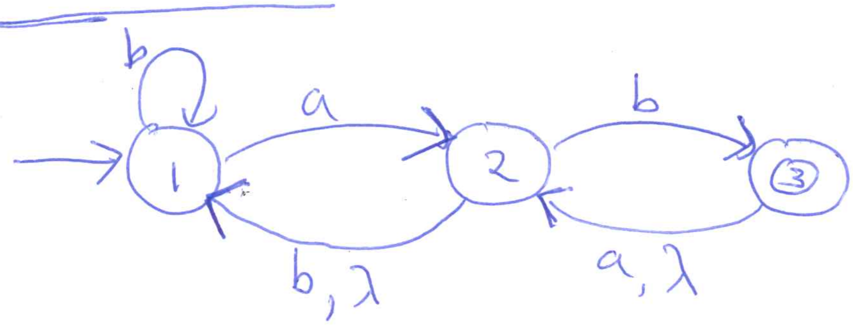
~~E~~ Office hours will be:

8/31

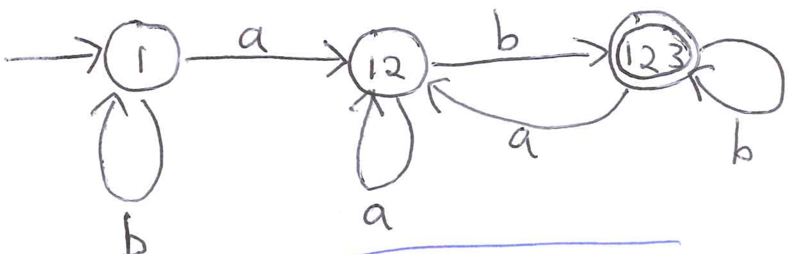
Mon 1-2

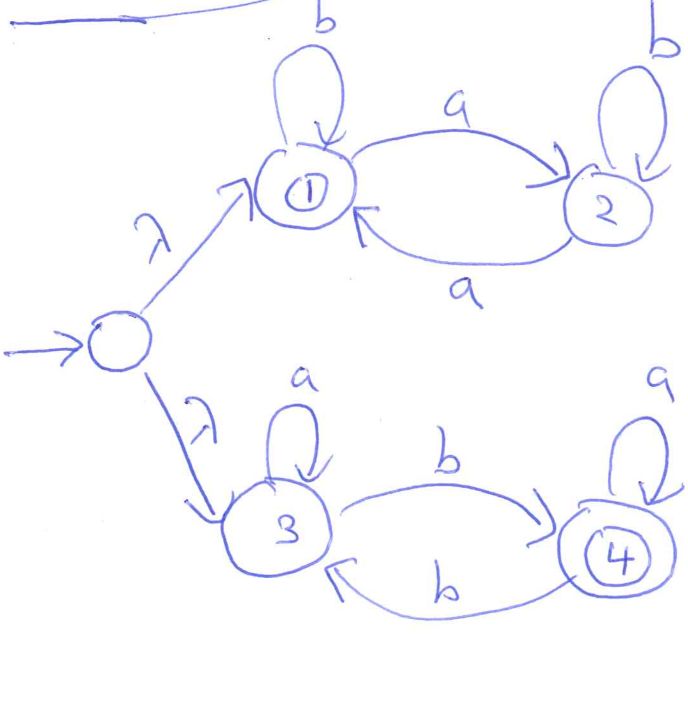
Tue 2-3 (will stay until 5:30 by request)

Fri 2-3



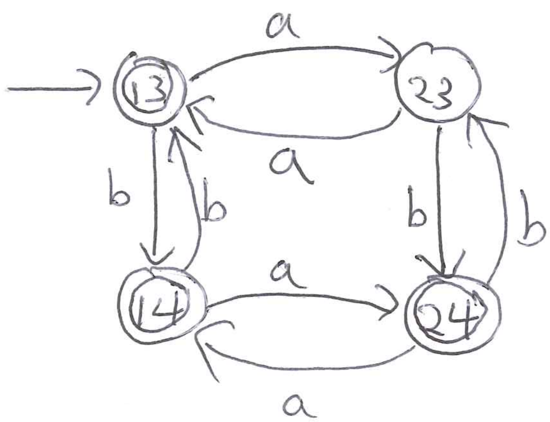
Construct ~~a~~ an equivalent DFA





Construct an equiv DFA

(This accepts all strings w/ an even # of a's <u>or</u> an odd # of b's.)


a
13
23
a
b
b
b
b
a
14
24
a

To finish the proof that every NFA has an equivalent DFA, I need to explain why my DFA accepts exactly the same strings as the NFA I was given.

Lemma: w is accepted by $\overline{M}$ starting at a state S if and only if w is accepted by M starting from some state in S without using a λ-transition to start.

remember $S \in \overline{Q}$ is a set of states of M

Pf: Suppose w is accepted by $\overline{M}$ starting at S. If $w = \lambda$, then $S \in \overline{F}$, so by our def'n of $\overline{F}$, $S \cap F \neq \emptyset$. In other words, there exists $q \in S \cap F$. Since $q \in F$, the NFA M accepts $w = \lambda$ starting at q. As $q \in S$, so M accepts w starting from a state in S.

If $w = \ell w'$, then w' is accepted by $\overline{M}$ starting at $\overline{\delta}(S, \ell)$. Note

$$\overline{\delta}(S,\ell) = \lambda\Big(\bigcup_{q \in S} \{ q' \in Q \mid (q, \ell, q') \in \delta \} \Big)$$

Since w' is shorter than w, I can appeal to induction, so we know using the inductive hypothesis that M accepts w' ~~for so~~ starting at q' for some

$$q' \in \lambda\Big(\bigcup_{q\in S} \{q' \in Q \mid (q,\ell,q') \in \delta\}\Big).$$

First assume $q' \in \bigcup_{q\in S} \{ \qquad \}$.

Since $w = \ell w'$, $(q,\ell,q') \in \delta$, and M accepts w' starting at q', M accepts w starting at q, for some $q \in S$.

Otherwise, there exists $q \in S, q_0, q_1, \dots, q_k \in Q$ such that $(q,\ell,q_0) \in \delta$, $(q_i,\lambda,q_{i+1}) \in \delta$ for all i, $(q_k,\lambda,q') \in \delta$. Then we know using induction, since M accepts w' at q', that M accepts w' at q_i for all i, and M accepts w at q.

The other direction is "left as an exercise for the reader".