Lecture - 1

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What is Mathematics?

Let's start with having a small discussion over the simple concept of Mathematics,

"It is the scientific study of structure, order, and relationships emerged from elemental procedures of counting, measuring, and explaining the format of objects. It copes with logical reasoning and quantitative calculation."

Categories of Mathematics

Mathematics can be broadly classified into two categories −

Continuous Mathematics − It is based upon continuous number lines or the real numbers. It is characterized by the fact that between any two numbers, there are almost always an infinite set of numbers. For example, a function in continuous mathematics can be plotted in a smooth curve without breaks.

Discrete Mathematics − It involves distinct values; i.e. between any two points, there are a countable number of points. For example, if we have a finite set of objects, the function can be defined as a list of ordered pairs having these objects, and can be presented as a complete list of those pairs.

What is Discrete Mathematics?

Discrete mathematics is the branch of mathematics handling objects that only considers distinct, separated values. In contrast with continuous mathematics, discrete mathematics can be characterized by integers. It is the mathematical language of computer science and can be applied to practical fields of mathematics.

In simple words, discrete mathematics gives an individual the ability to understand mathematical language that can be learned through various branches of it. Moreover;

1. It is considered an excellent tool in order to improve reasoning and problem-solving abilities. Therefore, its importance has progressed adequately in recent years with the growth of digital devices.

2. Combinations, graph theory and logical statements are broadly involved as structures in discrete mathematics along with finite or infinite numbers.

3. It is used in designing the daily used apps and programs in computer science.

4. It is essential to digital devices, though the tech world is continually rising, the research and study in discrete mathematics could mark valuable development for us.

5. More specifically, discrete mathematics is not just limited to integers, it also encompasses mathematical structures or diverse methods consisting of individual parts that can be explained in terms of finite sequences of characters from a computer keyboard.

In terms broadly described, discrete mathematics is the research study of techniques, ideas and means of reasoning indispensable in various applied disciplines such as computer science or information technology.

Being a portal within advanced theoretical mathematics, it is supportive in deciphering the difference between analog and discrete systems.

The various research domains included by Discrete Mathematics are graph and hypergraph theory, coding theory, block designs, combinatorics, set theory, matroid theory, discrete geometry, matrices, discrete probability, and parts of cryptography.

Topics in Discrete Mathematics

Though there cannot be a definite number of branches of Discrete Mathematics, the following topics are almost always covered in any study regarding this matter −

- Sets, Relations and Functions
- Mathematical Logic
- Group theory
- Counting Theory
- Probability
- Mathematical Induction and Recurrence Relations
- Graph Theory
- Trees
- Boolean Algebra

Discrete Mathematics Applications

- The research of mathematical proof is especially important in logic and has applications to automated theorem demonstrating and regular verification of software.
- Partially ordered sets and sets with other relations have uses in different areas.
- Number theory has applications to cryptography and cryptanalysis.