Name

CS 383 Exam 2 April 14, 2017

You only need to answer the first 5 questions. #6 is a bonus question to give you something to do if you finish early. Questions (1) through (5) are worth 20 points each.

- Here is a list of languages. Which of these are context-free? You don't need to give a justification for your answer, so you can guess randomly and have a 1/32 chance of getting them all right...
 - a. Strings of Os, 1s, and 2s with more 1s than Os and more 2s than 1s
 - b. Strings of 0s and 1s with odd length that have a 1 as the center digit. For example, 00100, 11111, and 11101 are all in this language.
 - c. $\{0^{n}1^{n}0^{m}1^{m} | n,m \ge 0\}$
 - d. $\{0^{n}1^{m}0^{m}1^{n} | n,m \ge 0\}$
 - e. $\{0^{n}1^{m}0^{n}1^{m} | n,m \ge 0\}$

Here is a grammar. Draw a parse tree for the derivation of bbbaaa
A => BbAa | aa
B => BB | b | ε

3. Construct a PDA that accepts by final state the language $\{1^n 2^m 3^{n+2m} | n, m \ge 0\}$

4. Give a careful proof that the language $\{1^n2^m3^{n^*m} \mid n,m \ge 0\}$ is not context-free.

5. Construct a Turing Machine that accepts the language $\{1^n 2^n 3^n | n > 0\}$

6. Optional bonus question. (Only do this if you are done with everything else.) For any language L let Half(L) be the first half of each even-length string in L. So if L is $\{0^n1^n | n \ge 0\}$ then Half(L) is $\{0^n | n \ge 0\}$ Show that L can be context-free without Half(L) being context-free. Hint: start with L = $\{0^n1^m2^m3^{3n} | m, n \ge 1\}$. Try looking at Half(L) \cap R, where R is a certain regular language.

You can use this as extra space for any question.

Please write and sign the Honor Pledge when you are finished with the exam