

Formal Languages Homework 5

Liam Dillingham

March 11, 2019

1 Problem 4.1.1

Prove that the following languages are not regular languages

1.1 e). $\{0^n 10^n \mid n \geq 1\}$

Using the pumping lemma, suppose that $x = \epsilon$, $y = 0^n$, and $z = 10^n$. Note that $|xy| \leq n$, and $y \neq \epsilon$. However, note that the pumping lemma requires that for all $k \geq 0$, the string is still in our language L . Lets choose $k = 0$. Then the string is essentially 10^n , where the number of 0's on either side of the 1 do not match. Therefore, the language is not regular.

1.2 f). $\{0^n 1^{2n} \mid n \geq 1\}$

Let $x = \epsilon$, $y = 0^n$, $z = 1^{2n}$. By choosing a $k = 0$, we have $0^{n*0} = \epsilon$. Since the number of 1's is not a square of the number of 0's, the language is not regular.

2 Problem 4.1.2

Prove that the following are not regular languages

2.1 e). The set of strings of 0's and 1's that are of the form ww , that is, some string repeated

Let $x = \epsilon$, and $y = w$, and $z = w$. Then yz should be in the language. However, by choosing any $k \neq 1$ gives us a string not equal to ww , and thus not in the language. Therefore the language is not regular.

3 Problem 4.2.4

Which of the following identities are true?

- 3.1 a). $(L/a)a = L$ (the left side represents the concatenation of the languages L/a and $\{a\}$)

Note that (L/a) is the set of words in L such that wa is in L . So if there is a word in L such that it ends in some other symbol, such as b , then it will not be in (L/a) . Thus concatenating a again on the end will not restore the set to L . Thus, false.

- 3.2 b). $a(a \setminus L) = L$ (again, concatenation with $\{a\}$, this time on the left is intended)

The argument for this identity follows the same as above, except on the left. Thus, false.

- 3.3 c). $(La)/a = L$

(La) is the set of all $w \in L$ with an a concatenated on the right side. And $(La)/a$ is all $w \in L$ where wa is also in L . Since we are appending an a to every $w \in L$, then we take the quotient, where we only keep w 's such that they have an a on the right side, then yes, it returns the original L . Thus true.

- 3.4 d). $a \setminus (aL) = L$

The argument follows the same from above, except considering for the left side of the w 's. Thus true.

4 Problem 4.4.2

Given the following transition table of a DFA

	0	1
→ A	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
*F	G	B
G	H	B
H	I	C
*I	A	E

4.1 a). Draw the table of distinguishabilities for this automaton

B	X							
C	X	X						
D		X	X					
E	X		X	X				
F	X	X		X	X			
G		X	X		X	X		
H	X		X	X		X	X	
I	X	X		X	X		X	X
	A	B	C	D	E	F	G	H

4.2 b). Construct the minimum-state equivalent DFA

