Discrete Mathematics Encyclopedia Article

Discrete Mathematics

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Discrete Mathematics

Discrete mathematics is the study of discrete phenomena involving the system of natural numbers. (For comparison, calculus is the study of continuous mathematics on the set of real numbers.) The natural numbers are considered discrete since each element of the set can be isolated. This is not possible with the rational numbers, for example, because one can always find a rational number between any pair of rational numbers.

Discrete mathematics is an inclusive field that embraces many areas of mathematical study, some hundreds of years old and others developed only within the past few decades. In general, these areas involve counting objects, studying the relationship between finite sets, and analyzing processes that terminate in a finite number of steps (i.e., **algorithms**).

Some of the topics covered in discrete mathematics courses include **first-order logic**, mathematical induction, sets, number theory, functions and relations, combinatorics, finite probability, graph theory, **Boolean algebra**, linear **programming**, algorithmic thinking, formal languages and modeling computation. By studying these fields, one can develop answers to questions like:

- What's the most efficient way to run phone wires in a housing development or cables in a computer network?
- How many ways can a **password** be chosen on a computer system?
- For any network of roads connecting two towns, which route minimizes the distance traveled to go fro one town to the other?
- How can a computer be programmed to sort a list of names into alphabetical order?

Courses in discrete mathematics first appeared around 1980 on account of the increasing impact of computers on mathematics and the need of computer science majors to master the topics listed above. Since the inner workings of digital computers are discrete, one must use discrete computer models to replicate continuous phenomena.