Homework #5

V_1

$V_4 \; V_2 V_2$

1. $V_1 \rightarrow V_2V_2 \mid V_4V_3 \mid V_4V_5 \mid \varepsilon$
   $V_2 \rightarrow V_2V_2 \mid V_4V_3 \mid V_4V_5 \mid$
   $V_3 \rightarrow V_2V_5$
   $V_4 \rightarrow ($
   $V_5 \rightarrow)$

(()) (()())
1 2 3 4 5 6 7 8 9 10

)(()))

	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
$l=1$	V_4	V_4	V_5	V_5	V_4	V_4	V_5	V_4	V_5	V_5
$l=2$	∅	V_1, V_2	∅	∅	∅	V_1, V_2	∅	V_1, V_2	∅	X
$l=3$	∅	V_3	∅	∅	∅	∅	∅	V_3	X	X
$l=4$	V_1, V_2	∅	∅	∅	∅	V_1, V_2	∅	X	X	X
$l=5$	∅	∅	∅	∅	∅	V_3	X	X	X	X
$l=6$	∅	∅	∅	∅	V_1, V_2	X	X	X	X	X
$l=7$	∅	∅	∅	∅	X	X	X	X	X	X
$l=8$	∅	∅	∅	X	X	X	X	X	X	X
$l=9$	∅	∅	X	X	X	X	X	X	X	X
$l=10$	$V_1 V_2$	X	X	X	X	X	X	X	X	X

ai. P[2,2], P[2,6], P[2,8], P[4,1], P[4,6] & P[10,1] contains V_1

aii P[1,4] contains V_5 True

(( ) ( )

V_4 ((((() (()(

$V_2 \rightarrow$ (),())() V_2()

aIII P[2,3] Contains V_4 False

V_2

$V_4 V_3$

$V_4 V_2 V_5$

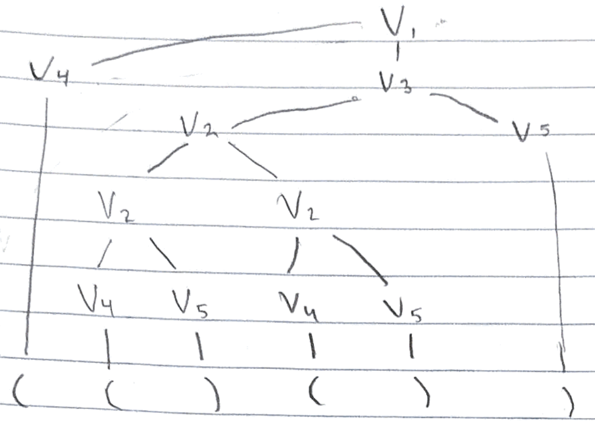
$V_4 V_4 V_3 V_5$

aIV P[5,6] contains V_3 True

aV P[6,5] contains V_2 True

aVI P[9,2] contains V_3 False

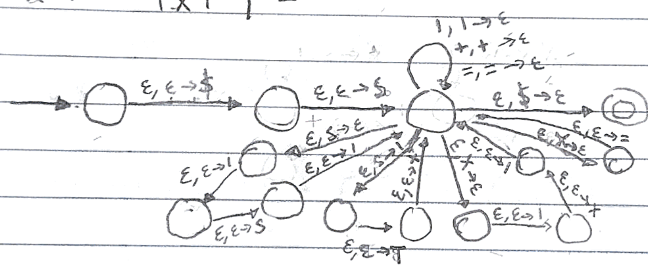
b.



$V_1 \Rightarrow V_4 V_3 \Rightarrow (V_3 \Rightarrow (V_2 V_5 \Rightarrow (V_2 V_2 V_5 \Rightarrow (V_4 V_5 V_2 V_5 \Rightarrow$
$((V_5 V_2 V_5 \Rightarrow (( ) V_2 V_5 \Rightarrow (( ) V_4 V_5 V_5 \Rightarrow (( ) (V_5 V_5 \Rightarrow (( ) ( ) V_5 \Rightarrow$
$(( ) ( ))$

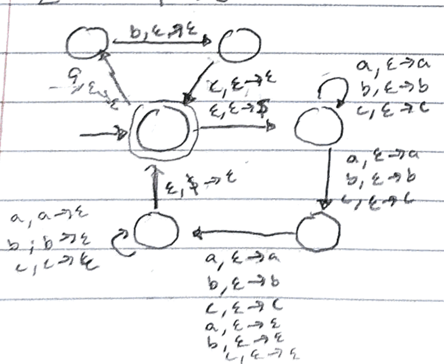
2a. $S \rightarrow 1S1 \mid +X$ a+b=c
$X \rightarrow 1X1 \mid =$

b.



3a. $S \rightarrow SS \mid X \mid abc \mid \varepsilon$
$X \rightarrow aYa \mid bYb \mid cYc$
$Y \rightarrow aZa \mid bZb \mid cZc \mid a \mid b \mid c$
$Z \rightarrow Y \mid \varepsilon$

b.



4a. $L(P) = \{ a^{n+m} b^n c^{2m} \mid n, m \geq 0 \}$

b. Let $p > 0$ and pick $s = a^{2p} b^p c^{2p}$. Consider any decomposition $s = uvxyz$ with $|vy| > 0$, $|vxy| \leq p$.

case 1: If v or y has an a, then v and y cannot have a c, thus the balance of a's and c's falls off.

case 2: If v or y has a c, then v and y cannot have an a, thus the balance of a's and c's falls off.

case 3: If v and y are b's, then uxz has few too b's relative to a's and c's since the amount of a's and c's are not 2 times the amount of b's.

Citations: Used Class Notes and Textbook