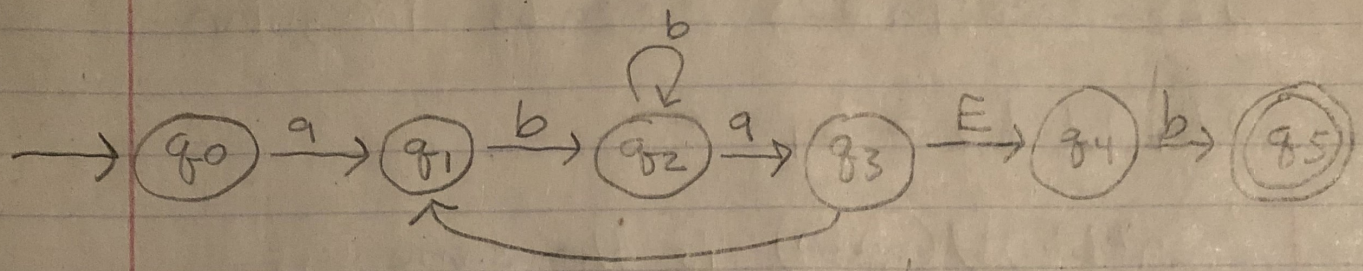
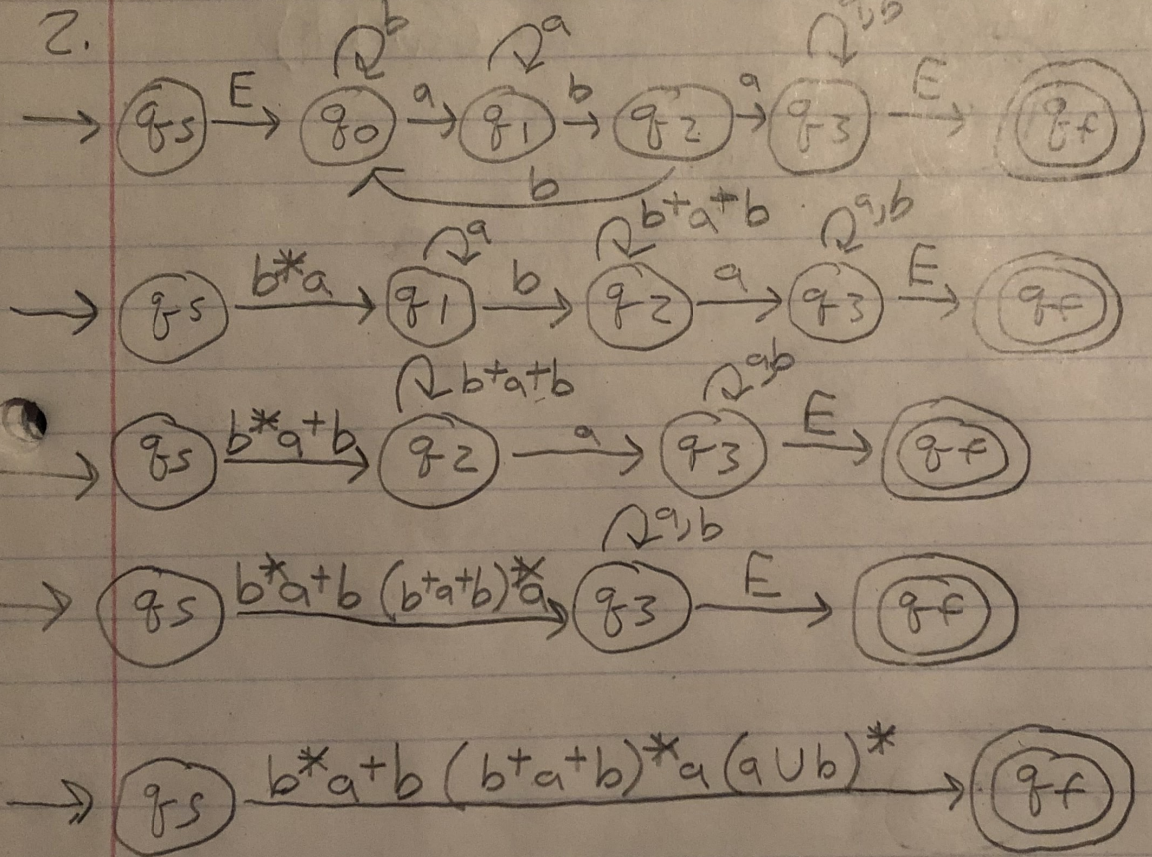
Thomas Hart
HW #3

1. NFA for $(ab^+a)^+b$



2.



3. Suppose $L = \{a^n b^{n-1} \mid n > 0\}$ is regular and therefore has a pumping constant p. Choose one string $w \in L$ and $|w| \geq p$. Look at every decomposition of w into xyz where $|y| \geq 1$ and $|xy| \leq p$. Then find one i value where $xy^iz \notin L$. $w = a^p b^{p-1}$
$x = a^\alpha \quad \alpha \geq 0$, $y = a^\beta \quad \beta \geq 1$, $z = a^{p-\alpha-\beta} 1^{p-1}$
Choose an i where $xy^iz \in L = \{a^n b^{n-1} \mid n > 0\}$
$i = 2$: $xy^2z = 0^\alpha 0^\beta 0^\beta 0^{p-\alpha-\beta} 1^{p-1} = 0^{p+\beta} 1^{p-1}$
This can only happen if $\beta = -1$, but $\beta \geq 1$, so that is impossible. Thus $L = \{a^n b^{n-1} \mid n > 0\}$ is irregular
(Note: β represents the length of y, which $y \geq 1$)

4. a) $L_1 = (a^*b^*)$ over $\Sigma = \{a, b\}$ regular
b) $L_2 = \{a^n b^n \mid n \geq 0\}$ $\Sigma = \{a, b\}$ irregular

c) $L_1 \cup L_2 = L_1$

$(a^*b^*) \cup (a^n b^n)$ is the same as (a^*b^*)