Another example of constructing an NFA and ~~and~~ converting it to an equivalent DFA.

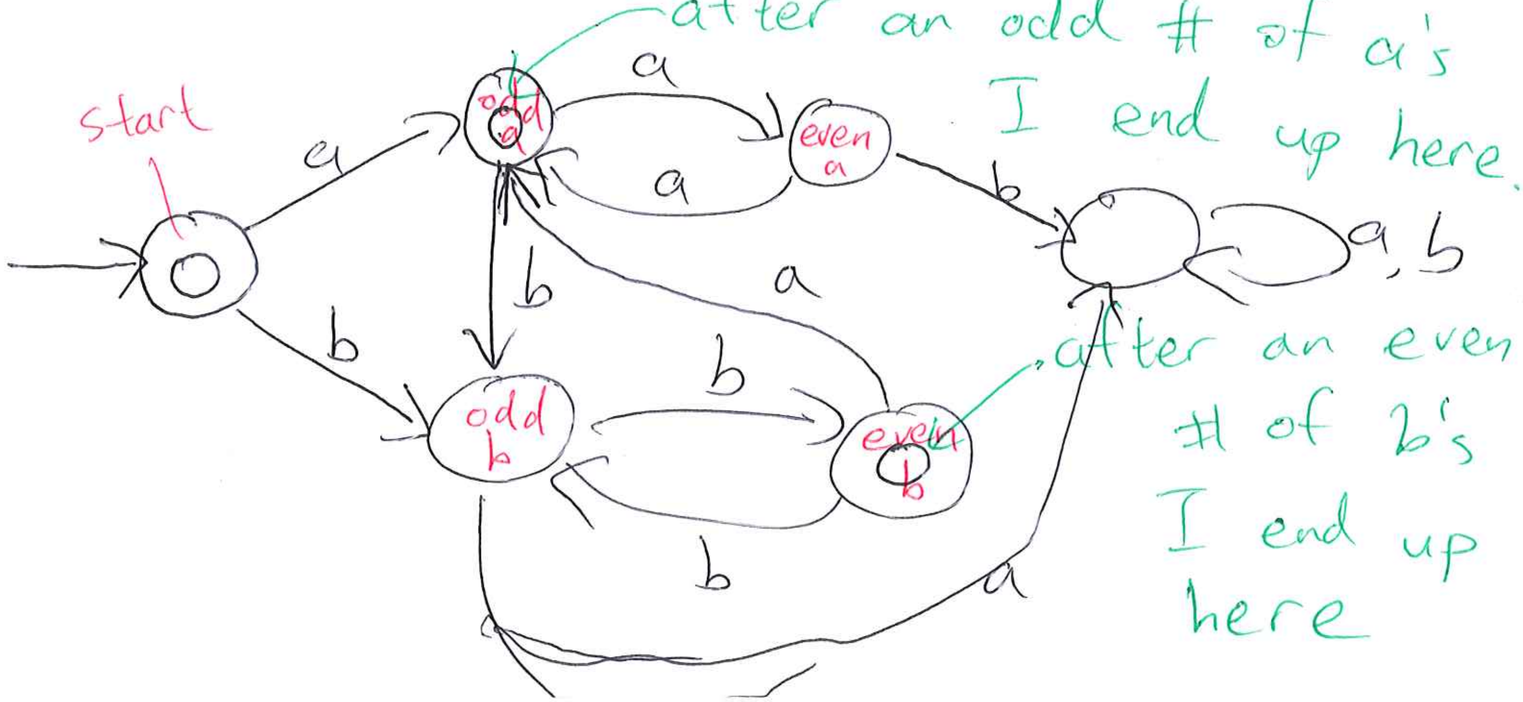
I want an NFA accepting strings on $\{a,b\}$ where in any run ~~of a's, t~~ of consec. a's, the # of a's is odd and in any run of consec b's, the # of b's is even.

