰ বেছিভাগ কথাকে সহজ সৰল ভাৱে মনোৰঞ্জক কৰি চিত্তাকৰ্ষক কৰাৰ বহুতো থল আছে।

অভিভাৱকে সৰুৰে পৰা ল'ৰা-ছোৱালীক গণিতৰ ক্ষেত্ৰত সুকীয়া মনোযোগ দিব লাগিব। গণিতৰ ৰাপ বহা শিক্ষাৰ্থীয়ে অইন বিষয়তো সহজে সোমাব পাৰিব। ঘৰুৱা অনুশীলনীৰ তত্বাৱধান, প্ৰাসঙ্গিক মনোৰঞ্জক গণিতৰ জনপ্ৰিয় কিতাপৰ লগত সম্পৰ্ক কৰোৱা, গাণিতিক কৰ্মশালা, প্ৰতিযোগিতা ইত্যাদি কৰ্মলৈ আগবঢ়োৱা আদিৰে ঘৰত গণিতৰ পৰিৱেশ এটা গঢ়ি তোলাতো প্ৰত্যেক অভিভাৱকৰ কৰ্তব্য।

৭। *সম্পাদকদ্বয় ঃ* আপোনাৰ বিবেচনাৰে এজন ভাল গণিত শিক্ষক হ'বলৈ কি কৰিব লাগে?

ড০ গোস্বামী ঃ শিক্ষণ কাৰ্য বিজ্ঞান পদ্ধতিতকৈও বেছি কলাত্মকহে। এটা শ্ৰেণীৰ ভিতৰতে বেলেগ বেলেগ পৰিৱেশত ডাঙৰ হোৱা বিভিন্ন চিন্তাধাৰা আৰু বিভিন্ন পৰ্যায়ৰ প্ৰায় দুকুৰি ছাত্ৰ-ছাত্ৰীৰ মনস্তত্ত্ব বুজি একেটা চিন্তা বা একেটা স্পৃহালৈ কেন্দ্ৰীভূত কৰিব পৰাকৈ শিক্ষক এজনৰ দক্ষতা থাকিব লাগিব। বিষয়ৰ লক্ষ্য ঠিক ৰাখি সহজ সৰল ভাৱে সুক্ৰমিত আৰু বোধগম্য কৰি উপস্থাপন কৰা, গাণিতিক তিক্ততা বা বৈমূৰ্ত্তিক বিষয়বোৰক মিঠা আৱৰণেৰে নিবেদন কৰা, সমস্যাৰ জটিলতাক বাস্তৱ মূৰ্ত্ত পৰিস্থিতিৰে ৰিজাই সৰল কৰি তোলা, বিষয়ৰ বোধ আৰু ইয়াৰ প্ৰায়োগিক কৌশল ব্যাখ্যা কৰাৰ আগতে ইয়াৰ উদ্দেশ্য, ব্যৱহাৰৰ দিশ আৰু মূল্যবোধৰ উপলব্ধি কৰোৱাৰ পৰা শিক্ষক এজন ভাল শিক্ষক। ছাত্ৰ-ছাত্ৰীৰ বুদ্ধিমত্তাক উৎকৰ্ষ কৰাৰ লগতে ছাত্ৰই যাতে জটিলতাৰ সমাধান নিজে আগবঢ়াব পাৰে, তেনেধৰণে ছাত্ৰ তেওঁ গঢ়িব পাৰিব লাগিব। এজন আদৰ্শ শিক্ষক তেঁৱেই, যি অধ্যয়ন পুষ্ট, পাণ্ডিত্যপূৰ্ণ আৰু সদায় প্ৰাসঙ্গিক বিষয়বোৰৰ লগত ব্যস্ত থাকে। ছাত্ৰৰ স্বভাৱসুলভ শংকা আঁতৰাই তেওঁ অনবৰতে পাঠ্যশিকন আকৰ্ষিত কৰিব লাগিব। গণিতৰ ভাল শিক্ষক এজন সদায়ে নিয়ম আৰু সময়ানুবৰ্তী, পদ্ধতি আৰু যুক্তিৰ সঠিকতা থকা পৰিপাটি, বহু পৰিশ্ৰমী আৰু বৈমূৰ্ত্তিক চিন্তাধাৰাৰ এজন সহজ আৰু সৰল ব্যক্তি। এইবোৰ আমাৰ বিশ্বাস।

৮। *সম্পাদকদ্বয় ঃ* ছাৰ, আপোনাৰ অনুভৱেৰে গণিত বা বিজ্ঞানৰ ছাত্ৰ হ'বলৈ কি কি গুণৰ অধিকাৰী হোৱা বাঞ্চনীয়?

ড০ গোস্বামী ঃ মোৰ চিন্তাত কিছুমান গুণৰ অধিকাৰী হোৱাটো বহুখিনি নিৰ্ভৰ কৰে আমাৰ জন্মগত সত্বা, পদ্ধতিগত চৰ্চা আৰু অনুকূল পৰিৱেশ। স্বাভাৱিক সত্বাবোৰৰ কিছুমান হ'ল এফালে সৃষ্টিশীলতা (অৰ্থাৎ সীমাৰ বাহিৰত চিন্তা কৰা), কল্পনা প্ৰৱণতা, বোধশক্তি, স্মৃতিপ্ৰৱৰতা, দিবাস্বপ্ন ইত্যাদি আৰু আনফালে থাকে যুক্তিগত চিন্তা, বিশ্লেষণ, ক্ৰমযুক্ত চিন্তা, চাতুৰ্য্য, কৌশল আদিৰ প্ৰৱণতাৰ অধিকাৰ থকা গুণ। প্ৰথমবোৰ গুণৰ অধিকাৰীসকলে সাধাৰণতে দাৰ্শনি, বিজ্ঞানী, উকীল, চাতুৰ্যৰ কলাকুশলী ব্যক্তিৰ গাত হেনো বেছিকৈ থাকে। ইয়াৰ পৰা বুজা যায় যে গণিত প্ৰেমীসকলৰ বেছিভাগৰ গাতেই এই দুয়োবিধ গুণেই কম-বেছি পৰিমাণে থাকে।

যিয়েই নহ'লেও সুক্ষ্ম আৰু যুক্তিপূৰ্ণ চিন্তা, আৰ্হিগত প্ৰণালী, সজ প্ৰচেষ্টা, অধ্যৱসায় আৰু মনোবল থকা প্ৰত্যেক ব্যক্তিয়ে ওপৰৰ গুণবোৰৰ অধিকাৰীহৈ ভাল গণিত কৰিব।

৯। *সম্পাদকদ্বয় ঃ* ছাৰ, আপোনাৰ ব্যক্তিগত অভিজ্ঞতাৰে আমাৰ শিক্ষা ব্যৱস্থাৰে গণিত শিক্ষাৰ উত্তৰণৰ দিশত কি কৰা উচিত বুলি ভাৱে?

ড০ গোস্বামী ঃ আমাৰ ধাৰণাৰ গণিত শিক্ষাৰ উত্তৰণত ঘাই বাধা হ'ল দোষপূৰ্ণ অনুসূচীত কাৰ্য্যক্ৰম, শিক্ষণ প্ৰণালী, পাঠ্যপুথিৰ খুটিনাটি, কাৰ্যভিত্তিক গণিত শিক্ষাৰ পৰা আঁতৰি থকা আৰু প্ৰকৃত গাণিতিক বাতাবৰণৰ অভাৱ। গণিতৰ প্ৰতি স্পৃহা আৰু প্ৰলোভিত কৰিব পৰা কাৰ্যক্ৰম কিছুমান হাতত ল'লেহে শিক্ষাৰ্থীয়ে বিষয়টোৰ প্ৰতি আকৰ্ষিত হ'ব। ইয়াৰ বাবে বহলভিত্তিক কাৰ্যসূচী এখন চৰকাৰে গ্ৰহণ কৰিব লাগিব যিয়ে ব্যৱহাৰিক ক্ৰিয়াকলাপ, চাক্ষুস জ্ঞান, অন্বেষণভিত্তিক বিভিন্ন প্ৰকল্প আৰু প্ৰক্ৰিয়াৰ যোগেদি গণিত শিক্ষাৰ সংস্কাৰ সধাৰ ওপৰত গুৰুত্ব আৰোপ কৰে। কিন্তু ইয়াৰ বাবে শিক্ষক প্ৰশিক্ষণ, বিদ্যালয়ৰ শিক্ষা সমলকে ধৰি বিভিন্ন দিশত পৰিকাথামো এটা গঢ়ি তোলাৰ দায়িত্ব ৰাজ্য চৰকাৰৰ।

১০। *সম্পাদকদ্বয় ঃ* ২০১৩ চনত আপুনি বিজ্ঞান জনপ্ৰিয়কৰণৰ ৰাষ্ট্ৰীয় বঁটা পালে। গণিত আৰু বিজ্ঞান জনপ্ৰিয়কৰণৰ ধাৰণাটো আপোনাৰ মনলৈ কিয় আৰু কেনেকৈ আহিল?

ড০ গোস্বামী ঃ গণিত আৰু বিজ্ঞানক জনপ্ৰিয় কৰিম বুলি কাৰ্যসূচী এটা কোনোদিনে হাতত লোৱা নাছিলো। কিন্তু ছাত্ৰ জীৱনৰ পৰাই অনুভৱ কৰিছিলো গণিত বিশেষকৈ আমাৰ বহুতৰে প্ৰিয় বিষয় হোৱা স্বত্বেও ইয়াক গ্ৰহণ কৰিব পৰা ক্ষমতাটোৰ যেন ক'ৰবাত কেৰোণ সোমাই আছে। বেছিভাগ ছাত্ৰ-ছাত্ৰীয়ে গণিতৰ প্ৰতি আকৃষ্ট নহয়। অনুসূচীত কাৰ্যক্ৰম, শিক্ষণ প্ৰণালী, পাঠ্যপুথিবোৰৰ খুটি-নাতিৰ উপৰি প্ৰকৃত গাণিতিক বাতাবৰণৰ অভাৱেই যেন ইয়াৰ মূল কাৰকৰূপে শিকণৰ বাধা হৈ দেখা দিছে যাৰ ফলত মই নিজকে ধৰি প্ৰায়ভাগ শিক্ষাৰ্থীয়ে প্ৰধানকৈ আত্মশিকণৰ ওপৰতহে নিৰ্ভৰ কৰিবলগীয়া হৈছিল।

আজিৰ শিক্ষাবিদসকলেও ভাবে যে বিষয়ৰ ধাৰণা আৰু জ্ঞানৰ বুজ লোৱাৰ উপৰি গণিতৰ প্ৰতি স্পৃহা আৰু উত্তেজনা জন্মাব পৰা কাৰ্যক্ৰম কিছুমান নল'লৈ বিষয়টোৰ প্ৰতি শিক্ষাৰ্থী আকৰ্ষিত নহ'ব। স্পষ্ট আৰু সহজ সৰল পাঠ্যপুথি, বিষয়ৰ প্ৰাসঙ্গিক মনোৰঞ্জক কাৰ্যসূচী, খেল-ধেমালি আৰু হাতে-কামে কৰি চাক্ষুস অভিজ্ঞতাৰ মাজেৰে শিক্ষা নহ'লে কোনেও গণিতৰ প্ৰতি অনুৰাগী নহ'ব। শিক্ষাক জীৱনৰ অভিজ্ঞতাৰ এটা অংশ কৰি ল'ব লাগিব। একেদৰে শিক্ষকসকলৰ প্ৰতিও কৰিবলগীয়া কাৰ্যসূচী থাকিব লাগিব।

এনে অনুভৱতে মই নিজে নিজেই শিক্ষাৰ্থী, শিক্ষক আৰু সমাজক জড়িত কৰি ব্যক্তিগতভাৱে কিছুমান কাৰ্যক্ৰম হাতত লৈ কৰি আছো-যাক হয়তো জনপ্ৰিয়কৰণ বুলি নাম দিব পাৰি। এনে কাৰ্যক্ৰমৰ, বহুখিনি সফলতা স্বীকাৰ কৰি আৰু গুৰুত্ব প্ৰদান কৰিয়েই যোৱা বছৰ ভাৰত চৰকাৰে বিজ্ঞান-প্ৰযুক্তি বিজ্ঞানৰ জনপ্ৰিয়কৰণৰ সৰ্বভাৰতীয় "ৰাষ্ট্ৰীয় বিজ্ঞান বঁটা"ৰে মোক সন্মানিত কৰিছে।

১১। *সম্পাদকদ্বয় ঃ* আপোনাৰ ছাত্ৰ জীৱনৰ বিষয়ে কিছু কথা ক'ব নেকি?

***ড০ গোস্বামী* ঃ মোৰ স্কুলীয়া জীৱন আছিল** পাটাছাৰকুছি বিদ্যাপীঠ হাইস্কুলত। ছাত্ৰ জীৱনত মই এজন সৰল, লাজকুৰীয়া আৰু অৰ্ন্তমুখী স্বভাৱৰ ছাত্ৰ আছিলো বাবেই ঘনিষ্ঠভাৱে খুব বেছি শিক্ষকৰ সান্নিধ্যলৈ অহা নাছিলো। কিন্তু প্ৰতিজন শিক্ষকেই মোৰ প্ৰতি অত্যন্ত মৰমীয়াল আছিল আৰু পঢ়া-শুনা নিয়মিতভাৱে কৰিছিলো বাবেই সকলোৰে প্ৰিয়ভাজন হৈছিলো। গণিতত শ্ৰদ্ধেয় দিকেন নাথ শৰ্মা 'হৰেন্দ্ৰ নাথ শৰ্মা (হেডমাষ্টাৰ), অনন্ত গোস্বামী, সংস্কৃতত 'প্ৰাণকৃষ্ণ' দেৱ শৰ্মা ছাৰহঁতৰ শিক্ষণশৈলীয়ে মোক আকৃষ্ট কৰিছিল। এই আটাইবোৰ শিক্ষকলৈ মোৰ শ্ৰদ্ধা স্মৃতি সদায়েই থাকিব।

১২। *সম্পাদকদ্বয় ঃ* আপোনাৰ ছাত্ৰ জীৱনৰ বিষয়ে কিছু কথা ক'ব নেকি?

