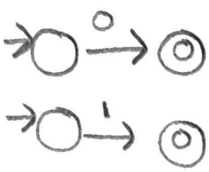
1.19) a)

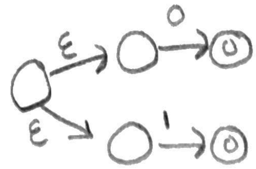
1)



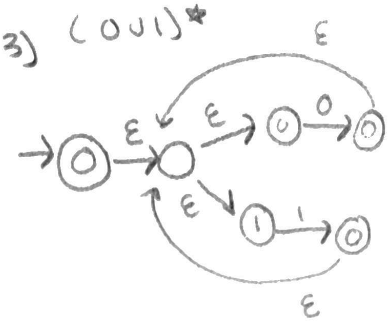
0

1

2) $(0 \cup 1)$

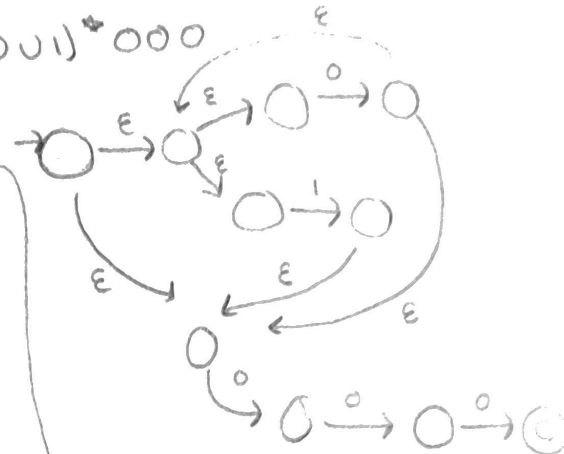


3) $(0 \cup 1)^*$

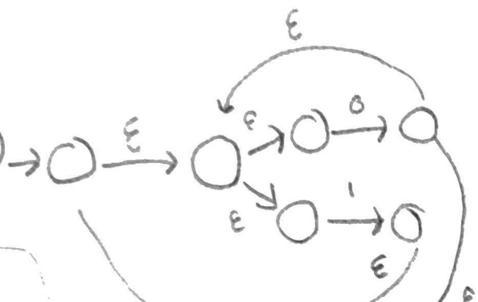
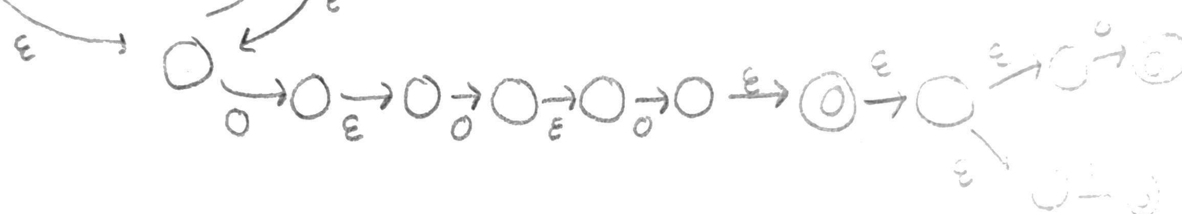


4) 000

5) $(0 \cup 1)^* 000$



6)

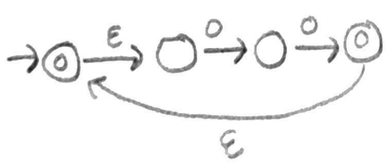



b)

