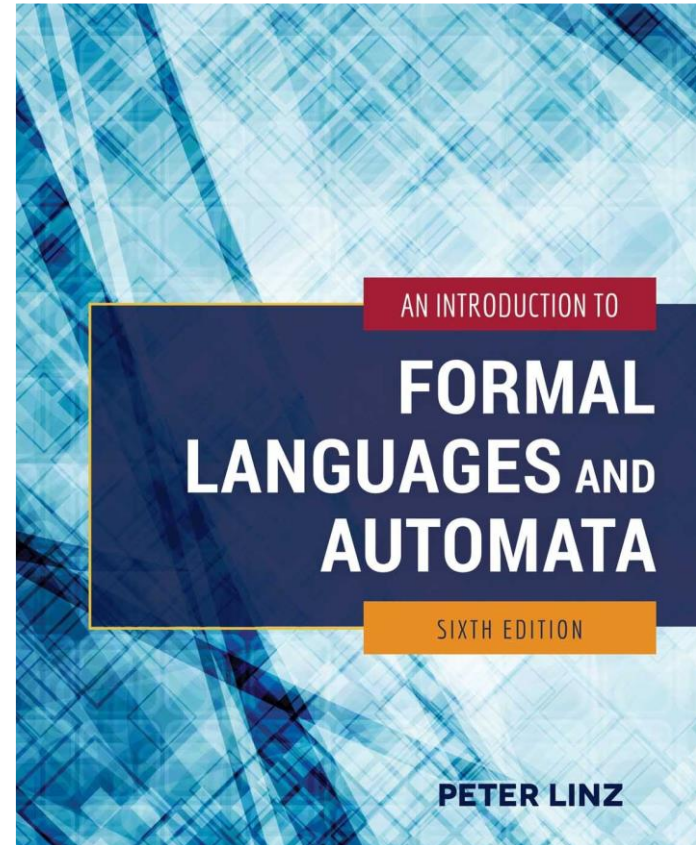
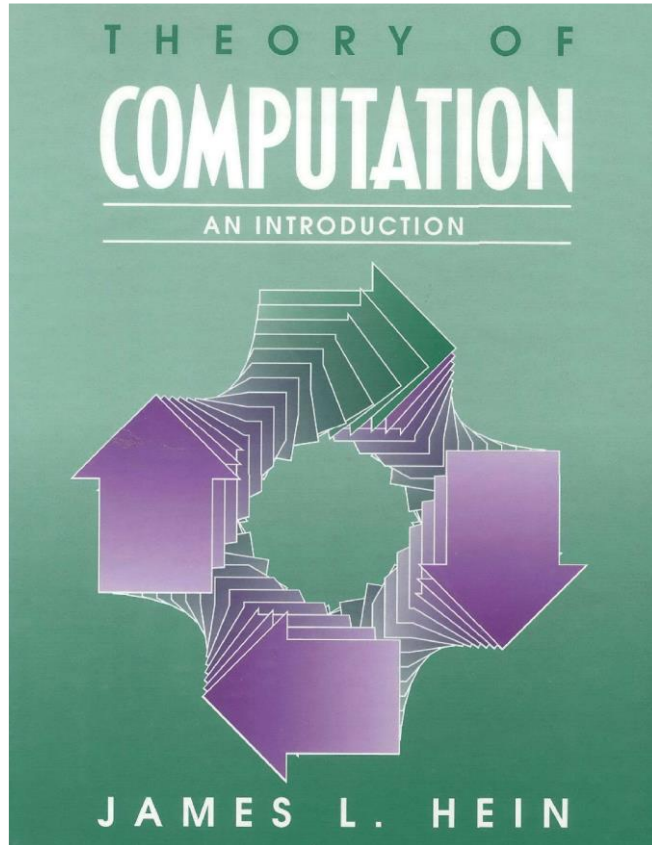


Automata and Formal Languages

Lecture 01

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 various icons.

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

Course password

Course files [add files](#)

Course URLs [add URLs](#)

Course assignments [add assignments](#)

Course Exams & Model Answers [add exams](#)

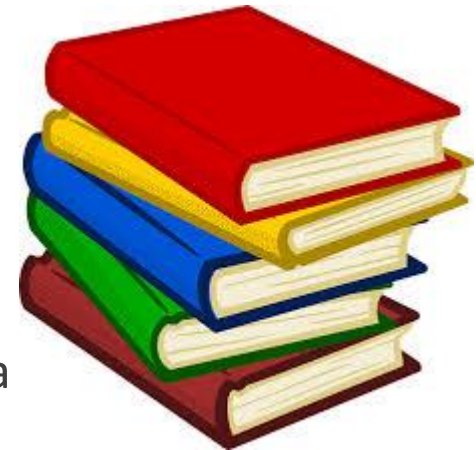
(edit)

Agenda

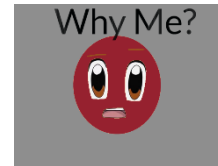
- Course Contents
- Why???
- A Simple Vending Machine
- Language
- Words
- Combining Languages
- Word Concatenations
- Properties

Course Contents

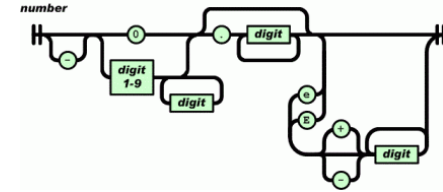
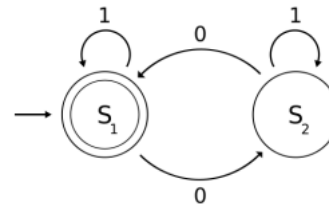
- Introduction to formal languages.
- Regular Languages and Finite Automata
 - Regular Languages
 - Regular Expressions
 - Finite Automata
 - Regular Grammar
 - Pumping Lemma (Regular Languages)
- Context-Free Languages and Pushdown Automata
 - Context-Free Languages
 - Pushdown Automata
 - Context-Free Grammars



