

Tutorial: DFA, NFA.

What we were calling a FA will now be called a

DFA - Deterministic Finite Automaton.

- exactly **one** transition can be made at each point in the computation, while $\exists$ input to be processed.

Exercises and Homework and Assignments.

Exercises - pointers to problems (usually in the text) that you can work on to learn the material

Homework - problems I assign you, NOT for handing in. I expect you **ask** questions if you run into difficulties.

Assignment - problems for you to do and for you to hand in - marked results will contribute to your grade

However - I will typically assign about 4 questions and mark about 2.

Exercises: 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10.
Do a handful in each category...
as many as you need to get good at it.

Defn: For $x, w \in \Sigma^*$, x is a substring
of w if $\exists u, y \in \Sigma^*$ such that $uxy = w$

E.g. $abcab = w$ then ab is a substring of w
So is bca
So is $abcab$
So is ϵ .

How to devise substring detector FAs.

Let $\Sigma = \{a, b\}$ for the FAs here, unless o.w. stated.

1. has "a" as a substring

2. has "ab" as a substring

3. has "aabb" as a substring

4. has "abaab" as a substring

5. For your homework: DFA
has "ababbab" as a substring.

How to convert a DFA that recognizes L
into one that recognizes $\overline{L}$.

"contains aab as a substring"

"does not contain aab as a substring".

Problems for us to work on today:

Assume $\Sigma = \{a, b\}$. Give DFAs.

1. $\{w \mid w \text{ does not contain exactly two } a\text{'s}\}$
2. $\{w \mid w \text{ ends in } ab \text{ or in } ba\}$.
3. $\{w \mid \text{every odd position is an } a\}$
4. $\{w \mid w \text{ contains at least 3 } a\text{'s}\}$

Give NFAs of the following size: $\Sigma = \{0, 1\}$

5. $\{w \mid w \text{ ends in } 011\}$, 4 states.
6. $\{\epsilon\}$, 1 state.

7. Give a NFA or DFA for :

$$\{ w \in \{0,1\}^* \mid |w| \equiv 2 \pmod 3 \text{ and } \text{2nd last symbol is } 0 \}$$

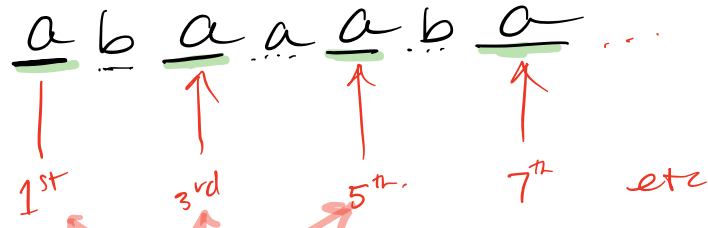
1. "not exactly 2 a's", $\Sigma = \{a,b\}$

2. "ends in ab or ba " $\Sigma = \{a,b\}$

3.

a b a a a b a ...

1st 3rd 5th 7th etc



All the odd positions in the string
must be "a"

Note - only applies to existing positions
E has no odd positions, so all its odd
positions are "a"

4. $\{w \in \{a,b\}^* \mid w \text{ contains } \geq 3 \text{ a's}\}$

5. NFA for $\{w \in \{0,1\}^* \mid w \text{ ends in } 00\}$,
3 states:

6. $\{\epsilon\}$, 1 state NFA:

Note: This is also a DFA
under our convention that
missing transitions go to dead
state