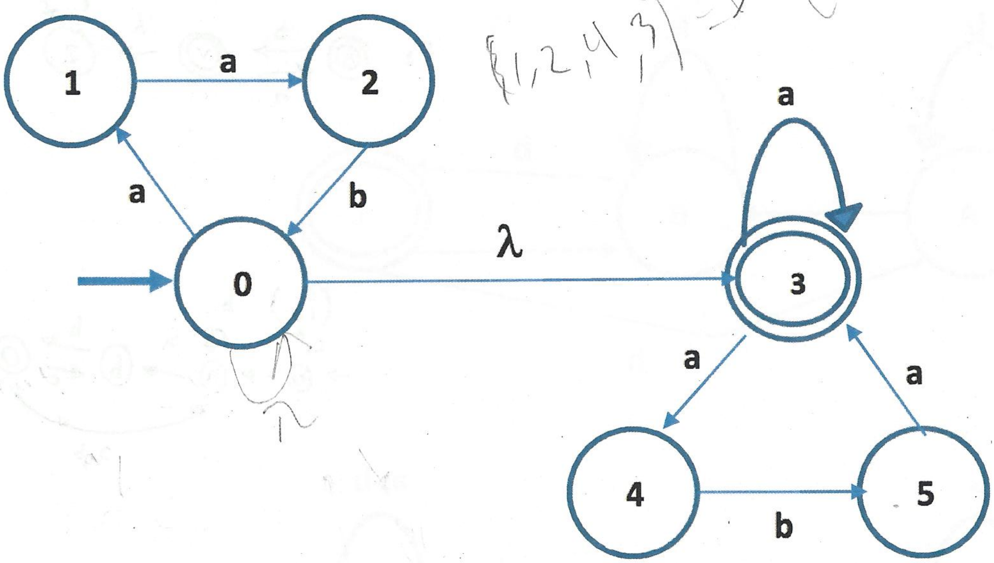
NAME Robert Martinez 77

#	Pts
1	1
2	6
3	26
4	0
5	6
Total	

Midterm #2

PROBLEM #1. Given the following NFA find its DFA.



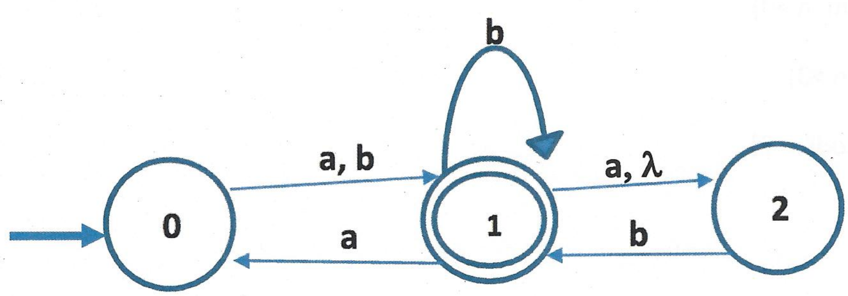
A = λ-clos(0) {0,3}

(A,a) = {1,3,4} = B

(A,b) = ∅ = C

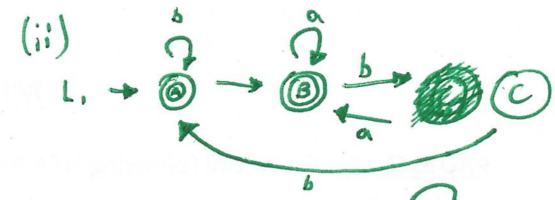
PROBLEM #2. Given the regular expression (11, 112)*{2} with Σ = {1, 2} find its NFA. Don't have to show all the steps.

