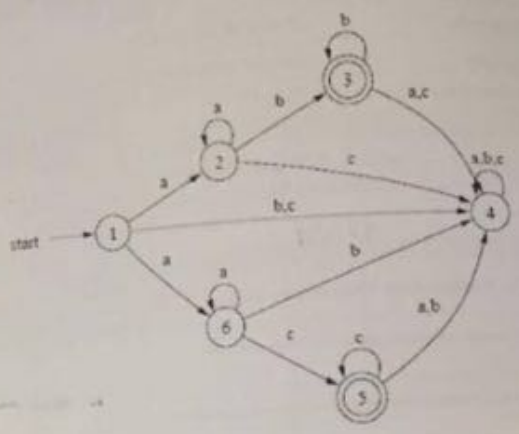
Exercise 1 [1 pt]

Give the language accepted by this automaton.



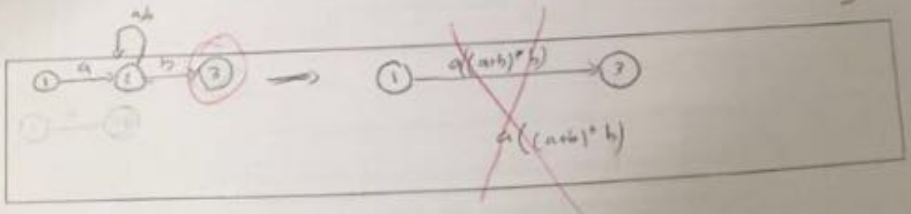
aa^*bb^*
aa^*cc^*

all string that start with a and end with b or start with a and end with c $\{aa^*bb^* | aa^*cc^*\}$

Exercise 2 [1 pt]

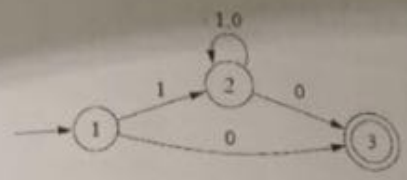
Construct finite automata for the following regular expression

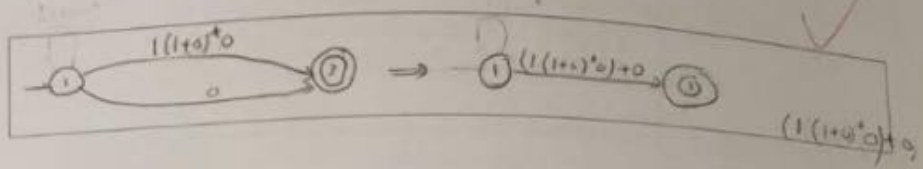
$$a(a \cup b)^*b$$



Exercise 3 [1 pt]

Give the regular expression of the following finite automata





Exercise 4 [1 pt]

Prove that the following language is non-regular

$$L=\{(01)^n(10)^n \mid n \geq 0\}$$

Assum L is a regular language and infinite so we can apply pumping lemma
Chose m length
Pick w st: $w \in L$
$w = xyz$ and $|w| \geq m$
$|xy| \leq m$ $|y| \geq 1$
$xyz = (01)^m (10)^m$
$x\ y\ z$
Thus: $y = (01)^k$ $1 \leq k \leq m$?

xy^2z $x\ y^{m+k}\ z^m$
$x\ y^{m+k}\ z^m \notin L$
contradiction
our assumption is not true →
L is not regular

Exercise 5 [1 pt]

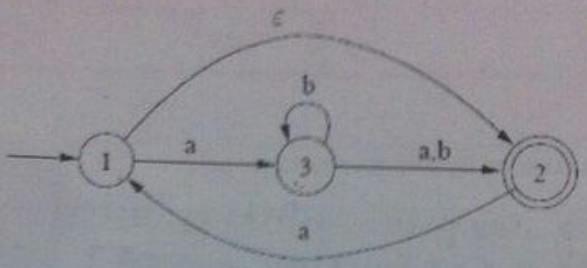
Prove that the following language is regular

$$L=\{(01)^n(10)^m \mid n \geq 0, m \geq 0\}$$

Assum L is a regular language (infinite → we can apply pumping lemma
is Critical length
Pick w st $w \in L$
$w = xyz$ and $|w| \geq 3$
$|xy| \leq 3$ $|y| \geq 1$
$xyz = (01)^n (10)^m$
x y z
thus: $y = (01)^k$ $1 \leq k \leq j$
$xy^2z \in L$
$j+k = n$
$xy^{j+k}z^n \in L$ → L is regular language

Exercise 1.3 [1.5 pts]

