Sample Assignment # 6.1 Key

1. Write a CFG for the following languages:

$L = \{\, c^k\, a^n\, b^m \mid n < m,\ \text{if } k=0;\ n > k+m,\ \text{if } k>0 \,\}$.

$S \rightarrow S1 \mid S2$

$S1 \rightarrow a\, S1\, b \mid S1\, b \mid b$

$S2 \rightarrow c\, C\, a\, B$

$C \rightarrow c\, C\, a \mid C\, a \mid a$

$B \rightarrow a\, B\, b \mid \lambda$

Sample Assignment # 6.2a Key

2. Convert the following grammar to a CNF equivalent grammar. Show all steps.
   G = ({S, B, L, P, E}, {i, t, s, e, {, }, ;, 0, 1}, R, S), where **R** is

   S → i P t S E | s | B

   B → { s L }

   L → λ | ; s L

   P → 0 | 1

   E → λ | e S

   Remove lambda rules

   Nullables = {L, E }

   S → i P t S E | i P t S | s | B

   B → { s L } | { s }

   L → ; s L | ; s

   P → 0 | 1

   E → e S

Sample Assignment # 6.2b Key

Remove Unit Rules

Chain(S) = {S, B}; Chain B = {B}; Chain (L) = {L}; Chain(P) = {P}; Chain(E) = {E}

$S \rightarrow i\ P\ t\ S\ E\ |\ i\ P\ t\ S\ |\ s\ |\ \{\ s\ L\ \}\ |\ \{\ s\ \}$

$B \rightarrow \{\ s\ L\ \}\ |\ \{\ s\ \}$

$L \rightarrow ;\ s\ L\ \ |\ ;s$

$P \rightarrow 0\ |\ 1$

$E \rightarrow e\ S$

Remove Non-Productive Symbols

Productive = {S, B, L, P, E}

NO CHANGE

Remove Unreachable Symbols

Reachable= {S, P, E, L}

$S \rightarrow i\ P\ t\ S\ E\ |\ i\ P\ t\ S\ |\ s\ |\ \{\ s\ L\ \}\ |\ \{\ s\ \}$

$L \rightarrow ;\ s\ L\ \ |\ ;s$

$P \rightarrow 0\ |\ 1$

$E \rightarrow e\ S$

Sample Assignment # 6.2c Key

Convert to CNF

$S \rightarrow$ <<i> P <t> S> E | <<i> P <t>> S | s | <<{> <s> L> <}> | <<{> <s> > <}>

$L \rightarrow$ <<;> <s>> L | <;> <s>

$P \rightarrow 0 | 1$

$E \rightarrow$ <e> S

<<i> P <t> S> $\rightarrow$ <<i> P <t>> S

<<i> P <t>> $\rightarrow$ <<i> P > <t>

<<i> P> $\rightarrow$ <i> P

<<{> <s> L> $\rightarrow$ <<{> <s>> L

<<{> <s>> $\rightarrow$ <{> <s>

<<;> <s>> $\rightarrow$ <;> <s>

<e> $\rightarrow$ e

<i> $\rightarrow$ i

<s> $\rightarrow$ s

<t> $\rightarrow$ t

<{> $\rightarrow$ {

<}> $\rightarrow$ }

<;> $\rightarrow$;

Sample Assignment # 6.3

3. Present the **CKY** recognition matrix for the string **babba** assuming the Chomsky Normal Form grammar,
   G = ({S,A,B,C,D }, {a,b}, R, S), specified by the rules **R**:

   S → AB | BA | SC

   A → CS | CD | a

   B → DS | b

   C → a

   D → b

	b	a	b	b	a
1	B,D	A,C	B,D	B,D	A,C
2	S	S,A		S	
3	S,B	S	B		
4	B	S			
5	B,S				