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A Historical View of Computers and Mathematics

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Abstract

There always exist a deep relationship between computers and mathematics from the ancient time. Although computers are the most powerful tool for mathematical teaching and learning but one can't ignore the role of mathematics to invent computers in ancient time. This paper not only represents the development of theories and methods for computer and information sciences, implementation, and analysis of algorithms and software tools for mathematical computation and the integration of mathematics but also reflects the importance of mathematics in developing the computer science. Learning with computers serves more effectively than the traditional methods. Technological changes transform the pedagogy in mathematics education and also in the nature of mathematical thinking and understanding.

Keywords: Mathematics, Computers, Mathematical teaching and learning

Introduction

The 21st century world can be called a scientific world, advancing rapidly in information technology, medicine, engineering, space communication, astronomy, astrophysics, artificial intelligence, robotics and many other disciplines. Our country requires technically skilled manpower. The use of multimedia in education has significantly changed people's learning processes. Computer technology holds promise for improving student performance and quality of teaching education program at all levels. Pupils and teachers are under monumental pressure to achieve greater success in their classrooms. The combination of demand and pressure push teachers to seek new materials, resources and ways to teach all children in the classrooms easily. Teachers are hopeful that innovative ways of teaching will help pupils learn and motivate them to excel and increase their performance on standardized testing. Computers and Mathematics are the different sides of the same coin and play an important role of today life as they provide various opportunities in this modern era. Computer has a major role in developing Mathematics. Different types of technologies developed in Computer Science work as an advancement in the study of mathematics. Further research in mathematics is merely not possible without these software's such as MATLAB, MATHEMATICA etc. Also Mathematics is widely used in computers both in hardware and software. Today computers are being used effectively in Science and technology to solve complex computational and logical problem, to control production processes to carryout economic planning and forecasting and to store large number of information. Mathematicians played an important role in the development of computer in ancient time. Computer can roughly be described as an information processor, that is, a machine which can perform arithmetic and logical operation. The first computer



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was probably the Abacus which consisted of beads strung on fixed parallel rods. It was developed around 650 B.C. to perform arithmetic operations.



Fig: 1 Abacus

In 1642, Blaise Pascal, a French Mathematician and Physicist developed the first Mechanical Calculator. Later Gottfriend Leibnitz, a German Mathematician and Philosopher identified the importance of calculating machine for Commercial use. This could perform various arithmetical operations and thus was useful for lengthy calculations. In 1946 John van Aloumann, a famous mathematician wrote a paper in which he discussed the basis for the design of a computer on the basis of which Mauchly, Eckart and their associates developed EDVAC (Electronic Discrete Variable Automatic Computer) in 1952.



Fig: 2 Electronic Discrete Variable Automatic Computer

Computer in Mathematics

Computer Science is divided into two parts

Software - This part deals with programming, codes and different types of programming languages. Programming shows its effectiveness with maths to apply complex algorithms and help to find solutions of various problems in Mathematical form.
Hardware - This involves working with the device itself, like the control unit, arithmetic logic unit etc. When learning about these structures and trying to design them you not only



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need to use Boolean Maths but also engineering principles of electronics and circuit design, and this needs the use of Maths for various calculations.

In today generation every department and organisation demanding the students who are well prepared in different types of skills like creativity and imagination, flexibility and adoptability, teamwork, Technology Literacy etc. *So the major focus in all the institutions is on acquiring, learn and how to observe everything in different dimensions rather than to get good marks.* Research indicates that computer technology can help in support learning and acquiring that all skills which a student requires in today generation to compete with their fellow ones and thus achieve the ladder of successes in their lives.

Mathematics, to most, is a complex and difficult subject. The tendency for most students is to consider the subject as one that is boring and difficult, thus, creating lack of interest in this powerful and effective subject. This poses a great challenge for teachers and educators, to inculcate the mathematical skills in students, especially in the primary and intermediate levels, wherein a good study habit and a fantastic grasp of basic concepts needs to be developed., The CEO of the International Society for Technology in Education, Don Knezek tells that education without technology is same as the medical profession without technology. He says "If in 1970 you had knee surgery, you got a huge scar," he says. "Now, if you have knee

Surgery you have two little dots."

Einstein famously said that his pencil was more intelligent than he was - meaning, that he Could achieve far more using his pencil as an aid to thinking than he could unaided. There is a need to be familiar that digital technologies in Mathematics are the pencils of today. Mathematics is witnessed as the regent of all Sciences. In preceding time, the role of Mathematics was bounded up to on academic domain but now the time has been changed and the role of Mathematics is beyond to academic domain rather It has entered into the domain of Technology and Industry. New fields in Mathematics such as Operation Research, Control Theory, Signal Processing and Cryptography have been generated. Technology has reduced the effort to find the solutions of the complex calculations and increases students' focus on more important mathematics. The use of technology in studying mathematics is not a new issue, since humankind always has been looking for a tool which helps them to do their work easier and save their time and that tool in today time is Technology.

