Abstract

Conceptualization and visualization of significant aspects of theoretical computer science is the thrust of this thesis. The concepts considered here are databases, computation, logic, and set theory. In this thesis the close connection between these areas is investigated. Databases use a diluted form of mathematical logic in dealing with functional dependencies, and boolean lattices form a foundation on which mathematical logic stands. Thus a study of lattices leads to visualization of concepts in relational database theory. The NuMachine introduced here computes all recursive functions and is thus equivalent to Turing Machine in computing power. It makes string manipulation and numerical computation totally equivalent. Sentient Arithmetic (SA) is defined by adding the Sentient rules to Elementary Arithmetic. The addition of these rules makes the proof of Gödel’s Incompleteness Theorems simple, and entirely within SA. The definition of a new binary operator helps to visualize the Ackermann functions. It also enables the systematic listing of Cantor’s transfinite ordinals. Every recursive set defines a number, called regular number, in the unit interval $(0,1]$. Since the real line can be split into unit intervals, it can be thus defined as a set of regular numbers. The attempt has been to build a sound theoretical base for developing visualization software.