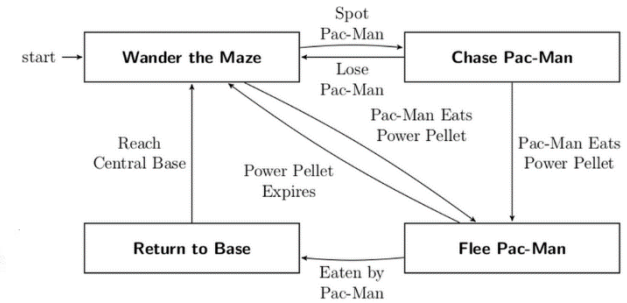
Why????????



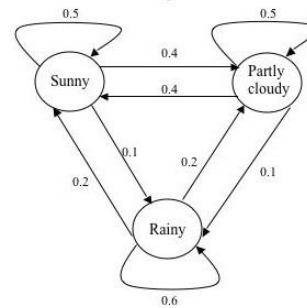
In compilers ,interpreters ,
natural language processing



a model of computation



artificial intelligence



in probability

.....

A Simple Vending Machine

Suppose we have a simple vending machine that allows the user to pick from two 10-cent items A and B. (To simplify things, the slot will accept only dimes.)



A Simple Vending Machine

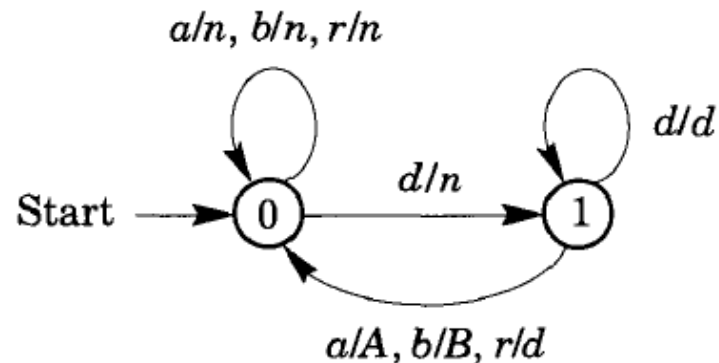
- There are four inputs to the machine:

- d (dime),
- a (select item A),
- b (select item B),
- and r (return coins).



- The outputs will be

- n (do nothing),
- A (vend item A),
- B (vend item B),
- and d (dime).



Words

A **word** over an alphabet is a finite sequence of letters.

$$A = \{a\}$$

$$W_1 = aaa$$

$$A = \{a,b\}$$

$$W_1 = aaa$$

$$W_2 = aba$$

Examples

$$A = \{a\}$$

$$L_1 = \emptyset$$

$$L_2 = \{\epsilon\}$$

$$L_3 = \{\epsilon, a, aa, aaa, aaaa, \dots\}$$

$$A = \{a, b\}$$

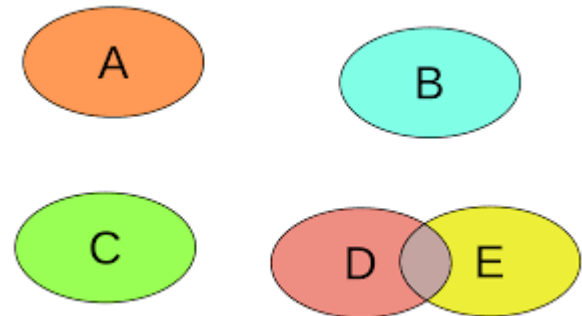
$$L_1 = \{a, aa, aaa, \dots\}$$

$$L_2 = \{aa, ab, ba, bb\}$$

$$L_3 = \{a, aa, ab, aaa, aab, aba, abb, \dots\}$$

Combining Languages

- Since languages are sets of strings, they can be combined by the usual set operations of:
 - union,
 - intersection,
 - difference,
 - and complement



Concatenations

- Another important way to combine two languages L and M is to form:
 - the set of all concatenations of strings in L with strings in M .
- This new language is called the product of L and M and is denoted by $L \cdot M$.
- $L \cdot M = \{s \cdot t \mid s \in L \text{ and } t \in M\}$



Word Concatenations

$W = bb$

$W.U = bbab$

$U = ab$

$U.W = abbb$

$V = b$

$W.W = bbbb$

$W.V = bbb$

$V.W = bbb$

Is $W.U = U.W$ for any
two words W and U ?

Example

- $L = \{ab, ac\}$
- and $M = (a, bc, abc)$

$L \cdot M = (aba, abbc, ababc, aca, acbc, acabc).$

Properties

$$L.\{A\} = \{A\}.L = L.$$

$$L.\emptyset = \emptyset.L = \emptyset.$$

$$L^0 = \{\Lambda\},$$

$$L^n = L \cdot L^{n-1} \quad \text{if } n > 0.$$

$$L^* = L^0 \cup L^1 \cup L^2 \cup \dots$$

$$L^+ = L^1 \cup L^2 \cup L^3 \cup \dots$$

Properties of Closure

Let L and M be languages over the alphabet A . Then

- a) $\{\Lambda\}^* = \emptyset^* = \{\Lambda\}$.
- b) $L^* = L^* \cdot L^* = (L^*)^*$.
- c) $\Lambda \in L$ if and only if $L^+ = L^*$.
- d) $(L^* \cdot M^*)^* = (L^* \cup M^*)^* = (L \cup M)^*$.
- e) $L \cdot (M \cdot L)^* = (L \cdot M)^* \cdot L$.

