CSE322

Formal Languages and Automation Theory

Lecture #0

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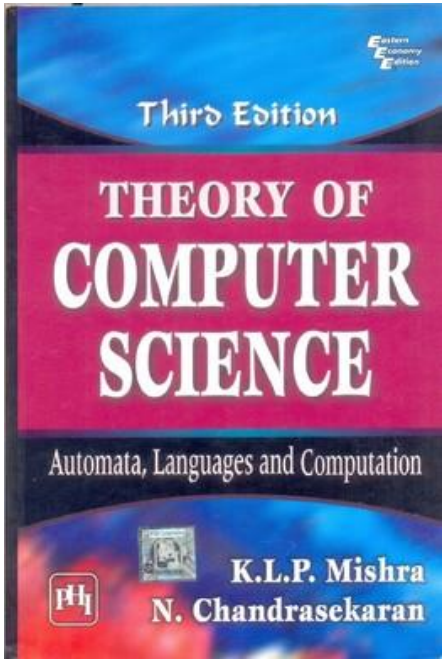
Course details

- LTP – 3 0 0 [Three lectures/week]

- Text Book
  - Theory of Computer Science: Automata, Languages and Computation
    - Author: KLP Mishra and N. Chandrasekaran



C ment Mode

1. >=90% marks -- 5
2. >=85% and <90% marks -- 4
3. >=80% and <85% marks -- 3

Each CA would be of 30

MTE would be of 40

ETE would be of 70 marks and it would be prorated to 50 at the end

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f 3)

- MTE 25
- ETE 50
- **Total 100**

Detail of Academic Tasks

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CSE322

- AT1: Test1 Lecture #11 (Before MTE)
- AT2: Test2 Lecture #19 (Before MTE)
- AT3: Test3 Lecture #33 (After MTE)

The course contents

- UNIT 1 - Finite automata
- UNIT 2 - Regular expressions and regular sets
- UNIT 3 - Formal languages and regular grammars
- UNIT 4 - Context- free languages and simplification of context-free grammar
- UNIT 5 - Pushdown automata and parsing
- UNIT 6 - Turing machines and complexity

Main Perspective

The three main perspective are:

- Why are we learning Automata Theory?
- What would we do with it?
- What will be the course outcome?

Why Study Automata Theory?

- Automata theory tells very important equivalence between
-

  a language: some -- usually -- infinite set of strings

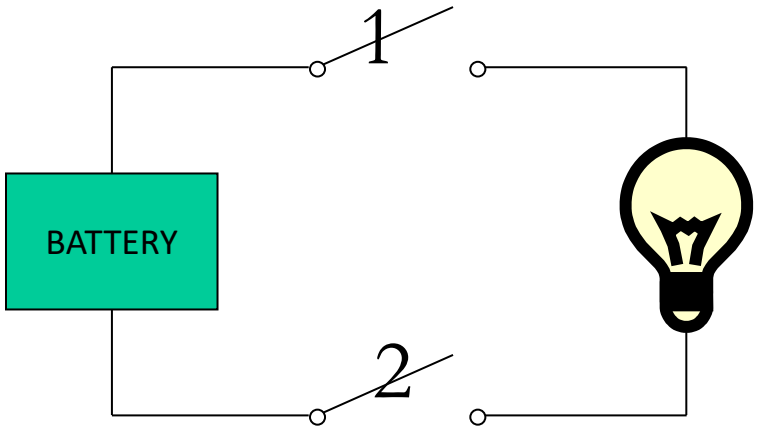
- a grammar: the finite set of rules to generate that language