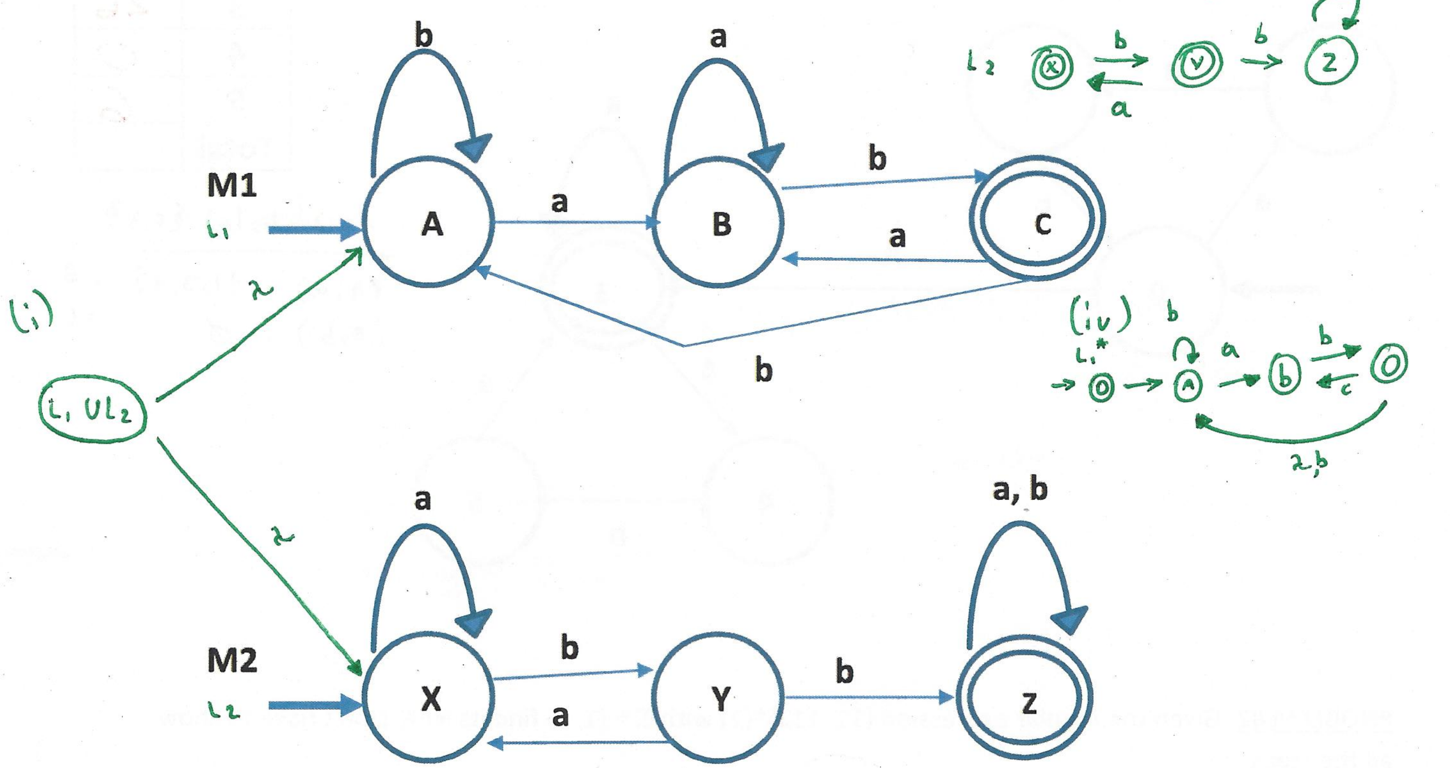
PROBLEM #3. Given Σ = {a, b} and the strings: aa,abaab, baaba, aaa, bbbb. Which of these strings are accepted by the NFA given below? Prove it by doing **ALL** the corresponding delta transitions.



