

Oct 4–5

COMPSCI 3331

Fall 2022

What's next?

- ▶ Quiz 1 grades available now on gradescope
- ▶ Assignment 1: out now, due Oct 11.
- ▶ Quiz 2: Oct 5. Lecture 4, part 3.
- ▶ Midterm: October 25.
- ▶ Office hours: this Thursday - 1-3 PM.

A1 Q1

► $L_1 \subseteq L_2$. What does it mean?

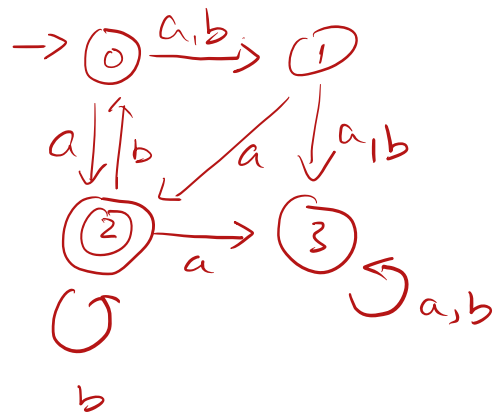
► How do we use this?

$$x \in L_1 \rightarrow x \in L_2.$$

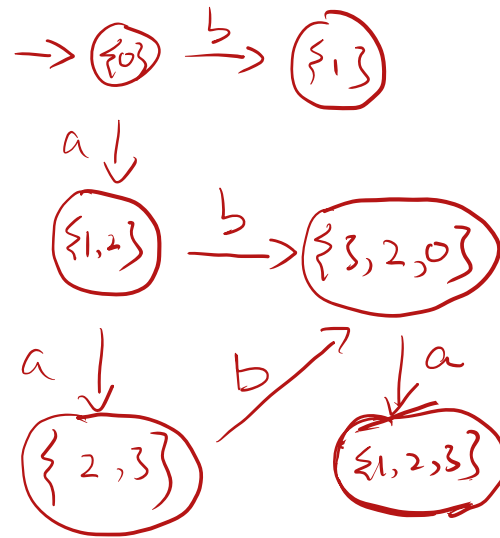
goal: $L_1^* \subseteq L_2^*$.

$$\text{iff } \forall x \in L_1^* \rightarrow x \in L_2^*.$$

Subset Construction

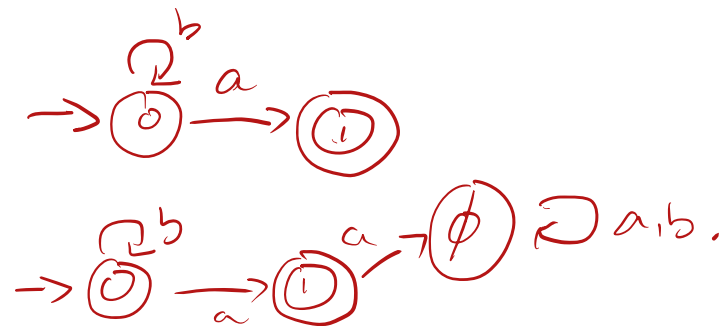


it ends when nowhere
new state is found.
(all possible subsets are
reached)
any state containing
2 is final state.



Since DFA must be complete,
sink states are required.
But NFA does not.

Empty sets are allowed in DFA.
Not all DFA has empty sets.



Regular expression:

$(ab)^*(cd)^*$.

- abababcd
- abcdcd
- cd.

Automata \leftrightarrow Regular expression.

Reg exp to ε -NFA example

Translate $r = (aba)^*(bb + aa)$

why ε -NFA?

make sure the answer is correct.

DFA to Reg Exp example

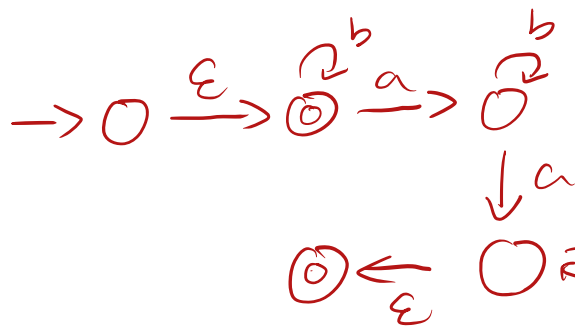


State eliminations.

DFA

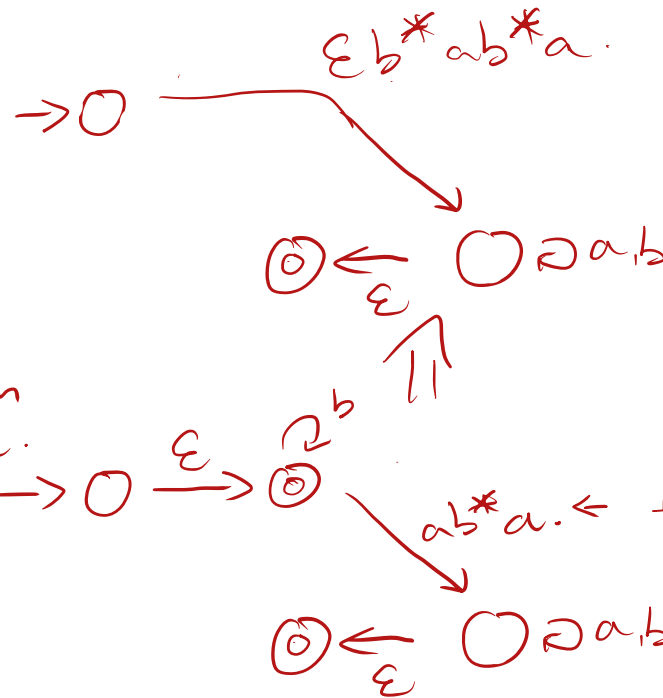


ε-NFA. \Downarrow



eliminate
a random
transition.

