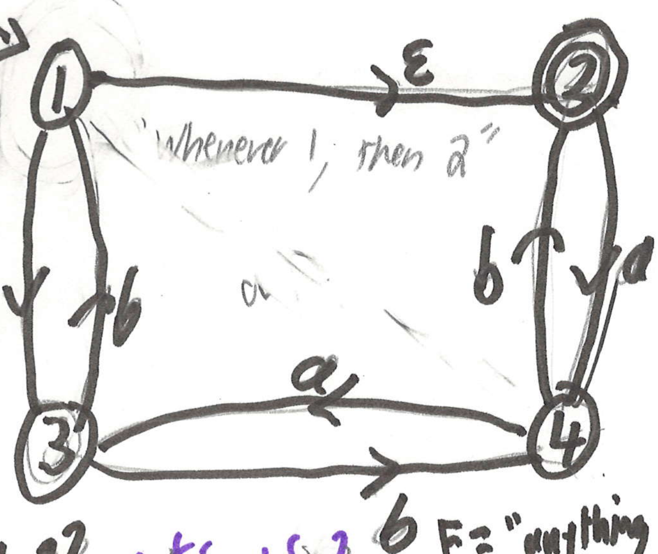
CSE 491/596 Lecture Wed. 13 Sep. 2023. Fall 2023

NFA-to DFA from Fall 2022 HW1



δ	a	b
1	$\emptyset$	{3}
2	{4}	$\emptyset$
3	$\emptyset$	{1, 2, 4}
4	{3}	{2}

No column for ε like in Sipser—that's the point.

$S = \{1, 2\}$ not just {1}

$\underline{\delta}(p, c) = \{r$: you can get to r by an arc on c from p, then any trailing εs$\}$

For all $P \subseteq Q$ that we've reached,

$\Delta(P, c) = \bigcup_{p \in P} \underline{\delta}(p, c)$.

$\Delta(S, a) = \Delta(\{1,2\}, a) = \underline{\delta}(1, a) \cup \underline{\delta}(2, a) = \emptyset \cup \{4\} = \{4\}$

$\Delta(\{1,2\}, b) = \underline{\delta}(1, b) \cup \underline{\delta}(2, b) = \{3\} \cup \emptyset = \{3\}$

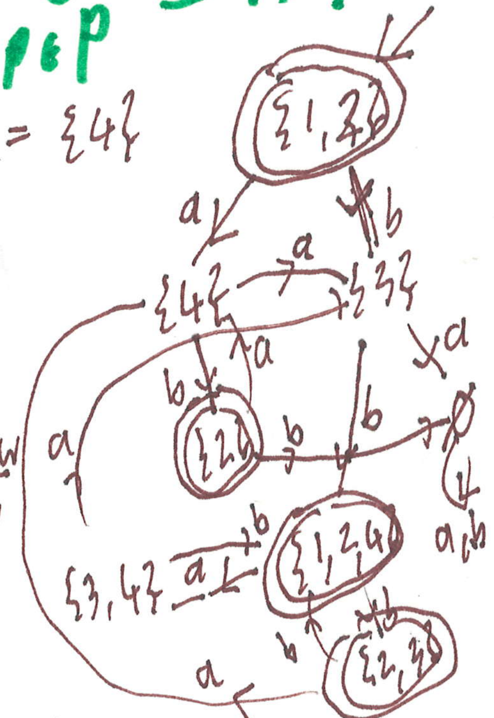
$\Delta(\{4\}, a) = \underline{\delta}(4, a) = \{3\}$, $\Delta(\{4\}, b) = \underline{\delta}(4, b) = \{2\}$

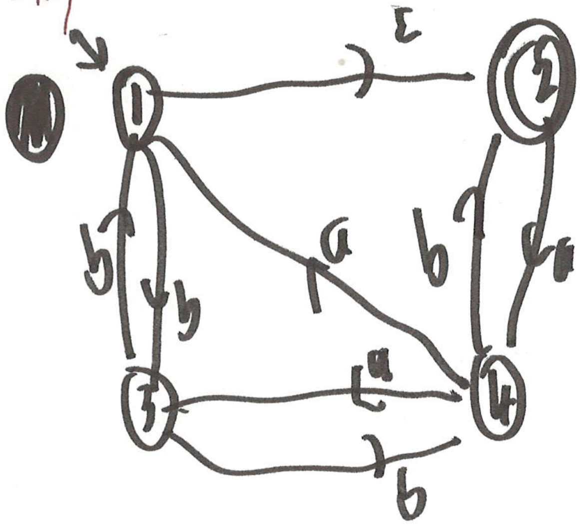
$\Delta(\{3\}, a) = \underline{\delta}(3, a) = \emptyset$ $\quad \Delta(\{3\}, b) = \underline{\delta}(3, b) = \{1, 2, 4\}$

$\Delta(\{1,2,4\}, a) = \underline{\delta}(1, a) \cup \underline{\delta}(2, a) \cup \underline{\delta}(4, a) = \emptyset \cup \{4\} \cup \{3\} = \{3, 4\}$, new

$\Delta(\{1,2,4\}, b) = \underline{\delta}(1, b) \cup \underline{\delta}(2, b) \cup \underline{\delta}(4, b) = \{3\} \cup \emptyset \cup \{2\} = \{2, 3\}$ new

Expanding {3, 4} and {2, 3} closes the BFS, so we stop.