We can see the long history of the use of technology in the education of Mathematics. Starting from magic slate, book, magic lantern, Blackboard, OHP, Radio, Slide rule video tape, Television, Calculator, computer, Interactive Board, Apple I pad all come under technology. Paper money and coins, beans, bears, buttons, and other small items are helpful for counting and computation skills. Geo boards are useful for introducing geometric concepts. Clinometers are useful for teaching and learning of Trigonometry. An abacus allows children to conceptualize math formulas by working with tangible objects.



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Mathematics and Computer side by side

We cannot only say that computers are used in mathematics and mathematics is used in computers. Both the subjects/ fields have the same importance and both are equal in their use with each other so we cannot ignore the fact of usage of Mathematics and computers side by side. Further are some applications of Mathematics in field of Computer.

Algorithmic Analysis uses Combinatorics and Recurrence Relations

A large part of computer science involves trying to understand just how efficient algorithms to do specific tasks are. We need a special way to understand whether an algorithm is faster or less resource-usage than another - this way; you can design programs that accomplish the similar task with less resource. This is necessary if you want to be able to scale your applications to handle large inputs and need effective results. To do this, Computer Scientists have invented a number of notations and tricks to classify the presentation of algorithms. The idea is pretty effortless.

Data Compression Schemes by using Probability and Statistics

A large number of algorithms by themselves enterprise advanced mathematics. Probability is a lifelong favourite.

Data compression schemes are used to *flatten* files by exploiting patterns in the data. However, sometimes it's not very easy to discern patterns that can be exploited. That's where probability comes in.

Computer Vision, Graphics and Image Processing

If you've ever played a video game or watched animation, you're really looking at one of the most monumental mathematical feats in computer science. Since everything in computer graphics can be explained as a *transformation*: you take a <u>vector</u>, and you will apply a number of few matrices to it to get a next vector. The vector is the fundamental unit of graphics - a good analogy is a straight line. Combining them together you construct really interesting graphics.





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Cryptography by using Number Theory

Today a large percentage of data is stored electronically. As a results individuals and businesses need assurance that their data can be moved and secured securely. Encryption plays an important role in protecting information. Various Cryptographic and hashing techniques are used to secure information. Modern cryptography is the combination of the disciplines of mathematics, communication science, computer science, electrical engineering and physics. Applications of cryptography include chip-based payment cards, electronic commerce, computer passwords, digital currencies, , and military communications.

Fig:3 Cryptography

Database System uses Set Theory and Mathematical logic

The key of relational database systems is formalism called *relational algebra*, in which we view a *relation* (data table) as a set of *n*-tuples (rows). The operations on the algebra are either considered directly from set theory (union, intersection, cross product) or readily defined in it (sub setting of rows or columns, combining two relations *aka* join).

Software Engineering / Programming

It does not require much mathematics still if you are good in Mathematics, you will get more knowledge in this. Computer science does not require Mathematical Skills. It is an important part of many topics such as Artificial Intelligence, Machine Learning, Algorithms, Data Structures, Machine Architecture, and Computational Complexity etc... If you are trying to learn more, that attitude will not make you best in programming or computer science until you are not good in Mathematics.

Programming/Coding

Here use of maths is very limited. Basically, when you are doing some Algorithm Designs, you are left nothing but to transform that algorithmic logic into programming logic which is required the use of Maths. The basic use of maths in computer science is - Boolean algebra. It is the backbone of any computerized system (on/off, true/false, 0/1, and, or, not).

Computer Science is not merely a science. It's much more a part of an engineering discipline. As such, it uses math all over the place. Computational complexity is all maths. Data structures and Algorithms are the parts of applied math. Networking uses graph theory daily. And everyone who is doing engineering seriously on real computation needs Numerical Analysis.

Basically, the most important goal of Computer Science is to solve the problems and to find the best solutions for human lives and for that one should require mathematics. Any problem needs an algorithm (way) to be solved well and a tool uses this algorithm is from the mathematics background

Conclusion

We conclude that mathematics and computer are correlated to each other. One cannot be defined without other. In the modern technological world, computers become the backbone of the mathematics and its research work. No Mathematician can do his work without



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computer. We cannot compare mathematics and computer that is which is more effective. In spite the many uses of computers in mathematics, one cannot ignore the root of mathematics in computers. So, one cannot survive without other.

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