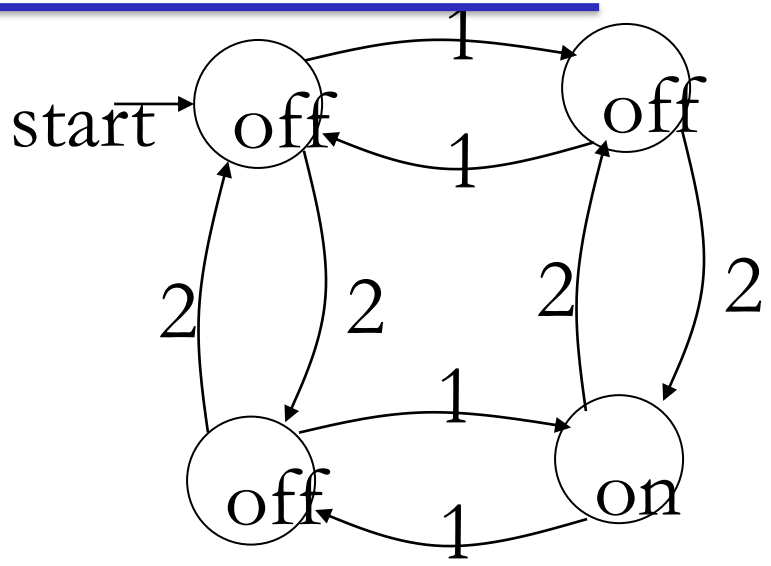
- an automaton: the abstract processing device that can recognize that language

Why Study Automata Theory?

- Automata theory is the study of abstract computational devices
- Abstract devices are (simplified) models of real computations
- Computations happen everywhere: On your laptop, on your cell phone, in nature, …
- Why do we need abstract models?

Why Study Automata Theory?





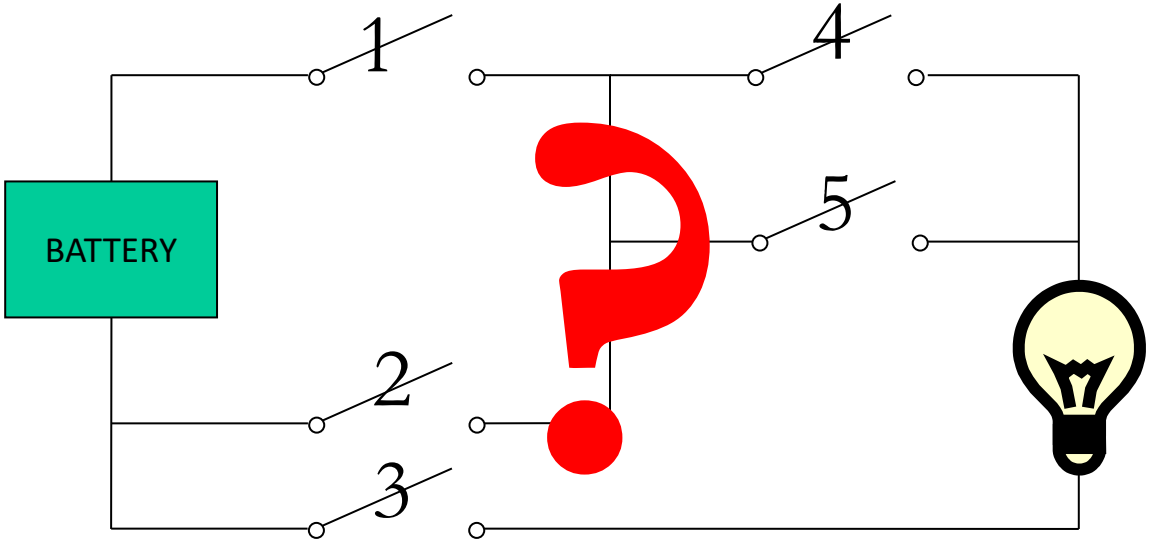
inputs: switches 1 and 2

actions: 1 for "flip switch 1"
2 for "flip switch 2"

states: on, off

bulb is on if and only if
both switches were flipped
an odd number of times

Why Study Automata Theory?



Can you design a circuit where the light is on if and only if all the switches were flipped exactly the same number of times?

