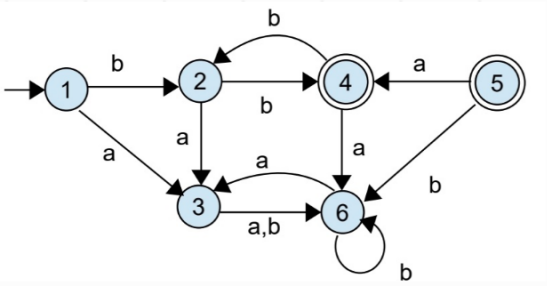
Exercise 6.1

Let A be the following DFA. Answer the following questions (with short justification).
Hint: not necessary to compute all equivalent states using the algo from lesson 11.



a) Are states 2 and 4 equivalent?

No, they are not equivalent as they do not reach an accept state with the same strings.
-ie: If we use an empty string, we end up in an accept state from 4, but from 2 we end up in an non-accept state.

b) Are states 2 and 3 distinguishable?

Yes, String 'b' will take us to final state from 2; but not from 3.

c) Are states 3 and 6 distinguishable?

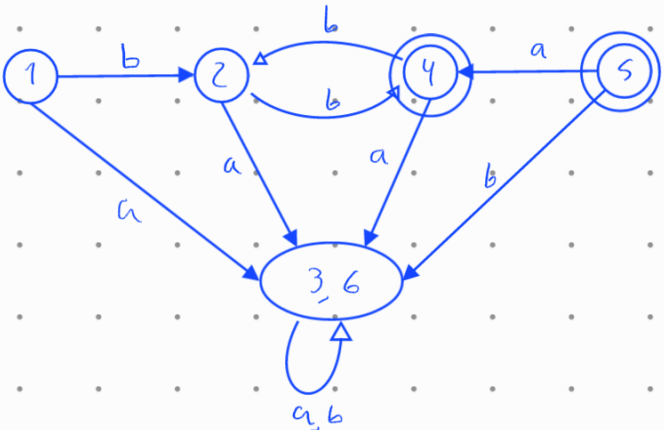
No, both states are error states and cannot reach an accept state.

d) Is A a minimal automaton?

No, there can be 4/5 states, depending on there error state {5}. S → bb(b)* | a(b)*

	a	b
1	3	2
2	3	4
3	6	6
(4)	6	2
(5)	4	6
6	3	6

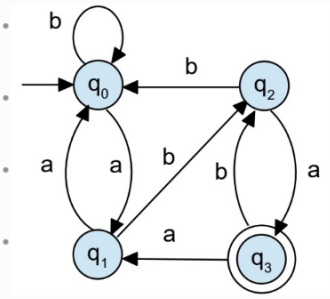
0 equiv: {1,2,3,6} {4,5}
1 equiv: {1,3,6} {2} {4} {5}
2 equiv: {3,6} {1} {2} {4} {5}
3 equiv: {3,6} {1} {2} {4} {5}

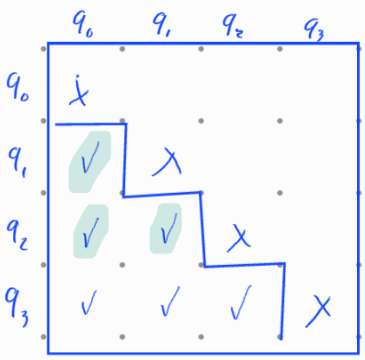


	a	b
{3,6}	{3,6}	{3,6}
{1}	{3,6}	{2}
{2}	{3,6}	{4}
{4}	{3,6}	{2}
{5}	{4}	{3,6}

Exercise 6.2

Compute all equivalent states of the following DFA, using the table-based algorithm.



