More on Languages

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Languages Continued

Σ^* = set of all strings over the alphabet Σ

A language L1 is a subset of Σ^*

ϵ is an empty string.

If $\omega \in \Sigma^*$, $|\omega|$ = length of the string.

Examples of languages

1. $\emptyset$
2. Σ^* > English is a language where the strings are all words in a dictionary and punctuation marks and the collection is grammatically correct > > C++ any string of characters the compiler accepts
3. $\Sigma = \{a,b\}$, $L = \{x \in \Sigma^*$ st x begins with a & ends with b$\}$
4. $\Sigma = \{0,1,..,9\}$, $L=\{x \mid x$ is the decimal representation of a prime$\}$

Equality of Languages

Languages are equal if the set of strings are equal.

Encoding (informal)

A bijective mapping from one set to another. - Pictures are colours encoded as numbers - Similarly movies

Ordering of a language

Σ is finite, hence can be ordered.

Σ^* can then be ordered by length first and then the lexographic order on Σ

Existance of a string in a Language

Graph of a function

$G(f) = \{x,y \mid y=f(x)\}$

A string exists in the language if it exists in G(f) where f is the defining function of the Language.

> There are uncountable languages but a countable set of strings. So we cannot hope to describe all the languages using strings.

Deterministic Finite State Automaton

Solve the existance of string problem - Read the string one char at a time - Remember something, and react to the next char accordingly. - Do this again and again

Consider -

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

$l = \{x|x \text{ consists of an even number of 1s}\}$

Given a string, what do you do?

Go char by char, switching between an “even state” and an “odd state”

DEFN: Deterministic Finite State Automaton is a 5 tuple $(Q, \Sigma, \delta, q0, F)$ where

- Q = A finite set called the set of states
- Σ = Alphabet
- δ = is a function $Q \times \Sigma \to Q$
- $q0 \in Q$ and is called the initial state
- $F \subseteq Q$ and is the set of accepted states.