Why Study Automata Theory?

- Such devices are difficult to reason about, because they can be designed in an infinite number of ways

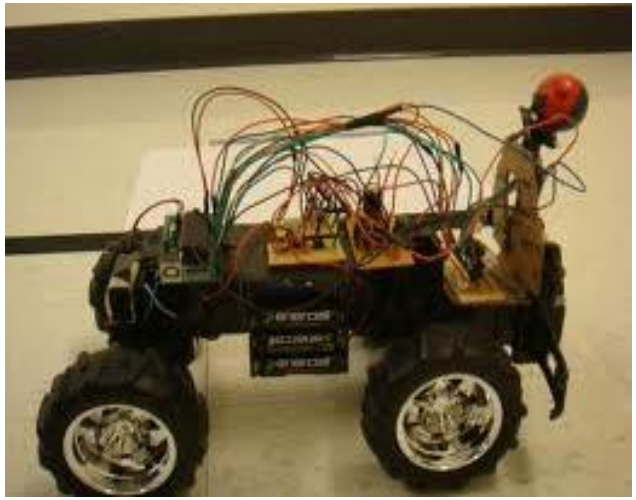
- By representing them as abstract computational devices, or automata, we will learn how to answer such questions

What would we do with it ?

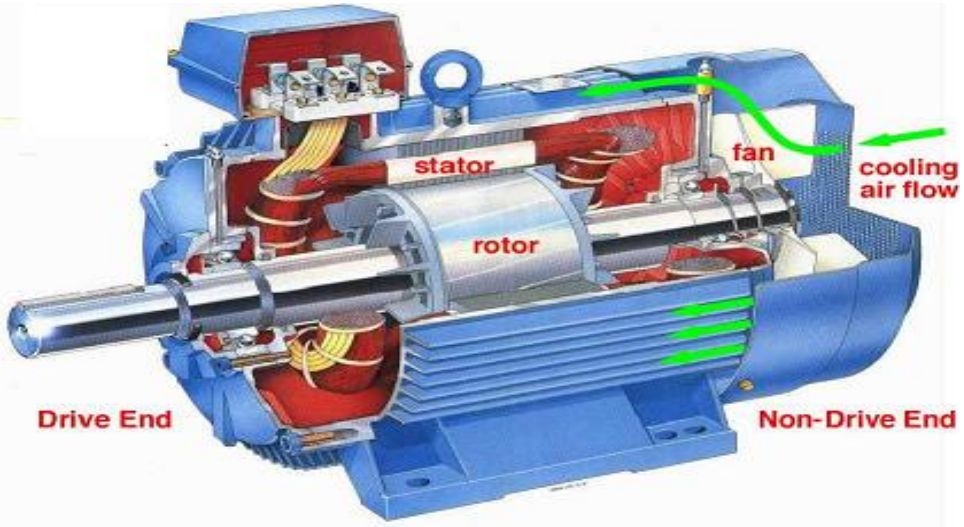
There are numerous applications of Formal languages and Automata Theory like:

- Text processing, Compilers and Hardware Design
- Motors and Vending machines
- Sensors and Transducers
- Automata Simulators
- And many more ….

