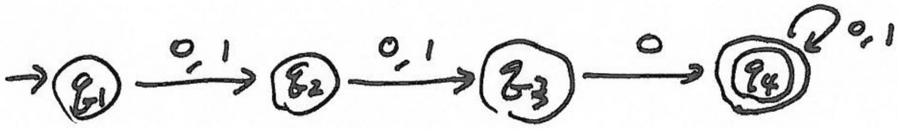
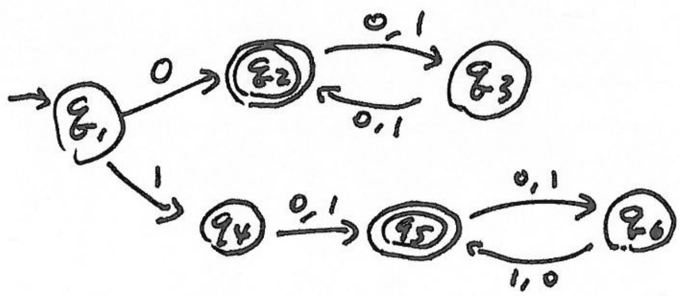
CSCI 338, Assignment #2

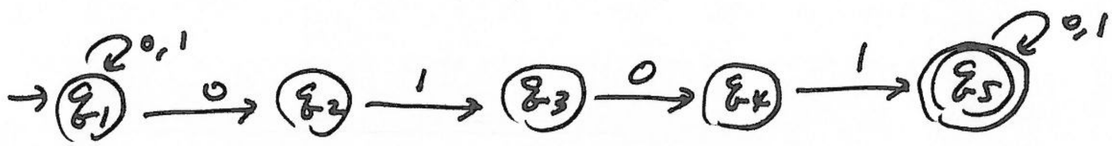
Q1. 1.6.d



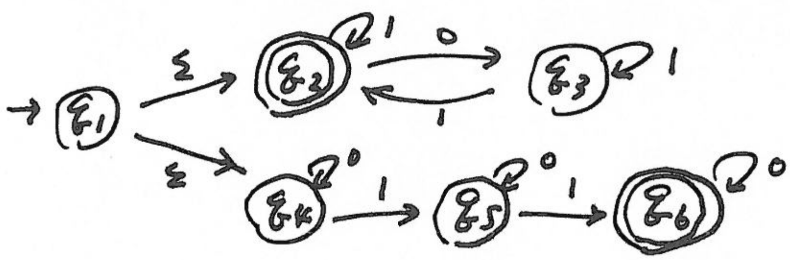
1.6.e



1.7.b

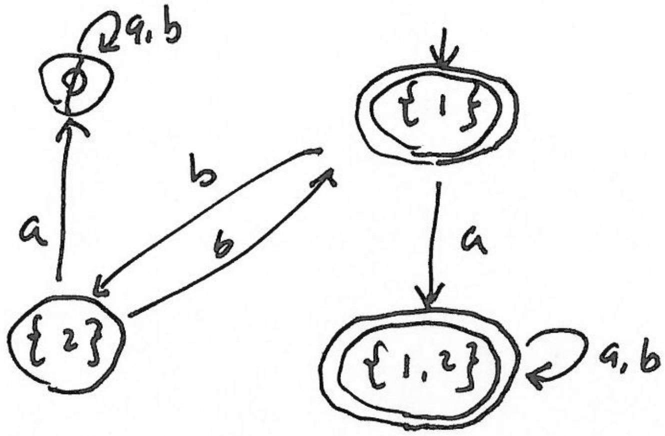


