CPSC 421/501 Oct 15, 2025

- Bad news / good news:

Bad news:

- Midterm Oct 31 (2 weeks from Friday)

  Location: SWNG 222

  11am - 11:50am (45 minute exam)

Good news:

Last topic covered:

Myhill-Nerode Theorem

Bad news:

You'll need to write any regular expressions in [Sip] form.

Good news / bad news: All the conventions in [Sip] can be discerned from the regular expression for DIV-B4-3

Good news! You get a 2-sided note sheet, 8.5" x 11", handwritten or computer generated

Bad news! No microfiche readers.

Good new: Midterm study guide will soon appear.

Look at CPSC 421/501 2024, a little topics

Myhill-Nerode: See handout:

Non-Regular Languages and the Myhill-Nerode Theorem

For any $L \subset \Sigma^*$, Σ an alphabet, and for any $s \in \Sigma^*$

$$\text{AccFut}_L(s) = \{ s' \in \Sigma^* \mid ss' \in L \}.$$

The idea comes from "merging states" mentioned earlier by Auden H. (in 2025)

Accfut = "Accepting future"

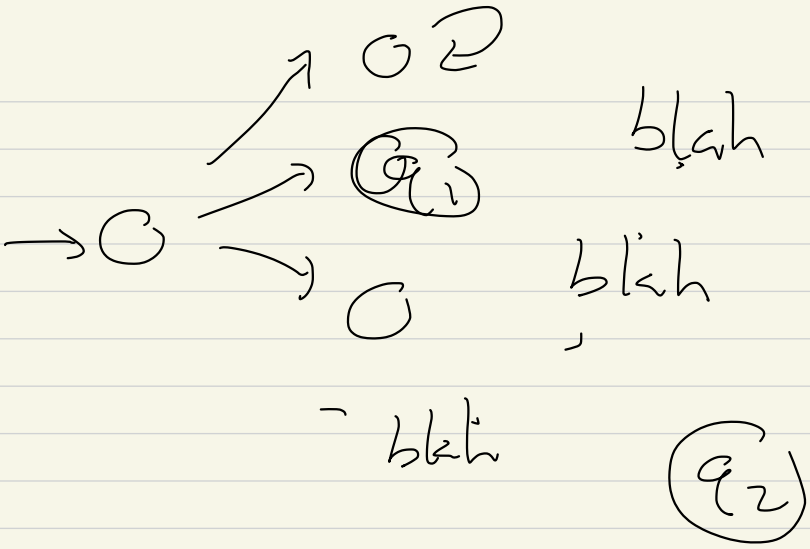
Lemma: Let $M = (Q, \Sigma, \delta, q_0, F)$ be a DFA, and $q_1, q_2 \in Q$. Then q_1 and q_2 can be "merged" iff ?????

Applications I:

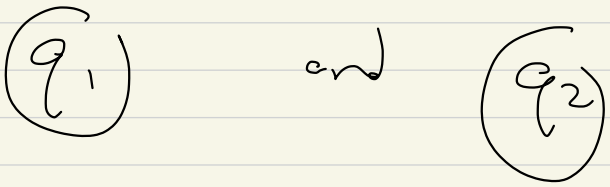
Min # states in

Σ^*, $abba$, $abba^*$,

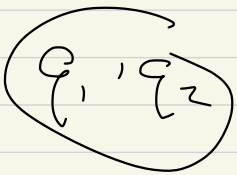
$a^2 \cup b$ or $aa \cup b$ or $(a \circ a) \cup b$



When can we merge states



can merge



??

