Linguistics 106
Homework Five
Finite State Automata

Due: 25 July 2002

1 Building FSAs

For each language $L_n$ described in this section, present a deterministic FSA which generates that language.

An FSA is deterministic when, out of every state, there is a defined transition (and no more than one defined transition) for each symbol in the alphabet.

An FSA $M$ generates a language $L$ iff the set of all strings accepted by $M$ is exactly the set $L$.

1. $L_1 = \{a1z, a2z, a3z, b1y, b2y, b3y\}$
   The alphabet of $L_1$ ($\Sigma_{L_1}$) is $\{a, b, y, z, 1, 2, 3\}$.
   For problems 2–5, assume that the alphabet of the language is $\{a, b\}$.

2. $L_2 = \{\sigma \mid \text{any } b \text{ in } \sigma \text{ is adjacent to at least one other } b\}$

3. $L_3 = \{\sigma \mid \sigma = (ab)^n(ba)^m; \ n \geq 0, m \geq 0\}$

4. $L_4 = \{\sigma \mid \sigma \text{ includes the substring } bbb\}$

5. $L_5 = \{\sigma \mid \text{every third symbol in } \sigma \text{ is } a\}$

1
2 Describing the language of an FSA

For each FSA $M_n$ presented in this section, describe the language of $M_n (L(M_n))$. If you can, either use the set-theoretic style of description employed in section 1, or use Regular Expressions. Otherwise, use ordinary English—but be clear and explicit.

In each of the following FSAs, the start state is named $q_0$.

1. $M_6$:
   ![Diagram of $M_6$]

2. $M_7$:
   ![Diagram of $M_7$]

3. $M_8$:
   ![Diagram of $M_8$]
3 Regular Grammars

1. Provide a Regular Grammar for the language $L_1$, defined in problem 1 of section 1.

2. Provide a Regular Grammar for the language $L_3$, defined in problem 3 of section 1.