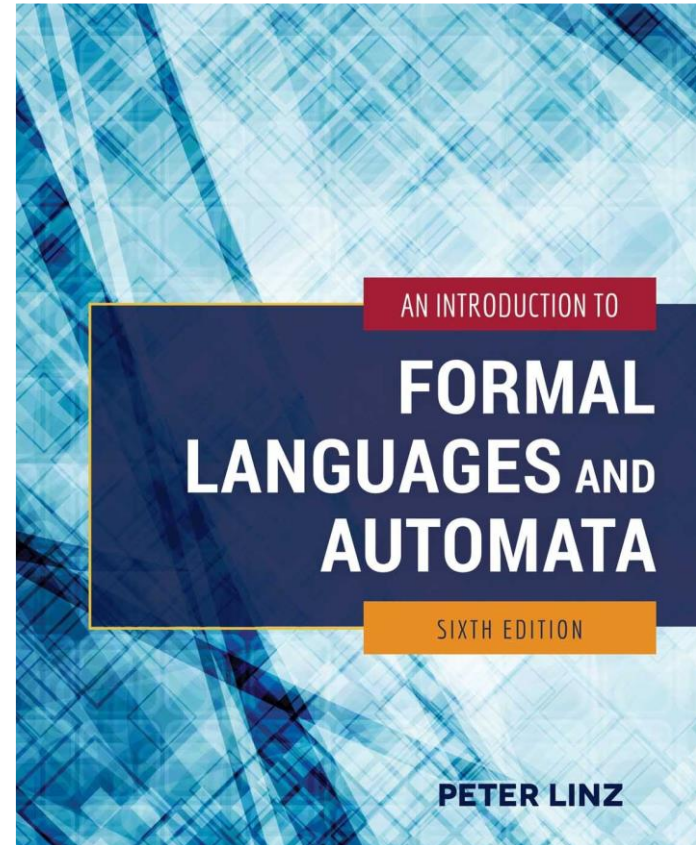
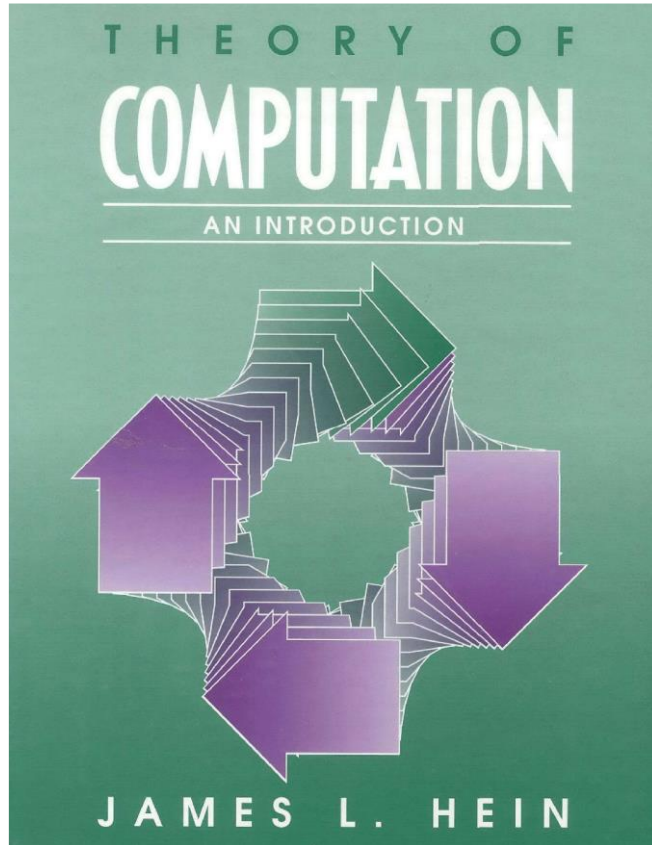


Automata and Formal Languages

Lecture 02

Books



PowerPoint

http://www.bu.edu.eg/staff/ahmedaboalatah14-courses/14767

The screenshot shows a web interface for Benha University. At the top, there is a blue header with the university logo, the name 'Benha University', and a welcome message for 'Ahmed Hassan Ahmed Abu El Atta' with a 'Log out' link. Below the header, a navigation menu on the left lists various university services. The main content area displays course details for 'Automata and Formal Languages' by 'Ass. Lect. Ahmed Hassan Ahmed Abu El Atta'. The details are presented in a table with blue headers and white content. A 'Course password' section is also visible. On the right side, there are social media icons and a vertical toolbar with icons for Google, a book, RG, LinkedIn, Facebook, Twitter, Google+, YouTube, WordPress, a camera, a globe, a question mark, and an edit icon.