1.7.c



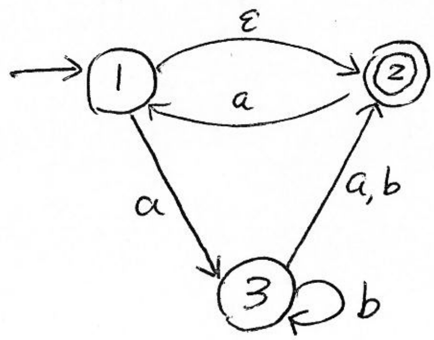
Q2. 1.16.a

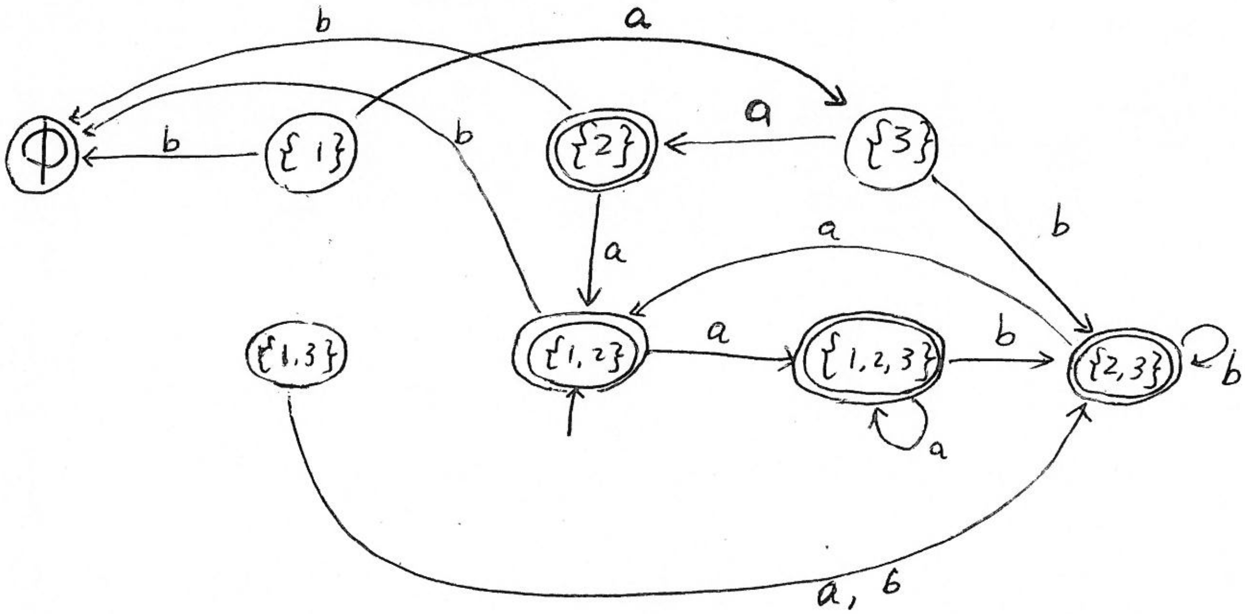
DFA:



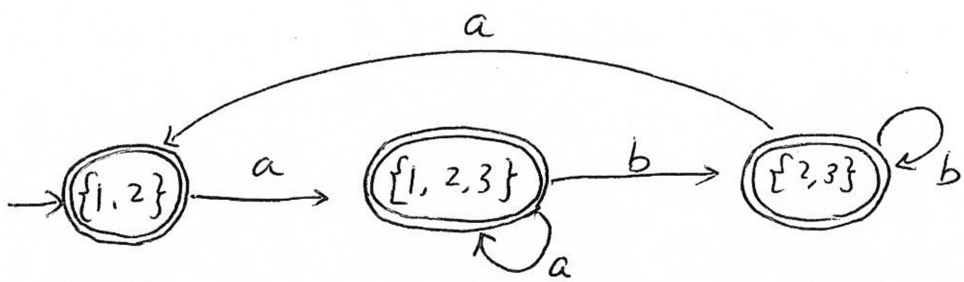
Question 2. Convert the following NFA to DFA.

1.16.b





After simplification (you don't have to do that):

