MODERN ACADEMY FOR COMPUTER SCIENCE
AND MANAGEMENT TECHNOLOGY IN MAADI
Department: Computer Science.

Sheet (1)

Academic year: 2021/2022 / Level: 4th Level	**Specialization: CS**
Title: Theory of Computation	**Code: CS 403**
Reference: Textbook3 (Introduction to the theory of computation), Sipser.	

1. 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, $\Sigma = \{a, b\}$.

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

   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$\}$

   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$\}$

2- Give state diagrams of NFAs with the specified number of states recognizing each of the following languages. In all parts, the alphabet is {0,1}.

a. The language $\{w \mid w$ ends with 00$\}$ with three states

b. The language of Exercise (1.6c in textbook3) with five states

c. The language of Exercise (1.6l in textbook3) with six states

d. The language **{0}** with two states

e. The language $0^*1^*0^+$ with three states

f. **The language $1^*(001^+)^*$ with three states**

g. The language **{ε}** with one state

h. The language 0^* with one state

3- Give regular expressions generating the following languages, In all parts, the alphabet is {0,1}.

a. {w| w begins with a 1 and ends with a 0}

b. {w| w contains at least three 1s}

c. {w| w contains the substring 0101 (i.e., w = x0101y for some x and y)}

d. {w| w has length at least 3 and its third symbol is a 0}

e. {w| w starts with 0 and has odd length, or starts with 1 and has even length}

f. {w| w doesn't contain the substring 110}

g. {w| the length of w is at most 5}

h. {w| w is any string except 11 and 111}

i. {w| every odd position of w is a 1}

j. {w| w contains at least two 0s and at most one 1}

k. { ε , 0}

l. {w| w contains an even number of 0s, or contains exactly two 1s}

m. The empty set

n. All strings except the empty string

4- For each of the following languages, give two strings that are members

and two strings that are *not* members—a total of four strings for each part. Assume the alphabet $\Sigma = \{a,b\}$ in all parts.

a.	a^*b^*
b.	$a(ba)^*b$
c.	$a^* \cup b^*$
d.	$(aaa)^*$

e.	$\Sigma^*a\Sigma^*b\Sigma^*a\Sigma^*$
f.	$aba \cup bab$
g.	$(\varepsilon \cup a)b$
h.	$(a \cup ba \cup bb)\Sigma^*$