Kush Patel

HW 4

1.) $L_1 = \{w = 010^n1^n \mid n \geq 0\}$

a) Provide the 4-tuple for your CFG'

$$G_1 = (V, \Sigma, R, S)$$

$V = \{S, A\}$

$\Sigma = \{0, 1\}$

$R =$ → $\{ S \to 01S \mid A$
$\quad\quad A \to 01 \mid S$

$S = A$

b) Convert your grammar (a) into Chomsky Normal Form.

$S \to 01S \mid A$
$A \to 01 \mid S$

→

$S_0 \to S$
$S \to 01S \mid A$
$A \to 01 \mid S$

←

$S_0 \to S$
$S \to 01S \mid 01 \mid S$
$A \to 01 \mid S$

→

$S_0 \to 01S \mid 01 \mid S$
$S \to 01S \mid 01 \mid S$
$A \to 01 \mid 01S \mid 01 \mid S$

←

$S_0 \to abS \mid ab \mid S$
$S \to abS \mid ab \mid S$
$A \to ab \mid abS \mid ab \mid S$
$a \to 0$
$b \to 1$

2.) Provide the 4-tuple for your CFG

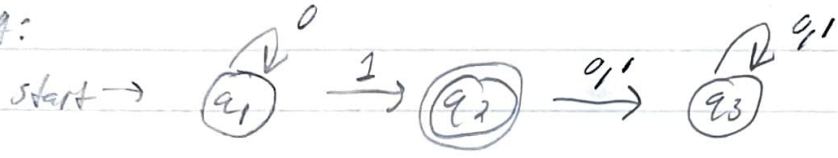
$L_2 = \{w = (01)^n 0^k \mid n, k \in Z, \text{ and } n, k \geq 0 \text{ and } n > k\}$

$V = \{S\}$
$\Sigma = \{0, 1\}$
$R =$
$S = A, B$

$S \rightarrow 01S \mid 0150$
$A \rightarrow 01 \mid S$

3.) Convert DFA to CFG. Provide the 4-tuple for your CFG

DFA:



1 $C_1 \rightarrow 0C_1$
2 $C_1 \rightarrow 1C_2$
3 $C_2 \rightarrow 0C_3$
4 $C_2 \rightarrow 1C_3$
5 $C_3 \rightarrow 0C_3$
6 $C_3 \rightarrow 1C_3$
7 $C_3 \rightarrow \varepsilon$

$C_1 \rightarrow 0C_1 \mid 1C_2$
$C_2 \rightarrow 0C_3 \mid 1C_3$
$C_3 \rightarrow 0C_3 \mid 1C_3$

$V = \{q_1, q_2, q_3\}$
$\Sigma = \{0, 1\}$
$R = C_1 \rightarrow 1C_2, 1C_2 \rightarrow 011C_3, 011C_3 \rightarrow 011$
$S = A$

$C_1 \xrightarrow{2} 1C_2 \xrightarrow{3,4} 011C_3 \xrightarrow{7} 011$
011

4.) Give a CFG for generating the complement of the language $\{a^n b^n \mid n \geq 0\}$

$G = \{V, \Sigma, R, S\}$

$V = \{S, A\}$

$\Sigma = \{a, b\}$

$R =$

$S = A$

$\rightarrow \{ S \rightarrow aSb \mid A$

$\{ A \rightarrow ab \mid S$

Complement:

$G = \{a^n b^m : n \neq m\}$

$S \rightarrow aSb \mid A$

$A \rightarrow ab \mid S$