1) 00

3) 11

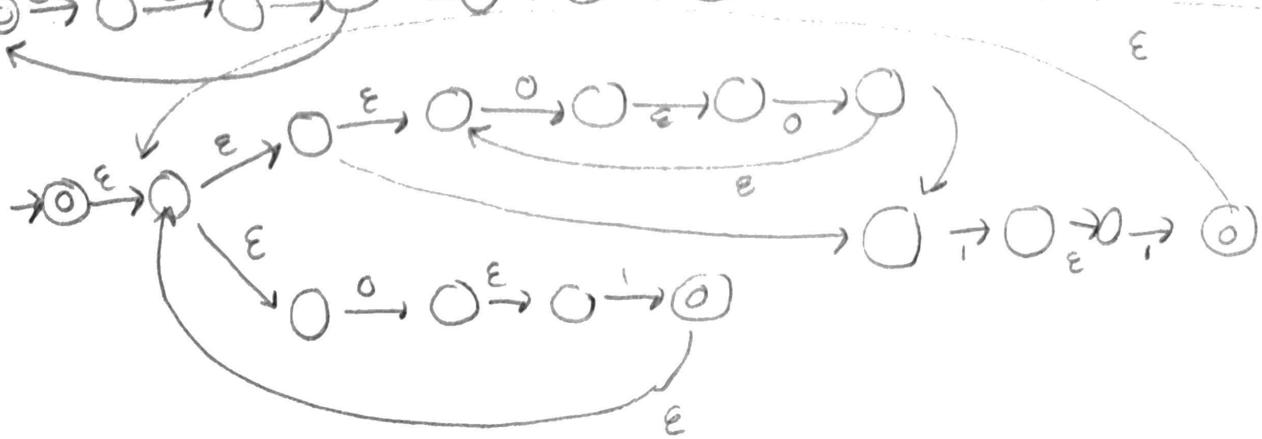
2) $(00)^*$



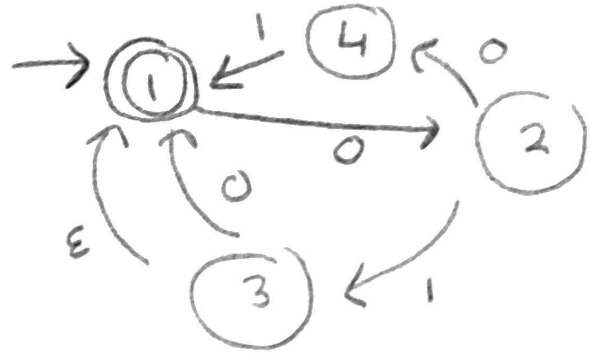
4)