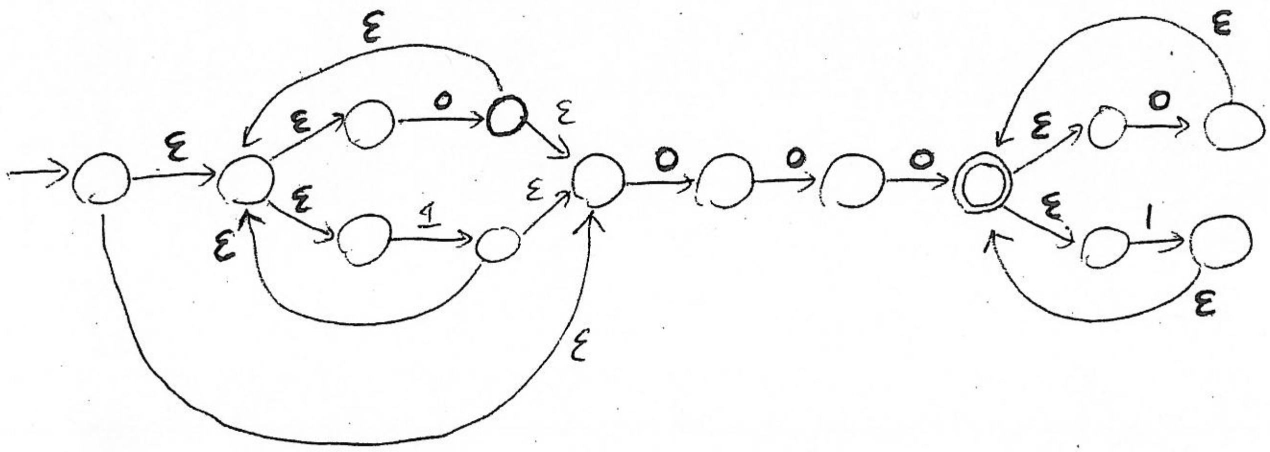


Note: As we have ε-transitions, you have to use E (extension of a set)

Ex:
$$\begin{aligned}\delta'(\{1,3\},a) &= E(\delta(1,a)) \cup E(\delta(3,a)) \\ &= E(\{3\}) \cup E(\{2\}) \\ &= \{3\} \cup \{2\} = \{2,3\}\end{aligned}$$

Q3. 1.19.a)