PROBLEM #4. Given $\Sigma = \{a, b\}$. Let M1 and M2 be the FAs pictured below accepting the languages L_1 and L_2 respectively. Draw FAs accepting the following languages:

(i) $L_1 \cup L_2$ (ii) $L_1 \cap L_2$ (iii) $L_1 - L_2$ (iv) $L_1{}^*L_2{}^*$





PROBLEM #5. Given $\Sigma = \{a, b\}$. Which one of the following is a regular language? If regular, prove it by building FAs or using theorems studied in class or giving the correct argument. If not, then explain why.

(i) $L_1 = \{w \in \{a\}^*: |w| \bmod 5 = 3)$

(ii) $L_2 = \{w \in \Sigma^*: w = a^n b^m,\ m, n > 0\}$

(iii) $L_3 = \{w \in \Sigma^*: w = a^n b^n,\ n > 0\}$

(iv) $(L_4)^C = \{w \in (a)^*: |w| \bmod 6 > 2\}$

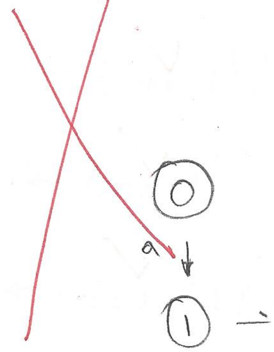
(v) $L_4 - L_1$

(vi) $L_3 - L_4$

#1

S	a	b	λ
→ 0	1	∅	3
1	2	∅	∅
2	∅	∅	∅
3	3, 4	∅	∅
4	∅	5	∅
5	3	∅	∅

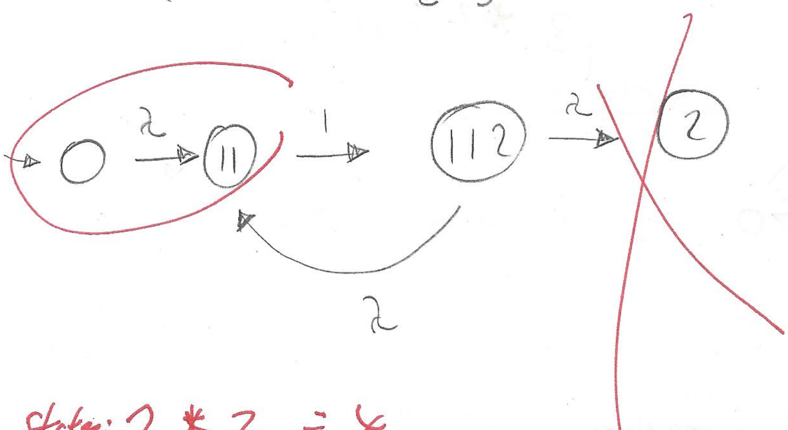
a = λ-Closure (0)



#2

(11, 112)* {2}

λ jumps

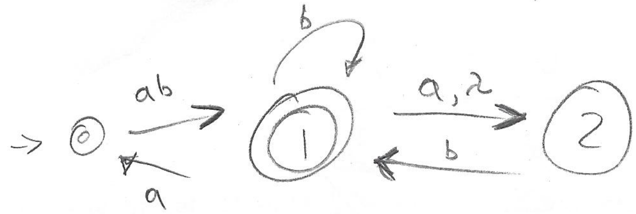


States: 2 * 2 = 4

λ: 1 * 2 = 2

6

3



Not Accepted Final State

× $\delta(0, aa) \to \delta(1, a) \to \delta(2, \lambda)$ — NAFS

× $\delta(0, abaab) \to \delta(1, baab) \to \delta(1, aab) \to \delta(2, ab)$ — $\emptyset$

× $\delta(0, baaba) \to \delta(1, aaba) \to \delta(2, aba)$ — $\emptyset$

× $\delta(0, aaa) \to \delta(1, aa) \to \delta(2, a)$ — $\emptyset$

✓ $\delta(0, bbbb) \to \delta(1, bbb) \to \delta(1, bb) \to \delta(1, b) \to \delta(1, \lambda)$ — AFS

