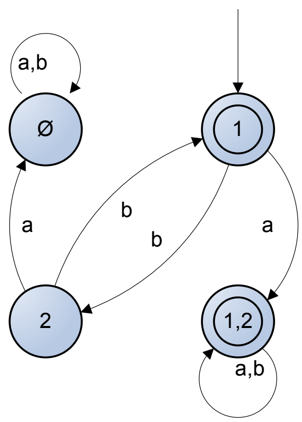
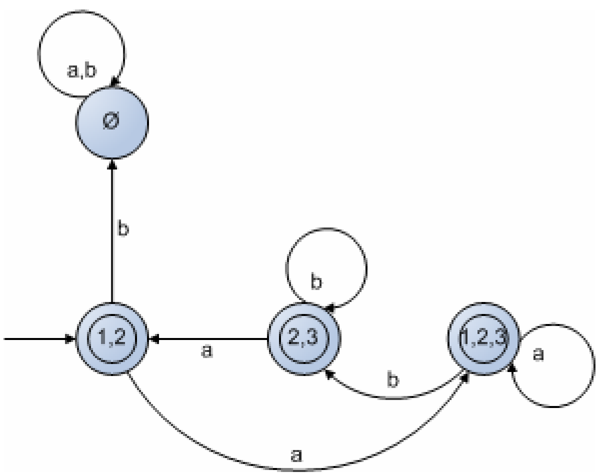
Homework #2 Solutions.

1.16

a.



b.



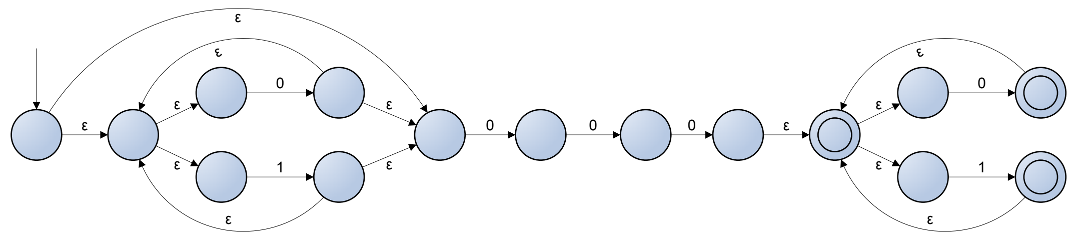
1.18

a. 1Σ*0
b. Σ*1Σ*1Σ*1Σ*
c. Σ*0101 Σ*
d. ΣΣ0Σ*
e. (0(ΣΣ)*) U (1Σ(ΣΣ)*)
f. (0 U 10)* 1*
g. ΣΣΣΣΣ U ΣΣΣΣ U ΣΣΣ U ΣΣ U Σ U ε
h. ε U 1 U 0 U 1(0 U 11(0 U 1)) (0 U 1)*
i. (1Σ)*
j. 000* U (000*1 U 100 U 010) 0*
k. ε U 0
l. (1*01*01*)*

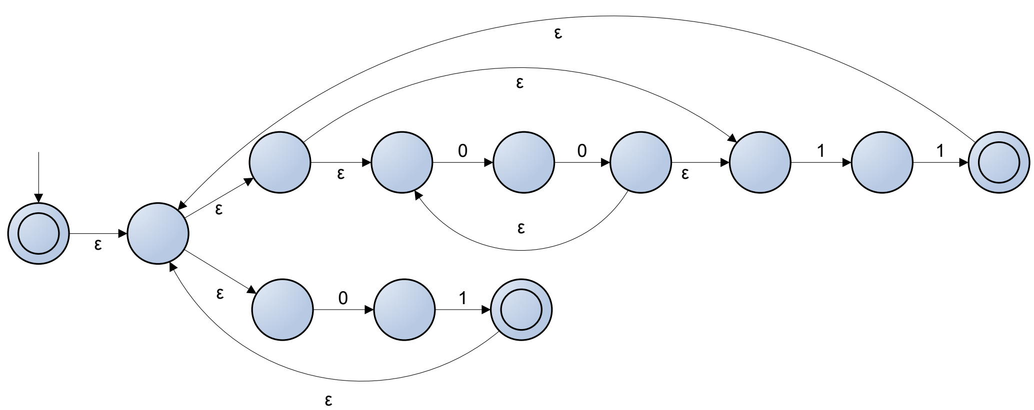
m. Ø
n. (0 U 1)(0 U 1)*

1.19

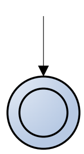
a.



b.



c.



1.20

c.