ড০ গোস্বামী ঃ পুৰণি দিনৰ পৰাই পাটাছাৰকুছি বিদ্যাপীঠে বজালী অঞ্চলৰ শিক্ষা-সংস্কৃতিৰ আপুৰুগীয়া জ্ঞানৰ ভঁৰাল হিচাপে গৰিমা বিলাই থকা কাৰণে মই ইয়াৰ এজন ছাত্ৰ হিচাপে আজিও গৌৰৱ বোধ কৰোঁ। ১৯৫৩ চনৰ পৰা মই ১৯৪০ চনলৈকে এই হাইস্কুলতে (তেতিয়া ই উচ্চতৰ মাধ্যমিক নাছিল) মোৰ ছাত্ৰ জীৱন অতিবাহিত হৈছিল। সেইদিন প্ৰেক্ষাপটত শিক্ষাৰ বাতাবৰণ উন্নত আছিল বিশেষকৈ শিক্ষকসকলৰ।

১৩। *সম্পাদকদ্বয় ঃ* আপোনাৰ লেখক জীৱন আৰু প্ৰকাশিত গ্ৰন্থসমূহৰ বিষয়ে কিছু কথা জনাব নেকি?

ড০ গোস্বামী ঃ মোৰ লিখা-পঢ়াৰ অভ্যাস এটা স্কুলীয়া ছাত্ৰ জীৱনতে আৰম্ভ হৈছিল। ইয়াৰ মূলতে আছিল বাহিৰা কিতাপ অধ্যয়ন। মোৰ দাদা সাহিত্যিক শিল্পী যতীন গোস্বামীৰ তত্বাৱধানত হোৱা আমাৰ ঘৰুৱা লাইব্ৰেৰীত সেই সময়ৰ প্ৰায়ভাগ ভাল গ্ৰন্থই জমা হৈছিল। সেইবোৰ পঢ়ি লগতে পুৰণি বিখ্যাত আলোচনীবোৰৰ পৰাও সাৰমৰ্মৰ ভাল কথা বা ভাল ভাষা সাহিত্যৰ কথাবোৰ সুকীয়া বহীত টোকা কৰি লিখি ৰখা অভ্যাস এটা মোৰ আছিল। এতিয়াও

এনেদৰে লিখা বা 'পেপাৰ কাট' ৰখাৰ অভ্যাসটো আছে। বাহিৰা কিতাপ অধ্যয়নেই মোৰ জীৱনটোক এটা সুকীয়া গঢ় দিয়া বুলি ভাবোঁ। নতুন কিবা এটা লিখা বা কৰাৰ মাদকতা মই ছাত্ৰকালৰ পৰাই অনুভৱ কৰিছিলোঁ। তৃতীয় শ্ৰেণীত থাকোতেই পাঠ্যপুথিৰ এটা গল্পৰ আধাৰত মই নিজেই 'এমুঠি তিল' নামৰ নাটক এখন লিখি তাৰ তালিমো দিছিলো। ইয়াৰ পিছতো বিদ্যালয়ত শ্ৰেণী আলোচনীত জীৱনী, কবিতা, প্ৰবন্ধ আদি লিখিছিলো অৱশ্যে কলেজীয়া জীৱনত পঢ়াৰ বোজাত লিখাৰ অভ্যাসটো কমিছিল। অধ্যাপনা আৰম্ভৰ পিছত বিভিন্ন কাকত, আলোচনীকে ধৰি কিতাপ-পত্ৰ আদিৰ লিখন আকৌ আৰম্ভ হৈছিল। ল'ৰা-ছোৱালীৰ গণিতৰ ধাৰণা, বুজ আৰু বিশেষকৈ ধাউতি বঢ়োৱাৰ ক্ষেত্ৰত এতিয়ালৈ প্ৰায় আঢ়ৈ কুৰি গ্ৰন্থৰ লেখন আগবঢ়াইছো। ইয়াৰ উপৰি বিভিন্ন মাধ্যমেৰে গাণিতিক লিখন, প্ৰদৰ্শনী খেল-ধেমালি, যাদু প্ৰদৰ্শন, ৰেডিঅ', টিভিৰ কাৰ্যক্ৰম, ছাত্ৰ শিক্ষকৰ প্ৰশিক্ষণ, কৰ্মশালা, বিভিন্ন জনপ্ৰিয় ৰচনা, বক্তৃতা শিক্ষণ-শিকণ সঁজুলিৰ আৰ্হিৰ ব্যৱহাৰ, মৌলিক কৰ্মভিত্তিক গ্ৰন্থ ৰচনা আদিৰ কৰ্মত নিজকে নিয়োজিত কৰি ৰাখি মই এটা স্বাভাৱিক তৃপ্তি লভি আছোঁ।

মোৰ প্ৰকাশিত জনপ্ৰিয় গ্ৰন্থসমূহৰ ভিতৰত কেইখনমান হ'ল—

(ক) বিজ্ঞানৰাণীৰ যাদুমঞ্চ (২০০৯) বৈজয়ন্তী প্ৰকাশন।

(খ) প'লিমিনো আৰু যাদুচিত্ৰৰ খেল (২০১১) অসম শিশু সাহিত্য ন্যাস।

(গ) সাঁথৰ আৰু বুদ্ধি পৰীক্ষা (২০১১) অসম শিশু সাহিত্য ন্যাস।

(ঘ) ধেমালিৰ ছলেৰে গণিত (২০১০-১২) অসম শিশু সাহিত্য ন্যাস। (পাঁচটা খণ্ডৰ এটা চিৰিজ) ম'মিনো, ড'মিনো, ত্ৰিবৰ্গ, চতুবৰ্গ, পঞ্চমবৰ্গ।

(ঙ) বিভ্ৰম আৰু বিভ্ৰান্তি (২০০৬) অসম শিশু সাহিত্য ন্যাস।

(চ) দৈত্য সংখ্যাৰ কাহিনী (২০০৬) অসম শিশু ন্যাস

(ছ) কণ এলিচৰ সপোন কাহিনী (২০১৬) অসম শিশু ন্যাস।

(জ) বুদ্ধিৰ সাঁথৰ আৰু ভ্ৰম (২০০৪) বৈজয়ন্তী প্ৰকাশন।

(ঝ) জ্যামিতিক ৰূপান্তৰঃ কটা চিত্ৰৰ খেল (২০১০) অসম গণিত শিক্ষায়তন।

(ঞ) ভাৰতীয় গণিতৰ চমু ইতিহাস (২০১২) অসম প্ৰকাশন পৰিষদ।

(ট) ব্যৱহাৰিক গণিতঃ লেব'ৰেটৰী পৰীক্ষা (২০১০) (তিনিটা খণ্ড) চন্দ্ৰ প্ৰকাশ।

(ঠ) Maths, Practical (তিনিটা খণ্ড) চন্দ্ৰ প্ৰকাশ।

(ড) Discover Maths, Playway-Level-0/ Level-1, Anwesha

(ধ) অজান দেশত লিমাকণহঁত (২০১৩) অসম বিজ্ঞান সমিতি।

(ণ) গণিত/পাটীগণিত (২০০৫-২০১২) অসম জাতীয় বিদ্যালয় ইত্যাদি।

ইয়াৰ উপৰি প্ৰায় প্ৰাথমিকৰ পৰা আৰম্ভ কৰি ডিগ্ৰী পৰ্যায়লৈকে গণিত, উচ্চ গণিতৰ প্ৰায় আঢ়ৈ কুৰিখনতকৈ ওপৰত পাঠ্যপুথিৰ লেখক হিচাপে গণিত শিক্ষাত সাধাৰণভাৱে কৰ্মনিয়োগ কৰি আহিছো।

সম্পাদকদ্বয় ঃ ধন্যবাদ ছাৰ।

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সম্ভাৱিতা তত্ত্ব

চাইদুল হক
প্ৰাক্তন ছাত্ৰ, বি. বৰুৱা কলেজ

ঊনৈশ শতিকাতে সম্ভাৱিতা তত্ত্বই গণিতৰ এটা মনোৰম শাখা হিচাপে স্থান লাভ কৰিছিল। কুৰি শতিকাত বীজগণিত আৰু সমাকলনৰ দৰে সম্ভাৱিতা তত্ত্বৰো আমূল পৰিবৰ্তন ঘটে। কুৰি শতিকাৰ আৰম্ভণিৰে পৰা সংহতি তত্ত্ব আৰু মাপ তত্ত্বৰ প্ৰভাৱ গণিতৰ বিভিন্ন শাখালৈ বিয়পিবলৈ ধৰে। কিন্তু সম্ভাৱিতা তত্ত্বতেই এই প্ৰভাৱ আটাইতকৈ প্ৰকট ৰূপত দেখা যায়। ফলত বিজ্ঞানৰ বিভিন্ন শাখাত সম্ভাৱিতাৰ ধাৰণা অত্যন্ত ফলপ্ৰসূতাৰে প্ৰয়োগ কৰাটো সম্ভৱ হৈ উঠিল। ১৯০১ চনত প্ৰকাশিত গিবছৰ Elementary Principles in Statistical Mechanics আৰু কাৰ্ল পিয়েৰচনৰ (১৮৫৭-১৯৩৬) দ্বাৰা স্থাপিত 'বায়োমেট্ৰিক' ই পদাৰ্থ বিজ্ঞান আৰু আনুবংশিক বিজ্ঞানত সম্ভাৱিতাৰ প্ৰয়োগিকতা সম্ভৱ কৰি তুলিলে।

ছোভিয়েট ৰাছিয়াত ১৯০৬-১৯০৭ চনতে এন্দ্ৰায় এন্তয়েভিছ মাৰ্কফ (১৮৫৬-১৯২২) নামৰ গণিতত এজনে আজিকালি মাৰ্কফ শৃংখল (Markoff Chain) নামেৰে অভিহিত সম্ভাৱিতাৰ এক নতুন দিশৰ অধ্যয়ন আৰম্ভ কৰে। আন এজন ছোভিয়েট গণিতজ্ঞ এন্দ্ৰায় নিকলাভিছ কল্‌মগৰফে (১৯০৩-১৯৮৭) প্ৰায় ১৯৩১ চনত মাৰ্কফ শৃংখলৰ ধাৰণাৰ ওপৰতে ভিত্তি কৰি মাৰ্কফ প্ৰক্ৰম (Markoff Processes) নামৰ এক নতুন বিষয়ৰ ভেটি ৰচনা কৰে আৰু সম্ভাৱিয়তাৰ সম্পূৰ্ণ স্বয়ং সিদ্ধভিত্তিক সংৰূপনৰ প্ৰয়োজনীয়তাৰ ওপৰত গুৰুত্ব আৰোপ কৰে। বৰ্তমান মাৰ্কফ প্ৰক্ৰম গণিতৰ এটা সুবিকশিত শাখা ৰূপে পৰিগণিত হৈছে। উল্লেখযোগ্য যে কলা আৰু বিজ্ঞানৰ বিভিন্ন শাখাত মাৰ্কফ প্ৰক্ৰমৰ প্ৰয়োগ দিনে দিনে বাঢ়িবলৈ ধৰিছে।

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Do you know?

- The word 'hundred' is derived from another word 'hundrath' which actually means 120. Not very logical for this logic subject!
- Do you believe in magic? Then Maths does it too! The number I is said to be a magical no. Because if any number is multiplied by 9, then sum of the digits of the resulting no always comes out to be 9.

Chaos Theory (a.k.a. Butterfly Effect)

Rahul Kalita
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How many of you have heard of the Chaos Theory before? Well you might have heard it in movies though I believe. Our favourite science dude Einstein once said,

"As far as the laws of mathematics refer to reality, they are not certain, and as far as they are certain, they do not refer to reality." Amazing! But for that to make sense we need to understand the basis of what exactly led to this statement. Chaos Theory is an intriguing concept of modern Mathematics that explains how small differences in initial conditions within complex dynamic systems can result in widely different outcomes.

Edward Lorenz, a Mathematician and meteorologist once while using a computer model to predict the weather started off by feeding data relating to interdependent variables such as temperature, humidity, air pressure, strength and direction of wind. Running the computer program for the first time, he typed in '.506127' for one of the variables. Then, he ran the program again. But this time, he rounded off the figure to '.506'. The weather scenario that resulted the second time was completely different from the first. The tiny and minute difference of .000127 had a disproportionate effect.

In the year 1972, a paper's headline read, *'Does a flap of a butterfly's wings in Brazil set off a tornado in Texas?'* which was a question put forth by a fellow who was once a colleague of Edward challenging the Chaos Theory and its claims. Well surely, the flap of a single butterfly's wings does not cause the tornado per se. But numerous other factors when play their part, it can surely cause the tornado which metaphorically speaking can be termed as a result of that little action of a mere butterfly. Hence the Butterfly Effect! However despite its name I would say that Chaos Theory is anything but chaotic. The theory is rigorously mathematical. Over the past decades it has helped to explain the underlying order that engulfs a range of seemingly random systems of which a few factors acting as influencers are the air turbulence that causes drag in moving vehicles and the traffic flow in the congested cities.

Chaos Theory is an intriguing contradiction which acts like a catalyst for the science of predicting the behaviour of "inherently unpredictable" systems. It is a mathematical toolkit that opens up windows into the complex workings of extensively diverse natural systems such as the beating of a human heart and the various ongoing space trajectories of asteroids.

At the nucleus of Chaos Theory lies the captivating concept that order and chaos are not always diametrically opposed. Chaotic systems are an innate mix of the two: from

the outside they display unpredictable and chaotic behaviour, but when we dissect the inner workings we discover a perfectly deterministic set of working mechanism which is too good to be true. We would imagine that how can a little change on a smaller scale induce a bigger change on a larger scale? And how can we differentiate between pure randomness and orderly patterns that are masked by chaos?

Chaos Theory from time to time swings everyone's attention back to those things once we considered being clear about, and shows us that nature is far more complex and surprising than we can ever imagine it to be. And after reading this article if you try to find out a little more about Chaos Theory, apparently that in itself is what the butterfly effect is all about. Cheers!

