Finite Automata

CS712
Dept. of Computer Science
Univ. of New Hampshire
Example

70 the initial state

① a final state

Accept: start in initial state, "consume" the string one symbol at a time by traversing an arc from the current state labelled with the symbol, and when string is fully consumed you are in a final state.

Reject: end in a non-final state.

The language of a finite automaton is the set of strings it accepts.
deterministic Finite automaton (DFA)

Each state has exactly one arc leaving it for each alphabet symbol.

Note: usually don't draw "error" arcs; they all go to a single, non-final "sink" state.

e.g. [Diagram of a DFA with states and transitions labeled with symbols a, b, and q.]
A state may have more than one arc labelled with the same symbol leaving it.

An arc can be labelled with $\lambda$, i.e., no input consumed when an arc is traversed.

An NFA accepts a string $w$ if there is a path from the initial state to some final state such that $w$ is the concatenation of the symbols on the arcs of the path. Otherwise, the NFA rejects the string.
All NFAs with more than one final state can be transformed to equivalent NFAs with a single final state.

\[ ((ab)^+) \cup ((ba)^+) \]
All NFAs with no final states can be transformed to equivalent NFAs with a single final state.

Let $M$ be: $\begin{array}{c}
\rightarrow \\
\rightarrow
\end{array}$

$L(M) = \emptyset$

i.e. no arcs to the final state
All NFAs with an initial state that is also a final state can be transformed to equivalent NFAs with initial states that are not final states.

\[ \bigcirc \Rightarrow \bigcirc \rightarrow \bigcirc \]