CSE625 Homework 5
Due Monday, 5th November

1. Give context-free grammars for each of the following languages:
   (a) $\{ a^i b a^{3i} \colon i \geq 1 \}$.
   (b) $\{ ww^{\text{rev}} : w \in \{a, b, c\}^* \text{ does not contain } bc \text{ as a substring}\}$.
   (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) $\{ w \in \{a, b, c\}^* \colon$ the number of a's is equal to the number of b's plus the number of c's $\}$.
   (f) $\{ a^i b^j \colon i + j$ is a multiple of $3\}$.

2. Construct a regular grammar which generates the language accepted by the finite automaton $< Q, \{a, b\}, \delta, q_0, F >$ where:

$$Q = \{q_0, q_1, q_2, q_3, q_4\} \qquad F = \{q_1, q_4\}$$

$$\begin{aligned} \delta(q_0, a) &= q_1 \\ \delta(q_0, a) &= q_3 \\ \delta(q_1, a) &= q_2 \\ \delta(q_2, b) &= q_3 \end{aligned} \qquad \begin{aligned} \delta(q_3, b) &= q_1 \\ \delta(q_3, b) &= q_4 \\ \delta(q_4, a) &= q_0 \end{aligned}$$

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