Accepted Final State

4 X

13 * 2 = 26

5

(i) $O \xrightarrow{a} O \xrightarrow{a} O \xrightarrow{a} ◎ \xrightarrow{a} O$

(ii) a^n is regular

b^m is regular

concatenation $a^n b^m$ is regular

(iii) L_3 is not Regular (showed in class)

(iv) $\to O \xrightarrow{a} O \xrightarrow{a} O \xrightarrow{a} ◎ \xrightarrow{a} ◎ \xrightarrow{a} ◎$

(v) $L_3 - L_1$ Not regular

(5) (i) $L_1 = \{ w \in \{a\}^* : |w| \bmod 5 = 3 \}$

Proof: We build a DFA knowing that $\{a\}^*$ is a regular language, then regardless of any $\{a\}^*$, it will be a regular language even after its condition.

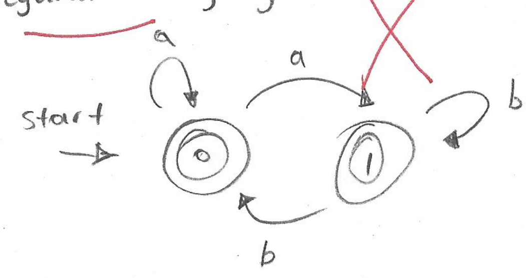
2

(ii) $L_2 = \{ w \in \Sigma^* : w = a^n b^m, n > 0$

Proof: Not a regular language, because $n > 0$, therefore m could be any arbitrary number and $n > 0$ is limited, therefore since they can't have the same then it's not a regular.

(iii) $L_3 = \{ w \in \Sigma^* : w = a^n b^n, n > 0 \}$

Proof: Regular Language

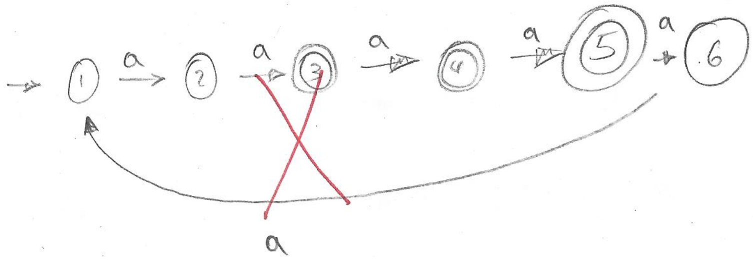


- Could always be regular language, as long as they have same numbers of 0's & 1's (a & b)

(iv) $(L_4)^c = \{ w \in (a)^* : |w| \bmod 6 > 2 \}$

Proof:

2 ✓ Regular Language



(v) $L_4 - L_1$

2.0

Proof: By definition L_4 is a regular language since by regular expression definition it says. Therefore L_1 is a regular language too. Even after $L_4 - L_1$, it's still a regular language. ✓

Say What?

(vi) $L_3 - L_4$

Proof: By definition L_3 is a regular language since by regular expression definition it says. Therefore L_4 is a regular language too. Even after $L_3 - L_4$, it's still a regular language.

Midterm #2 Corrections

$\{1,2,3,4,b\}$

Always itself or any lambda near there...

