CSC236 fall 2016

automata and languages

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Using Introduction to the Theory of Computation, Chapter 7

Computer Science
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Outline

FSAs (finite state automata)

notes

turnstile finite-state machine

what are the rules for turnstiles?

float machine

what strings are floats in Python?

states needed to classify a string

what state is a stingy vending machine in, based on coins?

accepts only nickles, dimes, and quarters,

no change given, and everything costs 30 cents...

here's a useful toy (you'll need JRE)

δ	0	5	10	15	20	25	≥ 30
n	5	10	15	20	25	≥ 30	≥ 30
d	10	15	20	25	≥ 30	≥ 30	≥ 30
q	25	≥ 30	≥ 30	≥ 30	≥ 30	≥ 30	≥ 30

integer multiples of 3

build an automaton with formalities...

quintuple: $(Q, \Sigma, q_0, F, \delta)$

Q is set of states, Σ is finite, non-empty alphabet, q_0 is start state
F is set of accepting states, and $\delta : Q \times \Sigma \mapsto Q$ is transition function

We can extend $\delta : Q \times \Sigma \mapsto Q$ to a transition function that tells us what state a **string** s takes the automaton to:

$$\delta^* : Q \times \Sigma^* \mapsto Q \qquad \delta^*(q, s) = \begin{cases} q & \text{if } s = \varepsilon \\ \delta(\delta^*(q, s'), a) & \text{if } s' \in \Sigma^*, \\ & \quad a \in \Sigma, s = s'a \end{cases}$$

String s is accepted if and only iff $\delta^*(q_0, s) \in F$, it is rejected otherwise.

example — an odd machine

devise a machine that accepts strings over $\{a, b\}$ with an odd number of as

Formal proof requires inductive proof of invariant:

$$\delta^*(E, s) = \begin{cases} E & \text{if } s \text{ has even number of } a\text{s} \\ O & \text{if } s \text{has odd number of } a\text{s} \end{cases}$$

more odd/even

L is the language of binary strings
with an odd number of as, but even length
Devise a machine for L

notes