CSE 105
THEORY OF COMPUTATION

Spring 2018

http://cseweb.ucsd.edu/classes/sp18/cse105-ab/

Definitions

pp. 13, 14, 64-65

- **Alphabet** non-empty finite set
- **Symbol** element of alphabet
- **String** over Σ finite list of symbols from Σ
- **Language** over Σ set of strings over Σ
- **Regular expression** over Σ

  syntactic expression built up recursively
- **Language** described by a regular expression

  set of strings matching pattern given by r.e.

Regular expressions

Which regular expression describes a language that includes the string a ?

A. a*b*
B. a(ba)*b
C. a* U b*
D. (aaa)*
E. (ε U a)b

Frequency: BB

To change your remote frequency
1. Press and hold power button until flashing
2. Enter two-letter code
3. Checkmark / green light indicates success

In practice

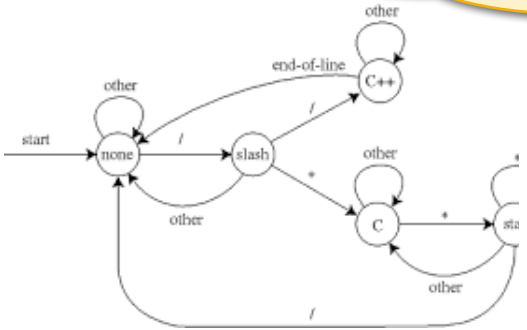
- How do computers check if a string is in the language described by a regular expression?

```
grep 'password' /etc/passwd
```

First model

Code input as strings
Model memory using states

- Text processing
  grep, regexp



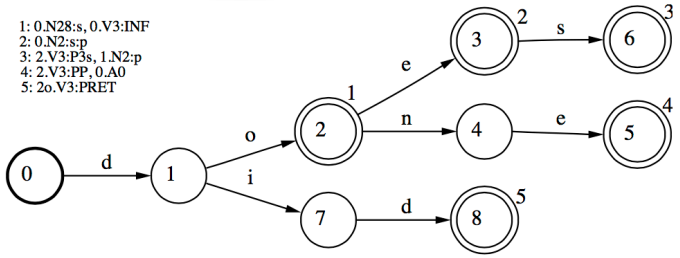
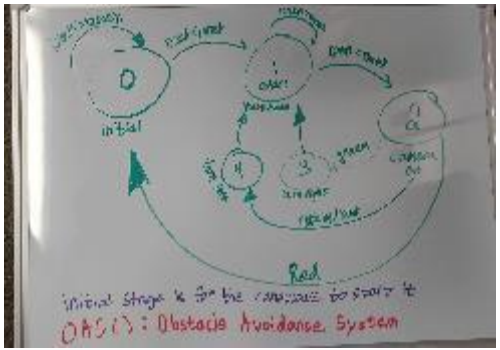


Fig. 1. Representation of dictionaries by automata.

- Natural language processing

- Hardware design
  Moore machines, Mealy machines: CSE 140
- Controllers / Robots
  SPIS!



Pre-class reading

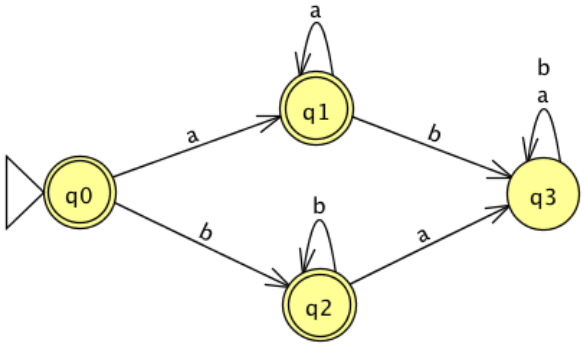
- Tracing the computation of a finite automata using its state diagram.
- Formal definition of finite automaton.

