COT 4210 Quiz #2 Part B: Push Down Automata and Pumping Lemma for CFGs

2/23/2021

Regular Start Time: 2:15 pm (EST)
Regular End Time: 3:00 pm (EST)
Regular Late Time: 3:10 pm (EST)

1) (12 pts) Consider designing a PDA to accept the following language of strings over the alphabet {0, 1}:

L = { w | w is a palindrome **with length 1 or greater**, with leading 0s allowed, whose binary value is divisible by 3 }

Note that with this definition, some strings in L are 11, 0110, and 10101. Examples of strings not in L are 110, 101, and 1001001. 110 is not in the language because 110 is not a palindrome. Both 101 and 1001001 are palindromes, but their numerical values in binary, 5 and 73, respectively, are not divisible by 3. **Your PDA should NOT accept ε.**

The design of this PDA is likely to require 9 states. Describe the conceptual meaning of each of the 9 states. In each description, explain both the property of the string read in so far as well as the meaning of the stack contents.

2) (10 pts) Use the pumping lemma for context free languages to prove that the following language over the alphabet {a, b} is NOT context free:

$$L = \{a^n b^{2^n} \mid n \in Z^+\}$$

Note: Recall that the set Z^+ is the set of positive integers.

3) (3 pts) Olivia Rodrigo's hit song Driver's License is about the singer getting her license to do this. (Note: it's really about something else, but at this point, hopefully you know how to answer these questions!)