In: aaab
In: b
Not in: aba
Not in: bbbbbbbbba

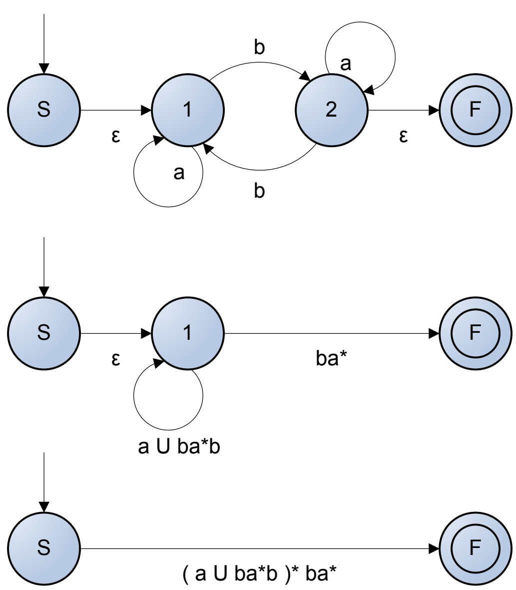
d.
In: aaa
In: aaaaaa
Not in: b
Not in: aaaaa

e.
In: aaaaabbbbbaaaaa
In: aaba
Not in: aaaaaabb
Not in: bab

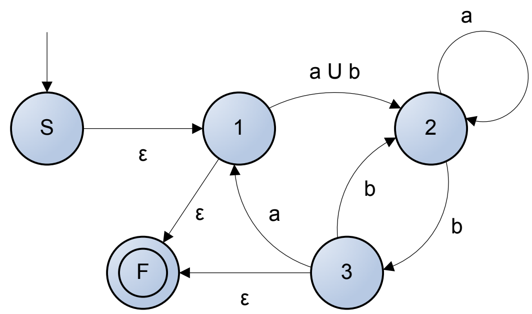
f.
In: aba
In: bab
Not in: abab
Not in: bb

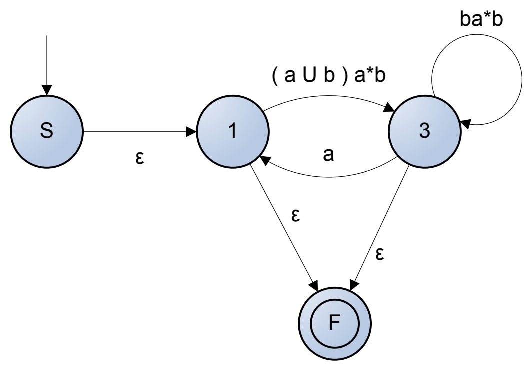
1.21

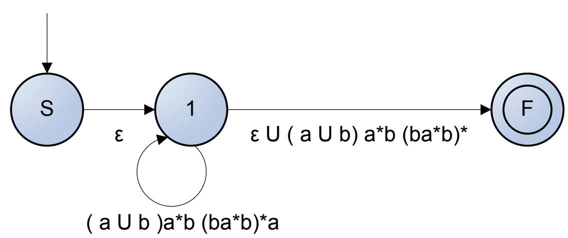
a.

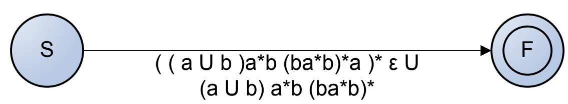


b.









1.29

a. text, page 96

b.

Let $w = ab^p$. Then $s = ab^p\ ab^p\ ab^p$. Now, with $|xy| \leq p$, then y must either be an a with some b's, or all b's. In the former case, pumping up will result in multiple a's in the first w (of www) that are not repeated in the remaining two instances. Likewise, in the latter case, where y contains strictly b's, then pumping up will result in too many b's for the first instance that are, again, not echoed in the remaining instances of the substring.

c. text, page 96

1.46

a. To show a is not pumpable, let s be the string 0^p10^p. By $|xy| \leq p$, y must contain only 0s. Let y be 0^k, where $0 \leq k \leq p$. Now, if we pump up the string s, we get $0^{p+ki}10^p$ for each pump i, which is not in the accepted language.

b. text, page 97

c. Let s be the string 0^p10^p. By $|xy| \leq p$, y must contain only 0s. Pumping up will result in a string that is no longer a palindrome. Since regular languages are close under complement, if non-palindromes were regular, then L would be too.

d. Let s by the string 0^p110^p1. By $|xy| \leq p$, y must contain only 0s. Let y be 0^k, where $0 \leq k \leq p$. When we pump on this y, we will end up with $0^{p+k}110^p1$, which is not in the accepted language.

1.49

Let s by the string 0^p10^p. By $|xy| \leq p$, y must contain only 0s. If we pump down in this case, then the resulting string will be $0^{p-k}10^p$, which is not in the accepted language.

1.55

a. 4
b. 1
c. 1
d. 3
e. 2