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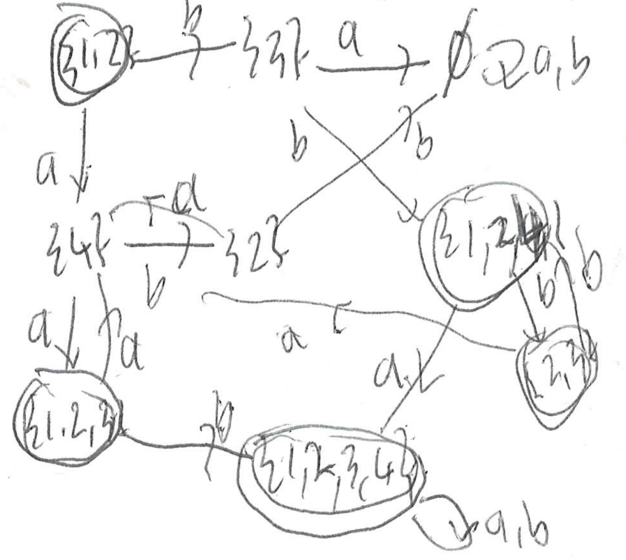
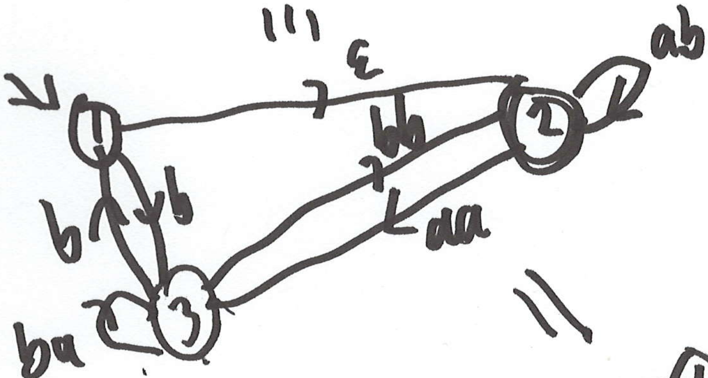
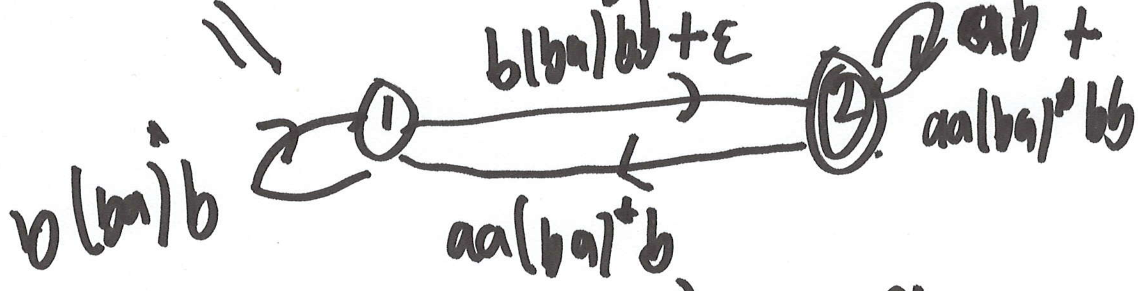


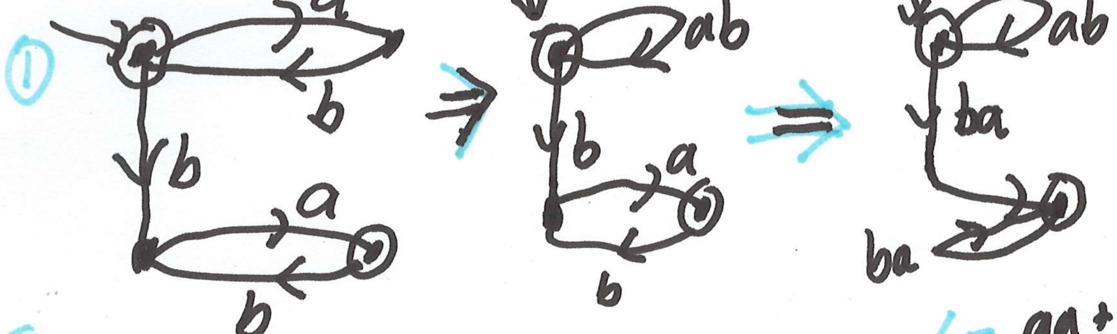


Can we write a regexp for the NFA without the (4, a, 1) arc?