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Tricks

Manali Paul

1. Given some structure of number. You have to put any mathematical operation to obtain the result is equal to '6'.

0	0	0	=	6
1	1	1	=	6
2	2	2	=	6
3	3	3	=	6
4	4	4	=	6
5	5	5	=	6
7	7	7	=	6
8	8	8	=	6
9	9	9	=	6

You are allowed to put any kind of operation but not digit.

Ans :

(0!	+ 0!	+ 0!)!	=	6
(1	+ 1	+ 1)!	=	6
2	+ 2	+ 2	=	6
3	x 3	− 3	=	6
$\sqrt{4}$	+ $\sqrt{4}$	+ $\sqrt{4}$	=	6
5	÷ 5	+ 5	=	6
6	+ 6	− 6	=	6
$\sqrt[3]{8}$	+ $\sqrt[3]{8}$	+ $\sqrt[3]{8}$	=	6
$\sqrt{9}$	+ $\sqrt{9}$	− $\sqrt{9}$	=	6

Mathematics in the 19th Century

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Alumnus
(2014-17 Batch)

The 19th century saw an unprecedented increase in the breadth and complexity of Mathematical concepts. Both Franch and Germany were caught up in the ae of revolution which swept Europe in the late 18th century.

Joseph Fourier's study at the beggining of the 19th century of infinite sums in which the Lerms are rigonometric functions were another important advance in mathematical analysis. Periodic functions that can be expressed as the sum of an infinite series of sines and cosenes are known today as fourier series, and they are still powerfull tools in pure and applied mathematics. Fourier also contributed towards defining exactly what is meant by a function, although the defination that is found in texts today. defininig it in terms of a correspondence between elements of the domain and the range is usually attributed to the 19th century German mathematician Peter Dirichlet.

The German Bernhard Riemann worked on a different kind of non-Euclidean geometry called elliptic geometry, as well as on a generalized theory of all the different types of geometry. Rumann, however, soon took this even further breaking away completely from all the limitations of 2 and 3 demensional geometry, whealy whether flat or curved, and began to think in higher demensions. His exploration of the zeta function in multidimensional complex numbers revealed an unexpected link with the destribution of prime numbers and his famous Ricmann hypothesis, still unprovers afer 150 years remains one of the world's great unsolved mathematical mysteries and the testing ground for new generations of mathematicians.

Another 19th century Englishman. George Peacock is usally credited with the invension of sysbolic algebra, and the extension of the scope of algebra beyond the ordinary system of numbers. This recognition of the possible existence of non-arithmetical algebras was an important stepping stone toward future developments in abstract algebra.

In the mid 19th century, the British mathematician Guorge Boole devised an algebra in which the only operators wer AND OR and NOT, and which could be applied to the solution of legual problems and mathematical functions. He also described a kind of binary system which used just two objects "ON" and "OFF" (or 'true' and false, 1 and 1) in which famously, 1 + 1 = 1. Boolean algebra was the starting point of modern mathematical logic and ultimately led to the development of computer science.

Most of the powerful abstract mathematical theories in use today originated in the 19th century so any historical account of the period should be supplemented by reference to detailed treatments of these topics. Yet mathematics grew so much during this period that any account must necessarily be selective. The growth of mathematics as a profession was accompained by a sharpering division between mathematics and the physical sciences, and contact between the two subjects takes place today across a dear professional boundary.

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জ্যামিতিৰ আদিগুৰু পাইথাগোৰাছ

আশিক হুছেইন
প্ৰাক্তন ছাত্ৰ, বি. বৰুৱা কলেজ
(২০১৪-১৭ বৰ্ষ)

"Number rules the universe".

– Pythagorus

প্ৰাচীন কালত যিসকল মহাপুৰুষে বিজ্ঞান আৰু দৰ্শন সম্পৰ্কে চিন্তা-চৰ্চা কৰিছিল, সেইসকলৰ ভিতৰত পাইথাগোৰাছো এজন। আজিকালি গণিতৰ সকলো ছাত্ৰই পাইথাগোৰাছৰ জ্যামিতি পঢ়িছে, আন ভাষাত পাইথাগোৰাছৰ নাম নুশুনা গণিতৰ ছাত্ৰ নাই।

খ্ৰীঃ পূঃ ৫৮০ত ইটালীৰ চাম্চ নামে এখন ঠাইত পাইথাগোৰাছে জন্ম লাভ কৰিছিল। সৰুৰে পৰাই পাইথাগোৰাছ আছিল বৰ চিন্তাশীল। তেওঁৰ কৰ্মস্থান আছিল দক্ষিণ ইটালীৰ ক্ৰটনা (Crotona) নামৰ ঠাইখন। সৰুৰে পৰাই পাইথাগোৰাছৰ ঈশ্বৰৰ ওপৰত আছিল অগাধ বিশ্বাস। তেওঁ আছিল একেধাৰে পণ্ডিত, দাৰ্শনিক, প্ৰকৃতিবিদ গণিতজ্ঞ আৰু ধৰ্মগুৰু। তেওঁৰ সাৰুৱা গঠনমূলক উপদেশ সমূহৰ কাৰণেই বহুতো লোক পাইথাগোৰাছৰ ওচৰ চাপিছিল আৰু সেই লোকসকলেই "পাইথাগোৰীয় সমাজ" নামেৰে এটি অনুষ্ঠান গঢ়ি তুলি পাইথাগোৰাছৰ উপদেশ, দৰ্শন আৰু আৱিষ্কাৰসমূহ প্ৰচাৰ কৰি ফুৰিছিল।

'সংখ্যা' সম্পৰ্কে এটা স্পষ্ট ধাৰণা পোন প্ৰথমে পাইথাগোৰাছেই দিছিল। তেওঁ কৈছিল যে — সকলো বস্তুৰেই সংখ্যা থাকিবই লাগিব আৰু সংখ্যা সদায় গণিব পাৰি। পাইথাগোৰাছেই পোন প্ৰথমে গণিতক বিজ্ঞান হিচাপে প্ৰতিষ্ঠা কৰিলে। জ্যামিতিৰ ক্ষেত্ৰতো পাইথাগোৰাছৰ অৱদান সৰ্বজন বিদিত। শ শ বছৰৰ পিছতো তেওঁ আৱিষ্কাৰ কৰি থৈ যোৱা এটি বিশেষ 'উপপাদ্য'— "পাইথাগোৰাছৰ উপপাদ্য (Theorem of Pythagorus) পঢ়ুওৱা হ'ল। এই উপপাদ্যৰ বিষয়বস্তু হ'ল —"এটা সমকোণী ত্ৰিভূজৰ অতিভূজৰ বৰ্গটো ইয়াৰ অইন দুটা বাহুৰ বৰ্গৰ যোগফলৰ সমান।"

এই উপপাদ্যটি সম্পৰ্কে এটি কাহিনীও আছে। পাইথাগোৰাছ হেনো এবাৰ মিছৰ দেশলৈ গৈছিল তাতেই পিৰামিড সাজিবলৈ অনা বৰ্গক্ষেত্ৰকাৰ পাথৰবোৰ তেওঁৰ চকুত পৰিল। সেইবিলাক চাওঁতে চাওঁতেই হেনো আৱিষ্কাৰ কৰিলে এই উপপাদ্যটো।

চিকিৎসা বিজ্ঞানৰ ক্ষেত্ৰতো পাইথাগোৰাছৰ অৱদান কম নহয়। পাইথাগোৰাছ নিজেই আছিল এজন চিকিৎসক। তেওঁ এক বিশেষ চিকিৎসা পদ্ধতি আৱিষ্কাৰ কৰিছিল। ৰোগীৰ মানসিক অৱস্থাৰ ওপৰত ভিত্তি কৰিহে তেওঁ কেনে ধৰণৰ চিকিৎসা কৰিব, সিদ্ধান্ত লৈছিল। চিকিৎসক হিচাপে তেওঁৰ মহত্ব ফুটি উঠিছিল সেইখিনিতে।

পাইথাগোৰাছৰ আগলৈকে মানুহৰ ধাৰণা আছিল যে পোহৰ হ'ল মানুহৰ চকুৰ পৰা ওলোৱা এক শক্তি। দিনত সূৰ্যৰ পোহৰত সেই শক্তি পায় আৰু ৰাতিৰ আন্ধাৰত সেই শক্তি হ্ৰাস পায়। পইথাগোৰাছেই প্ৰথমে এই ধাৰণাটো বিৰোধিতা কৰে আৰু ইয়াৰ বিজ্ঞানসন্মত কাৰণ দাঙি ধৰে। তেওঁ কয় যে—সূৰ্যৰ

পোহৰ ক্ষুদ্ৰ ক্ষুদ্ৰ কণিকাৰ আকাৰত পৃথৱীত পৰেহি আৰু যি বস্তুতে সেই ৰশ্মি পৰে, আমি সেইটোৱেই দেখা পাওঁ। তাৰ বহু বছৰৰ পিছত নিউটনেও পোহৰ সম্বন্ধে ঠিক একে ধৰণৰ মন্তব্যকে দাঙি ধৰিছিল।

কিন্তু অতি দুখৰ বিষয় যে এনে এগৰাকী মহান চিন্তানায়কেও সুখেৰে মৃত্যুবৰণ কৰিব নোৱাৰিলে। পাইথাগোৰাছৰ দৰে আমাৰ বহুতো মহাপুৰুষৰে শেষ অৱস্থা অত্যন্ত দুখজনক। পাইথাগোৰাছৰ বিভিন্ন ক্ষেত্ৰত আগবঢ়োৱা অৱদানে এহাতে যেনেকৈ তেওঁৰ অনুগামীসকলক অনুপ্ৰেৰণা দিলে, আনহাতে এচামে তেওঁৰ জনপ্ৰিয়তা দেখি হিংসাত জ্বলি উঠিল। এই লোকসকলে সকলো সময়তে পাইথাগোৰাছৰ বিৰোধিতা কৰিবলৈ ধৰিলে। দুই একে তেওঁক হত্যা কৰাৰ কথাই ভাবিলে। শেষত এই ভাৱকে তেওঁলোকে এদিন বাস্তৱত পৰিণত কৰিলে। পাইথাগোৰাছক নিৰ্মমভাৱে হত্যা কৰা হ'ল। এগৰাকী প্ৰখ্যাত বিজ্ঞানী তথা দাৰ্শনিকে দস্যুৰ হাতত প্ৰাণ হেৰুৱালে। কিন্তু সময়ৰ সোঁতে তেওঁক উটুৱাই নিব নোৱাৰিলে। তেওঁৰ জীৱন্ত শৰীৰ হয়তো আজি নাই, কিন্তু তেওঁৰ অৱদান আজি বিজ্ঞান বা দৰ্শনৰ ছাত্ৰৰ মুখে মুখে।

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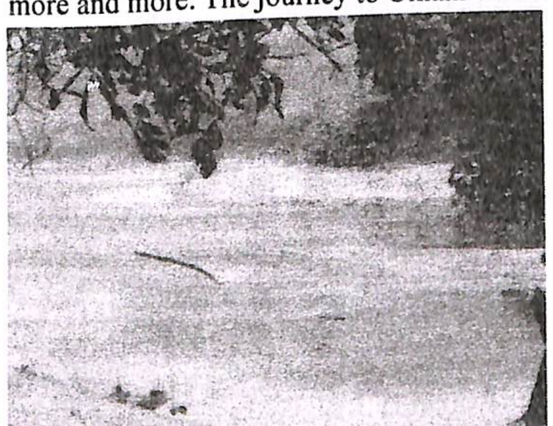
B. Borooah Dairies

Abhijita Borah
Alumna
(2014-17 Batch)

The day I entered the premises of B. Borooah, I felt as if I was already familiar with its surroundings from a very long time. I searched for the Mathematics Department and saw my beloved teachers, Anjana Ma'am,

Ripa Ma'am and Kashiram Sir busy talking to some students. I was filled with anticipation and fear as it was the beginning of my college life. With time going by, I got to know my classmates and started discovering myself more and more. The journey to Ukiam was a



memorable one. The still freshwater of the river, we played with, sends chills even today as I remember. The boat trip, the long walk to the hanging bridge with friends, passing through the river barefooted with each slippery step still wings smile to my face.

I grew each day as each day caught me a different lesson. The perception I had about myself and my life changed completely within three years. I found myself amongst these different individuals and personalities and formed a

family of my own. I feel my journey formed a beautiful sine curve with both ups and downs, bitter and sweet memories which was only possible if I was part of this unique prestigious college. I our many thanks to all my teachers and friends for making such wonderful memories. I now can say happily that I enjoyed these three years to my ablest and attached the bygone memories to my heart forever. Signing off with a heavy heart....

Calculus

Pappu Das
6th Semester

Introduction :

Calculus (from Latin Calculus, literally "Small Pebble" used for counting and calculations, as on an abacus) is the mathematical study of continuous change, in the same way that geometry is the study of shape and algebra is the study of generalisations of arithmetic operations. It has two major branches, differential calculus (concerning rates of change and slopes of curves) and integral calculus (concerning accumulation of quantities and the areas under and between curves). These two branches are related to each other by the fundamental theorem of calculus. Both branches make use of the fundamental motions' of convergence of infinite sequences and infinite series to a well defined limit. Generally modern calculus is considered to have been developed in the 17th century by Isaac Newton and G. W. Leibniz. Today, calculus has widespread uses in science, engineering and economics. Calculus is a part of modern mathematics education. A course in calculus is a gateway to other, more advanced courses in mathematics devoted to the study of functions and limits, broadly called mathematical analysis. Calculus has historically been called "the calculus of infinitesimals" or "infinitesimal calculus". The term calculus is also used for naming specific methods of calculation or notation as well as some theories, such as propositional calculus, Ricci Calculus, calculus of variations, lambda calculus and process calculus.

