Assignment # 6.1 Key

1. Write a CFG for the following languages:
   L = { w | w $\in$ {a,b}$^+$ $w_a = 2*w_b$ where **w_a** is the number of **a's** in **w; w_b** is the number of **b's }**.

   S $\rightarrow$ S a S a S b S | S a S b S a S | S b S a S a S |

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Assignment # 6.2a Key

1. Convert the following grammar to a CNF equivalent grammar. Show all steps.
   G = ({S,A,B,C,D}, {a,b,c}, R, S) where **R** is

   S → A | B

   A → aA | Cc

   B → aBc | Bc | Dc

   C → bCc | Cc | λ

   D → bD | aD

   Remove lambda rules

   Nullables = { C }

   S → A | B

   A → aA | Cc | c

   B → aBc | Bc | Dc

   C → bCc | Cc | bc | c

   D → bD | aD

Assignment # 6.2b Key

Remove Unit Rules
Chain(S) = {S, A, B}; Chain(A) = {A}; Chain B = {B}; Chain (C) = {C}; Chain(D) = {D}
S → aA | Cc | c | aBc |Bc | Dc
A → aA | Cc | c
B → aBc | Bc | Dc
C → bCc | Cc | bc | c
D → bD | aD
Remove Non-Productive Symbols
Productive = { S, A, C }
S → aA | Cc | c
A → aA | Cc | c
C → bCc | Cc | bc | c
Remove Unreachable Symbols
Reachable= {S, A, C}
NO CHANGE

Assignment # 6.2c Key

Convert to CNF

G’ = ({S,A,C}, {a,b,c}, R’, S)

R’:

S → <a>A | C<c> | c

A → <a>A | C<c> | c

C → <bC><c> | C<c> | <b><c> | c

<bC> → <b><C>

<a> → a

<b> → b

<c> → c

Assignment # 6.3a Key

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

S → AB | BA

A → SC | CD | a

B → SD | DC | b

C → a

D → b

Is abaabab in L(G)?

Assignment # 6.3 Key

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

$S \rightarrow AB \mid BA$
$A \rightarrow SC \mid CD \mid a$
$B \rightarrow SD \mid DC \mid b$
$C \rightarrow a$
$D \rightarrow b$

abaabab $\in$ L(G)