University of Nevada, Las Vegas Computer Science 456/656 Spring 2021
Assignment 3: Due Friday September 23 2022, 11:59 PM

Name:_____

   You are permitted to work in groups, get help from others, read books, and use the internet. Turn in the assignment in the manner given to you by our grader, Janeen Sudiacal.

1. Correctly state (not prove) the pumping lemma for regular languages.

2. Prove that the grammar G given below is ambiguous by giving two different parse trees of the string `iiaea`. Both of those parse trees are correct, but only one of them is consistent with the usual rule for resolving ambiguity of if-then-else statements. Which one?

   1. $S \rightarrow a$
   2. $S \rightarrow iS$
   3. $S \rightarrow iSeS$

3. The Dyck language is the language of balanced strings of left and right parentheses. For example, the strings $(), (()), ()(()), \lambda$ are members of the Dyck language, but $)(, (()$ are not.

Here is an unambiguous grammar for the Dyck language.

1. $S \to S(S)$
2. $S \to \lambda$

Using that grammar, write a left-most derivation for the string $(())$, then write a right-most derivation for the same string.

4. Give a context-free grammar for the language $\{a^n b^m : 0 \leq m = 2n\}$

5. You know that the intersection of two CF languages may not be CF. Here is an example. Using the pumping lemma for context-free languages, it is possible to prove that $L = \{a^n b^n c^n : n \geq 0\}$ is not context-free.

(a) Give context-free grammars for the languages L_1 and L_2, where

$L_1 = \{a^n b^m c^m : n \geq 0, m \geq 0\}$

$L_2 = \{a^n b^n c^m : n \geq 0, m \geq 0\}$

(b) Explain why $L_1 \cap L_2$ is not context-free.