History :

Modern calculus was developed in 17th century Europe by Isaac Newton and G. W. Leibniz (independently of each other, first publishing around the same time) but elements of it have appeared in ancient Greece, then in China and the Middle East, and still later again in medieval Europe and in India. The ancient period introduced some of the ideas that led to integral calculus, but does not seem to have developed these ideas in a rigorous and systematic way. Calculations of volume and area, one goal of integral calculus can be found in the Egyptian Moscow papyrus (13th dynasty, 1820 BC), but the formulas are simple instructions, with no indication as to method, and some of them lack major components. From the age of Greek mathematics, Eudoros used the method of exhaustion, which foreshadows the concept of the limit, to calculate areas and volumes, while Archimedes developed this idea further, inventing heuristics which resemble the methods of integral calculus. The method of exhaustion was later discovered independently in China by Liu Hui in the 3rd century AD in order to find the area of a circle. In the 5th century AD, Zu Gengzhi established a method that would later be called cavalieri's principle to find the volume of a sphere. The formal study of calculus brought together cavalieri's

infinitesimals with the calculus of finite differences developed in Europe. The product rule and Chain rule, the notions of higher derivatives and Taylor series and of analytic functions were introduced by Isaac Newton in an idiosyncratic notation which he used to solve problems of mathematical physics.

Significance :

While many of the ideas of calculus had been developed earlier in Greece, China, India, Iraq, Persia and Japan, the use of calculus began in Europe, during the 17th century, when Isaac Newton and G. W. Leibniz built on the work of earlier mathematicians to introduce its basic principles. The development of calculus was built on earlier concepts of instantaneous motion and area underneath curves. Applications of differential calculus include computations involving velocity and acceleration, the slope of a curve and optimization. Applications of integral calculus include computations involving area, volume, arc length, centre of mass, work and pressure. More advanced applications include power series and Fourier series. Calculus is also used to gain a more precise understanding of the nature of space, time and motion. For centuries, mathematicians and philosophers wrestled with paradoxes involving division by zero or sums of infinitely many numbers. These questions arise in the study of motion and area. The ancient Greek philosopher zero of Elea gave several famous examples of such paradoxes. Calculus provided tools, especially the limit and the infinite series that resolve the paradoxes.

Applications :

Calculus is used in every branch of the physical sciences, actuarial science, Computer Science, statistics, engineering, economics, business, medicine, demography and in other fields wherever a problem can be mathematically modelled and an optimal solution is desired. It allows one to go from rates of change to the total change or vice-versa and many times in studying a problem we know one and are trying to find the other. Physics makes particular use of calculus; all concepts in classical mechanics and electromagnetism are related through calculus. The mass of an object of known density the moment of inertia of objects, as well as the total energy of an object within a conservative field can be found by the use of calculus. An example of the use of calculus in mechanics is Newton's second law of motion: historically stated it expressly uses the term "change of motion" which implies the derivative saying the change of momentum of a body is equal to the resultant force acting on the body and is in the same direction. Commonly expressed today as Force = Mass x Acceleration, it implies differential calculus because acceleration is the time derivative of velocity or second time derivative of trajectory or spatial position. Starting from knowing how an object is accelerating we use calculus to derive its path. Maxwell's theory of electromagnetism and Einstein's theory of relativity are also expressed in the language of differential calculus. Calculus is also used to find approximate solution to equations : in practice it is the standard way to solve differential equations and do root finding in most applications.

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LYCHREL NUMBER:196 -ALGORITHM

Barsha Misra
6^{th} Semester

Numbers are highly interwined in our life and it appears in almost all areas.Almost all the things we do involves numbers and mathematics. Right from the atomic size to the distance between two galaxies,we need numbers to express them.In other words,they play an important role in our day to day lives.Since ancient times numbers have been studied extensively and classified into different groups based on their characteristics.Based on different types and properties, mathematicians have named different numbers.Lychrel numbers are one such class of numbers.The unique properties of Lychrel numbers have separated them from other numbers.

Before discussing about Lychrel numbers, it is necessary to have a brief knowledge about Palindromic numbers. Numbers that read the same backwards and forwards form a special pattern known as palindrome and consequently such numbers are considered as Palindromic numbers.Now let's have a look into our main topic i.e. Lychrel numbers.

A Lychrel number is a natural number that cannot form a palindrome through the iterative process of repeatedly reversing its digits and adding the resulting numbers. This process is sometimes called the *196-algorithm*, after the most famous number associated with the process. The name "Lychrel" was coined by Wade Van Landingham as a rough anagram of Cheryl, his girlfriend's first name.

There are no single or double digit Lychrel numbers. In base ten, no Lychrel numbers have been yet proved to exist, but many, including 196, are suspected on heuristic and statistical grounds. The first number that may be a Lychrel number is 196. However, there is no proof that 196 and others like it, such as 879 and 1997, are actually Lychrel numbers. It is just that the reverse-add-repeat procedure has failed to produce any palindromes and the procedure has been carried out to a billion iterations. The first few numbers not known to produce palindromes, are 196, 295, 394, 493, 592, 689, 691, 788, 790, 879, 887,.........

To understand the concept of Lychrel numbers better,let us proceed with an example; Think of a number. Reverse its digits to form a second number. Now add the two together. Is the result a *palindrome* (reads the same forwards as backwards)? If not, reverse the digits of the new number and repeat the process. Continue with the reverse-add-repeat procedure until the result is a palindrome. Most numbers become palindromes very quickly, in only a few iterations. Take 153 for example;

Iteration	Number		Reverse		Sum
1	153	+	351	=	504
2	504	+	405	=	909

Thus,153 requires two iterations to form a palindrome.

What would happen if the difference between two numbers were taken instead of their sum? Let's illustrate the procedure with 196.

Iteration	Number	Reverse		Difference
1	196	- 691	=	- 495
2	-495	- -594	=	99
3	99	- 99	=	0

Any further iterations will only produce further zeroes.

The leading zeros do not count, e.g. 594 – 495 = 99 not 099. The number of digits does not have to be preserved throughout the procedure. It is the actual numerical value that matters, as it does with Lychrel numbers.

All one-, two- and three-digit numbers reduce to zero. The first number worth considering beyond those is 1012.

Iteration	Number		Reverse		Difference
1	1012	-	2101	=	-1089
2	-1089	-	-9801	=	8712
3	8712	-	2178	=	**6534**
4	6534	-	4356	=	2178
5	2178	-	8712	=	-6534
6	-6534	-	-4356	=	-2178
7	-2178	-	-8712	=	**6534**

The difference in the third iteration. It turns up again four lines later as the difference in the seventh iteration. Any further reversal and subtractions will simply repeat the preceding four lines.

This appears to happen every time the reverse-subtract-repeat procedure is carried out: the numbers either converge to zero or end up going into a loop and repeat the same set of numbers over and over. Applying the reverse-subtract-repeat procedure to all numbers from one to 10 billion (10^{10}) plus a sample of 10.1 billion 18-digit numbers,the results showed that none of the 20.1 billion numbers went on iterating for ever; the procedure always terminated with either zero or an end-loop. Whether this holds true for all numbers remains to be seen.

In base 2, 10110 has been proven to be a Lychrel number, since after 4 steps it reaches 10110100, after 8 steps it reaches 1011101000, after 12 steps it reaches 101111010000, and in general after $4n$ steps it reaches a number consisting of 10, followed by n+1 ones, followed by 01, followed by n+1 zeros. This number obviously cannot be a palindrome, and none of the other numbers in the sequence are palindromes.

Lychrel numbers have been proven to exist in the following bases: 11, 17, 20, 26 and all powers of 2.

It would seem that adding a number to its reverse repeatedly is like sending a ball skywards; there's no limit to how far it can go. Subtracting the numbers is like dropping the ball;it goes only so far until it hits the ground and either stops or starts bouncing up and down.

Source: Google

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Math In Geodesy

Neelim Kumar Barman
6th Semester
ATTRIBUTION: WIKIPEDIA

Geodesy is the science of accurately measuring and understanding three of Earth's fundamental properties -its geometric shape, its orientation in space,and its gravity field. Early ideas about the figure of the Earth held the to be flat, and the heavens a physical dome spanning over it. But a few early astronomers thought the Earth to be spherical in shape. Two early arguments for a spherical earth were that the lunar eclipses were seen as circular shadows which could only be caused by a spherical Earth, and the polaris (commonly known as the North star) is seen lower in the sky as one travels south.

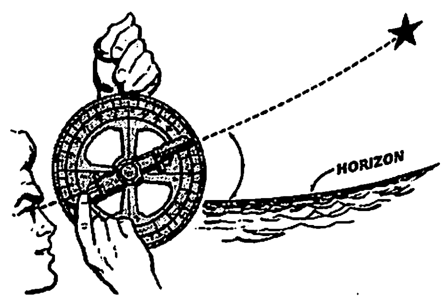
Eratosthenes, a Greek astronomer from Hellenistic Libya (276-194 BC) is believed to be the first person to calculate the circumference and thereby the radius of the earth.The circumference of the Earth is 40,075.16 km. Eratosthenes calculated the circumference of the Earth to be 40,000 km which is only about 0.4% too high.

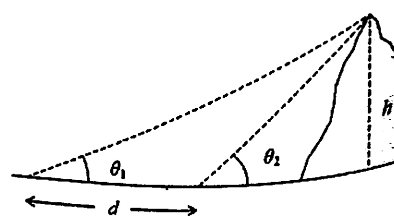
The Indian mathematician Aryabhata (AD 476-550) was a pioneer of mathematical astronomy who describes the earth as being spherical and that it rotates on its axis.Aryabhata estimated the circumference of the Earth as 4967 yojana* (~39,968.06 km), with an error of less than 1%.

The Muslim scholars, who held to the spherical Earth theory, used it to calculate the distance and direction from any given point on the Earth to Kaaba. Muslims are required to pray facing the direction of the Kaaba and being far from Kaaba does not spares one from this obligation. So no matter how far Muslims were from the Kaaba they needed to determine its exact direction to pray. To do this accurately they needed to know the curvature of the earth and knowing this demanded that they know the size of the Earth.

One of most Efficient, easy and ancient method to calculate radius of Earth was discovered by Al-Biruni. Al-Biruni devised a more sophisticated and reliable method to achieve this objective. To carry out his method Biruni only needed three things :

1. An astrolabe*.
2. A suitable mountain with a flat horizon in front of it so that angle of depression of horizon could be measured accurately.
3. Knowledge of trigonometry.





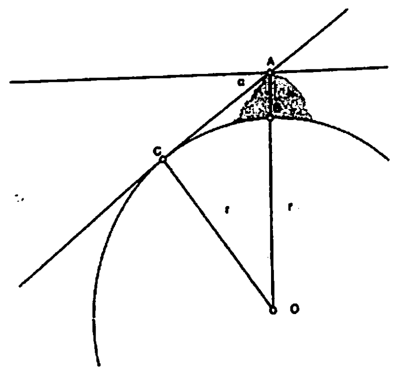
He first calculated the height of the mountain by going to two points at sea level with a known distance apart and then measuring the angle between the plain and the top of the mountain for both points.

He made both the measurements using an astrolabe. Biruni probably had a much larger astrolabe to calculate these angles with high precision.

He then used the following trigonometric formula to calculate the height of the mountain (h).

$$h = \frac{d \tan\theta_1 \tan\theta_2}{tan\,\theta_2 - tan\,\theta_1}$$

He stood at the heighest point of the mountain In order to find the angle of dip or angle of depression (?) of the flat horizon from the mountain top using the astrolabe again. It can be further seen from the diagram that his line of sight from the mountain top to the horizon will make an angle of 90Â° with the radius.



Now we can apply the law of sines of this triangle to find R .

$$\frac{AC}{\sin O} = \frac{R}{\sin A} = \frac{R+h}{\sin C}$$

$$\frac{AC}{\sin\alpha} = \frac{R}{\sin(90-\alpha)} = \frac{R+h}{\sin 90}$$

$$R = \frac{(R+h)sin(90-\alpha)}{\sin 90}$$

$$R = (R+h)\cos\alpha$$

This can be further simplified using trigonometry to arrive at the famous Biruni equation :

$$R = \frac{h\cos\alpha}{1-\cos\alpha}$$

Biruni estimated the radius to be ~6,340km, an error of 16.8km when compared to the modern value of 6,356.8km (polar radius). Mysteriously, his error is just 0.26% in calculating the circumference of the earth.

*A Yojana (Sanskrit: योजन) is a Vedic measure of distance that was used in ancient India. A Yojana is about 12-15 km.

*An astrolabe is an elaborate inclinometer, historically used by astronomers and navigators to measure the inclined position in the sky of a celestial body, day or night.

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Non-Euclidian Geometry

Pamela Chakraborty
6th Semester

To understand what non-euclidian geometry is you have to know what is meant by Euclidian geometry. Euclid was a Greek, born around 300 BC and is thus known for developing the math of geometry. The part of his treatise "The Elements include a series of anians and notions which laid the foundation of modern geometry. Though the elements is not a perfect text, but it succeeded in distilling the foundation of thirteen volume worth of mathematics into a handful of common notation and five obvious the so called postulates.

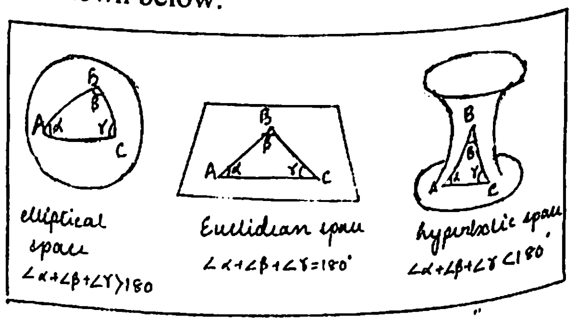
The five obvious truth from which all Euclid's geometry is derived are:-

The Euclid's Postulates:-

1. To draw a straight line from any point to any point.
2. To produce a finite line continuously in a straight line.
3. To describe a circle with any centre and distance.
4. All right angles are equal to one another.
5. If a straight line following upon two straight lines make the interior angles on the same side less than two right angles (in sum) the two straight lines, if produced indefinitely, meet on that side on which are the two angles less than two right angles.

