Practice Questions

(a) L_0 = {w : w ends with 00}

(b) L_1 = {w : w starts with 11 and the substring 11 appears only once in the string}

(c) L_2 = {w : w has odd number of 0's and ends with 1}

(d) L_3 = {w : w is a binary string thats decimal form is divisible by 3}

(e) L_4 = {w : w contains exactly two 1s}

(f) L_5 = {w : w contains at least two 0's and at most one 1}

(g) L_6 = {w : the second letter of w is a 1 and the second-to-last letter is a 0}

(h) L_7 = {w : there exists a pair of 1s in w that are separated by an even number of 0s}

(i) L_8 = {w : the total number of 0s in w is divisible by 3}

(j) $L_0 \cap L_8$

(k) $L_4 \cap \overline{L_5}$

(l) $L_0 \cup L_2$

(m) $\overline{L_0 \cup L_4}$

From Previous Mid Questions

$\Sigma = \{0, 1, \#\}$

$L_1 = \{w \in \Sigma^*$: *w does not contain # and the number of 0s in w is not a multiple of 3*$\}$

$L_2 = \{w \in \Sigma^*$: *the substring between any two successive occurrences of #s in w is in L1*$\}$

(a) If you use the "cross product" construction shown in class to obtain a DFA for $L_1 \cap L_2$, how many states will it have?

$L_1 = \{w \in \{0, 1\}^*: w = 0^m1^n, \text{ where } m, n \geq 0\}$

$L_2 = \{w \in \{0, 1\}^*$: *1 does not appear at any even position in w*$\}$

(b) If you were to use the "cross product" construction shown in class to obtain a DFA for the language $L_1 \cap L_2$, how many states would it have?

$L_1 = \{w \in \{0, 1\}^*$: *w starts and ends with different letters*$\}$

$L_2 = \{w \in \{0, 1\}^*$: *the length of w is at least two*$\}$

(c) If you were to use the "cross product" construction shown in class to obtain a DFA for the language $L_1 \cap L_2$, how many states would it have?

From Practice Sheet of BUX

1. Draw a DFA for the set of binary strings that are divisible by 8 while considered as binary numbers. ∑ = {0,1}
2. Draw a DFA for the set of strings that end with **abb**. ∑= {a, b, c}
3. Draw a DFA for the set of binary strings that have an even number of **0**'s or an odd number of **1**'s. ∑ = {0,1}
4. Draw a DFA for the set of strings that have **011** as a substring and **001** as not a substring. ∑ = {0,1}
5. Draw a DFA for the set of strings that have a length of at least **4**. ∑ = {a, b}
6. Draw a DFA for the set of binary strings that contain at least three **1**'s. ∑ = {0,1}
7. Draw a DFA for the set of strings that have exactly three **a**'s. ∑= {a, b, c}
8. Draw a DFA for the set of strings that have lengths of not more than **6**. ∑= {0,1}
9. Draw a DFA for the set of strings that have exactly three **1**'s and four **0**'s. ∑= {0,1,2}
10. Draw a DFA for the set of strings that have **three** consecutive **1**'s. ∑= {0,1}

From Micheal Sipsers books Exercise :

Introduction to the Theory of Computation, Third Edition -- Michael Sipser -- Third edition, …

Page 83-84

1.4 Each of the following languages is the intersection of two simpler languages. In each part, construct DFAs for the simpler languages, then combine them using the construction discussed in footnote 3 (page 46) to give the state diagram of a DFA for the language given. In all parts, $\Sigma = \{\mathtt{a}, \mathtt{b}\}$.

a. $\{w \mid w$ has at least three a's and at least two b's$\}$

[A]**b.** $\{w \mid w$ has exactly two a's and at least two b's$\}$

c. $\{w \mid w$ has an even number of a's and one or two b's$\}$

[A]**d.** $\{w \mid w$ has an even number of a's and each a is followed by at least one b$\}$

e. $\{w \mid w$ starts with an a and has at most one b$\}$

f. $\{w \mid w$ has an odd number of a's and ends with a b$\}$

g. $\{w \mid w$ has even length and an odd number of a's$\}$

1.5 Each of the following languages is the complement of a simpler language. In each part, construct a DFA for the simpler language, then use it to give the state diagram of a DFA for the language given. In all parts, $\Sigma = \{\mathtt{a}, \mathtt{b}\}$.

- [A]**a.** $\{w \mid w \text{ does not contain the substring } \mathtt{ab}\}$
- [A]**b.** $\{w \mid w \text{ does not contain the substring } \mathtt{baba}\}$
- **c.** $\{w \mid w \text{ contains neither the substrings } \mathtt{ab} \text{ nor } \mathtt{ba}\}$
- **d.** $\{w \mid w \text{ is any string not in } \mathtt{a}^*\mathtt{b}^*\}$
- **e.** $\{w \mid w \text{ is any string not in } (\mathtt{ab}^+)^*\}$
- **f.** $\{w \mid w \text{ is any string not in } \mathtt{a}^* \cup \mathtt{b}^*\}$
- **g.** $\{w \mid w \text{ is any string that doesn't contain exactly two } \mathtt{a}\text{'s}\}$
- **h.** $\{w \mid w \text{ is any string except } \mathtt{a} \text{ and } \mathtt{b}\}$

1.6 Give state diagrams of DFAs recognizing the following languages. In all parts, the alphabet is $\{\mathtt{0},\mathtt{1}\}$.

- **a.** $\{w \mid w \text{ begins with a } \mathtt{1} \text{ and ends with a } \mathtt{0}\}$
- **b.** $\{w \mid w \text{ contains at least three } \mathtt{1}\text{s}\}$
- **c.** $\{w \mid w \text{ contains the substring } \mathtt{0101} \text{ (i.e., } w = x\mathtt{0101}y \text{ for some } x \text{ and } y)\}$
- **d.** $\{w \mid w \text{ has length at least 3 and its third symbol is a } \mathtt{0}\}$
- **e.** $\{w \mid w \text{ starts with } \mathtt{0} \text{ and has odd length, or starts with } \mathtt{1} \text{ and has even length}\}$
- **f.** $\{w \mid w \text{ doesn't contain the substring } \mathtt{110}\}$
- **g.** $\{w \mid \text{the length of } w \text{ is at most } 5\}$
- **h.** $\{w \mid w \text{ is any string except } \mathtt{11} \text{ and } \mathtt{111}\}$
- **i.** $\{w \mid \text{every odd position of } w \text{ is a } \mathtt{1}\}$
- **j.** $\{w \mid w \text{ contains at least two } \mathtt{0}\text{s and at most one } \mathtt{1}\}$
- **k.** $\{\varepsilon, \mathtt{0}\}$
- **l.** $\{w \mid w \text{ contains an even number of } \mathtt{0}\text{s, or contains exactly two } \mathtt{1}\text{s}\}$
- **m.** The empty set
- **n.** All strings except the empty string