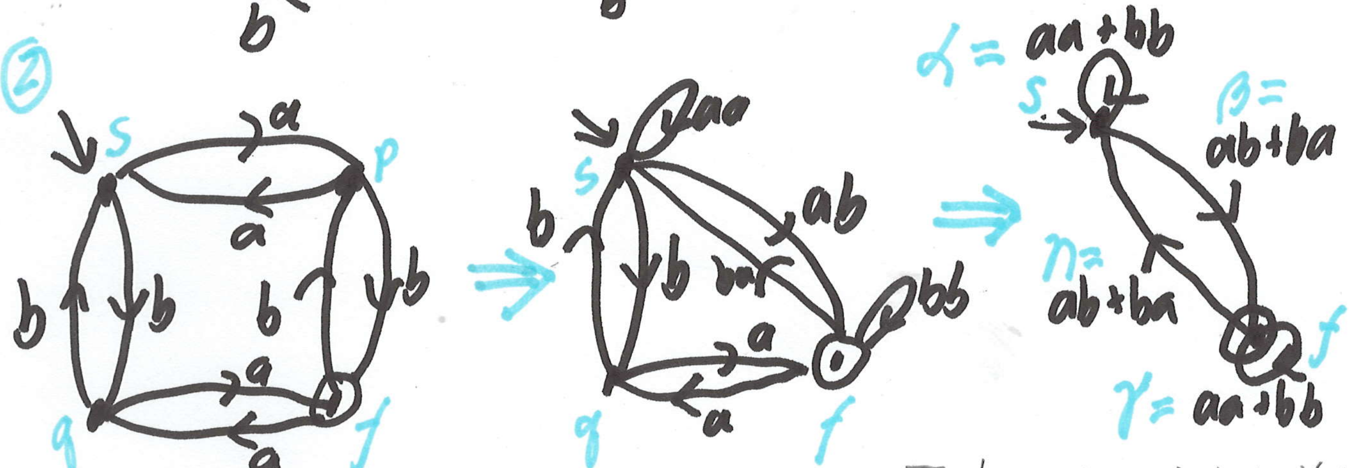


L(2-state "Generalized NFA") → Friday.

Added: Some more examples of FAs-to-regexps.

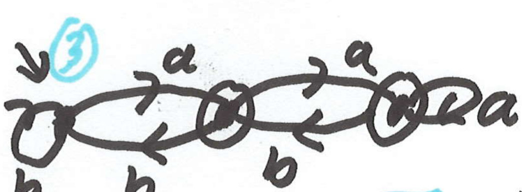
① 

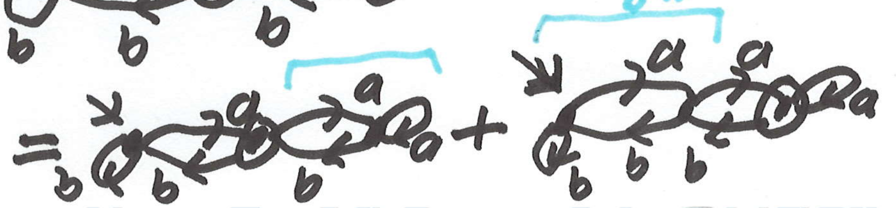
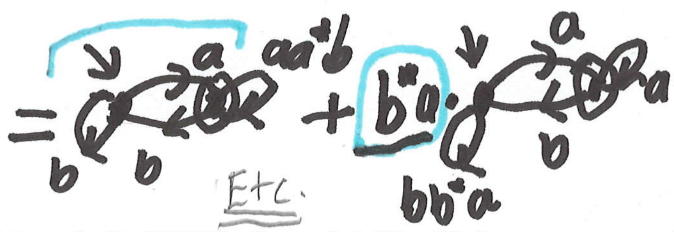
$= (ab)^* + (ab)^* ba (ba)^* \equiv (ab)^*(ba)^*$

② 

$L_{sf} = (\alpha + \beta\gamma^*\eta)^* \cdot \beta\gamma^*$

$= (aa + bb + (ab+ba)(aa+bb)^*(ab+ba))^* \cdot (ab+ba)(aa+bb)^*.$

③ 

$=$  $+ \boxed{b^*a} \cdot$ 

Etc.