The first four of these postulates are simply stated, basic assumption. The fifth is something altogether different.

Non-Euclid Geometry is simply a modification of "Euclid's Fifth Postulate". Two of the more common types of non-euclidian geometry and hyperbolic geometry and elliptic geometry. Each type of geometry is shown below:



Thus Euclidian space is essentially planar geometry, Straight lines, squares, cubes and angles of 45° and 90° degrees are Euclidian geometry. Non-Euclidian geometry is not just triangles and squares the familiar circle formulas of $C=2\pi r$ and $A=\delta r^2$ (C= circumference, r= radius, ð is 3.14159....) are Euclidian.

Thus the elliptical and hyperbolic geometry do not follow these Euclidian circle formulas and thus are defined as Non-Euclidian Geometry.

Non-Euclidian geometry is also used in everyday life. Let's say that you wished to go from Washington D.C to London. Then the shortest path would take you to the North Pole. The reason is that London and D.C lie on collinear location within spherical geometry

(they lie on a great circle). On a sphere, large triangle can have angles much larger than 180 degrees. While on a sphere there are 3 right angles.

Non-Euclidian Geometry in Space

Euclidian geometry mainly deals with flat surface. Non-Euclidian Geometry on the other hand in any form of geometry which negates the Euclidian parallel postulates.

The Non-Euclidian geometries are:

1. **Riemannian Geometry: (Elliptic Geometry on Spherical Geometry)**

Postulate: If l is any line and p is any point not on l, then all lines through p will intersect l.

Since Earth's surface is spherical, mapping places or countries, shortest flight path, navigation satellite (GPS) etc works on Riemannian geometry.

2. **Hyperbolic Geometry: (Saddle Geometry or Labachevskian Geometry)**

Postulate: If l is any line and p is any point not on l, then there are infinitely many lines through p that do not intersect l.

Hyperbolic geometry is used in predicting orbital path of satellite or comet etc. Within intense gravitational field like planet Mercury's orbit around Sun, distance of astronomical objects (e.g. stars on galaxies or black holes) from Earth; basically all astronomical events which occurs in varying gravitational field like famous light bending moment around the sun in full solar eclipse proving Einstein's special relativity, it all happens in Hyperbolic geometry as space-time is considered Hyperbolic in nature.

NASA will use Non-Euclidian Geometries for rockets and space exploration because space is a 3D area which is curved.

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Jokes

There are three people applying for the same job at a bank: a mathematician, a statistician, and an accountant. The interviewing committee asks the mathematician one question: What is 500 plus 500? The mathematician answers "1000" without hesitation, and they send him along. Next they call in the statistician and ask the same question. He thinks for a moment and answers "1000... I'm 95% confident." When the accountant comes in, he is asked the same question: "What is 500 + 500?" He bows and replies, "What would you like it to be?" They hire the accountant.

Mathematics in Life Science
The Maths & Computational New Science

Sudeshna Das
6th Semester

Mathematicians and biologists, including medical scientists have a long history of marking successfully together. Sophisticated mathematical results have been used in and have emerged from the life sciences. Examples are : stochastic process and statistical methods to solve a variety of population problems in demography, ecology, genetics and epidemics. Pythagoras, Riemann, Aristotle, Fibonacci, Einstein, Thompson-are some of the names abscised with both significant applications of maths to life science problems and significant development in mathematics motivated by the life sciences.

There are significant problems that need the attention of mathematicians in almost all areas of life and medical sciences. Whether these involve novel mathematical structures and interesting insight to know ones. One such topic is the computational new science.

Computational neuroscience also known as mathematical neuroscience is a branch of neuroscience which implies mathematical models, theoretical analysis and abstractions of the brain do understand the principles that govern the development, structure, information proceeding, physiology and cognitive abilities of the nervous system. It focuses on the description of functional and biologically realistic neurons and their physiology and dynamics. There models are useful since they capture they capture the essential feature of the biological system at multiple spatial-temporal scales, from membrane current, proteins and chemical supplies to network oscillation, columnar and topographic architecture and learning and memory.

Therefore, the models of constitutional neuroscience made with the part approaches of mathematics frames the hypothesis that can be directly tested by biological or psychological experiments. Furthermore mathematics thus has vast area in life science and so goes the saying-"Maths and Science are the blood of the future".

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Two Different Roads

Rimpa Sen Gupta
6th Semester

My journey in mathematics department made me learn the importance of teacher's motivation. Like everyone else I too had my own dreams and heartcore aspirations to fulfil my aims. And my aim was to acquire knowledge about chemistry completely and study hard. I passed my Higher Secondary Examination Scoring satisfied marks in chemistry, which increased my willingness towards chemistry. But unfortunately I did not get admission in chemistry. At that moment I lost my hope and taken admission in mathematics department. Even though I was not much excited, but I did not have any other choice. Then I started to attend classes of mathematics but I did not find anything interesting. Though my friends tried their best to motivate yet the situation remained some. Then one day I went to department where Ripa Ma'am, Anjana Ma'am, Bandita Ma'am were there then I conveyed my situation to them and they understand my situation to them and they understand my situation.

I'm grateful to them that they understood and took me out of the complicated situation. Out of this, I could realise that the more give importance to the subject the much of i get easier and interesting. The only way to learn Mathematics is to practice. I feel like Mathematics is not only about numbers, equations, complications or algorithms it's like a game. Though I could not score good marks in my first semester yet I did not lost my hopes. I tried my best to perform well in all examinations. Whenever I get demotivated, my professor helped me out.

I never thought that the journey of my bachelor degree in B.Borooah College would be so good. Though there were some hurdles but at last I had my professor and batch mates to come across all the hurdles and they made me feel like a family. I feel proud to BIBIAN of mathematics department.

"Miles to go before I sleep" The woods are lovely, dark and deep, but I have promises to keep. And miles to go before I sleep.

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Congruence and It's Application

Hirak Jyoti Sarma
Trinity Koushik
6th Semester

The language of congruence was first introduced by the great German Mathematician Carl Friedrich Gauss at the beginning of nineteen century. The congruence starts with very preliminary ideas about division that anyone from any discipline may have it as study topic. But its usages reveal it to be one of the most influential tools to handle many modern day necessities.

Definition of congruence:

If 'a' and 'b' are integers and 'm' is a positive integer then 'a' is said to be congruent to 'b' modulo m iff m divides a-b i.e. $m|a-b$.

Symbolically, this expressed as $a \equiv b \pmod m$

Here 'm' is called modulus of the congruence and 'b' is called a residue of 'a'(mod m).

Congruence is being used in our everyday life. Some of the examples are given below:

Clock modulo:

A clock has its own peculiar arithmetic. A familiar use of modular arithmetic is in the 12 hours clock, in which the day is divided into 12 hour periods. If the time is 7:00 now then 8 hours later the time will be 3:00. Usual addition would suggest that the later time should be 7+8=15, but this is not the answer because clock time wraps around every 12 hours as the hour number starts over after it reaches 12.

Actually 7+8=15. But in terms of congruence we have $15 \equiv 3 \pmod{12}$. That is why we call it 3 o'clock.

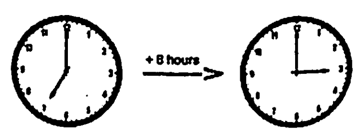

Fig: time keeping on this clock uses arithmetic modulo12.

According to definition, 12 is congruent not only to 12 itself but also to 0, so the time call '12:00' could also be called '0:00', since 12 is congruent to 0 modulo 12.

Check digit in credit card:

Here we describe how check digits are assigned in credit cards and how they are used to verify the validity of credit cards.

The identification numbers of different credit cards are different have different length and different prefixes. In master card the identification number consists of 16 digits and the number starts with 51, 52, 53, 54 or 55. For a visa card the identification number consists of 13 0r 16 digits and the number starts with digit 4. Both credit cards uses congruence mod 10to determine the check digit, and in all the cases the check digit is the rightmost digit in the number.

The check digit ak of the identification

number $a_1, a_2, a_3, \ldots, a_{k-1}, a_k$, where a_i's are the integer such that $0 \le a_i \le 10$, of the master card or the visa card is obtained from the following congruence:

If k is even, then

$((a_1, a_2, a_3, \ldots, ak\text{-}1).(2,1,2,1,\ldots,2)+r) + a_k \equiv \pmod{10}$

If k is odd, then

$((a_1, a_2, a_3, \ldots, a_{k-1}).(1,2,1,2,\ldots,2)+r) + a_k \equiv \pmod{10}$

Where r is the number of terms in dot product greater than or equal to 10.

To determine the check digit we use the following algorithm:

Step1: Starting from the second digit from the right end moving towards the left, multiply every alternate digit by 2.

Step2: Add individual digits comprising the products obtained in step1.

Step3: Add all the numbers of the card not multiplied by 2 in step1.

Step4: Add the results obtained in step2 and step3.

Step5: if S is the sum obtained in step 4, then solve the congruency $S \equiv 0 \pmod{10}$ to obtain the check digit ak, where $0 \le a_k \le 10$.

we can also determine the validity of a given credit card by using ateps 1 to 5. If the credit number is valid, then the sum S obtained in step 4 must satisfy $S \equiv 0 \pmod{10}$.

Let us explain this algorithm with the help of the following example:

Consider a credit card with the following identification number-

5546 1997 2335 5004

Here the first two digits indicate that it is a master card. We know check the validity of this card:

Step1: Starting from the second from the right and moving toward the left, multiply every alternate digit by 2. (The digits to be multiplied by 2 are underlined)

<u>5</u>5<u>4</u>6 <u>1</u>9<u>9</u>7 <u>2</u>3<u>3</u>5 <u>5</u>0<u>0</u>4

O*2=0	5*2=10
3*2=6	2*2=4
9*2=18	1*2=2
4*2=8	5*2=10

Step2: Add the individual digits comprising the products obtained in step1

0+1+0+6+4+1+8+2+8+1+0=31

Step 3: add all of the digits of the card not multiplied by 2 in step1

4+0+5+3+7+9+6+5=39

Step 4: add the results from step2 and step3

31+39=70

Now $70 \equiv 0 \pmod{10}$. Hence the identification number of the card is valid.

Round-Robin Tournament:

Congruence also has a place in the world of spots, specially in the scheduling of round- robin tournament. A tournament of 'n' different teams in which each team plays against each other team exactly once is called a round-robin tournament.

Let us make a schedule for a round robin tournament for n teams. Suppose that the teams are labeled 1,2,3,....,n. let i and j be two teams. We use the following rule to make the schedule for the round robin tournament:

Team i plays against team j in the kth round if $i+j \equiv k \pmod n$

Suppose 5 teams participate in a round-robin tournament. We will make a schedule for the tournament. Let us label the teams as 1,2,3,4,5. We use the following rule to determine whether team i plays against team j in the kth round:

Team i plays against team j in the kth round if $i+j \equiv k \pmod 5$

Now for k=1, i.e. for the 1st round

$1+5 \equiv 1 \pmod 5$ $\quad 2+4 \equiv 1 \pmod 5$

$3+3 \equiv 1 \pmod 5$

For k=2, i.e. for the 2nd round

$1+1 \equiv 2 \pmod 5$ $\quad 2+5 \equiv 2 \pmod 5$

$3+4 \equiv 2 \pmod 5$

For k=3, i.e. for the 3rd round

$1+2 \equiv 3 \pmod 5$ $\quad 3+5 \equiv 3 \pmod 5$

$4+4 \equiv 3 \pmod 5$

For k=4, i.e. for the 4th round

$1+3 \equiv 4 \pmod 5$ $\quad 2+2 \equiv 4 \pmod 5$

$4+5 \equiv 4 \pmod 5$

For k=5, i.e. for the 5th round

$1+4 \equiv 5 \pmod 5$ $\quad 2+3 \equiv 4 \pmod 5$

$5+5 \equiv 4 \pmod 5$

Thus we obtain the following schedule for the tournament

Round↓ Team→	1	2	3	4	5
1	5	4	bye	2	1
2	Bye	5	4	3	2
3	2	1	5	bye	3
4	3	bye	1	5	4
5	4	3	2	1	bye

From this table we find that in the 1st round team 1 will play against team 5, team 2 will play against team 4, team 3 will be not playing, team 4 will play against team 2 and team 5 will play against team 1 and so on.

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Unknown Facts

Among all shapes with the same area, circle has the shortest perimeter.

2520 is the smallest no. that can be exactly divided by all the numbers 1 to 10.

40 (fourty) is the only number with utters in alphabetical order.

Study Skills in Mathematics

Hrishikesh Parasar

B. Sc. 4th Semester

Introduction :

Learning mathematics is very difficult from learning other objects, as anyone tries to read text book finds out and learning mathematics at university level is very different from learning mathematics in school, as anyone who sits through a university lecture soon finds out. Intense is the word that springs to my mind when I try to describe the difference in style between school and university of mathematics.

Lecture are intense compared with lessons because there are comparatively few of them, Super lessons are intense compared with lessons because you go over a week work in a single hour, work is intense because terms are much shorter and examinations are intense because you have to exam 6 months worth into three hour papers taken in the space of few days.

Lectures:

The really big difference between school and university is in lecture. The lecturers have only 12 lectures a week which to give you enough material to keep you occupied for the other 156 hours. Therefore, the material comes at you pretty fast.

It follows that at school you probably expected to understand what teacher said as it was said, here there will be great chunks of the notes which you will not understand until you worked on then later. Even then, there may be some paths of the course that only really some clear when you came to revise the material. Nevertheless it is very important to understand as much as possible of what is being laid as it said. So-

- Do make the efforts to concentrate. We all have heard that, in a mathematics lecture, what lecture writes on the blackboard goes into the student's note without passing the brain through either. You should do everything in your power to prevent this happening.
- Do ask questions during the lecture rather than let something pass by. Don't be afraid to ask what you may think is a silly question. Nine times out of ten most of the rest of the audience will be impressed and many of them will also want to know the answer and it is just possible that the lecture has made a mistakes.
- Don't ever miss lecture and rely on getting notes from a friend you will understand the material much better if were there to hear the explanation yourself.
- Here the most important tip: you will save an immense amount of time if you always get to grip with one lecture before going to the next. This way you will get much more out of the lecture, which will in turn save time when you go through your notes later.