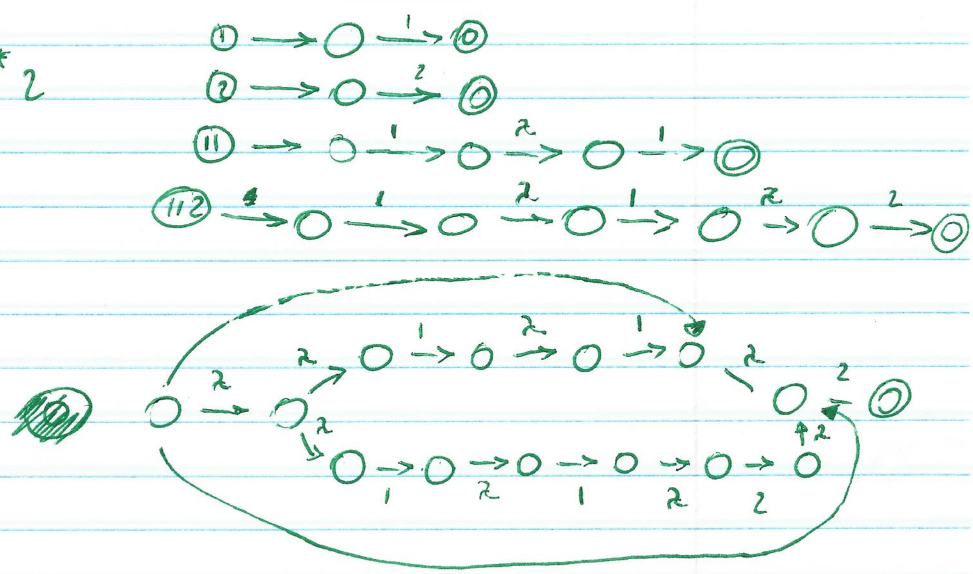
$A = \lambda\text{-Clos}(0) = \{0,3\}$

$(A,a) = \{1,2,3,4\} = B$	$(E,a) = \{3\} = H$
$(A,b) = \emptyset = C$	$(E,b) = \emptyset = C$
$(B,a) = \{2,3,4\} = D$	$(F,a) = \{3,4\} = F$
$(B,b) = \{5\} = E$	$(F,b) = \{5\} = E$
$(C,a) = C$	$(G,a) = \{1,3,4\} = B$
$(C,b) = C$	$(G,b) = \emptyset = C$
$(D,a) = \{3,4\} = F$	$(H,a) = \{3,4\} = F$
$(D,b) = \{0,3,5\} = G$	$(H,b) = \emptyset = C$

	a	b
A	B	C
B	D	E
C	C	C
D	F	G
E	H	C
F	F	E
G	B	C
H	F	C

2

z! $(11, 112)^* 2$



3 δ(0,aa) → δ(1,a) → δ(2,a) x

→ δ(2,λ) x

→ δ(0,λ) x

δ(2,aab) x

δ(2,ab) x

δ(0, abaab) → δ(1, baab) → (1, aab) → δ(0,ab) → δ(1,b)

→ (2, baab)

δ(1,λ)

accept

δ(aab) → δ(2, aab)

→ δ(2,ab)

δ(1,aab) → δ(2,aab)

→ δ(2,ab)

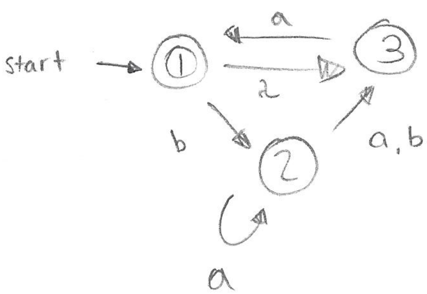
→ δ(0,ab)

δ(1,b)

δ(1,λ)