Benha University

Staff Search: **Welcome: Ahmed Hassan Ahmed Abu El Atta (Log out)**

You are in: [Home](#) / [Courses](#) / [Automata and Formal Languages](#) [Back To Courses](#)

Ass. Lect. Ahmed Hassan Ahmed Abu El Atta :: Course Details:
Automata And Formal Languages [add course](#) | [edit course](#)

Course name	Automata and Formal Languages
Level	Undergraduate
Last year taught	2018
Course description	Not Uploaded
Course password	
Course files	add files
Course URLs	add URLs
Course assignments	add assignments
Course Exams & Model Answers	add exams

(edit)

FINITE AUTOMATA

Regular Language

Agenda

- Regular Languages
- Example : Regular Languages
- Finite Automata
- Example Finite Automaton
- Finite Automata (FA) as Acceptor
- Transition Function & Transition Table
- Nondeterministic Finite Automata (NFA)
- Example: DFA
- Examples Find DFA & NFA
- Example: What is the language?

Regular Languages

The collection of regular languages over A is defined inductively as follows:

- **Basis:** Φ , $\{\epsilon\}$, and $\{a\}$ are regular languages for all $a \in A$.
- **Induction:** If L and M are regular languages, then the following languages are also regular: LM , $M.L$, and L^* .

Example : Regular Languages

Regular languages over the alphabet $A = (a, b)$:

$\Phi, \{\epsilon\}, \{a\}, \{b\}$

$\{\epsilon, b\} = \{\epsilon\} \cup \{b\}$

$\{a, ab\} = \{a\} \cdot \{\epsilon, b\}$

$\{\epsilon, b, bb, \dots, b^n, \dots\} = \{b\}^*$

$\{a, ab, abb, \dots, ab^n, \dots\} = \{a\} (\epsilon, b, bb, \dots, b^n, \dots) = \{a\} \cdot \{b\}^*$

$\{\epsilon, a, b, aa, bb, \dots, a^n, b^n, \dots\} = \{a\}^* \cup \{b\}^*$

Finite Automata

A finite Automata or **FA** is defined by the

$$M = (Q, \Sigma, \delta, q_0, F),$$

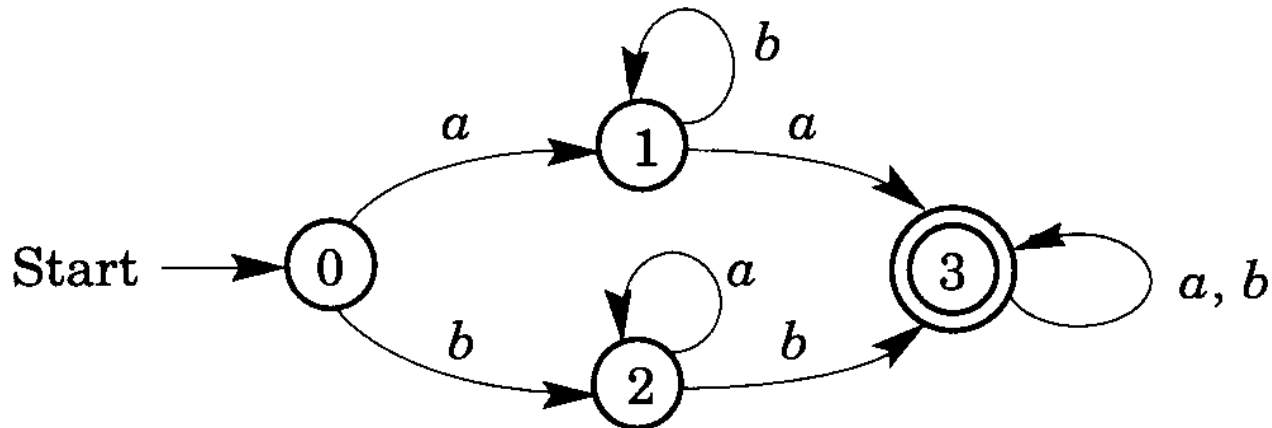
where

- Q is a finite set of states,
- Σ is a finite set of symbols called the input alphabet,
- $\delta : Q \times \Sigma \rightarrow Q$ is a total function called the transition function,
- $q_0 \in Q$ is the initial state,
- $F \subseteq Q$ is a set of final states.

Example Finite Automaton

A path 0, 1, 1, 3 with edges labeled a , b , a . Since 0 is the start state and 3 is a final state, we conclude that the FA accepts the string aba .

The FA also accepts the string $baaabab$ by traveling along the path 0, 2, 2, 2, 2, 3, 3, 3.



