CSE355 Fall 2016–Recitation Quiz 7 (Solutions)

Name: _____ ASU ID: _____

1. Construct a CFG for the language $L = \{0^n 1^{n+m} 2^m \mid m, n \geq 0\}$ (Hint: think of $\{0^n 1^n \mid n \geq 0\}$).

$$S \to AB$$
$$A \to 0A1 \mid \epsilon$$
$$B \to 1B2 \mid \epsilon$$

Here, we want the A variable to make the first n characters in the 1 "section," and B to make the last m characters (in order to match up with the 0 and 2 sections). This is essentially two embedded copies of $\{0^n 1^n \mid n \geq 0\}$.

2. My friend says he understands regular languages (RLs) vs. context-free languages (CFLs). He says that there are some RLs that are not CFLs, some CFLs that are not RLs, and some others that are both a RL and a CFL. From what you know so far in CSE355, is my friend correct? If you think he is correct, give a brief proof of each of the 3 statements; if not, give a brief proof *of all correct statements*, and a counterexample of the incorrect ones.

My friend has 2 correct statements out of 3.

- There are some RLs that are not CFLs: this is *not correct*. Every RL can be recognized by a DFA, and equivalently by a regular grammar. Since regular grammars are already context-free grammars (just a restricted form of them), we have that every regular language is context-free.

- There are some CFLs that are not RLs: this is *correct*. One example is $L = \{0^n 1^n \mid n \geq 0\}$. We showed in class that it is context-free by giving a CFG for it, but also proved it is not regular due to the Pumping Lemma for Regular Languages.

- There are others that are both a RL and a CFL: this is *correct*, due to the analysis of the first claim above (since all RLs are CFLs). An example is $\emptyset$.

_____

TA use only! Quiz has been recorded: ☐