

CSE625 Homework 5
Due Monday, Feb 16

1. Give context-free grammars for each of the following languages:
 - (a) $\{ a^i b a^{3i} : i \geq 1 \}$.
 - (b) $\{ w w^{\text{rev}} : w \in \{a, b, c\}^* \text{ does not contain } bc \text{ as a substring} \}$.
 - (c) $\{ a^i b^j a^j b^i : i \geq 0 \}$.
 - (d) $\{ a^i b^j c^k : j < i + k, i, j, k \geq 0 \}$.
 - (e) $\{ w \in \{a, b, c\}^* : \text{the number of } a\text{'s is equal to the number of } b\text{'s plus the number of } c\text{'s} \}$.
 - (f) $\{ a^i b^j : i + j \text{ is a multiple of } 3 \}$.
2. Construct a regular grammar which generates the language accepted by the finite automaton $\langle Q, \{a, b\}, \delta, q_0, F \rangle$ where:

$$\begin{array}{lll} Q & = & \{q_0, q_1, q_2, q_3, q_4\} \\ F & = & \{q_1, q_4\} \end{array} \quad \begin{array}{ll} \delta(q_0, a) & = q_1 \\ \delta(q_0, b) & = q_3 \\ \delta(q_1, a) & = q_2 \\ \delta(q_1, b) & = q_3 \\ \delta(q_2, a) & = q_3 \\ \delta(q_2, b) & = q_3 \end{array} \quad \begin{array}{ll} \delta(q_3, b) & = q_1 \\ \delta(q_3, a) & = q_4 \\ \delta(q_4, a) & = q_0 \\ \delta(q_4, b) & = q_0 \end{array}$$

(The grader will only grade a subset of these problems.)