Announcements

Assignment problems from Text Sheet 1
- 1c, 1d, 2b, 3a due Feb 1, Monday
  (Attempt all problems that are covered in lecture)
- Short quiz on Wed (Jan 27)

Relation between r.e. and Finite Auto

NFA with ɛ-moves

\[
\begin{align*}
&\text{NFA with ɛ-trans. can be simulated by NFA} \\
&\text{w}_1: 0^1 1^2 0^1 1^0 \\
&\text{w}_2: 0^0 0^0 1^1
\end{align*}
\]
To show equivalence between two machine models $M_1$ and $M_2$, we must show that:

(i) $M_1$ can simulate $M_2$

(ii) $M_2$ can simulate $M_1$

"simulate": we can design a machine to accept the same language as the other machine

$\varepsilon$-closure ($q_0$): All the states reachable from $q_0$ with only $\varepsilon$-transitions.

If $\varepsilon$-closure ($q_{go}$) $\cap$ F $\neq \emptyset$ then $q_{go}$ is a final state in the NFA without $\varepsilon$-transition.
Finite Automata vs r.e.

(i) Build a FA for a given r.e.

(ii) For a given FA, we must design an equivalent r.e.

\[ \Sigma: \{0, 1\} \]

Bar case 0, 1, 0, 1, \epsilon, \emptyset

\[ \rightarrow 0 \rightarrow 0 \]

Using NFA with \epsilon-transitions we can convert any NFA to an equivalent NFA with exactly one final and one initial state.
Continued with

\[ L = \emptyset \]

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\[ \phi \]

\[ L_1 + L_2 \quad L_1 \cdot L_2 \]

Proof (Construction) on the regular expression

Inductively we can construct NFA for \( n_1 \), \( n_2 \) and \( n_1 + n_2 \)

\[ |n_1|, |n_2| \] are strictly smaller than \( |n_1 + n_2| \)

\[ (a+b)^* \]

The length of the regular expression

\[ (n_1)^* \]
\( \eta_1 \) 

\[ \varepsilon \quad \text{Of} \quad \varepsilon \]

\( \lambda \quad \eta_1 \quad \eta_2 \quad \eta \)

\[ w \in \eta_1 \cdot \eta_2 \iff w, \varepsilon \in \eta_1, \quad w_2 \in \eta_2 \]

\[ n^* \quad \varepsilon \]

Does this accept exactly \( n^* \)?