Homework 6

CptS 317, Spring 2021

Due Date: April 7, 2021 by 11:59 PM Pacific.

To be submitted on Canvas.

1. Convert the following Context Free Grammar (CFG) into an equivalent Push Down Automata (PDA) (note that in this problem, the start symbol is C):
   $C \rightarrow ACA|E$
   $E \rightarrow 0G1|1G0$
   $G \rightarrow AGA|A|\epsilon$
   $A \rightarrow 0|1$

2. Show that every Deterministic CFG is an unambiguous CFG.

3. The following is the transition table for a DFA. Note that the $\rightarrow$ symbol denotes the start state, and the $*$ symbol denotes accepting states. Construct a minimum state equivalent DFA using the Table Filling Algorithm (the Table Filling Algorithm was discussed in class on March 13).

	0	1
$\rightarrow R$	S	V
S	T	W
$*T$	U	Y
U	V	Y
V	W	Z
$*W$	X	S
X	Y	S
Y	Z	T
$*Z$	R	V

4. Give an informal description of a Turing Machine that decides if an input string is in the language $L = \{a^n b^n c^n | n \geq 0\}$.

5. Give a state diagram for a Turing Machine that accepts the language given by the regular expression $(ab)^*$, but which enters an infinite loop if its input is not in the language. Why might this behavior be undesirable?

6. Suppose you have a software library which supplies functions and associated data types that allow you to perform the following task:

   - As input, accept a formal specification of a CFG, as well as a string to parse.
   - If the input string is in the language generated by the CFG, output a parse tree for a leftmost derivation of the string.
   - If the input string is not in the language, return some default value (i.e. `nil`, `none`, `null`, and the like).

   Give an example of how you might use this library in a practical application. Describe in several sentences how such an application might be **implemented** using this library.