You have a language, L,

Idea: Say that

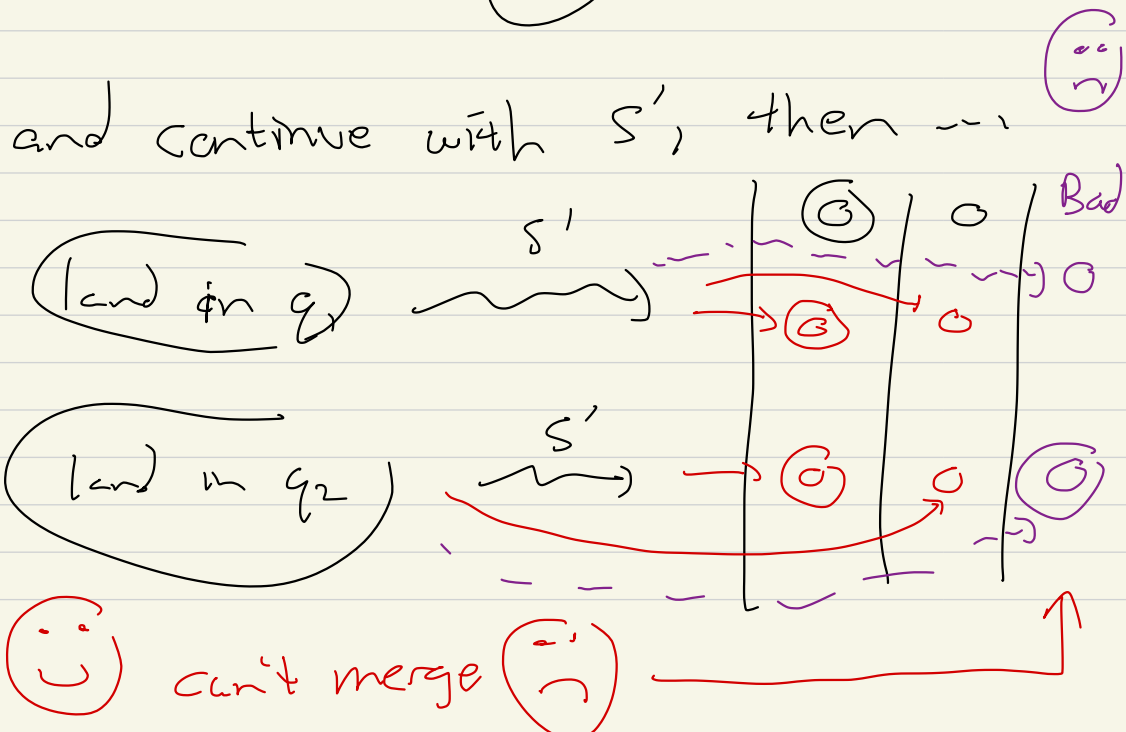
$\forall s' \in \Sigma^*$

if you land in q_1,

OR

" " " " q_2,

and continue with s', then ...



Skip the Pumping Lemma [Sip]

§ 1.4 — but use Myhill-Nerode

on homework and all exams

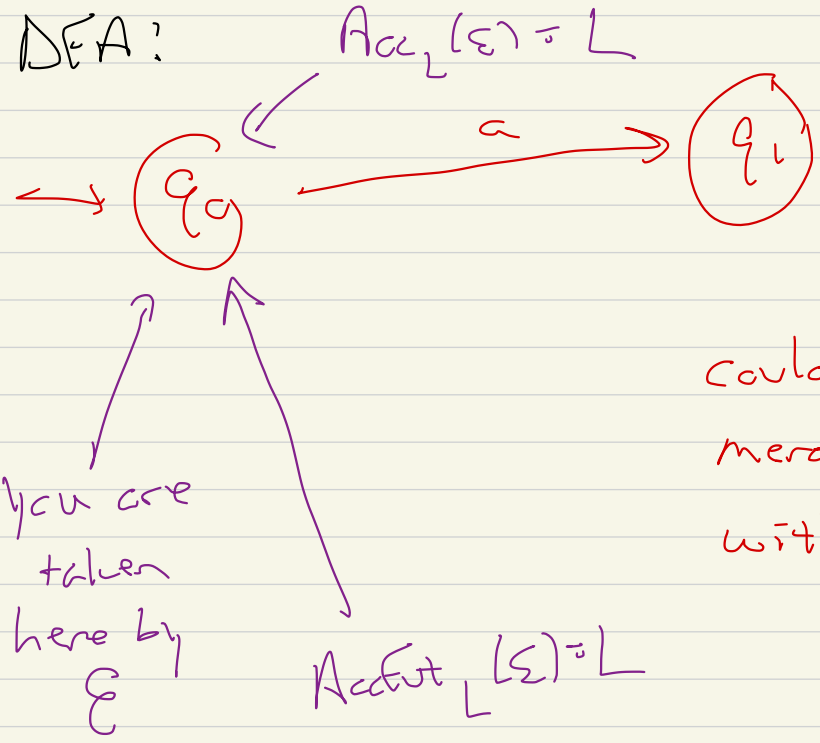
$AccFut$ = "Accepting future"

$$AccFut_L(s) = \{ s' \in \Sigma^* \mid ss' \in L \}.$$

The language described by $a^2 \cup b$, over $\Sigma = \{a, b\}$

$$L = \{ a^2, b \}$$

DFA:



$$Acc_{fut_L}(\varepsilon) =$$

$$\{ s' \mid \varepsilon s' \in L \} = \{ s' \in L \}$$

$$= L$$

$$Acc_{fut_L}(\cdot) : \Sigma^* \longrightarrow \text{Languages over } \Sigma$$

i.e. a subset of Σ^*

Can we merge q_1 & q_0 ?

No, because

$$Acc_{fut_L}(\varepsilon) = L$$

$$Acc_{fut_L}(a) = \{ s' \mid s' \in \Sigma^*, as' \in L \}$$

correction Auden — thanks S.A.

$= \{ s' \mid a \}$

for which s' is

$a s' \in L = \{ a^2, b \}$

$a s' \in \{ a^2, b \}$

$a s' = aa$, $a s' = b$

~~$a s' = aa$~~

$s' = a$

~~$a s' = b$~~

What about any regular language?

How time complex, .. ?

Well ...

See you Friday ...

For Friday...

$$aba^* = (a \circ b) \circ (a)^*$$

Applications 2 : Non-regular languages:

$$\{ a^{n^2} \mid n \in \mathbb{N} \}$$

$$\{ a^{n^2} b^{3n+2} \mid n \in \mathbb{N} \}$$

$$\{ a^p \mid p \text{ prime} \}$$

$$\{ a^n b^n \mid n \in \mathbb{N} \}$$

$$\{ a^n b^n a^n \mid n \in \mathbb{N} \}$$

Class Ends ...

$L \subset \Sigma^*$ $\Leftrightarrow$

$L \in \text{Power}(\Sigma^*)$

$\text{Power}(\text{Power}(\Sigma^*))$

(subset of all languages)

often called "(complexity) class"