- Please remember to turn off your mobile phone in lectures, or better still, leave it in your room.

The brain is wonderful organ. It starts working the moment you get up in the morning and doesn't stop until you get into the lectures.

– Robert Frost

Lecturing Styles:

You will find that lectures adopt a range of strategies for conveying you to the material listed in schedules.

For example, some lectures work entirely on the blackboard or on overhead projectors, some gives out a complete set of printed notes, some over theory (say) on the blackboard and gives out the example (say) on handouts, some give out notes with gaps for diagram or equation to be filled by you, but it is very much personal matter, do not assume that others will agree with you about what is best.

Often some students want complete printed lecture notes thinking that this is what they need to learn the material as from a textbook. That maybe so, but the aim is to understand the material, which is a very different matter, for this it may be much more useful to have carefully distilled set of notes that brings out all the main ideas, the work you do in fleshing out the details will serve you too for better in a long run way than reading a complete set of printed notes.

Writing Mathematics:

Most mathematicians can write accurate grammatical process, they understand why the comma i this sentence should have been a full stop or a semi-colon. There is a grammar to writing mathematics as well symbol such as $\forall \Rightarrow \exists$ etc should be used in a way that makes grammatical sense if read out in full. If you are cares about this, then you will certainly find yourself using logic as well as sloppy mathematical grammar.

Solving Problems:

Mathematics is all about problem solving and the only way to test your understanding of the material is to work through examples. At school, problems were fairly short and the answers come out nearly. As an undergraduate, you will find that many problems take ages to do. If you know exactly what you r doing each problem may take a considerable time and several sheets of AP to complete.

Here are some thoughts on talking problem. If you can't get started on a problem try the following in order.

(1) Expans $(a + b)^3$

XIN $(a + b)^3 = (a + b)^3$

$= (a + b)^3$ etc.

Make sure that you understand the technical terms used in the statement of the problem

(2) $\frac{1}{x-8} \to \infty$ as $x \to 8$

so $\frac{1}{x-5} \to$ as $x \to 5$

But make sure that you understand fully the example you are working from.

- Write down your thoughts-in particular, try to express the exact reason why you are stuck
- And the important one to-make sure that you actually understand not only what you have done, but also why you have done it that way rather than some other way

Examination:

- In the examination, stay cool if it is hard for you, it does probably hard for everyone.
- Don't rush into a question –read the whole paper carefully and start with the question for most confident about.
- Analyse exactly what you are being asked to do, try to understand the minds (explicit and Implicit), remember to distinguish between terms such as explain/prove/define etc.
- Remember that different parts of a question are often linked.
- Set out your answer legibly and logically-thus not only helps you to avoid silly mistakes but also signals to the examiner that you know what you are doing.
- If you get stuck, state in words what you are trying to do and move on.

And Finally

Mathematics is difficult. However it is more difficult than anything else just in a different way. Most people can't read a math book and expect to end up with a decent understanding of the material. It has to be walked at line by line. It is different way of learning and no worse than the wondering through of hundreds of often contradictory textbooks.

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Mathematical Quotes

Mathematics is a game played according to certain rules with meaningless marks on paper.

— David Hilbert

Mathematics is concerned only with the enumeration and comparison of relations.

— Carl Friedrich Gauss

Mathematics is the door and key to the sciences.

— Roger Bacon

Mathematics is the science of what is clear by itself.

— Carl Jacobi

Mathematics – the unshaken Foundation of Sciences, and the plentiful Fountain of Advantage to human affairs.

— Isaac Barrow

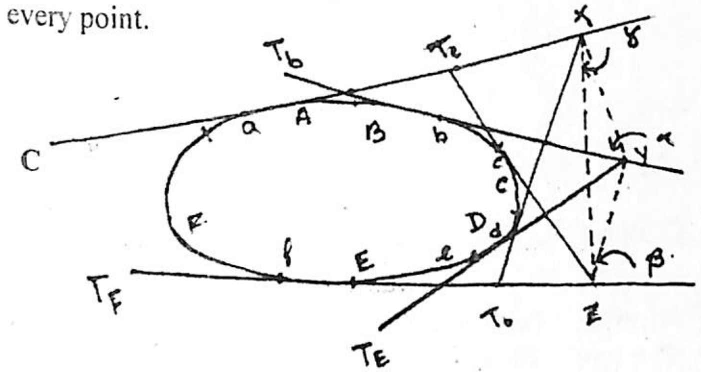
First Lady Mathematician – Hypatia

Gargi Gayan
4th Semester

Hypatia was a Hellenistic* Neoplatonist** philosopher, mathematician and astronomer who lived in Alexandria, Egypt, then parts of the Eastern Roman Empire. She is the first female mathematician whose life is well recorded. She was the head of the Neoplatonic school a Alexandria, where she taught philosophy and astronomy. Hypatia was renowned in her own lifetime as agreat teacher and wise counsellor. She was the daughter of Theon who was a mathematician and astronomer and last attested member of Alexandrian Museum. Nothing is known about her mother. Hypatia walk on her father's footsteps, taught philosophy and mathematics in Neo-Platonist school. As she gained wide spread fame as a mathematician and a scholar her way of teaching and living got in the eyes of Christian and she started receiving threats. Meanwhile, among all the chaos, she kept teaching and providing her father a helping hand with his researches and her popularity spread around widely. Her being a woman contributed to the hatred she earned from the supporters of Christianity and she became victim of a painful death from a Christian mobs while she was returning back on a chariot after delivering a lecture. She was dragged out brutually from the chariot and stripped naked and got beaten to death.

The exact number of her works is still not known as most of it was burned away. Hypatia was the first woman to make a substantial contribution to the development of mathematics. She was known for the work she did in mathematics than in astronomy . She was known for her work on the ideas of conic section introduced by Apollonius. She edited the work on the conics of Apollonius, which devided cone into different parts by a plane. Apollonius work on conic section was massive and difficult. The names of the curves parabola, ellipse and hyperbola are given by Apollonius Hypatia investigate conic section through a worksheet designed to engage them with both geometric algebraic formulation of parabola, ellipse and hyperb[illegible] This worksheet encourages visualization through hands on activities such as cutting and taping section of a cone and the exploration of each conic section as path of points satisfying algebraic conditions. The worksheet concludes with real-life application of conic section. Hypatia also worked on Pascal theorem. This is known as 'Hypatia Problem'. This problem has been inspired by Hypatia's role as editor of Apollonius.

Let L be any smooth, closed convex loop with a clock wise orientation in the ecludian or projective plane. (Convexity is a projectively well defined concept by the axioms of projective geometry) the smoothness needs only be C_1. That is to say there must be an unambiguous tangent at every point.



She invented the astrolabe for ship navigation and devices for measuring the density of fluids. She also invented hygrometer. It is an instrument used for measuring the water vapour in the atmosphere, in soil, or in confined spaces. She invented an for distilling water. Her most important writing are "The Astonomical Canon". A comment of the "Diophantus Arithmetic" and the "Conic sections of Apollonius of Perga".

There is a lot of magical thinking about her life and work. The movie "Agora" used a mythical search for heliocentrism. (The sun as the centre of solar system VS The Ptolemaic earth-centred view, held by most people at that time) as a metaphor for Hypatia's scientific thinking. Hypatia devoted herself as a teacher, to preserve the knowledge of the past through a turbulent time so she was much more than a geometry teacher.

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* Period of philosophy following Aristole ending with beginning of Neoplatonist.
** Modern term for a stand of platonic philosophy started with platinus.

Some Math Myths

Myth # 1 : Some people having "math gene" and others don't.

Myth # 2 : Boys are better at maths than girls.

Myth # 3 : Speed is measure of ability in maths.

Myth # 4 : A great memory is the key to excelling in math.

From an Element to the Universe

Monica Deb
4th Semester

Beauty of Math Lies from an Element to the Universe :

We heard them say "Nothing is Perfect". Well, there are two things in this world that are perfect. One is Mother Nature, the other is mathematics. When I say perfect, I mean it cannot get better than this.

How do I make this conclusion? Mother Nature is a complete web of life and the lifeless. The very state of its being so perfect is the reason for life and also for death. Mathematics, on the hand is man-made, to understand nature and beyond. Now, there is a debate over whether mathematics was invented or discovered, but either way it is still perfect.

Every day there are new discoveries that are made in nature, and in math as well. Math founded on simple yet with more powerful elements in that set.

This relationship is universally valid. The equation $(a+b)^2=a^2+b^2+2ab$, stands true on earth, on Jupiter and on even if the sun goes down. It doesn't exist in physical dimension. It exits entirely in the human mind, it's a mental concept and ever made by the human mind. Math and human are co-dependent to aid each other growth.

Hence, any real-world problem can be solved in math and any maths solution is effective in the real world.

So, what is the largest number your mind can conceive? Well, what is the size of the universe? Can you answer? Well the hint of the answer to both these question is one and the same.

The answer is not infinity, it is zero.

Yes! The size of the universe is zero & so the largest number.

Explanation: For every positive number there exist a negative number in mathematics. For every matter there exists anti-matter in nature. Well this is the big picture. Therefore when you put everything together, the size of the universe is zero. Zero is thus simultaneously everything as well as nothing. That's why it's called a whole number. You add or remove anything this whole, it still remains a whole .Isn't it?

This beautiful conception was made in ancient India at a time when rest of the world was busy figuring out whether earth is flat or round.

It is astonishing & makes everyone proud of the intellectual wisdom of Ancient India, making such a ground- breaking revolution. Such revolution actually had changed the human thought process once & for all.

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Role of Mathematics in Various Fields of Our Society

Indunesi Saikia
4th Semester

Mathematics is a branch of science which deals with numbers and their operations. It involves calculations, computation, solving of problem etc. Its dictionary meaning is that, 'Mathematics is the science of measurement, quantity and magnitude. It is exact, precise, systematic and a logical subject'.

Mathematics occupies a crucial and unique role in the human societies. The ability to compute, related to the power of technology and to the ability of social organisation, and the geometrical understanding of space-time that is the physical world and its natural pattern, shows the role of mathematics in our society.

In other to live a social life, mathematical knowledge is needed because of the give and take process, business and industry depends upon the knowledge of mathematics. The change in the social structure with regards to the modern facilities like made of transport, means of communication and progress in the field of science and technology is due to mathematics only. In this way, mathematics has played an important role in understanding the progress of society.

In education system, mathematics plays an important role in shaping the future probability of young people. For almost every subject, we study in school and university, we need to study mathematics too eg; physics, chemistry, economics, life-science, business and accountancy, history, statistics etc.

Economics of the society is developed by establishment of industries. The applied mathematics like computational science, applied analysis, optimization, differential equation, data analysis and discrete mathematics etc. are essential for industrial field. By application of mathematical method, exploration cost of oil and communication cost of images could be reduced. Numerical simulation of models helps us to manufacture super conductor cables to reduce the cost of electricity.

In modern times, adoption of mathematical method in the social, medical and physical science had expanded rapidly, confirming mathematics as in indispensable part of all school curricular and creating great drama for university-level mathematical training. Mathematics has been successfully used in development of science and technology in 20th -21st century. The areas like advanced semi-conductor device, bio-technology, digital image technology, nano-technology, artificial satellite and rocket all are based on mathematical concepts.

The recent success of NASA's Mars Rover is also based on mathematics.

Mathematics is applied in agriculture, ecology, epidemiology, tumour and cardiac modelling, DNA sequencing and gene technology. It is used to manufacture medical devices and diagnostics, optic-electronics and sensor technology. These are the role of mathematics in medical science and agricultural field.

Mathematics has useful application in development of infrastructure i.e. business, industry, music, politics, medicine, agriculture, engineering etc. The physical appearance and development of infrastructure is crucial in society. Thus for the construction of roads, building, stadium, airport, dams, bridges, vehicle etc. in mechanical engineering, civil engineering, electrical engineering etc.

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Longer Math Jokes

A statistics professor is going through security at the airport when they discover a bomb in his carry-on. The TSA officer is livid. "I don't understand why you'd want to kill so many innocent people!" The professor laughs and explains that he never wanted to blow up the plane; in fact, he was trying to save them all. "So then why did you bring a bomb?!" The professor explains that the probability of a bomb being on an airplane is 1/1000, which is quite high if you think about it, and statistically relevant enough to prevent him from being able to fly stress-free. "So what does that have to do with you packing a bomb?" the TSA officer wants to know, so the professor explains. "You see, if there's 1/1000 probability of a bomb being on my plane, the chance that there are two bombs is 1/1000000. So if I bring a bomb, the chance there is another bomb is only 1/1000000, so we are all much safer."

The History of Pi
Pi-A brief Introduction

Gyandip Baruah
2nd Semester

Throughout the history of Mathematics, one of the most enduring challenges has been the calculation of the ration between a circle circumference and diameter, which has come to be known by the Greek letter pi. From ancient Babylonia to the middle age in Europe to the present day of supercomputers, mathematicians have been striving to calculate the mysterious number. They have searched for exact fractions, formula and more recently patterns in the long string of numbers starting with 3.141592653...., which is generally shortened to 3.14. William L. Schaaf once said, "Probably no symbol in mathematics has evoked as much mystery, romanticism, misconception and human interest as the number pi". We will probably never know who first discovered that the ratio between a circle's circumference and diameter is constant, nor will we ever know who first tried to calculate this ratio. The people who initiated the hunt for pi were the Babylonians and Egyptians, nearly 4000 years ago. It is not clear that how they found their approximation for pi, but one source makes the claim that they simply made a big circle and measured the circumference and diameter with a piece of rope. They used this method to prove that pi is slightly greater than 3, and came up with the value 3.125. However this theory is probably a fantasy based on a misinterpretation of the Greek word "Harpedonaptae", which Democritus once mentioned in a letter to a colleague. The word literally means "rope-stretchers" or "ropefasteners". The misinterpretation is that these men were stretching ropes in order to calculate circles, while they were actually making measurements in order to mark the limits and areas for temples.

