CSE 322: Introduction to Formal Models in Computer Science
Assignment #5
November 4, 2005
due: Monday, November 14

1. For the context-free grammar G_4 given in Example 2.4 [1st Ed: Example 2.3], show a parse tree for the string $a \times (a \times a) \times (a + a)$.

2. In class we saw how to construct a context-free grammar G, from a given deterministic finite automaton M, such that $L(G) = L(M)$. There was a central claim

$$q_i \Rightarrow^*_G wq_j \text{ iff } (q_i, w) \vdash^*_M (q_j, \varepsilon)$$

that I left unproved, where $q_i, q_j \in Q$ and $w \in \Sigma^*$. Prove this claim by induction on $|w|$.

3. Give a context-free grammar G such that

$$L(G) = \{w \in \{0, 1\}^* \mid w \text{ has an equal number of 0s and 1s}\}.$$

You need not turn in a proof of correctness, though it would be good reassurance for yourself to do such a proof.

4. Exercise 2.16 [1st Ed: Problem 2.15].

5. Exercise 2.17 [1st Ed: Problem 2.16].

6. Convert the context-free grammar G_4 given in Example 2.4 [1st Ed: Example 2.3] into Chomsky normal form, using the procedure from the class handout. Show a parse tree for the string $(a + a) \times a$ in your Chomsky normal form grammar.