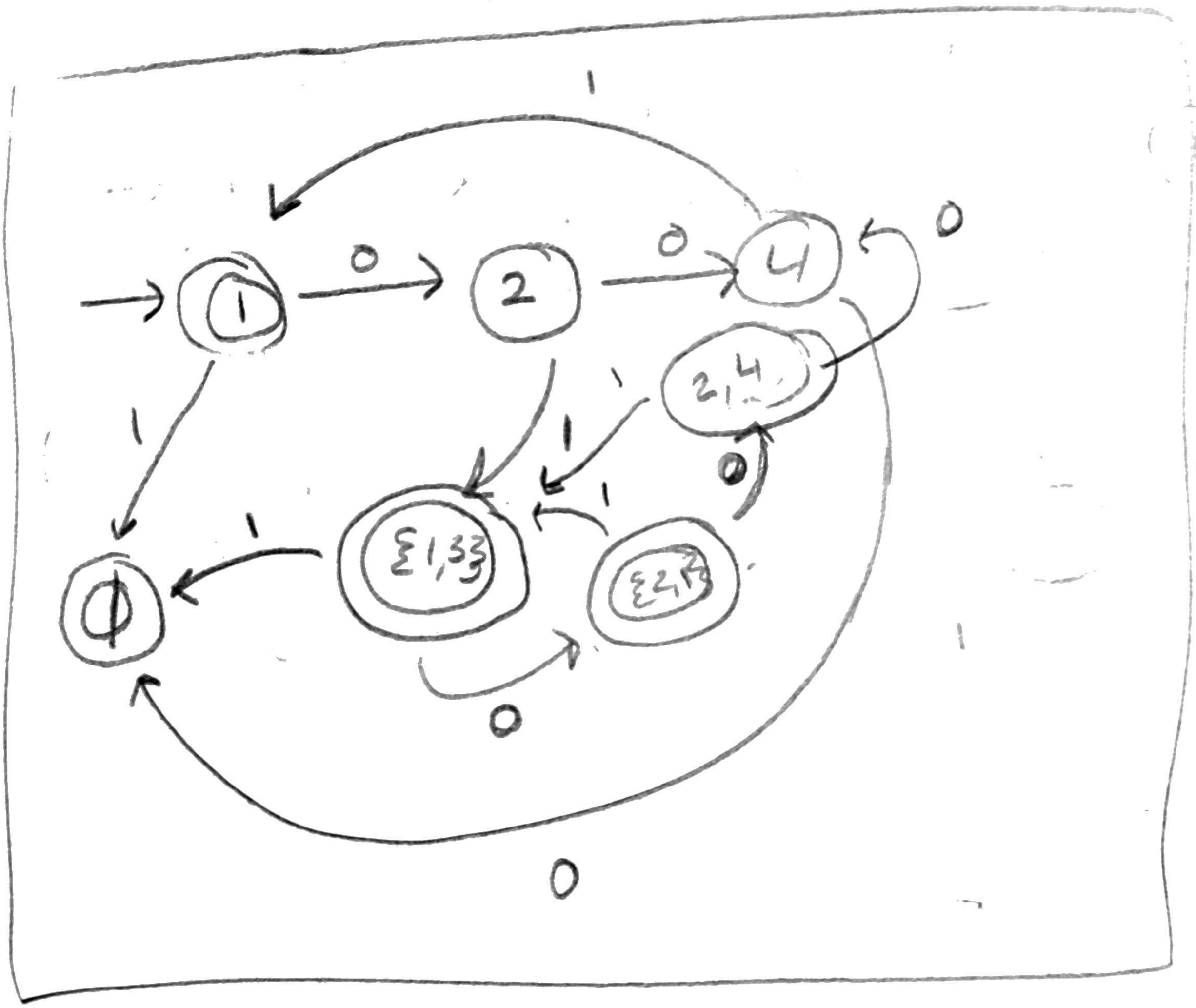
3) $(00)^* 11$

5)



1.17b) NFA:





1.18) f) $R = 0^*(100^*)^*1^*$

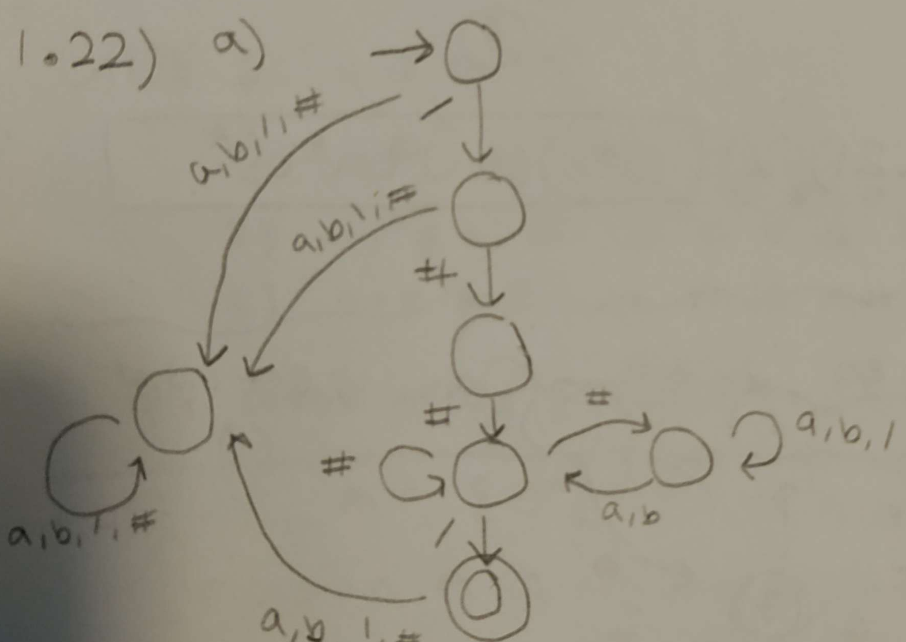
h) $R = \varepsilon \cup \Sigma \cup 0\Sigma \cup 10 \cup 0\Sigma\Sigma \cup 10\Sigma \cup 110\Sigma\Sigma\Sigma\Sigma^*$

i) $R = (1\Sigma)^*(\epsilon \cup 1)$

j) $R = 00^*00^*(\epsilon \cup 1) \cup 00^*(\epsilon \cup 1)00^* \cup (\epsilon \cup 1)00^*00^*$

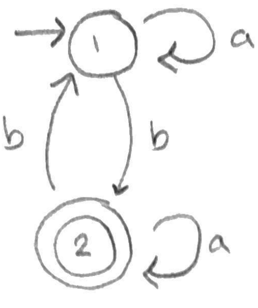
l) $R = 1^*(01^*01^*)^* \cup 0^*10^*10^*$