NFA → DFA

NFA



$A = Clos(1) = \{1, 3\}$

$(1,3,a) = (A,a) = \{1,3\}$ A

$(1,3,b) = (A,b) = \{2\}$ B

$(2,a)$ $(B,a) = \{2,3\}$ C

$(2,b)$ $(B,b) = \{3\}$ D

$(2,3,a)$ $(C,a) = \{2,3,1\}$ E

$(2,3,b)$ $(C,b) = \{3\}$ D

$(3,a)$ $(D,a) = \{1,3\}$ A

$(3,b)$ $(D,b) = \{\emptyset\}$ F

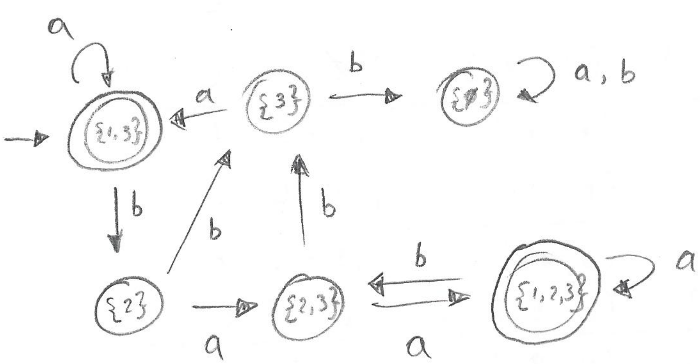
$(1,2,3,a)$ $(E,a) = \{2,3,1\}$ E

$(1,2,3,b)$ $(E,b) = \{2,3\}$ C

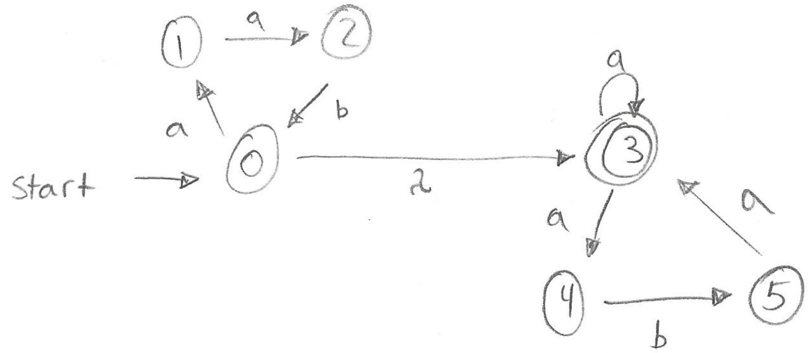
$(\emptyset,a)$ $(F,a) = \{\emptyset\}$ F

$(\emptyset,b)$ $(F,b) = \{\emptyset\}$ F

DFA	NFA	a	b
A	$\{1,3\}$	A	B
B	$\{2\}$	C	D
C	$\{2,3\}$	E	D
D	$\{3\}$	A	F
E	$\{1,2,3\}$	E	C
F	$\{\emptyset\}$	F	F



NFA → DFA (Midterm #2 Problem)



$A = \lambda\text{-}Clos(0) = \{0,3\}$

$(0,3,a)$	(A,a)	$= \{1,3,4\}$	B
$(0,3,b)$	(A,b)	$= \{\emptyset\}$	C
$(1,3,4,a)$	(B,a)	$= \{2,3,4\}$	D
$(1,3,4,b)$	(B,b)	$= \{5\}$	E
$(\emptyset,a)$	(C,a)	$= \{\emptyset\}$	C
$(\emptyset,b)$	(C,b)	$= \{\emptyset\}$	C
$(2,3,4,a)$	(D,a)	$= \{3,4\}$	F
$(2,3,4,b)$	(D,b)	$= \{0,3,5\}$	G
$(5,a)$	(E,a)	$= \{3\}$	H
$(5,b)$	(E,b)	$= \{\emptyset\}$	C
$(3,4,a)$	(F,a)	$= \{3,4\}$	F
$(3,4,b)$	(F,b)	$= \{5\}$	E
$(0,3,5\ a)$	(G,a)	$= \{1,3,4\}$	B
$(0,3,5\ b)$	(G,b)	$= \{\emptyset\}$	C
$(3,a)$	(H,a)	$= \{3,4\}$	F
$(3,b)$	(H,b)	$= \{\emptyset\}$	C

NFA	DFA	a	b
A	$\{0,3\}$	B	C
B	$\{1,3,4\}$	D	E
C	$\{\emptyset\}$	C	C
D	$\{2,3,4\}$	F	G
E	$\{5\}$	H	C
F	$\{3,4\}$	F	E
G	$\{0,3,5\}$	B	C
H	$\{3\}$	F	C