From the website:

DFA *Reading* Sec 1.1: Figure 1.4 (p. 34), Definition 1.5 (p. 35)
Optional extra practice: Chapter 1 Exercise # 1, 2, 3

Deterministic Finite Automaton

Sipser p. 34



Start state(s)?

Accept state(s)?

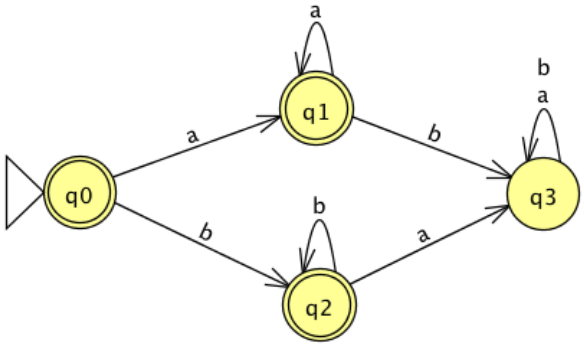
Transitions?

Deterministic Finite Automaton

Sipser p. 34, 40

Input:

Output:



Computation of the machine on an input string

Sequence of states in the machine, starting with the initial state, determined by transitions of the machine as it reads additional input symbols.

Deterministic Finite Automaton

Sipser p. 34, 40

Computation of the machine on an input string

Sequence of states in the machine, starting with the initial state, determined by transitions of the machine as it reads additional input symbols.

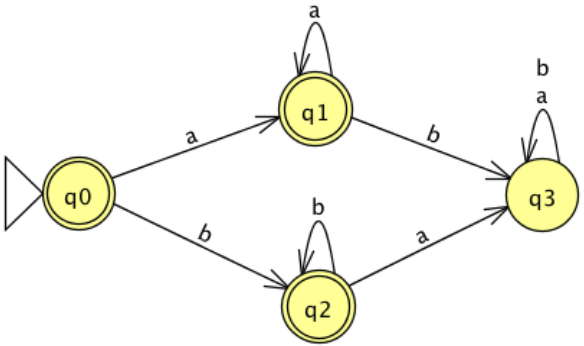
Machine accepts the input string if

Machine rejects the input string if

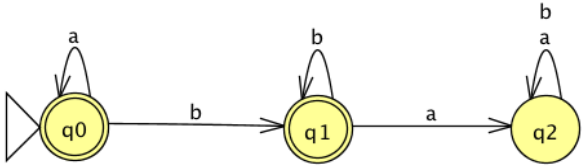
The **language recognized by the machine** is the set of strings it accepts.

Examples

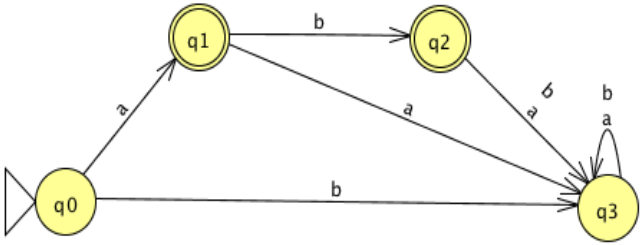
1.



2.



3.



Which of these automata accept each string $a^n b^m$, where n,m>=0?

A. 1
B. 2
C. 3
D. More than one of them.
E. None of the them.

For next time

- Individual Homework 0 **due Saturday**
  - Set up course tools: *Gradescope*, Piazza
  - Read all the questions + relevant examples in the book
  - Start working ☺
  - *Review CSE 20 / Math 109 / CSE 21 / Sipser Ch 0 as needed.*

Pre class-reading for Friday: Example 1.21

Deterministic finite automaton

Sipser p. 35 Def 1.5

A **finite automaton** is a 5-tuple $(Q, \Sigma, \delta, q_0, F)$ where

1. Q is a finite set called the states
2. Σ is a finite set called the alphabet
3. $\delta : Q \times \Sigma \to Q$ is the transition function
4. $q_0 \in Q$ is the start state
5. $F \subseteq Q$ is the set of accept states.