Logistics

MTE – 25

ETE – 50

CWS – 25

→ 5 Attendance

- >95% – 5
- 90 – 94% → 4
- 85 – 89 → 3
- 80 – 84 – 2
- 75 – 79 – 1
- <75 – 0

20 — Assignments
— Test

Books:

Hopcroft Ullman Introduction to Automata Theory, Languages & Computation.

Theory of Computation:

Symbol: a, b, c, d, 1, 2, 3 . . . . — Basic Building Blocks (letters, numbers)

Alphabet: $\Sigma = \{a, b\}$, $\Sigma = \{a, b, c\}$ — Subset of Symbols Σ

String: $\Sigma = \{a, b, c\}$ a, b, aa, bc, ca, cc . . . . — Sequence of Alphabets

$\Sigma = \{a, b\}$ a, b, aaa, ab, ba . . . . .

How many strings are possible of length n with $\{a, b\}$ alphabets?

Length 3

$$\underset{a,b}{\_}\ \underset{a,b}{\_}\ \underset{a,b}{\_}$$

$2 \cdot 2 \cdot 2$

$= 2^3$

aaa
aab
aba
abb
baa
bab
bba
bbb

$\Big\}$ 8 strings

Length n

$$\underset{2}{\_}\ \underset{2}{\_}\ \underset{2}{\_}\ \_\ \_\ \_\ \_\ \ldots\ \underset{2}{\_}$$

2^n

n → length

2 → no. of alphabets

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

$|\Sigma|$ = no of alphabets

no of strings of length n = $|\Sigma|^n$

Language — Collection of Strings

L_1 — Set of all strings of length 2

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

$L_1 = \{aa, ba, bb, ab\}$ → finite language

L_2 Set of all strings of length 3

$L_2 = \{aaa, aab, aba, abb, baa, bab, bba, bbb\}$

Language

finite infinite

L_3 Set of all strings where each string starts with a

$L_3 = \{a, aa, ab, aaa, aba, aaaa, \ldots\ldots\}$

Infinite language

Powers of Σ

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

Σ^1 = Set of all strings over Σ of length 1

$= \{a, b\}$

Σ^2 = Set of all strings over Σ of length 2

$= \Sigma \cdot \Sigma = \{a, b\}\{a, b\}$

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

$\Sigma^3 = \Sigma \cdot \Sigma \cdot \Sigma = \{a, b\}\{a, b\}\{a, b\}$

$|\Sigma^3|$ = Cardinality of Σ^3

$= \underline{\hspace{6cm}} \; \{a, b\}\{a, b\}\{a, b\} = 8$

no of elements in Σ^3

Σ^n = n length strings

Σ^0 = Set of all strings over Σ of length 0

$= \{\varepsilon\}$

↳ epsilon is a spcl symbol of length 0

$|\varepsilon| = 0$ (length of epsilon is 0)

$\Sigma^* = \Sigma^0 \cup \Sigma^1 \cup \Sigma^2 \cup \Sigma^3 \ldots\ldots \Sigma^n$

$= \{\varepsilon\} \cup \{a, b\} \cup \{aa, ab, ba, bb\} \ldots\ldots$

$= \{\varepsilon, a, b, aa, ab, ba, bb \ldots\ldots\}$

→ Set of all strings possible over $\{a, b\}$ of all length

Σ^*

$\boxed{\Sigma^0 \; \Sigma^1 \; \Sigma^2 \ldots \; \Sigma^n}$

Case 1: finite $\Sigma = \{a, b\}$

L_1 = Strings of length 2

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

'bc' ? X

Case 2: Infinite

L_1 = Strings starting with a

$= \{a, ab, aa, aba \ldots\ldots\}$

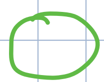
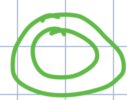
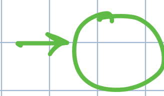
'bc' ?

Given a language L, you need a finite (machine) representation which can be stored in a memory and by using it you should be able to tell if a string is present in language or not.

Finite Representation

Finite Automata

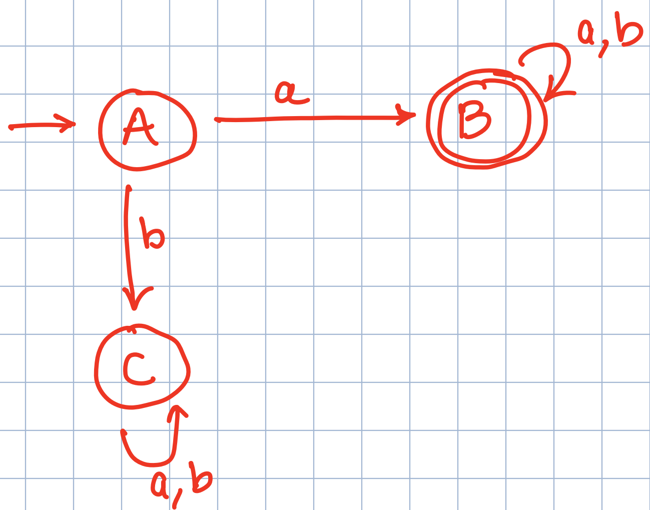
(i) Machine

State:  Final State:  Initial State : 

L_1 = Set of all strings which start with 'a'.

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

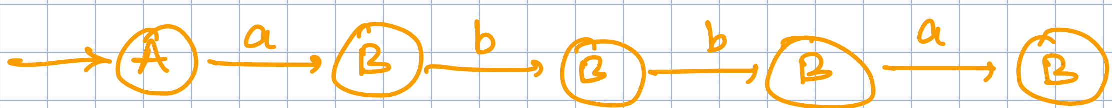
FA:



"abba"

"baa"

abba



final State (String is in the language)

baa

$\to A \xrightarrow{b} C \xrightarrow{a} C \xrightarrow{a} C$

(non final)

(String is not in the language)

Finite Automata

- FA without output
  - DFA
  - NFA
  - ε-NFA
- FA with output
  - moore
  - mealy

Attendance

76 — 150

						Absent
78	101	109	117	126	139	150
81	104	110	118	127	142	
90	105	111	119	128	143	
91	106	113	122	129	144	
99	108	116	123	133	146	
			124		147	