Oh I guess I managed to get a DFA

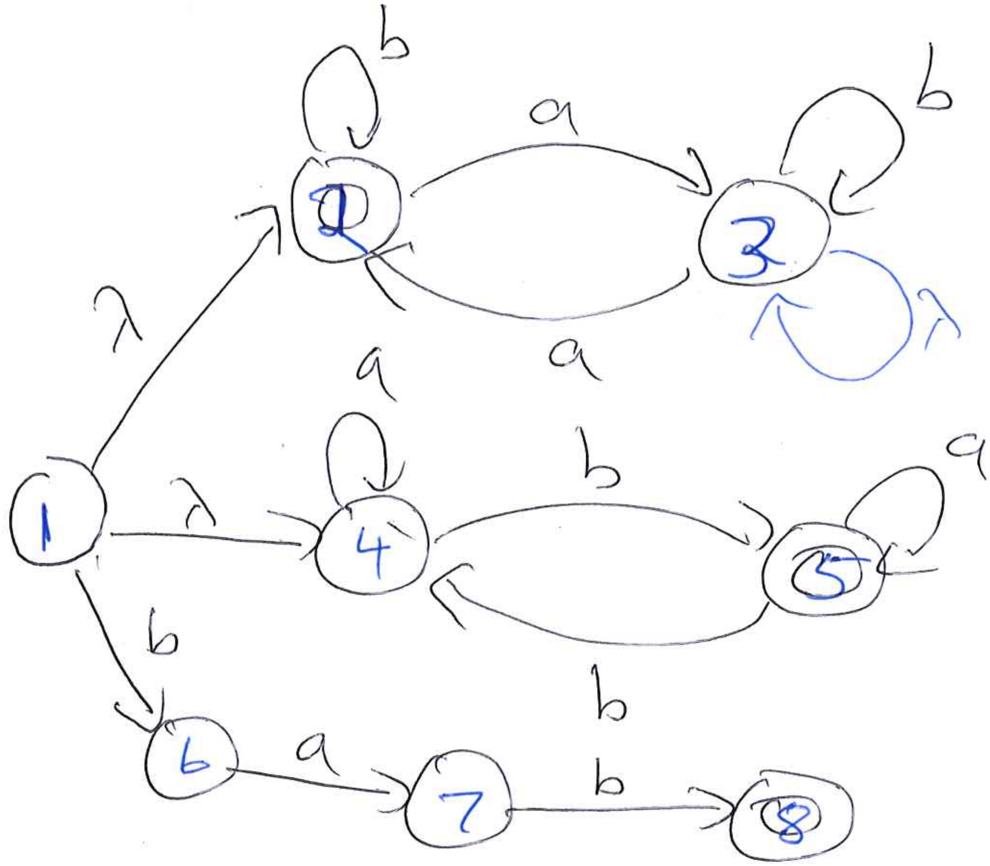
E.g. aaabbabbbb is good

aaabbbbbb is good

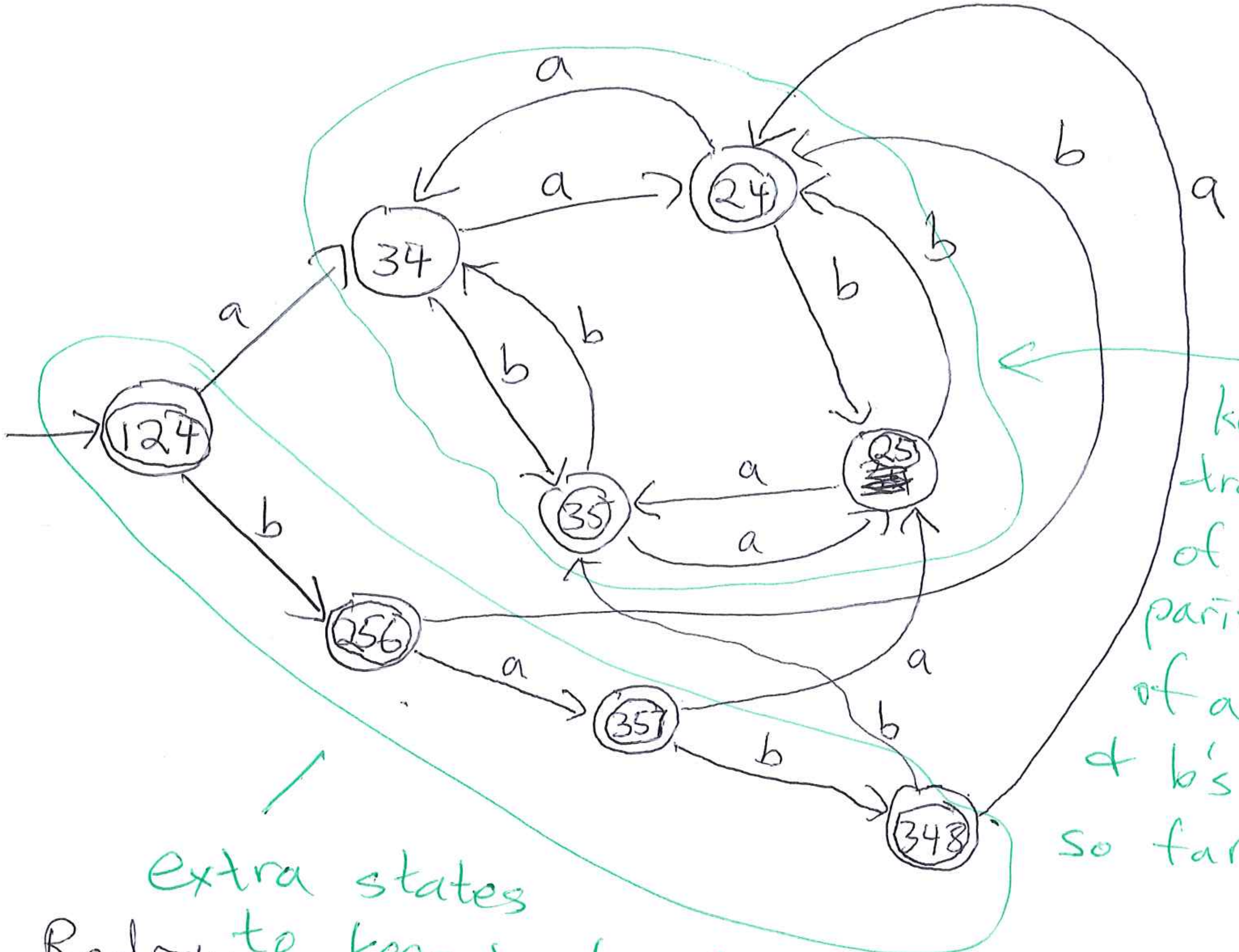
aaabb$\boxed{aa}$bbbb is bad.



