

CSE625 Homework 3
Due Wednesday, January 28

1. Construct a deterministic finite automaton which accepts each of the following languages. (Give a transition diagram for each.) :

- (a) $\{aa, bb, cc\}^*$
- (b) $\{s \in \{a, b\}^* : s \text{ does not contain more than four } b\text{'s.}\}$
- (c) $\{s \in \{a, b, c\}^* : s \text{ does not contain } abc \text{ as a substring.}\}$
- (d) $\{s \in \{a, b\}^* : \text{the number of } b\text{'s in } s \text{ is divisible by } 3.\}$
- (e) $\{a^i b^j : i + j \text{ is odd and } i \geq 1, j \geq 1.\}$

2. Let M_1 be the deterministic finite automaton $\langle P, \Sigma, \delta, p_0, F_1 \rangle$ where:

$$\begin{array}{lll} P & = & \{p_0, p_1\} \\ \Sigma & = & \{0, 1\} \\ F_1 & = & \{p_1\} \end{array} \quad \begin{array}{ll} \delta(p_0, 0) & = p_0 \\ \delta(p_0, 1) & = p_1 \end{array} \quad \begin{array}{ll} \delta(p_1, 0) & = p_1 \\ \delta(p_1, 1) & = p_0 \end{array}$$

Let M_2 be the deterministic finite automaton $\langle Q, \Sigma, \delta, q_0, F_2 \rangle$ where:

$$\begin{array}{lll} Q & = & \{q_0, q_1, q_2\} \\ \Sigma & = & \{0, 1\} \\ F_2 & = & \{q_0, q_2\} \end{array} \quad \begin{array}{ll} \delta(q_0, 0) & = q_0 \\ \delta(q_0, 1) & = q_2 \\ \delta(q_1, 0) & = q_2 \\ \delta(q_1, 1) & = q_0 \end{array} \quad \begin{array}{ll} \delta(q_2, 0) & = q_1 \\ \delta(q_2, 1) & = q_0 \end{array}$$

Let L_1 and L_2 be the languages accepted by M_1 and M_2 , respectively.

- (a) Construct a deterministic finite automaton which accepts $\overline{L_2}$, the complement of language L_2 . (Give a transition diagram.)
- (b) Construct a deterministic finite automaton which accepts $L_1 \cap L_2$. (Give a transition diagram.)
- (c) Construct a deterministic finite automaton which accepts $L_1 - L_2$. (Give a transition diagram.)