Hardware design



Motor

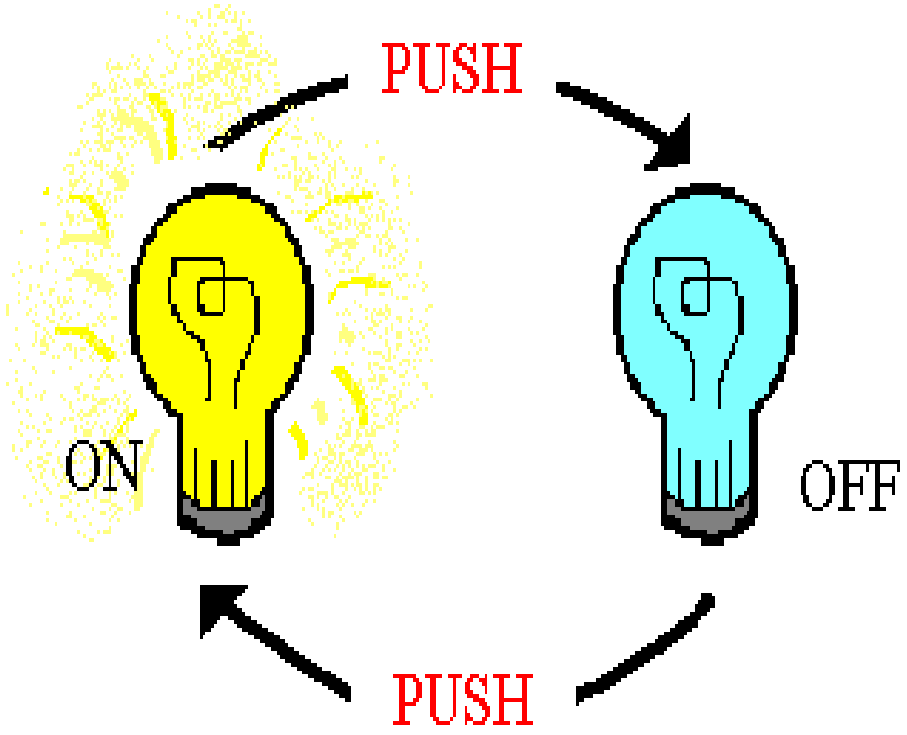


Vending machine

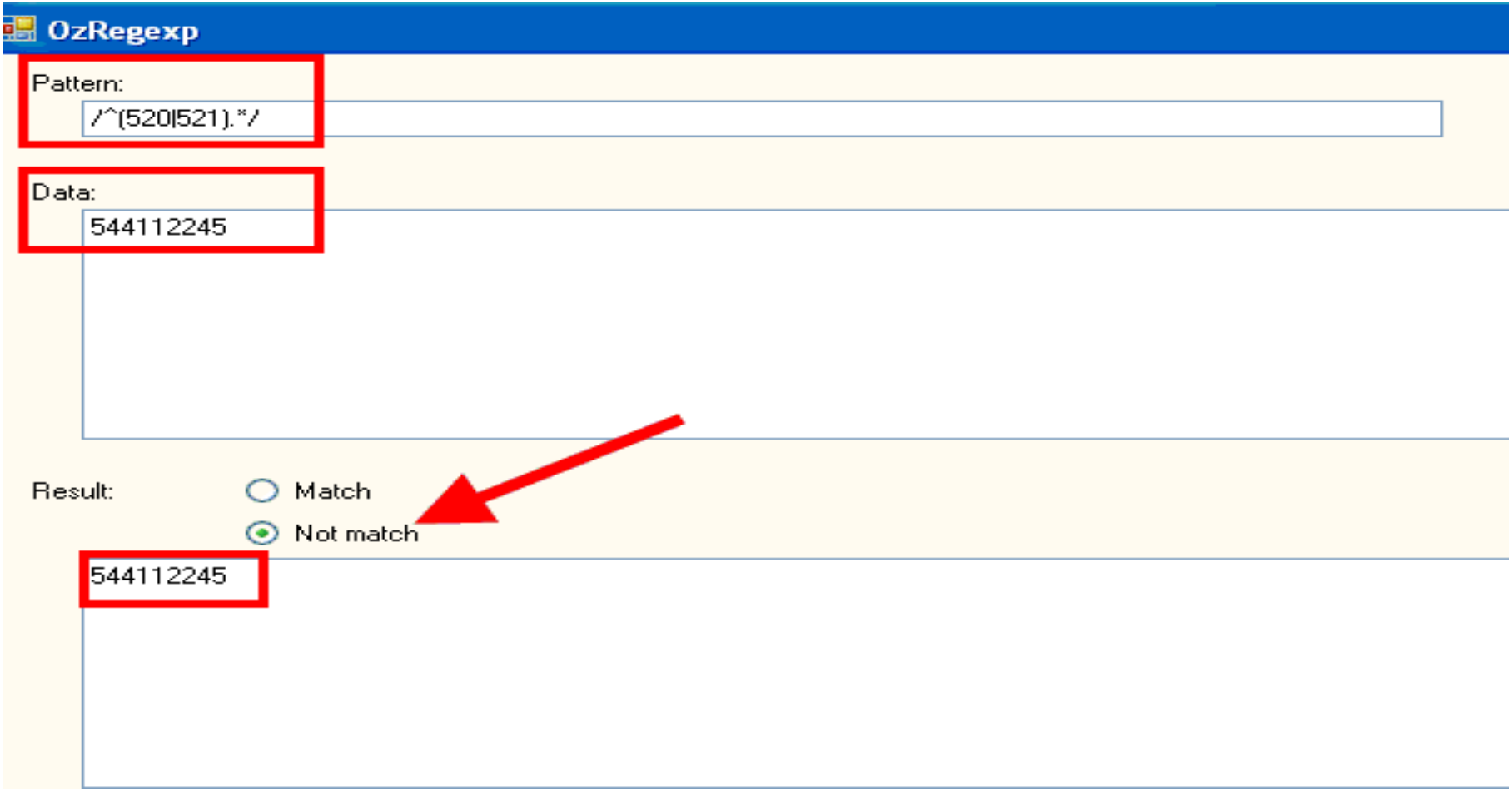
Transducers

Finite Automata

A lightswitch is an example of a finite automaton which has two states--on and off.



Regular Expressions and Regular Sets



Formal Languages &Regular Grammar

An **alphabet** is a set of symbols

{ a, b }

Sentences are strings of symbols

a, b, aa, ab, ba, a....

