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Areas of Discrete Mathematics in Information Theory and Theoretical Computer Science

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Perspective

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DESCRIPTION

The study of mathematical systems that are "discrete" in a way similar to discrete variables, having a bijection with the set of natural numbers rather than being "continuous," is known as discrete mathematics. In discrete mathematics, things like integers, graphs, and logical assertions are examined. Inversely, discrete mathematics does not include "continuous mathematics" concepts like calculus, real values, or Euclidean geometry. Integers are frequently used to count discrete objects, and discrete mathematics is the area of mathematics that deals with countable sets. In discrete mathematics, there can be an infinite or a finite number of objects. Elements of discrete mathematics that deal with finite sets is commonly referred to as "finite mathematics," especially those sections that have a bearing on economy. Set theory is the mathematical discipline that investigates collections of objects such as blue, white, and red, as well as the (infinite) set of all prime numbers. Partially ordered sets and sets with other relations have many applications. Countable sets, including finite sets, are the primary focus of discrete mathematics. The study of trigonometric series inspired the development of set theory as a field of mathematics, and further development of the theory of infinite sets is outside the scope of discrete mathematics.

Indeed, current descriptive set theory research makes extensive use of traditional continuous mathematics. Graph theory, or the study of graphs and networks, is frequently considered a subfield of discrete mathematics. Graphs are one of the most important topics in discrete mathematics. They are

one of the most common types of natural and man-made structures. They can simulate many different kinds of relationships and process dynamics in physical, biological, and social systems.

In computer science, they can represent network connectivity, data organization, supercomputing machines, data processing stream, and so on. They are useful in geometry and certain aspects of topology. The adoption of digital computers which work in "discrete" steps and store data in "discrete" bits contributed to the growth of discrete mathematics research in the second half of the 20th century. Computer algorithms, programming languages, cyber security, robotic thesis testing, and software development are a few areas of computer science where concepts and principles from discrete mathematics can be used to investigate and describe objects and issues. On the other hand, computer implementations are important for translating concepts from discrete mathematics to practical issues. Even though discrete objects are the primary study objects in discrete mathematics, analytical techniques from "continuous" mathematics are also frequently used.

Hypothetical computer science covers discrete mathematics that is relevant to computing. It makes extensive use of graph theory and mathematical logic. The analysis of algorithms and data structures is included in theoretical computer science. Computability, which is closely related to reasoning, tests what can be calculated in theory, whereas complexity studies the time, space, and other resources consumed by computations. Computability is closely related to automata theory and formal language theory. Computer networks are modeled using Petri nets and process algebras, and VLSI electronic circuits are analyzed using discrete mathematics methods. Computational geometry applies algorithms to simple geometric problems and three dimensional object representations, whereas computer image analysis applies them to image representations. The study of various continuous computational topics is also included in theoretical computer science. The quantification of information is core to information theory. Programming theory, which is used to design efficient and dependable data transmission and storage methods, is closely related. Continuous topics in information theory include analogue signals, analogue coding, and analogue encryption.