Theory of Computation

Fall 2012, Homework # 2

Due: Nov. 14 (Wednesday), 2012

1. (20 pts) Design a context-free grammar (CFG) to generate the following language:

$$\{a^i b^j c^k | i, j, k \geq 0, \quad i = j \quad or \ i = k\}$$

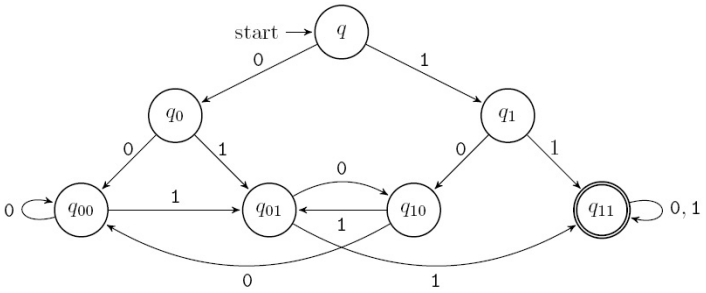
2. (20 pts) Convert the following CFG (over $\{0\}^*$) into an equivalent CFG in Chomsky normal form.
   $S \to BSB \ \mid \ B \ \mid \epsilon$
   $B \to 00 \ \mid \ \epsilon$

3. (20 pts) Are the following two languages context-free? Justify your answers.

   (a) $C_1 = \{w \mid \exists i, j \geq 0, \ w = a^i b^j c^i d^j\}$.

   (b) $C_2 = \{w \mid \exists i, j \geq 0, \ w = a^i b^j c^j d^i\}$.

4. (20 pts) Apply the DFA minimization algorithm to the following FDA. Show your derivation in sufficient detail.



5. (20 pts) Let R be a regular language and L be a context-free language, prove that $R \| L$ is also context-free. ($\|$ denotes the shuffle operator.)