Finite Automata (FA) as Accepter

- A **FA** *accepts* a string w in A^* if there is :
 - a path from the start state to some final state such that w is the concatenation of the labels on the edges of the path.
 - Otherwise, the **FA** *rejects* w .
- The set of all strings accepted by a **finite Automata** M is called the *language* of M and is denoted by $L(M)$.

Transition Function & Transition Table

$$\delta(q_0, a) = q_0 \quad \delta(q_1, b) = q_2$$

$$\delta(q_0, b) = q_1 \quad \delta(q_2, a) = q_2$$

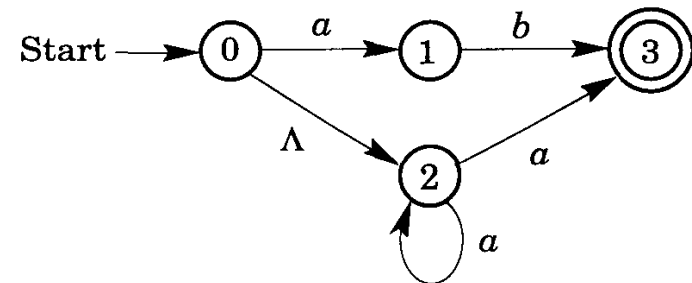
$$\delta(q_1, a) = q_2 \quad \delta(q_2, b) = q_2$$

	<i>a</i>	<i>b</i>
<i>q</i> ₀	<i>q</i> ₀	<i>q</i> ₁
<i>q</i> ₁	<i>q</i> ₂	<i>q</i> ₂
<i>q</i> ₂	<i>q</i> ₂	<i>q</i> ₂

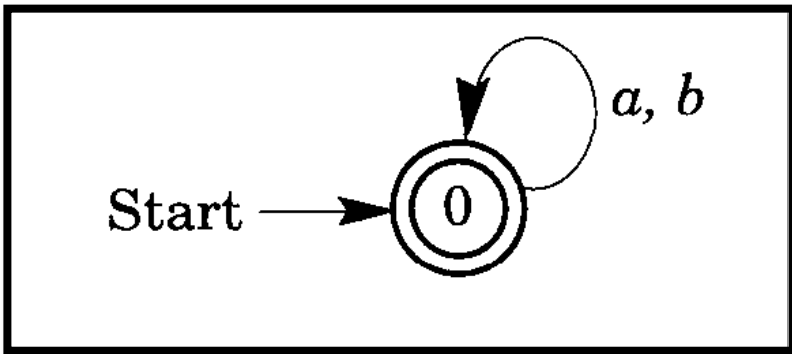


Nondeterministic Finite Automata (NFA)

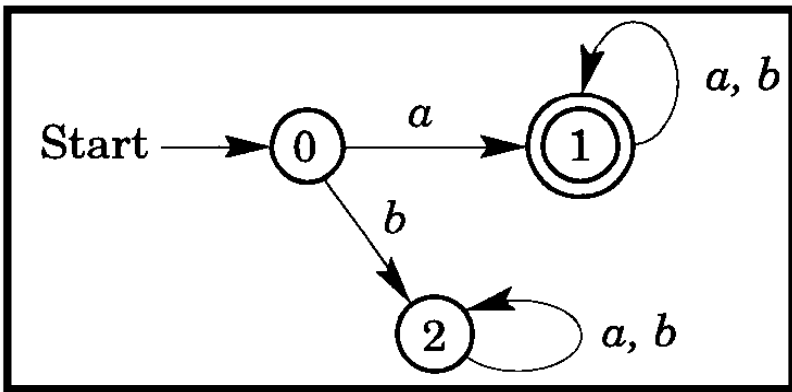
1. Edge with ϵ .
2. Missing labels
3. Multiple edges start from the same state with the same label



Example: DFA



The set $(a, b)^*$ of all strings over $\{a, b\}$



The set of all strings over $\{a, b\}$ that begin with a

Examples Find DFA & NFA

Regular languages over the alphabet $A = (a, b)$:

$\Phi, \{\epsilon\}, \{a\}, \{b\}$

$\{\epsilon, b\} = \{\epsilon\} \cup \{b\}$

$\{a, ab\} = \{a\} \cdot \{\epsilon, b\}$

$\{\epsilon, b, bb, \dots, b^n, \dots\} = \{b\}^*$

$\{a, ab, abb, \dots, ab^n, \dots\} = \{a\} \cdot \{\epsilon, b, bb, \dots, b^n, \dots\} = \{a\} \cdot \{b\}^*$

$\{\epsilon, a, b, aa, bb, \dots, a^n, b^n, \dots\} = \{a\}^* \cup \{b\}^*$

Example: What is the language?

