COT 4210 Quiz #2 Part A: Context Free Grammars 2/23/2021

Regular Start Time: 1:45 pm (EST)
Regular End Time: 2:15 pm (EST)
Regular Late Time: 2:25 pm (EST)

1) (9 pts) Below is the formal description of a DFA which describes a language L. Use the algorithm shown in class to convert a DFA to an equivalent context free grammar to produce a CFG that accepts L.

$Q = \{a, b, c, d\}$ $\Sigma = \{0, 1\}$ $q_0 = a$ $F = \{b, d\}$

δ State\Character	0	1
a	b	d
b	a	c
c	d	b
d	c	a

Clearly designate your CFG formally, listing each of the components in the formal designation. Please make your variable names easy to follow such that the correspondence to the DFA is clear.

2) (9 pts) The following grammar over the alphabet {a, b} below is in the process of being converted into Chomsky Normal Form. A new start symbol, S' has been added. The next step is to remove all epsilon rules. Show the resulting grammar when all epsilon rules have been removed. To save time, feel free to copy and paste all of the old rules and then just add the new rules at the end. (Note: the variables in the grammar currently are S', S, T, U, V

S' → S
S → aS | Sb | TUV
T → TT | TU | VT | ε
U → bUb | bVVa | bVUVb
V → aab | bVa | ε

3) (7 pts) Design a context grammar over the alphabet { (,) } representing the set of strings of matching parentheses. Use the usual notion of matching parentheses, namely, each open parenthesis has a matching close parenthesis and inside of each pair of matching parentheses any valid set of matching parentheses are allows. Examples of strings in the language are: (), ()(), (()), (()()(())) and ε. Examples of strings that aren't matching parentheses are: ())(, ((), and ()()())(). In the first example, the prefix of the first three characters has more close parentheses than open parentheses. In the second example, the full string has more open parentheses than close parentheses and in the last example, the prefix of the first seven characters has more close parentheses than open parentheses. Clearly designate your CFG formally, listing each of the components in the formal designation.