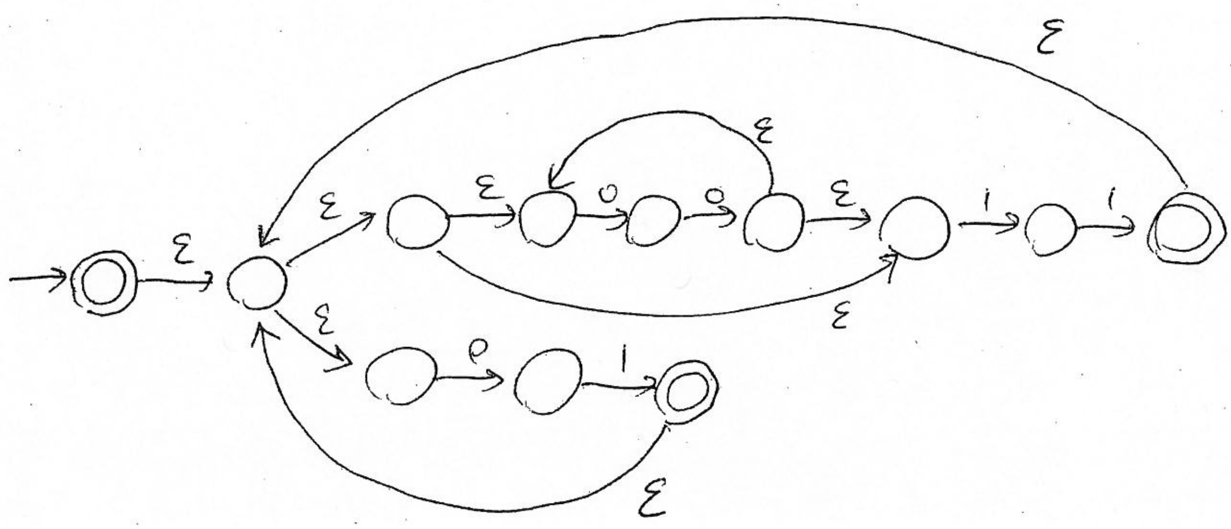
$(0 \cup 1)^* 000 (0 \cup 1)^*$



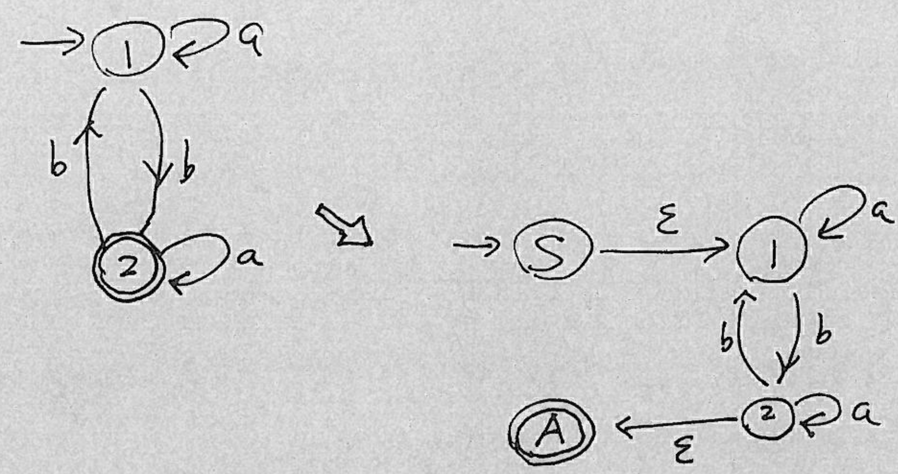
Q3.

(1.19.b)

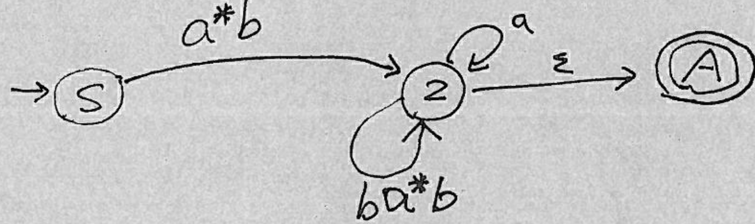
$((00)^*(11) \cup 01)^*$



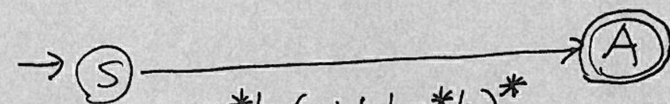
Q4.



Rip ①:



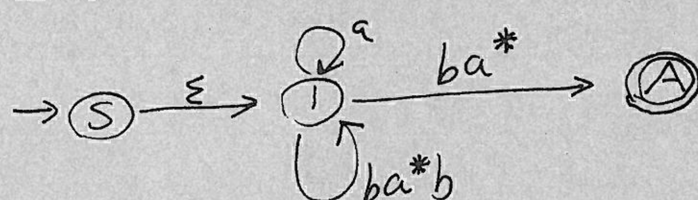
Rip ②:



$a^*b\,(a \cup ba^*b)^*$

Answer

Rip ②:



Rip ①:

$(a \cup ba^*b)^*ba^*$

Answer.

Q5. (5.1) $A = \{a^{n^3} \mid n \geq 0\}$.

proof. Assume that A is regular.

Select $s = a^{p^3}$, p being the pumping length.

By the pumping lemma, s can be decomposed into $s = xyz$, s.t.

① $xy^iz \in A$, for $i \geq 0$

② $|xy| \leq p$

③ $|y| \geq 1$

By ②, $|xy| \leq p$, so $|y| \leq p$. As $|xyz| = p^3$,

$|xy^2z| = |xyz| + |y| \leq p^3 + p < p^3 + 3p^2 + 3p + 1 < (p+1)^3$.

By ③, $|y| \geq 1$, so $|xy^2z| = |xyz| + |y| > p^3$.

$\therefore$ $xy^2z \notin A$. This is a contradiction, so A is not regular.

□

(5.2) $B = \{0^n 1^m 0^n \mid m, n \geq 0\}$

proof. Assume that B is regular.

Select $s = 0^p 1 0^p$, p being the pumping length.

By the pumping lemma, s can be decomposed into $s = xyz$, s.t.

① $xy^iz \in B$, for $i \geq 0$

② $|xy| \leq p$

③ $|y| \geq 1$

By ②, $|xy| \leq p$, so y must only contain 0's (before 1).

Then xy^2z must have more than p 0's before 1,

hence $xy^2z \notin B$.

This is a contradiction to the pumping lemma, so B is not regular. □