

Math 3342

Prof Staecker

Theory of Computation

~ 1900 people started thinking about algorithms

a specific procedure for
solving a problem in finitely many steps

Al - Kwarizmi

$$\begin{array}{r} 127 \\ + 55 \\ \hline 182 \end{array}$$

Al Jabr

~ 1900 was when all of math was being
formalized using set theory.

No set-theory description of what an algorithm is.

1912-1954
Turing: an algorithm is any process that could
be mechanized. T. described very

specifically (set theory) the capabilities of the machine.

This he called the Universal Machine (1936)

What kinds of things can be computed by physical machines? (not everything)

(this is about me too!)

Languages

Basic Terms

An alphabet is a finite set of symbols,

like $\{a, b, c, \dots, z\}$

or $\{0, 1\}$

or ASCII or unicode

usually our alphabet is called Σ .

A string is a finite sequence of symbols

from the alphabet.

so if $\Sigma = \{0, 1\}$,

strings look like 001010

or 11111

or 0

|01010| means length

$$|0101| = 4$$

The string of no characters is the empty string

written $\varepsilon \leftarrow$ the empty string.

ε is not an alphabet symbol,
it represents the empty string.

Usually we'll use a, b, c for letters,

x, y, z for strings.

We can concatenate two strings

if $x = 00110$

$y = 111$

then $xy = \overbrace{00110}^x \overbrace{111}^y$

$$yx = 11100110$$

we'll do $x^2 = xx = 0011000110$

etc.

there's no x^{-1}

Def A language is a set (possibly infinite)
of strings from some alphabet.

for $\Sigma = \{0, 1\}$,

this is a language: $\{0, 1, 00, 11, 10, 01\}$

or $\{01^n0 \mid n \in \mathbb{N}\}$

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