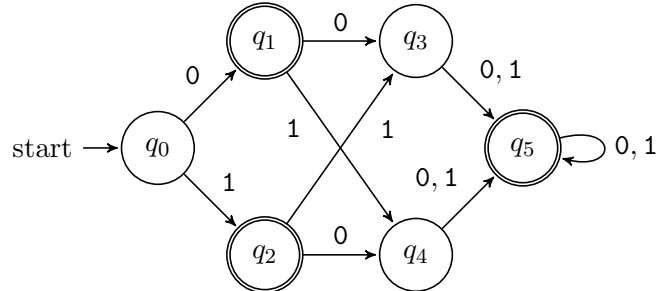


Homework 2–CSC 320 Fall 2015

Due in class on Friday October 16

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 each of the following languages are not regular. You may use the pumping lemma, or closure properties of the regular languages.
 - (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) $\{w \mid w \text{ contains the same number of 0's and 1's}\}$
 - (c) $\{w \mid w = 0^n 1^n, n \geq 0\}$
4. Give a CFG that generates the language

$$A = \{a^i b^j c^k \mid i = j \text{ or } j = k \text{ where } i, j, k \geq 0\}$$

Is your grammar ambiguous. Why or why not?

5. Convert the following grammar into a grammar in Chomsky normal form:

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow (E) \mid \mathbf{num}$$

6. Using the CNF version of the grammar

$$E \rightarrow E * E \mid E + E \mid (E) \mid \mathbf{id} \mid \mathbf{num}$$

given in class, show the result of running the CYK algorithm on the string $w = (\mathbf{id} + \mathbf{num}) * \mathbf{num}$. Just show the entries of the resulting table.

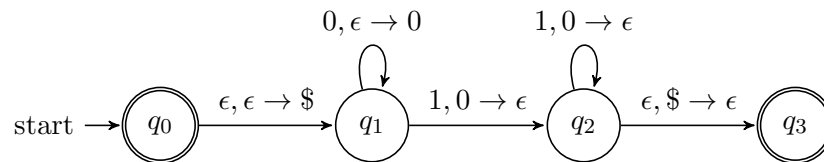
7. Convert the following CFG to a PDA using the construction given in class

$$S \rightarrow aAbS \mid bBaS \mid \epsilon$$

$$A \rightarrow aAbA \mid \epsilon$$

$$B \rightarrow bBaB \mid \epsilon$$

8. Convert the following PDA to a CFG using the construction given in class



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