

# Test 1 Review

## CS-450

April 29, 2013

### 1 AFSA

Question 1:

- a) Design a AFSA for  $x \in \{0,1\}^*$  —  $x$  has a 0 fourth from the end and  $x$  represents in binary an integer evenly divisible by 3
- b) Construct the computation tree for  $m$  on 10101

Question 2:

- a) Design a AFSA for  $x \in \{0,1\}^*$  —  $x$  does not have a 0 fourth from the end and  $x$  represents in binary an integer that doesn't evenly divisible by 3
- b) Computation tree for  $m$  on 10101

Question 3:

- a) Design AFSA  $L = \{x \in \{0,1\}^*\}$  , x represents in binary evenly divisible by 15.
- b) Design  $L_2 = L_1'$

Question 4:

Let  $M_1 = \{x \in \{0,1\}^* \mid x \text{ begins or ends with } 00\}$

Let  $M_2 = \{x \in \{0,1\}^* \mid x \text{ has both } 00 \text{ and } 11 \text{ as substring}\}$

a) Design AFSA  $M_3 = M_1 \cap M_2$ .

b) Design AFSA  $M_4 = M_1 \cup \bar{M}_2$

c) Design AFSA  $M_5 = \bar{M}_3$

Question 5:

Convert the AFSA to DFSA

M	0	1
1	$2 \wedge 3$	1
2	$3 \vee 4$	$2 \vee 4$
3	$3 \vee 1$	3
4	$1 \wedge 4$	$2 \wedge 3$

The initial state is 1, and the final state is also 1

Question 6

Given the AFSA, where 1 is the initial state, and 1 and 3 are final states

M	0	1
1	1	$1 \vee 3$
2	$2 \wedge 4$	$3 \wedge 4$
3	3	4
4	$2 \vee 3$	$1 \vee 4$

a) Draw the computation tree for string 101100 and explain if it is an accepting computation

b) Convert M to its equivalent DFSA. Represent all of the states in CNF and simplify them. Don't forget to indicate final states.

## 2 Two way FSA

Question 7:

Given machine M, where 1 is initial state, and 3 is final state

M	a	b
1	2L	3R
2	4L	2R
3	2L	4R
4	4R	1L

- a) Construct the Rebound Table
- b) Convert machine M to 1 DFSA using the Rebound Table
- c) Simulate the 2 dfsa to see if ba or bb string got rejected or accepted

Question 8

Given machine M, where  $q_1$  is the final state

M	0	1
$q_0$	$q_0R$	$q_1R$
$q_1$	$q_1R$	$q_2L$
$q_2$	$q_0R$	$q_2L$

- a) Construct the Rebound Table for machine M
- b) Simulate the 2dfs to show that 1001 is accepted by M



Question 9

Given the following 2-way deterministic fsa (2dfsa), where state 1 is the initial state, and states 2 and 3 are final states.

- (a) Simulate the 2dfsa and show how the string babb is accepted.
- (b) Construct the rebound tables and the equivalent 1dfsa partially only for consuming the string babb

M	a	b
1	2R	3R
2	4L	2R
3	4R	2L
4	1R	4L

# CS-450

## Homework # 3

Name: Huy Le

Question 1: Design a DTM to recognize  $\{a^m b^n c^{m+n} | m, n > 0\}$ .

Question 2: Design a DTM to recognize  $\{0^a 1^b 0^c \mid a + c = b, \text{ where } a, b, c \geq 0\}$ .

Question 3: Design a DTM to compute the function  $f(m, n) = m \bmod n$ , where  $m$  and  $n$  are positive integers. Note that  $m$  and  $n$  are represented as  $0^m 1 0^n$  on the input tape initially.

Question 4: Design a DTM to compute the following function  $f(m, n)$  where both  $m$  and  $n \geq 0$ . Note that  $m$  and  $n$  represented as unary numbers and separated by a 1 on the input tape initially. The ceiling operator  $\lceil x \rceil$  will return the smallest integer that is greater than or equal to  $x$ .

$$f(x) = \begin{cases} \lceil \frac{m}{2} \rceil - 1, & \text{if } \lceil \frac{m}{2} \rceil > n. \\ 0, & \text{otherwise.} \end{cases} \quad (1)$$