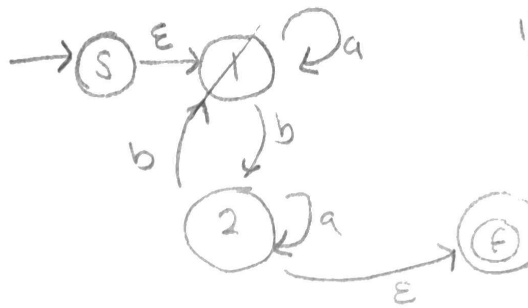
1.22) a)



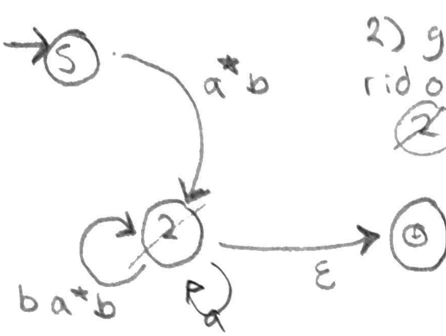
b) $/\#(a \cup b \cup /)^*\#(\# \cup (a \cup b)(a \cup b \cup /)^*\#)^*/$

1.21) a)

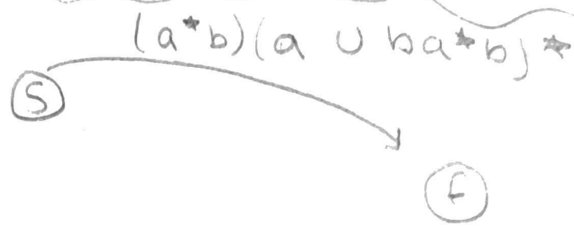




1) get rid of 1

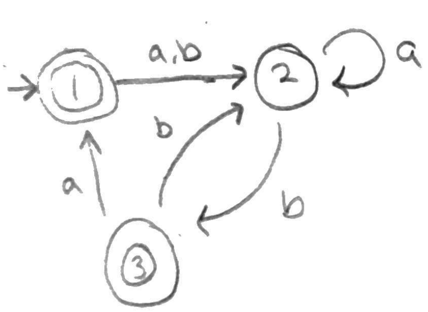


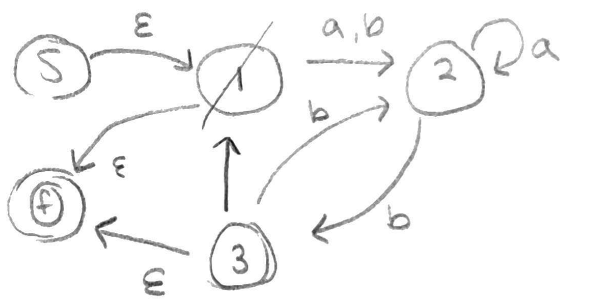
2) get rid of 2



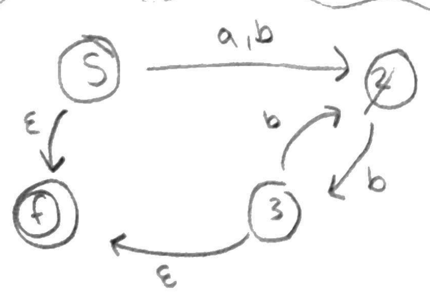
1.21) a) $\boxed{(a^*b)(a\cup ba^*b)^*}$

1.21) b)

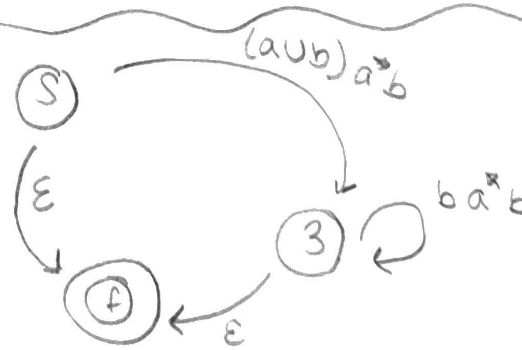




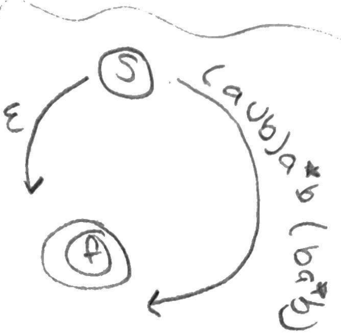
1) Get rid of 1



2) get rid of 2



get rid of 3



$\boxed{R = \varepsilon \cup (a\cup b)a^*b((a(a\cup b)\cup b)a^*b)^*(\varepsilon\cup a)}$