Construct an NFA that accepts all strings that have an even # of a's or an odd #bs, and also accepts the string 'bab'.



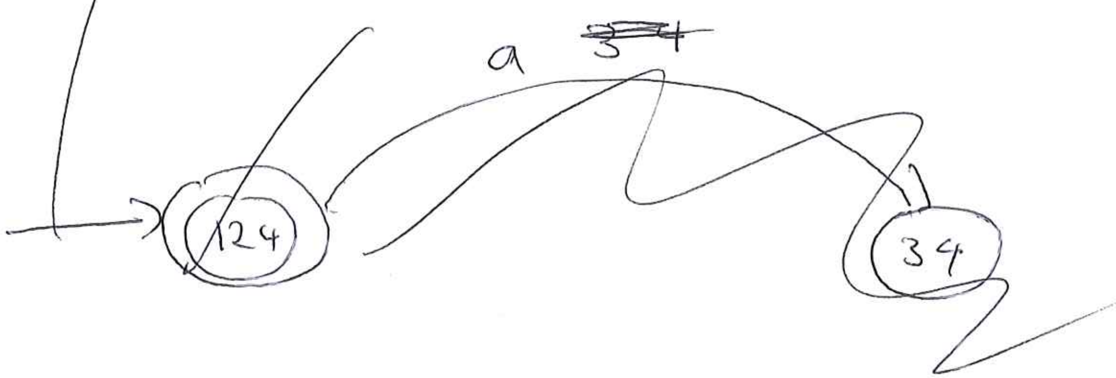
Convert this to a DFA:



keeping track of parity of a's & b's so far.

extra states to keep track of the "bab" possibility.

Redraw



Our every class visit to formalism land:

Think about a proof that our method of constructing a DFA from an NFA

$\overline{M}$ M

works. ← i.e. they both accept exactly the same strings.

↑

~~i.e.~~ i.e. M accepts w if and only if $\overline{M}$ accepts w.

↑

i.e. $\delta^*(w, q_0)$ ~~is~~ contains a final state if and only if $\overline{\delta}^*(w, \overline{q}_0)$ is a final state

↑

This is true b/c we constructed $\overline{\delta}$ in such a way so that $\overline{\delta}(\ell, q)$ " = " $\delta(\ell, q)$

Outline of proof: We need to show that

M accepts w if and only if $\overline{M}$ accepts w. But $\overline{\delta}^*(w, \overline{q_0})$ is the ~~set of~~ state~~s~~ we get to in $\overline{M}$ starting at $\overline{q_0}$ and reading w, which, by how we constructed $\overline{M}$ from M, is precisely the ~~set~~ state corresp. to the set of states in M which are reacheable from q_0 reading w. In symbols,

$$\underbrace{\overline{\delta}^*}_{\text{in } \overline{M}}(w, \overline{q_0}) = \underbrace{\delta^*}_{\text{in } M}(w, q_0)$$

By our definition of $\overline{F}$, $\overline{\delta}^*(w, \overline{q_0}) \in \overline{F}$ if and only if $\delta^*(w, q_0) \cap F \neq \emptyset$.

Hence w is accepted by $\overline{M}$ if and only if w is accepted by M.

so $\delta^*(w, q_0) = \overline{\delta}^*(w, \overline{q}_0)$,
and $\overline{q}$ is a final state of $\overline{M}$ precisely if $\overline{q}$ contains a final state of M.

We have set up our notation so that $\overline{q}$ can be thought of as either a state of $\overline{M}$ or as a set of states of M.