A famous Egyptian piece of papyrus gives us another ancient estimation for pi. Dated around 1650bc, the Rhind Papyrus was written by a scribe named Ahmes. Ahmes wrote, "Cut off 1/9 of a diameter and construct a square upon the reminder; this has the same area as that of the circle". In other words he implied that pi=4(8/9)2 = 3.16049, which is also fairly accurate. Word of this did not spread to the East, however, as the Chinese used the inaccurate value pi=3 hundreds of years later.

Chronologically, the next approximation of pi is found in the old testaments. A fairly well known verse, 1 kings 7:23, says : "Also he made a molten sea of ten cubits from brim to brim, round in compass, and five cubits thereof; and a line of thirty cubits did compass it round about". This implies that pi=3. Debates have raged on for centuries about this verse. According to some it was just a simple approximation, while others say that".... the diameter perhaps was measured from outside, while the circumference was measured from inside". However the most mathematician and scientists neglect a far more accurate approximation for pi that lies deep within the mathematical "code" of the Hebrew language. In Hebrew, each letter equals a certain number and a word's "value" is equal to the sum of its letters. Interestingly enough, in 1 kings 7:23, the word "line" is written kuf vov Heh, but the Heh does not need to be there and is not pronounced. With the extra letter the word has a value of 111but without it, the values is 106.

When the Greeks took up the problem they took two revolutionary steps to find. Pi. Antiphon and Bryson of Heraclea came up with the innovative idea of inscribing a polygon inside a circle, finding its area and doubling the sides over and over. Bryson also calculated the area of polygons circumscribing the circle. This was most likely the first time that a mathematical result was determined through the use of upper and lower bounds. Unfortunately, the work boiled down to finding the areas of hundreds of tiny triangles, which was very complicated, so their work only resulted in a few digits. Anaxagoras of clazomenae started working on a problem that would not be conclusively solved for over 2000 years. In his time, dozens of mathematicians would rack their brains trying to find a way to draw a square with equal area to a given circle; some would maintain that they had found methods to solve the problem, while others would argue that it was impossible. The problem was finally laid to rest in the nineteenth century.

The first man to really make an impact in the calculation of pi was the Greek, Archimedes of Syracuse, where Anliphon and Bryson left off with their inscribed and circumscribed polygons, Archimedes took up the challenge. However he used a slightly different method than they used. Archimedes focused on the polygons.

Perimeters opposed to their areas, so that he approximated the circle's circumference instead of the area. He started with an inscribed and a circumscribed hexagon, then doubled the sides four limes to finish with two 96 sided polygons. The method of Archimedes is given below.....

Given a circle with radius, =1 circumscribe a regular polygon A with K = 3(2n-1 sides and semi perimeter and inscribed a regular polygon B with K = 3 (2n-1 sides and semi perimeter bn. This results in a decreasing sequence a1, a2, a3.... and an increasing sequence b1, b2, b3.... with each sequence approaching pi. We can use the trigonometric notation to find the two semi perimeters, which are : an = ktan (c/k) and bn = kSin (1/k). Also an + 1 = 2ktan (1/2k) and bn +1 = 2k Sin (1/2k). Archimedes began with a1=3tan (1/3) = 3(3 and b1 = 3sin (1/3) = 3 (3/2 and used 265/153<(3<1351/780). He calculated up to a6 and b6 and finally reached the conclusion that 310/71<b6<pi<a6<31/7. Archimedes ended with a 96 sided polygon, and numerous delicate calculations.

For the next few hundred years, no significant break thoughts were made in the search of pi. Hindu mathematician Aryabhatta gave the 'accurate' value 62,832/20,000=3.1416, but he apparently never used it, nor did anyone else for several centuries.

Thus the simplest approximation for pi is just 3. We all know that is incorrect, but it can at least get as started if we want to do something with circles. In the past, many math books listed pi as 22/7. Again this is just an approximation but it is better than the value of 3.

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The Binary Number System

Bedanta Nath
2nd Semester

From simple mechanism to sophisticated quantum modelling, our world has evolved greatly over time. The only thing that hasn't changed is our 'will' to count. A hundred or so year ago the primary system that human used for calculation was the decimal number system. But, computers and other technological advancement fuelled the need for a more sophisticated and technological number system. This is what prompted the birth of the binary number system. Here, the history applications and advantages of binary number system are as follows:-

A brief history : of all positional system, the binary number system seems to be the simplest. 2 is the radix or the base of the system, meaning that only two digits represented by 0 and 1 appear in the system. Today, this number system is used in every digital computer. The two digits, 1 and 0 are considered as two states (off/on) and these states are used to carry instruction and store data in computers. Generally, this element represent just one bit which is referred to as binary digit.

In 1701, Grottfried Wilhelm Leibniz, the person who co-invented calculus wrote a paper essay to D'une Nouvelle science des submitted to the Paris academy. But it took another twenty years for the discovery to happen just like it took few hundred years to develop a binary convertor. According to him, available literature on the subject, 1796 was the first time binary arithmetic entry was reported. So, the binary number system was born just before the start of the 19th century.

Understanding the Binary Numbers:

With the help of two symbols 0 and 1 the binary numeral system represents numeric value. To be more specific, a positional notation with a 2 radix is what the typical base 2 system is represented by only two digits 0 and 1 are used to represent all possible values in the binary number system. Here '1' represents a three state while '0' exhibits the false state.

Around two hundred B.C. Pingala, an Indian writer, introduced sophisticated mathematical concept that described matrices and as such gave the world its first ever description of a binary number system.

When we use the decimal number system in our everyday life we count items in the following ways. Here are ten different symbols that have the ability to define ten units. The number are {0,1,2,3,4,5,6,7,8,9}.

Nothing but combination of these ten primary numbers what complex numbers such as 100 or 1350 represents. The position of the numbers is increased each time they are count exceeds the ten primary symbol set and this gave us a new set of ten more possible values. A tool that can help us with the calculation is the binary converter.

Coming back to the topic at hand, the binary system has only two symbols 0 and 1 in the primary set. This causes the decimal place to shift by 2n factor. Here n is a representation of the binary place. While the binary number system can increase in value, it is easily understood by machines as it has only two primary states.

Application:

The computer technology is where the most common application for this number system can be seen. After all, a two digit number system used in digital encoding is all what all computer language and programming is based on. Taking data and then depicting it with restrain bits of information is what makes up the digital encoding process. The restrained information comprises of binary system 0s and 1s. An example of this is image on our computer screen. A binary line for each pixel is used to encode these images.

In case a screen uses a sixteen-bit code, each pixel will be given instruction about what colour to show based on which bits are 0s and 1s. The outcome of this is more than sixty-five thousand colour being represented by 2^{16}.

What the future holds for the Binary System:

With the introduction of the quantum technology, the binary system may become absolute in the future. However the only time will tell whether that actually happens. For now, the binary number system is powering computer system around the world and in doing so, is helping the world to stay connected and perform complex task over the internet. And this ability of the binary number system is upgraded by the binary convertor.

At last we must admit that it's been a long time from its invention but still Binary Number System performing at its best and hope it will contribute more to the computer technology and to its respective applications.

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Jokes

Q: How do you know your math tutor is hungry?

A: She'll work for pi.

Q: How can you make seven an even number?

A: Take the 's' out!

Q: Why is a math book depressed?

A: Because it has so many problems

Q: What do you call an angle that is adorable?

A: Acute angle.

Mathematics as a Life Skill

Dhiraj Baral
4th Semester

We all know that mathematics is a subject that interesting for some but a dreaded one for others. But we all agree that it is a subject which helps us to score marks. If a solution is correct, we get full marks. Hence it is a subject by which we can increase our aggregate scores in exams. Or for some students, it is a subject to crack an entrance exam. Whatever may be the objective, we all have to learn mathematics till class X. There is no choice. So why be afraid of it?

How this fear does develop? There are many reasons:-

· A strict maths teacher.

· Hereditary : Most parents believe that if they were poor at math during their childhood, their children may also face the same problem

· Leaving gap: If a few basis concepts are not taught properly in primary classes, it becomes difficult for a child to learn the subject in higher classes.

Think about the solar system. It is a perfect example of mathematics. How was life possible on earth? It is because the earth is at an optimal distance from the sun. Therefore, adequate sunlight helps sustain life. This is pure mathematics.

When you are transferred to a new place, is it wise to buy a car immediately or hire a cab to commute in and around the city? You compare the cost of buying a car and the cost of hiring a cab. You are using maths here.

You have a meeting at 11a.m and you must travel in peak hour traffic. What will you do? Plan your departure to reach on time. You are using maths here.

Even musicians or sportspersons use maths. Without maths, musicians won't able to compose great smoothing music. Without maths, a cricketer or footballer won't be able to strategise their game.

Maths therefore is a life skill. Just as a language helps us to communicate better, math helps us to plan, decide and think smarter. This means that math is not just a subject to score good marks in school or to crack any entrance exam. It shouldn't be looked at as a short term goal to pass class X exams or to crack an entrance.

Mathematics is a combination of concepts, aptitude and reasoning. But most of the time, parents think math is just a subject which is taught in school. Mathematics is beyond the subject the subject covered in school. As the child grows, they should be able to think logically and creatively in any given solution.

The jobs of the future will be that of complex problem solving .Hence, it is high time that maths education is taken seriously by children as well. as parent. It should not be feared. It should be loved.

It is a popular belief that when a child is good at maths, he/she can take up any career. A child that scores A+ is not necessarily good at maths. Being good at math means to be able to think logically, creatively and smartly. It also makes them more confident.

Having said that, let us try to eliminate the fear of maths and help our future generation to embrace the subject as a life skill and not just as a subject.

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কুঁৱলী

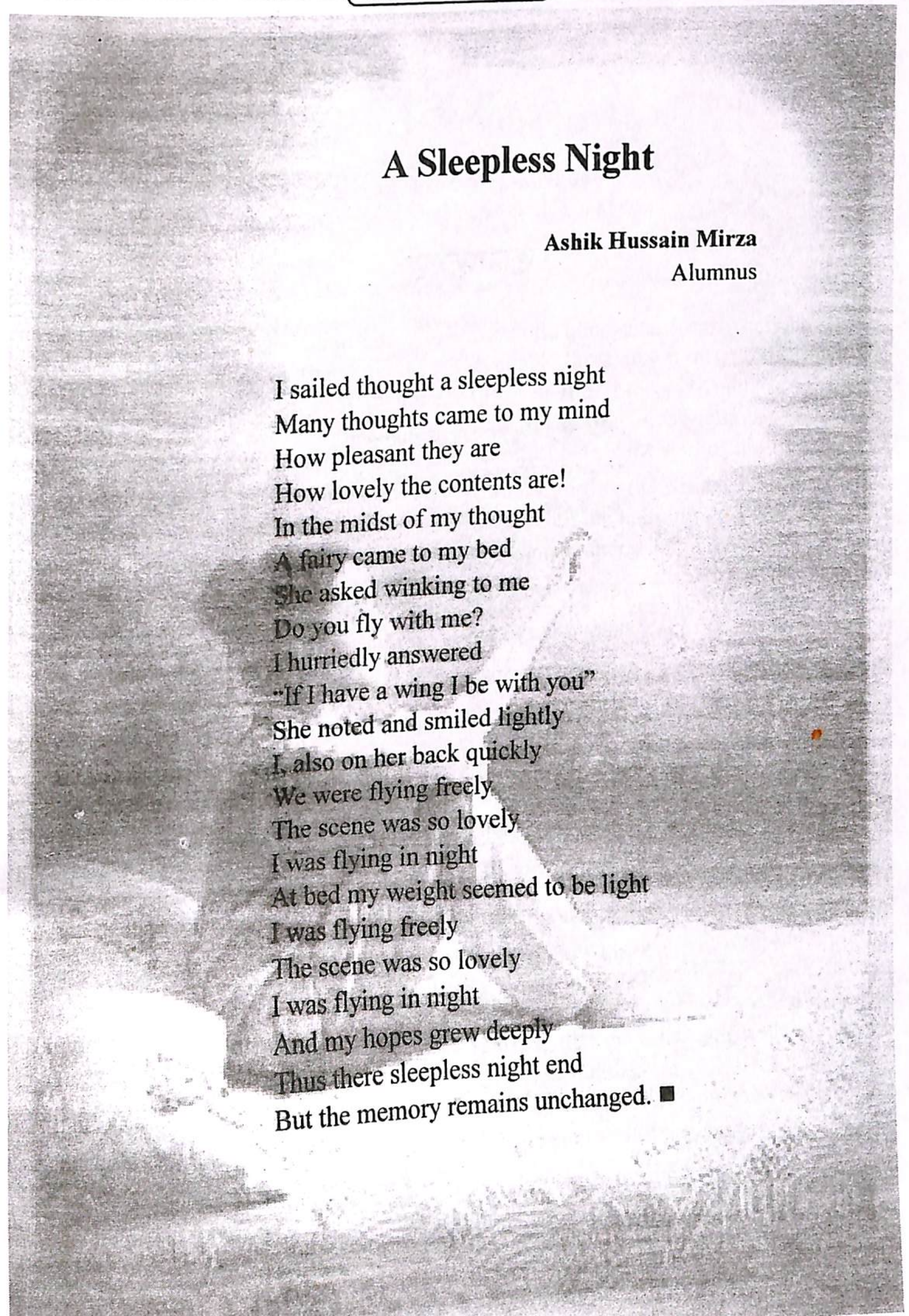
ৰূপম তালুকদাৰ
স্নাতক ষষ্ঠ যান্মাষিক

জনশূন্য উদাৰ ৰাজপথৰ
উদং পথাৰৰ
ক'ত যে বিষাদ হৃদয়ৰ আৱৰণ তুমি
মৌনতাৰে নামি অহা কুঁৱলী
শুভ্ৰ ৰঙৰ মাজত
লুকুৱাই লোৱা সমস্ত ধৰণী
শব্দৰ পম খেদি
তোমাৰ মাজেৰে আগবাঢ়ে ক'ত অনুসন্ধানী।
ভগ্ন হৃদয়ৰ, উজাগৰি শীতৰ নিশাৰ
ক'ত যে কাহিনী
মৌনতাৰে দোহাৰিলো
তোমাকে সাক্ষী কৰি কুঁৱলী।
মন যায় তোমাকো লব আকোঁৱালি
কিন্তু আনবোৰৰ দৰেই
তুমিও মোক নিসংগ কৰি
চিৰবৈৰী বতাহ জাকৰ লগত যোৱা আঁতৰি। ■

