Name: Student ID:

Quiz #6 6%

CS2336 Discrete Mathematics, Instructor: Cheng-Hsin Hsu

Department of Computing Science, National Tsing Hua University, Taiwan

This is a closed book test. Any academic dishonesty will automatically lead to zero point. If the total points are more than 6 points, you will get at most 6 points out of it.

1) (2%) For $\Sigma = \{0, 1\}$ determine whether the string 00010 is in each of the following languages (taken from Σ^*).
   a) $\{000, 101\}\{10, 11\}$
   b) $\{00\}\{0\}^*\{10\}$
   c) $\{000\}^*\{1\}^*\{0\}$
   d) $\{00\}^*\{10\}^*$

   Answer:
   a) Yes
   b) Yes
   c) Yes
   d) No

2) (2%) Consider the finite state machine $M = (S, \mathscr{I}, \mathscr{O}, \nu, \omega)$, where $S = \{s_0, s_1, s_2\}$, $\mathscr{I} = \mathscr{O} = \{0, 1\}$, and ν, ω are given by the state table below. Find the output for each of the following input strings $x \in \mathscr{I}^*$, and determine the last state in the transition process. (Assume that we always start at s_0.)
   a) $x = 1010101$
   b) $x = 1001001$
   c) $x = 101001000$
   d) $x = 00100111$

   Answer:
   a) 0010101;s_1

	ν		ω	
	0	1	0	1
s_0	s_0	s_1	0	0
s_1	s_2	s_1	0	0
s_2	s_0	s_1	0	1

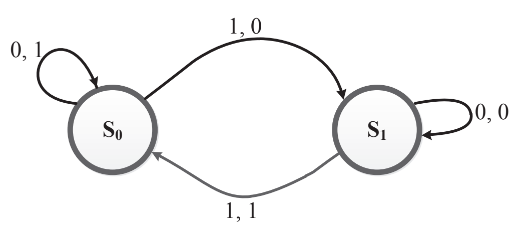
b) 0000000;s_1

c) 001000000;s_0

d) 00000000;s_1

3) (2%) For $\mathscr{I} = \mathscr{O} = \{0, 1\}$ a string $x \in \mathscr{I}^*$ is said to have *even parity* if it contains an even number of 1's. Construct a state diagram for a finite state machine that recognizes all nonempty strings of even parity. (Assume that we always start at s_0.)

Answer:



4) (2%) For $\Sigma = \{0, 1\}$ describe the strings in A^* for each of the following language $A \subseteq \Sigma^*$

a) $\{01\}$

b) $\{000\}$

c) $\{0, 010\}$

d) $\{1, 10\}$

Answer:

a) Here A^* consist of all strings x of even length where if $x \neq \lambda$ then x starts with 0 and ends with 1, and the symbols $(0$ and $1)$ alternate.

b) In this case A^* contains strings made up of $3n$ 0's for $n \in N$

c) Here a string $x \in A^*$ if and only if

1) x is a string of n 0's for $n \in N$; or

2) x is a string that starts and ends with 0, and it has at least one 1 but without consecutive 1's. There are at least two consecutive 0's between two 1.

d) For this case A^* consist of the following:

1) Any string of n 1's for $n \in N$; and

2) Any string that starts with 1 and contain at least one 0 without consecutive 0's.