\Rightarrow



→ $Q \xrightarrow{\epsilon b^* a b^* a (a+b)^* \epsilon} Q$

\Downarrow

ab^*a . ← this expression could
only be in middle
step.

Midterm Format

- ▶ Midterm will be a **two-stage exam**
- ▶ Contains both an individual and a group portion.
 - ▶ You write the individual portion, then hand it in. *just like normal midterm.*
 - ▶ You get into groups of 4 (assigned). *random.*
 - ▶ You solve a subset of very similar problems with your group and hand in **one copy**.
- ▶ Your mark will **never go down** because of the group portion.

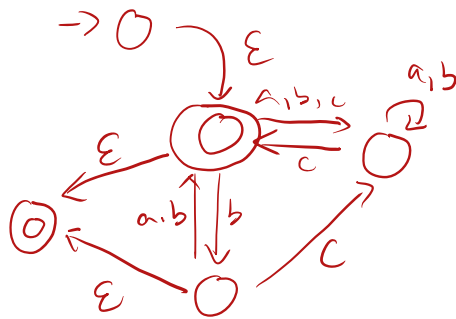
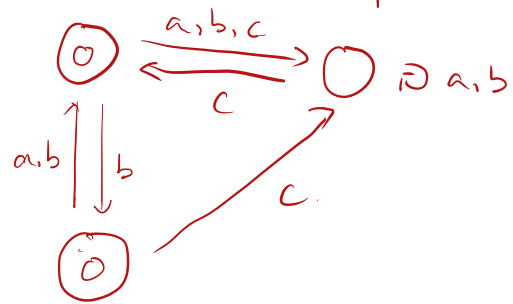
Midterm Format

- ▶ You must write both parts of the midterm.
- ▶ Individual Portion: 90 % of your grade.
- ▶ Group Portion: 10 % of your grade.
- ▶ But your mark will never go down because of the group portion (if you write it). ($\max(.9S_1 + .1S_2, S_1)$)
- ▶ Time: 80 minutes for individual stage, 5 minutes to find groups, 20 minutes for group stage.

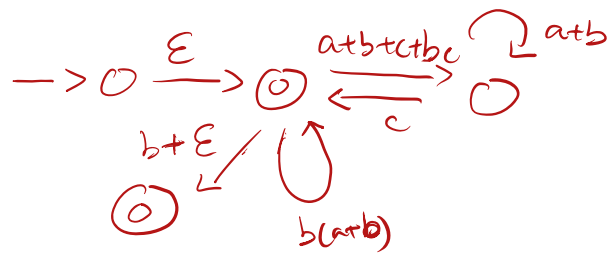
Midterm Groups

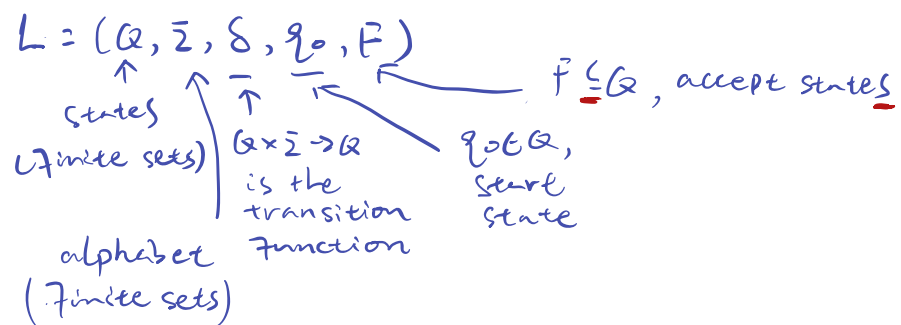
- ▶ Groups have been assigned randomly.
- ▶ Group numbers and names will be distributed to you before the exam
- ▶ A map of the exam room will be distributed showing the meeting zone for all groups.
- ▶ Practice Group finding time on Oct 18 in class.

Conversion Example:



ϵ -transition to the final/start state.





Assume we have

$$M_1 = (Q_1, \bar{Z}_1, \delta_1, q_{01}, F_1)$$

$$M_2 = (Q_2, \bar{Z}_2, \delta_2, q_{02}, F_2)$$

$$\overline{M_1} = (Q_1, \bar{Z}_1, \delta_1, q_{01}, \underline{Q - F_1}) \Leftarrow \odot \Leftrightarrow \bigcirc, \text{ which works for DFA only.}$$

if it is NFA, it should be converted to a DFA first.

$$M_1 \cup M_2 = (Q_1 \times Q_2, \bar{Z}, \delta, q_1 + q_2, F)$$

in the union case, the final state be the union of final states, and so does the transition.

$M_1 \cap M_2$. \Leftarrow if it is an intersection, switch to the intersection and keep others same as union.