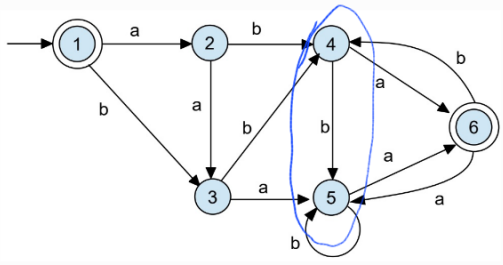


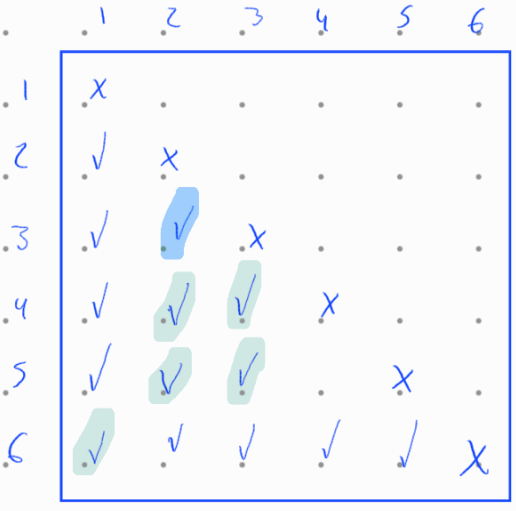
$\{q_1, q_0\}$ - $\delta(q_1, a) = q_0$ $\delta(q_1, b) = q_2$
$\delta(q_0, a) = q_1$ $\delta(q_0, b) = q_0$
(q_2, q_0) - $\delta(q_2, a) = q_3$ $\delta(q_2, b) = q_0$
$\delta(q_0, a) = q_1$ $\delta(q_2, b) = q_0$
(q_2, q_1) - $\delta(q_2, a) = q_3$ $\delta(q_2, b) = q_0$
$\delta(q_1, a) = q_0$ $\delta(q_1, b) = q_2$

Exercise 6.3 – obligatory (10 points)

Let A be the following DFA:

a) Compute all equivalent states of the DFA. Show the intermediate steps of the computation.





$\{3,2\}$ - $\delta(3, a) = 5$ $\delta(3, b) = 4$
$\delta(2, a) = 3$ $\delta(2, b) = 4$

$\{4,2\}$ - $\delta(4, a) = 6$ $\delta(4, b) = 5$
$\delta(2, a) = 3$ $\delta(2, b) = 4$

$\{4,3\}$ - $\delta(4, a) = 6$ $\delta(4, b) = 5$
$\delta(3, a) = 5$ $\delta(3, b) = 4$

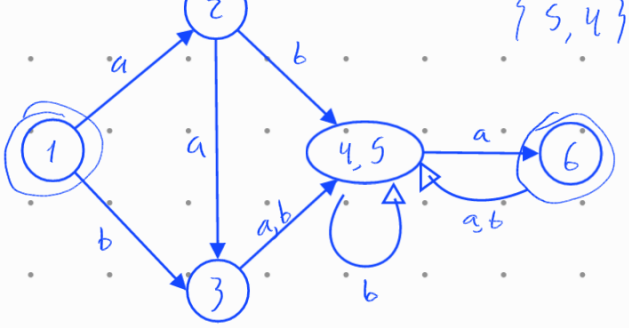
$\{5,2\}$ - $\delta(5, a) = 6$ $\delta(5, b) = 5$
$\delta(2, a) = 3$ $\delta(2, b) = 4$

$\{5,3\}$ - $\delta(5, a) = 6$ $\delta(5, b) = 5$
$\delta(3, a) = 5$ $\delta(3, b) = 4$

$\{5,4\}$ - $\delta(5, a) = 6$ $\delta(5, b) = 5$
$\delta(4, a) = 6$ $\delta(4, b) = 5$

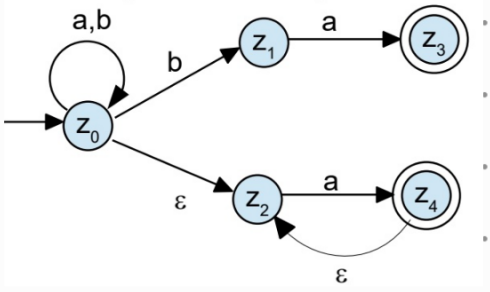
$\{6,1\}$ - $\delta(6, a) = 5$ $\delta(6, b) = 4$
$\delta(1, a) = 2$ $\delta(1, b) = 3$

b) Build an equivalent minimal automaton.



Exercise 6.4 - obligatory (4 points)

Let the following e-NFA A be given:



a) Which of the following strings are accepted by A?

(1) e = not accepted
(2) a = accepted
(3) aa = accepted
(4) bb = not accepted
(5) bbaa = accepted
(6) aabb = not accepted

b) Which language is accepted by A?

LA = {a^n b^k a | n ≥ 0, k ≥ 0 }

S → A | B
A → a*b*ba
B → a*b*a+

Exercise 6.5 - obligatory (4 points)

Let S = {a, b, c, d}. Define an ε-NFA that accepts all strings that end with cddc, cdab or abab.

δ : Q x E ∪ ε → 2^Q