1.21) b)

1.29) b) $A = \{www \mid w \in \{a,b\}^*\}$

Assume A is regular and has a pumping length 'p'

Assume a string 's' $= a^p b^p a^p b^p a^p b^p = xyz \in A$ such that

1. $xy^iz \in A$, $i \geq 0$
2. $|y| > 0$
3. $|xy| \leq p$

CASE 1: "y is a w"

1) $y = a^k$, $k \geq 1$
2) $xy^2z = a^{p+k} b^p a^p b^p a^p b^p \notin A$
3) $p+k \neq p$, so A is not regular

By proof of contradiction, A is not regular

1.46) a) $A = \{0^n 1^m 0^n \mid m, n \geq 0\}$

Assume A is regular and has a pumping length 'p', such that $s = 0^p 1 0^p = xyz$ such that,

1. $xy^iz \in A$, $i \geq 0$
2. $|y| > 0$
3. $|xy| \leq p$

CASE 1: "y is 0's"

1) $y = 0^k$, if $k \neq 0$
2) $xy^2z = 0^{p+k} 1 0^p$
3) $p+k \neq p$

By proof of contradiction A is not regular

.29)

a) $A = \{0^n 1^n 2^n \mid n \geq 0\}$

Assume A is regular. assume 'A' has a pumping length 'P'. Assume a string, S, is $S = 0^P 1^P 2^P = xyz$ such that:

1. $xy^iz \in A$ for every $i \geq 0$
2. $|y| > 0$
3. $|xy| \leq P$

pumping lemma lets 'S' be split into xyz

CASE 1: "y is all 0's or all 1's or all 2's"

1) Since $y \neq \varepsilon$, $y = 0^K$, $K \neq 0$
2) $xy^iz = xy^2z = 0^{P+K} 1^P 2^P$
3) $P+K \neq P$, so $xy^2z \notin N$ by contradiction
4) Since 0, 1, and 2 share the same exponent there should not be any difference in condraticton proof.

CASE 2: "y is a combination of 2 of the alphabet"

1) since y will have two strings out of order, it wont follow the 012 format and will not belong to the language by contradiction

Therefore A is not regular by contradiction

1.46) b) $A = \{ 0^m 1^n \mid m \neq n \}$

Assume A is regular and has a pumping length P.
Assume a string $s = 0^P 1^{P+1} = xyz \in A$ such that:

1. $xy^iz \in A, i \geq 0$
2. $|y| > 0$
3. $|xy| \leq P$

CASE 1: "y is a 0"

1) Since $y \neq \varepsilon$, $y = 0^1$
2) $xy^2z = (0^P)(0^1)^2(1^{P+1}) =$
2i) $xy^2z = 0^{P+1} 1^{P+1}$
3) $P+1 = P+1$ which is a contradiction

By proof of contradiction, A is not regular

1.46) c) , $A = \{ w \mid w \in \{0,1\}^* \text{ is not a palindrome} \}$

If a is regular, then $\bar{A}$ is regular.
$\bar{A}$ should be $\bar{A} = \{ w \mid w \in \{0,1\}^* \text{ is a palindrome} \}$
Assume P is the pumping length of $\bar{A}$
Let $s = 0^P 1 0^P$ such that $s = xyz = 0^P 1 0^P$:

1. $xy^iz, i \geq 0$
2. $|y| > 0$
3. $|xy| \leq P$

CASE 1: "y is 0"

1) since $y \neq 0$, $y = 0^K, K > 0$
2) $xyz = (0^P)(0^K) 1 (0^P)$
3) $xyz = 0^{P+K} 1 0^P$
4) Since $P+K$ and P are different, the string will not be a palindrome.

By proof of contradiction since $\bar{A}$ is not regular, neither is A.