Monograph
Def Prog on calc

Computer Science as a mathematical discipline

Pioneers (eg Backus, Minsky, McCarthy) initiated subject around about 1960
Centrally concerned with **data representation** and **manipulation**

Not a new theme:

Arabic vs Roman numerals - arithmetic
Newton / Liebnitz - calculus
Gauss / Galois - algebraic numbers and polynomials
Boole / Frege - propositional and predicate logic
Hilbert / Turing - constructive proof, decideability

What **is** new:

tremendous variety of different sorts of data to be represented
diversity of representations and manipulations to be considered
formality with which have to describe
concern for practicality, feasibility and efficiency

Characteristic is:

need to model data at many different levels of abstraction
need to translate data between form suitable for human interpretation

and form suitable for mechanical processing

What ELSE does "data representation and manipulation" entail?

Gauss's algorithmic solution to
"given a quadratic equation with integer coefficients, what are all its solutions?"
can be fancifully viewed as
"devising a **programming language**, *or equivalently*
devising an **abstract machine model**,
in which all the required subroutines can be programmed".

Computer Science requires coherent - not *ad hoc* - data representations: need
- all data manipulation in terms of a common machine model
theory of compilers and information structures
- good abstract machine models for specific classes of algorithm

for comprehensibility and effective analysis
theories such as formal languages and automata for parsing
- need to develop "abstract machine models" for general purpose algorithms
programming languages and programming paradigms

Also "2nd order effects" - problems of data representation at a high-level of abstraction derived from **applications** of computers

Need formal specifications for large software programs, for communicating systems of processes, for VLSI architectures

Need data representations for interactive applications eg databases where emphasis on unifying framework for many different related (often simple) algorithmic tasks. The contrast between a "calculator" and a "spreadsheet" is indicative.

AI - vision, knowledge representation

Philosophy / politics

Appropriate technology
Naive physics: relevance of system specifications