

NFA $\xrightarrow{\text{equiv}}$ regex

Thm: For any NFA N , there exists a regex that denotes $L(N)$.

Proof is by construction.
 Start with $N = \langle Q, \Sigma, \delta, q_0, F \rangle$

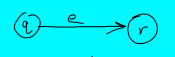
Def: A generalized finite automaton (GFA or GNFA) is a tuple $\langle Q, \Sigma, \delta, q_0, F \rangle$

where Q, Σ, q_0, F are as with an NFA, and

$$\delta: Q \times Q \rightarrow \text{REG}_\Sigma$$

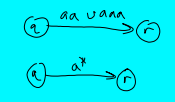
[REG_Σ is the set of all regexes over Σ .]

We allow arbitrary regexes as edge labels:

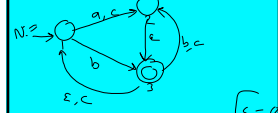


means $\delta(q, r) = e$
 e is a regex over Σ .

Can move from q to r by reading the next chunk of the input if it is in e .



Note: An NFA can be trivially converted to a GNFA. Ex:



Tabular form:

$\delta(q_i, q_j)$	1	2	edges cross
1	$a \cup b \cup c$	b	
2	ϵ	$a \cup b \cup c$	
3	$\epsilon \cup c$	$b \cup c$	ϵ

Plan: Given N
 1. Make N clean.
 2. Let G_0 be the GNFA equiv to N (as described above)