Non-deterministic Finite State Automaton

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Problem of Language Unions

Given two regular languages, L and L' are regular, then L $\cup$ L' is also regular.

M = (Q, Σ, δ, q0, F)

M' = (Q', Σ, δ', q0', F')

Make a DFA M'' which accepts L1 $\cup$ L2.

- Q'' = Q $\times$ Q'
- q0'' = q0 $\times$ q0'
- δ'' ((qi, qj'), a) -> (δ(qi, a), δ(qj', a))
- F'' = {F$\times$Q' $\cup$ Q$\times$F'}

Proof that this works - let s = w1w2w3...wn which is accepted.

Then $\exists$ r0', r1', ... rn" st rn'' $\in$ F'' and δ(ri', wi") = ri+1

But by definition, rn'' is (rj, rk') where either rj accepts s or rk' accepts s.

Non-Deterministic Finite State Automaton

Instead of moving to one state only, it goes to a set of states.

N = (Q, Σ, δ, q0, F)

δ: (Q $\times$ (Σ, ϵ)) -> $\bigcup$ Qi where i $\in$ **N**