CS 334 – Fall 2004: Answers to Assignment 5

1. Assume the language of matched parentheses is regular. Then there is some n such that any string w in the language with |w| greater than n can be factored into 3 parts xyz with $y \neq \Lambda$, $|xy| \leq n$, and $\forall k \geq 0$, xy^kz is in the matched parentheses language. Suppose w is such a string and we factor it so that all of the left parens are in x. Then whether y has left or right parens, when they are repeated, they fail to match. Similarly for other possible factorizations.
2. Assume the language is regular and choose an appropriate w of length n or greater. Say $w = 0^n10^n$. Suppose we factor w as xyz with $|xy| \leq n$. Then x consists of all 0's, n or fewer, so xz, which must be in the language, consists of fewer than n 0's followed by a 1 and exactly n 0's, not in the language.
3. Let n be the pumping lemma constant and choose $w = 0^{n^2}$. If w = xyz, then y consists of between 1 ands n 0's. So xyyz has length between $n^2 + 1$ and $n^2 + n$. The perfect square after n^2 is (n + 1)2 = $n^2 + 2n + 1$. So the length of xyyz lies strictly between the consecutive perfect squares n^2 and $(n + 1)^2$. Hence, pumping will not work.
4. When we try to factor any string of the form ww^R into xyz as required in the pumping lemma, we spoil the form of the strings needed.
5. The pumping lemma cannot prove a language is regular. The contrapositive can be used to prove that a language is not regular.
6. aabbaa
7. The language of the regular expression **a(ab)*ba**
8. Start with a DFA, say M, for L. Construct a new DFA, B, the same as M except that state q is an accepting state of B iff $\delta(q, a)$ is an accepting state of M. Then B accepts input string w iff A accepts wa.
9. Take the complement of the given language. The result is the language consisting of all strings of 0's and 1's that are not in 0*1*, plus the strings of form 0^n1^n. Intersect this with 0*1* and we get the language of strings of the form 0n1n. Since complementation and intersection with a regular language preserve regularity, if the given language were regular, then the language of 0^n1^n would be regular, but we have proven otherwise.
10.

B	X						
C	X	X					
D	X	X	X				
E	X	X		X			
F	X		X	X	X		
G		X	X	X	X	X	
H	X	X	X	X	X	X	X
	A	B	C	D	E	F	G

11. Apply the algorithm for determining distinguishable states to both FSA's at once.
12. Same as the cardinality for N - - countable.
13. We will draw a finite state machine in class.
14. Check to see if there is any path from the starting state to a final state.