CFG

$V = \{A, B\}$, $\Sigma = \{0, 1\}$, $S = A$, $R = A \to BAB \mid B \mid 1 \mid \epsilon$

$B \to 00 \mid \epsilon$

CNF Steps

① Add a new start state S. ⇒

$S \to A$
$A \to BAB \mid B \mid 1 \mid \epsilon$
$B \to 00 \mid \epsilon$

② Do step 2 of converting the following CFG's into CNF by removing ϵ rules.

2.a) $V = \{S, A, B, C\}$, $\Sigma = \{a, b, c\}$, $S = S$, $R = S \to A$
$A \to AaB$
$B \to b \mid C \mid \epsilon$
$C \to CC \mid c \mid \epsilon$

Remove $B \to \epsilon$:
$S \to A$
$A \to AaB \mid Aa$
$B \to b \mid C$
$C \to CC \mid c \mid \epsilon$

→ Remove $C \to \epsilon$:
$S \to A$
$A \to AaB \mid Aa$
$B \to b \mid C$
$C \to CC \mid c$

2.b) $V = \{S, A, B\}$, $\Sigma = \{a, b\}$, $S = S$, $R = S \to A$
$A \to AA \mid AB \mid B \mid a$
$B \to BB \mid b \mid \epsilon$

Remove $B \to \epsilon$:
$S \to A$
$A \to AA \mid AB \mid B \mid a \mid A$
$B \to BB \mid b$

③ Do step 3 on the following CFG's by removing unit rules.

3.a) $V = \{S, A, B\}$, $\Sigma = \{a, b\}$, $S = S$, $R = S \to A$
$A \to AA \mid AB \mid A \mid B \mid aB$
$B \to BB \mid Bb \mid b$

⇒ Remove $A \to B$, $A \to A$, and $S \to A$

$S \to AA \mid AB \mid aB \mid BB \mid Bb \mid b$
$A \to AA \mid AB \mid aB \mid BB \mid Bb \mid b$
$B \to BB \mid Bb \mid b$

3.b) $V = \{S, A, B, C, D\}$, $\Sigma = \{a, b, c\}$, $S = S$, $R = S \to A \mid \epsilon$
$A \to BC$
$B \to BD \mid bb$
$C \to CD \mid cc$
$D \to B \mid C$

⇒ Remove $D \to B$, $D \to C$, and $S \to A$.

$S \to BC \mid \epsilon$
$A \to BC$
$B \to BD \mid bb$
$C \to CD \mid cc$
$D \to BD \mid bb \mid CD \mid cc$

CNF Steps Cont. | HWK. 6 - CFG to CNF/PDA | rcrocke6 | Riley Crockett | 2

(4) Do step 4 on the following CFG's by removing remaining rules.

(No more than 2 vars. and no mix of vars. & terminals on the RHS)

$V = \{S, A, B\}, \Sigma = \{a, b\}, S \to S, R =$

$S \to AAB \mid aBb \mid ABB \mid Ab$

$A \to AAB \mid aBb \mid ABB \mid Ab$

$B \to BB \mid Bb \mid b$

$S \to AC \mid u_0Bu_1 \mid AD \mid Au_1$

$A \to AC \mid u_0Bu_1 \mid AD \mid Au_1$

$B \to BB \mid Bu_1 \mid b$

$C \to AB$

$D \to BB$

$u_0 \to a$

$u_1 \to b$

(5) Convert CFG to PDA: $V = \{A, B, C, D\}, \Sigma_\epsilon = \{x, \sqrt{}, +, (,)\} \cup \{\epsilon\}, S = A, R =$

$A \to B \mid C \mid x$

$B \to \sqrt{C} \mid \sqrt{A}$

$C \to (D) \mid (A)$

$D \to A + A$