সম্ভৱতঃ

জিতুৰাজ ৰায়
প্ৰাক্তন ছাত্ৰ

সম্ভৱতঃ
এইদৰেই আৰম্ভ হৈছিল
এটা বৃত্ত নিৰ্মাণৰ আধাৰশিলা
স্পষ্ট এটা বিন্দুৰ পৰা সকলোৰে অজ্ঞাতে
সৰি পৰিছিল একো একোটা দিন
সম্ভৱতঃ
এইদৰেই আৰম্ভ হৈছিল
শেলুৰৈ ধৰা সময়ে উলিয়াই দিয়া
কাঁইটীয়া বাটেৰে জীৱনৰ খেলা
কাঁইটবোৰত ওলমি ৰয় তেজৰ চেঁকুৰা
সম্ভৱতঃ
এইদৰেই এলাগী হৈ পৰি ৰয়
অন্তহীন বুলি ভাবি থকা একোটা ধাৰণা
সম্ভৱতঃ
এইদৰেই সম্পূৰ্ণ হয় জীৱন বৃত্ত
ঠিক
সেউজীয়াৰ পৰা হালধীয়া হৈ
সৰি পৰাপাতৰ কাহিনীৰ দৰেই....। ■



A Sleepless Night

Ashik Hussain Mirza
Alumnus

I sailed thought a sleepless night
Many thoughts came to my mind
How pleasant they are
How lovely the contents are!
In the midst of my thought
A fairy came to my bed
She asked winking to me
Do you fly with me?
I hurriedly answered
"If I have a wing I be with you"
She noted and smiled lightly
I, also on her back quickly
We were flying freely
The scene was so lovely
I was flying in night
At bed my weight seemed to be light
I was flying freely
The scene was so lovely
I was flying in night
And my hopes grew deeply
Thus there sleepless night end
But the memory remains unchanged. ■

অনুতাপ

জিন্তুমণি নাথ
প্ৰাক্তন ছাত্ৰ

এটি ভগা পঁজাত আছো অকলে
প্ৰতিটো পলকতে মৃত্যুৰ ক্ষণ গণি
আৰু এতিয়া তুমি আছা
মোৰ পৰা বহু আঁতৰত।
এদিন মোৰ মনলৈও যৌৱন আহিছিল
আৰু সেই যৌৱনত,
মই হ'লো প্ৰান্নোজ্বল জীৱনৰ কবি,
তুমি হ'লা মোৰ মানস প্ৰতিমা
তোমাক লৈ ৰচিলো অনেক সপোন।
ভালপোৱাৰ চলনা কৰি মিছা হাঁহিৰে
কিয় মোৰ সৰ্বস্ব কাঢ়ি নিলা
এয়ে নেকি তোমাৰ ভালপোৱা
অ' মোৰ অনামী প্ৰিয়া।
আজিও মই জীয়াই আছো পৃথিৱীৰ মুকলি বুকুত
খন্তেকীয়া আলোকৰ মায়াজাল তৰি,
ক্লান্ত মনে আশ্ৰয় ল'লে অতীতৰ আন্ধাৰ গহ্বৰত
মাথোঁ, দেহৰ প্ৰতি ৰন্ধ্ৰে ৰন্ধ্ৰে সিচঁৰতি হৈ আছে
-এটি দীৰ্ঘশ্বাস। ■

The Dream Never Dreamt

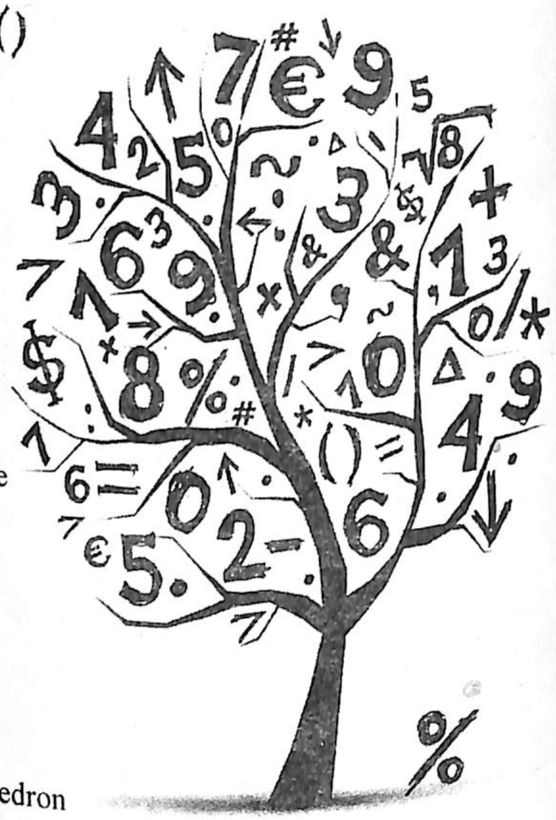
Parthajyoti Barman
6th Semester

In my darkest days and sleepless nights,
The one who was always by my side,
The one to keep me in sight,
The one who never left ever since.
How could I forget those days?
Running and chasing you,
Just to be in the endless shine of yours
The one who had wings to fly,
And I, the one who wanted to try,
But never given the choice
To make the path for mine
You dreamt your own dreams,
Worked hard, always praised
Leaving me to be in the shadows,
And shattering everything I believed
You were so busy with your life
That little did you know any,
Of the tears behind my smile
But it was may responsibility
To make you happy, keeping away:
From the darkness I was falling into.
And never did I blame you,
For the choices you made for yourself,
Cause did I have the coverage?
Is the question I ask to myself
The wishes I kept hidden for years,
Getting ready to go all out,
But with the passage of time,
I got drawn to the bottomless pit
Believing the saying to be true
'Sometimes losing is better than winning'
For the people who I care
I stopped dreaming, for all my life,
It was my dream that was denied. ■

Know the Maths with their Facts

Monica Deb
4th Semester

Maths cannot be translated
Yet can only be formulated
It asks us to arrange it's deform
But often we puzzle to perform
Maths has its own particular solution
It can have different ways of substitution.
When it reach to right quantity
Observes and challenge brain's quality
It may have some complex
But it gives the joy of success
Trying many times, may feel like null,
Though it never makes us to feel like dull
Number 1/89 encodes the Fibonacci sequence
Spiral shapes of sunflower has its influence
Two interesting lines can never be parallel,
If so, I have questions to ask several
Numbers we hope can be odd or even
It is found that most people like seven
Polygon with 50 sides called pentacontagon
Rolyhedron with 50 faces called rentacontahedron
Do you know the whole value of Pi?
We too are unsure, so don't be shy. ■



Longing for Peace

Poushali Nag
2nd Semester

Longing for peace
Every heart dwelling here and there
But found nowhere.
They say it is everywhere
But we never saw anywhere
Yes, it is here
Only if we have the eyes to see there. ■

স্মৃতিৰ সঁফুৰা

ৰূপম তালুকদাৰ
স্নাতক ষষ্ঠ ষান্মাষিক

জীৱনৰ কাঁইটীয়া বাটত খোজ দিওঁতে
তোমাক লগ পাইছিলো বহল ধৰাৰ বুকুত
তুমিয়েই শিকাইছিলা জীয়াই থকাৰ গান
উকা কাগজত ... আৰু
সাত সাগৰ পাৰ হৈও যাৰ নীলা বুকুখন
এবাৰো ঠমকি নৰয়....
যন্ত্ৰমানৱক ঠেলি সভ্যতাৰ মাজলৈ
কাৰ বাবে তোমাৰ এই অদম্য হেঁপাহ?
হে মোৰ আই, তুমি চিৰ সেউজ উদ্দীপ্ত
তুমিয়েইটো নোৱাইছিলা এদিন
স্বাক্ষৰতাৰ গভীৰ পুখুৰীত...
কেনেকৈ পাহৰো তোমাৰ এই নীলাভ স্মৃতি।
তোমাৰ অতীতক সাৱটিয়েই আগুৱাইছো
হৃদয়ত আঁকি থৈছো তুমি শিকোৱা প্ৰতিটো গান
কিয় জানা মা? তুমিয়েইটো মোৰ কলিজাৰ কেঁচা তেজ
আৰু মোৰ জীৱন মানেই তোমাৰ স্মৃতি। ■

Three Years

(In memory of BBC day)

Parthajyoti Barman
6th Semester

Different people of different culture,
Coming together to build the future.
Unknown place and selfish people's team,
Just to fulfill each other's dream.
The first time we saw each other,
We knew we were destined to be together.
With the hope to find the lost days,
We decided to cope with what everyone says.
Realizing we have a life to live,
And a family waiting for us to give.
But little did we care about other things,
As we were a group of special beings.
Making memories and shearing everything,
Spent all till we had nothing.
And when the times of exams are near,
We did lose our mind with fear.
For all we studied only to pass,
As we were always out of the class.
No matter how much the teachers were flattered,
Our faces won't be remembered.
Still we tried to give our best,
And in the darkest days we fought the hardest.
The days passed away in search of serenity,
But it almost felt like eternity.
For it was a lifespan of just three years,
So we promise ourselves not to shed tears.
And we will always be bonded by heart,
Thanking the ones who gave us birth. ■

The meetings of Dream Team of Numbers

1: Hello! gentleman, As the representative and father of all mathematics, I propose we start by each introducing ourselves.

π: I represent geometry, You know, circles, spheres.... I'm very popular but no one really knows me!

e: I'm all about changes, dynamics as I'm the symbol of Calculus, Especially that of growth

0: I've gone from zero to hero, long forgotten, I hae inspired the inception of negative number and that of algebra as well.

i: I'm a ghost to some and a masterpiece to those who dare to reflect on the beauty of Maths.

Washmin Ara Begum
2nd Semester

Students of our Department who secured 1st Class in B. Sc Final Examination

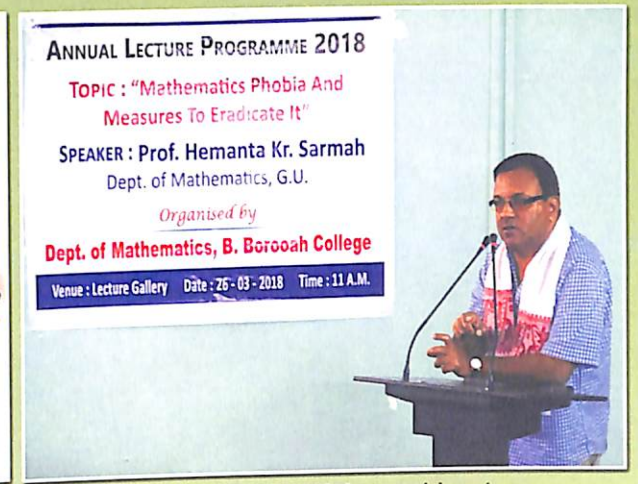
(Batch 2013-16)

1. Bhaskarjyoti Deka
2. Rupam Ahmed
3. Rownak Kundu
4. Moonmee Devi
5. Abinash Das
6. Jayashree Mahanta
7. Poonam Kaur
8. Smritirekha Kalita
9. Rishav Dev
10. Abinash Sarma
11. Paragjyoti Jyoti Sarma
12. Pallavi Deka
13. Mahmadul Islam
14. Bikash Talukdar
15. Jyotirmoy Baruah
16. Isha Bezbaruah
17. Anjuma Sarma
18. Kuldip Agarwala
19. Bhawarnav Nath
20. Ekumoni Deka
21. Parismita Saikia
22. Dolly Bharadwaj
23. Pranab saha
24. Sanjib Kalita
25. Premendra bora
26. Rahul Kalita
27. Pranami Das
28. Mrinmoy Kumar

(Batch 2014-17)

1. Jintumani Nath (First Class Second Position)
2. Reeshav Choudhury
3. Ashik Hussain Mirza
4. Hirakjyoti Das
5. Dibya Jyoti Das
6. Sangita Kalita
7. Kristina Sarma
8. Nisha Kumari
9. Jituraj Roy
10. Rituparna Dutta
11. Kangkana Rabha
12. Abhijita Bora
13. Manoj Doley
14. Rohit Singh
15. Bikash Das
16. Chitra Ranjan Gogoi
17. Manash Jyoti Choudhury
18. Junu Rabha
19. Ranjan Kakati
20. Rockey Paul

Teachers' Day Celebration



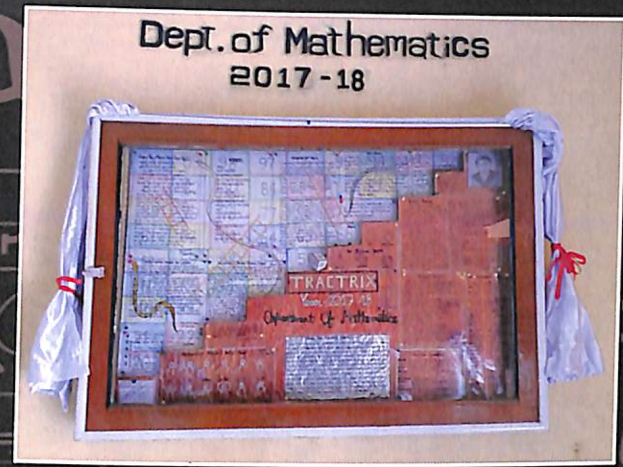
Departmental Annual Lecture

Freshmen Social

Departmental Library

Science Exhibition

Departmental Picnic at Ukiam



Departmental Wall Magazine
(3rd Prize in College Week)

Departmental Wall Magazine

Cultural Rally

TDC
6th Semester

TDC
4th Semester

TDC
2nd Semester