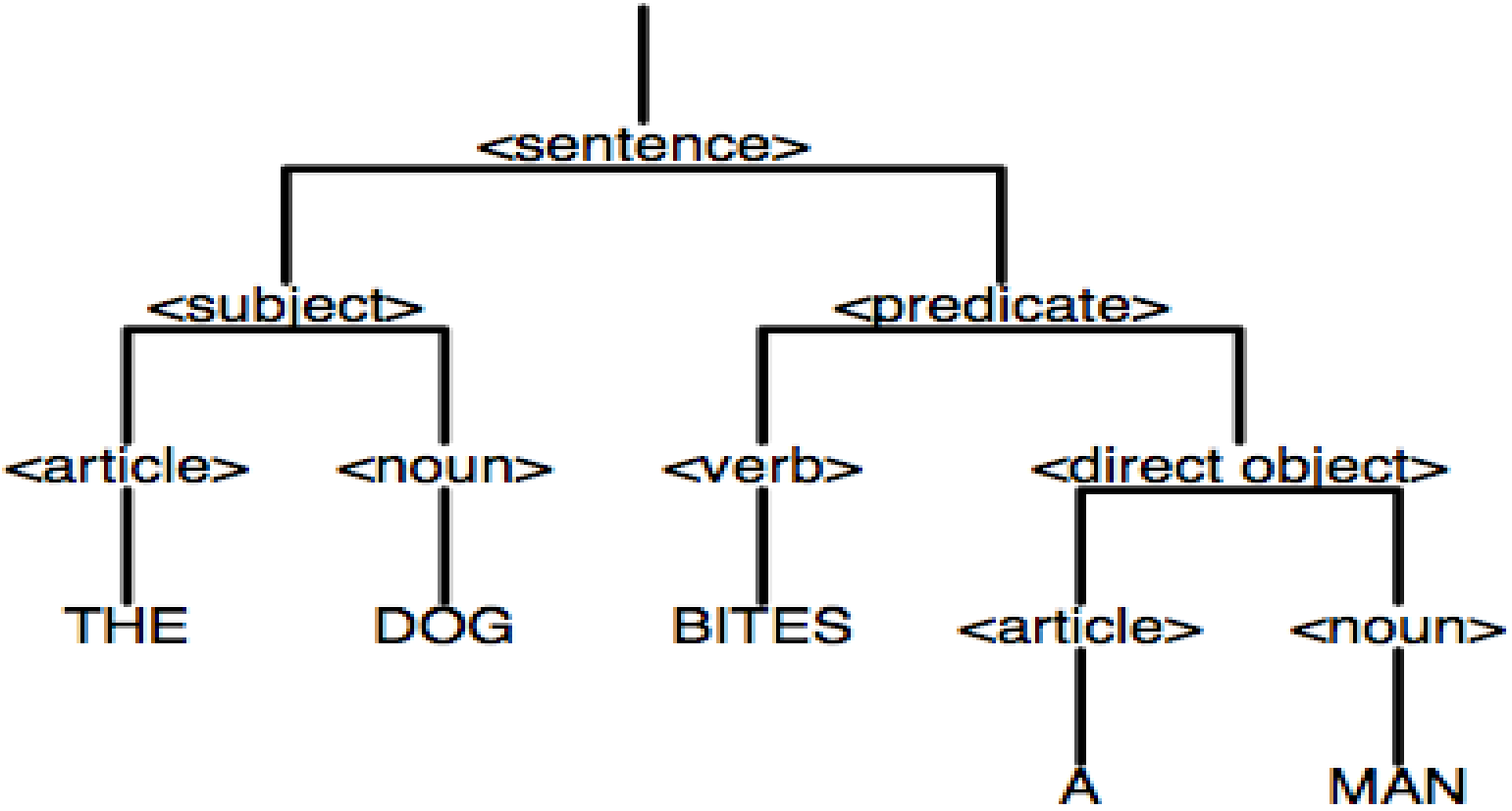
A **language** is a set of sentences

L = (aaa, abaa, aaba, bbb)

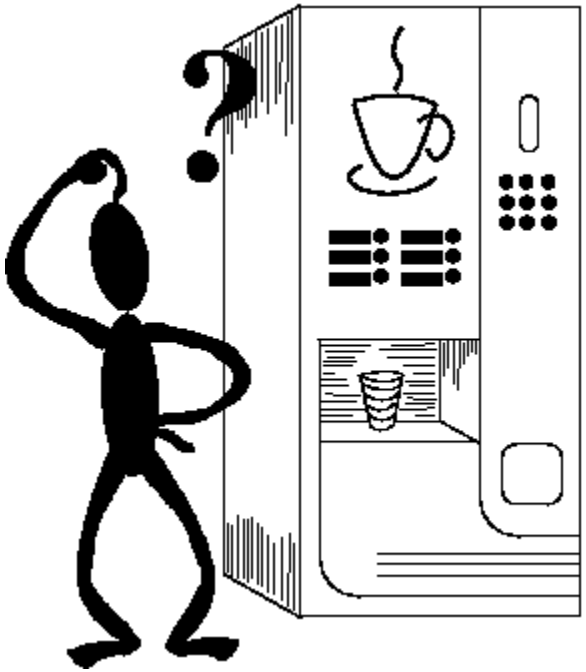
A **grammar** is a finite list of rules defining a language

S→ aA	B→ bB
A→ bA	B→ aF
A→ aB	F→ ε

Context-Free languages and Simplification of context-free grammar



Push Down Automata & Parsing



Turing Machine and Complexity

What will be the course outcome?

A student completing this course would be able to:

- Compute and differentiate between complete (or so it seems) and incomplete models of computation.
- Solve or prove unsolvable open problems.
- Determine reducibility and equivalence relations among unsolvable problems.
- Apply results to various other areas of Engineering.

Let's Start: Finite Automata