Considering following NFA,



Compute

σ({1,2},a)= $(\{1\},a) \cup (\{2\},a) = \{3,1\} \cup \{1,2\} = \{1,2,3\}$ ✓

σ({1,2},b)= $(\{1\},b) \cup (\{2\},b) = \emptyset \cup \emptyset = \emptyset$ ✓

σ({1,2,3},a)= $(\{1\},a) \cup (\{2\},a) \cup (\{3\},a) = \{3,1\} \cup \{1,2\} \cup \{2\} = \{1,2,3\}$ ✓

σ({1,2,3},b)= $(\{1\},b) \cup (\{2\},b) \cup (\{3\},b) = \emptyset \cup \emptyset \cup \{3,2\} = \{2,3\}$ ✓

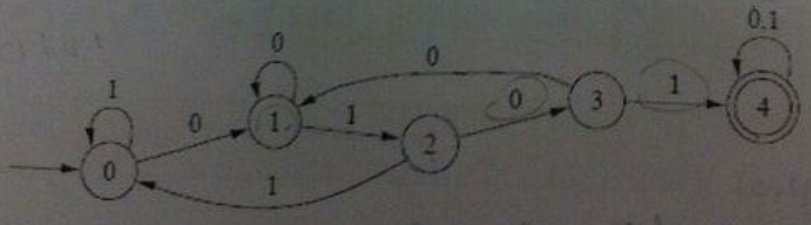
σ({2,3},a)= $(\{2\},a) \cup (\{3\},a) = \{1,2\} \cup \{2\} = \{1,2,3\}$ ✗ (-0.25)

σ({2,3},b)= $(\{2\},b) \cup (\{3\},b) = \emptyset \cup \{3,2\} = \{2,3\}$ ✓

Part 2

Exercise2.1[2.5 pts]

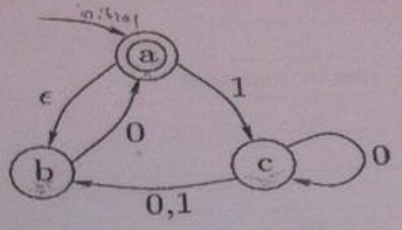
Consider the following automata:

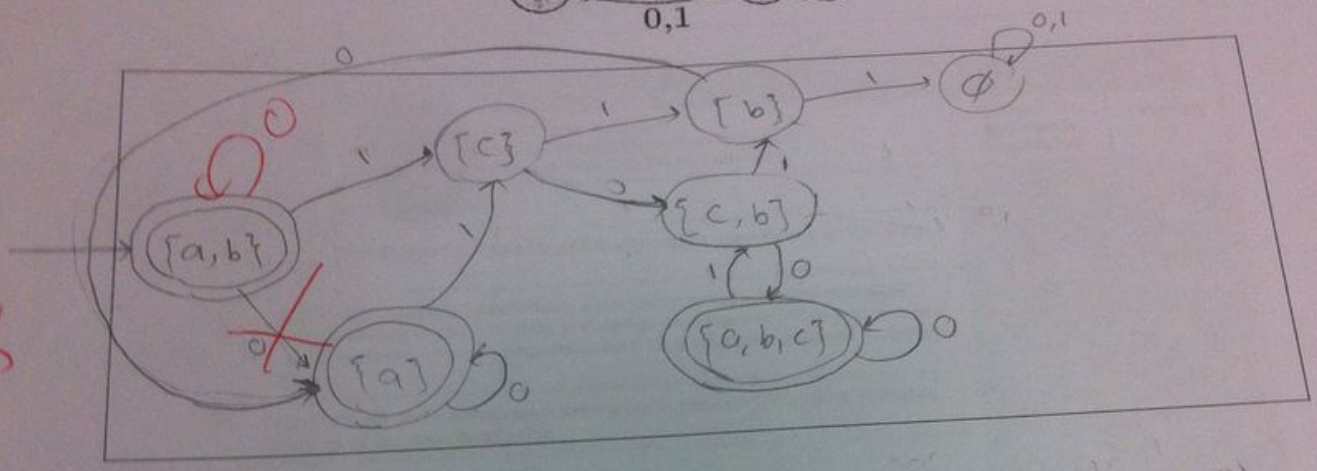


$(1^*,0)0^*1(11^*00^*1)^*0(0^*11^*00^*1)^*(0,1)^*$

Exercise 3 [2.5 pts]

Convert the following NFA to an equivalent DFA





Exercise 4 [2.5 pts]

Prove that the language $L=\{ 0^n10^m,\ n > 1, m \geq 0\}$ is regular.