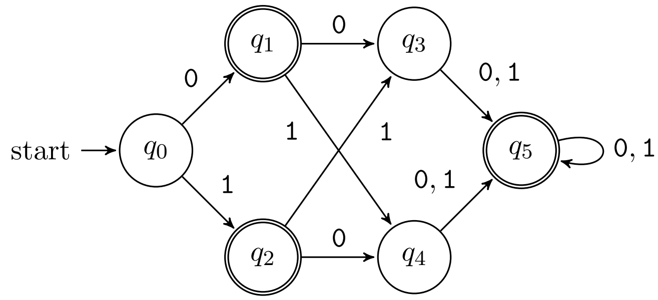
Homework 2–CSC 320 Fall 2015

Due in class on Wednesday October 21

1. (a) Using the state partitioning algorithm presented in class, find the minimal automaton equivalent to the following:



   (b) What is the language recognized by this automaton ($\Sigma = \{0, 1\}$)?

2. Prove the each of the following languages are not regular. You may use the pumping lemma, or closure properties of the regular langauges.
   (a) $\{0^n 1^m 0^n \mid m, n \geq 0\}$
   (b) $\{0^m 1^n \mid m \neq n\}$
   (c) $\{wtw \mid w, t \in \{0, 1\}^*\}$ (HINT: One way to do this is to use closure under intersection to get a simpler pumping lemma proof.)

3. Give CFGs for the following languages over $\sigma = \{0, 1\}$
   (a) $\{w \mid w = w^R\}$
   (b) $\{w \mid w$ contains the same number of 0's and 1's$\}$
   (c) $\{w \mid w = 0^n 1^n, n \geq 0\}$

4. Give a CFG that generates the language
$$A = \{\mathtt{a}^i \mathtt{b}^j \mathtt{c}^k \mid i = j \text{ or } j = k \text{ where } i, j, k \geq 0\}$$
   Is your grammar ambiguous. Why or why not?

5. Convert the following grammar into a grammar in Chomsky normal form:
$$E \to E + T \mid T$$
$$T \to T * F \mid F$$
$$F \to (E) \mid \textbf{num}$$

6. Using the CNF version of the grammar
$$E \to E * E \mid E + E \mid (E) \mid \textbf{id} \mid \textbf{num}$$
   given in class, show the result of running the CYK algorithm on the string $w = (\textbf{id} + \textbf{num}) * \textbf{num}$. Just show the entries of the resutling table.

7. Is every grammar in CNF unambiguous? If your answer is "yes", provide a proof. If your answer is "no", provide a counterexample.