

University of Nevada, Las Vegas Computer Science 456/656 Spring 2020

Assignment 3: Due Thursday February 20, 2020

Name: \_\_\_\_\_

You are permitted to work in groups, get help from others, read books, and use the internet. But the handwriting on this document must be your own. Print out the document, staple, and fill in the answers. You may attach extra sheets. Turn in the pages to the graduate assistant at the beginning of class, September 4. In each case, the identical problem is in both fifth and sixth editions.

1. Consider the Chomsky Normal Form grammar  $G$  given below.

$$S \rightarrow IS$$

$$S \rightarrow WS$$

$$S \rightarrow XY$$

$$X \rightarrow IS$$

$$Y \rightarrow ES$$

$$S \rightarrow a$$

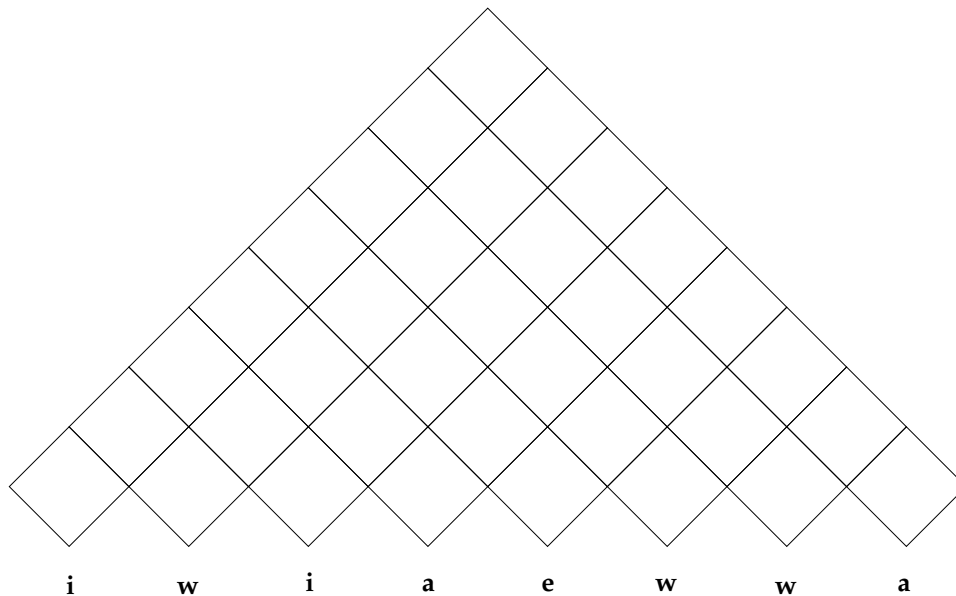
$$I \rightarrow i$$

$$W \rightarrow w$$

$$E \rightarrow e$$

(a) Show that  $G$  is ambiguous by giving two different **leftmost** derivations for the string  $iaea$ .

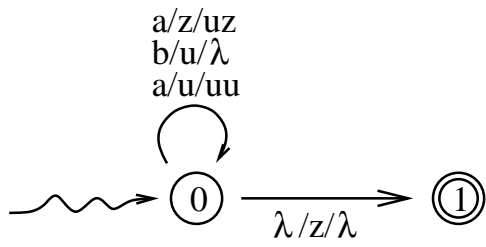
(b) Use the CYK algorithm to prove that  $iwiaewwa \in L(G)$ .



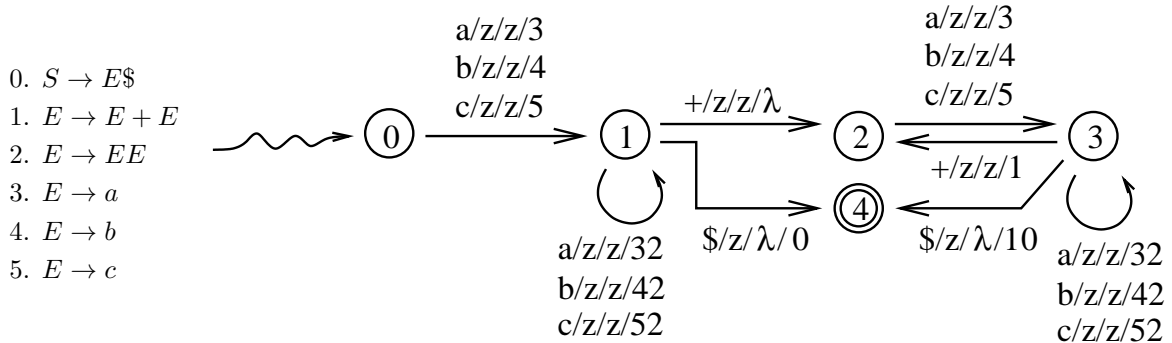
2. Work problem 6(b) on page 189 of the sixth edition, 4(b) in Chapter 7 of the fifth edition.

3. Work problem 6(g) on page 189 of the sixth edition, 4(g) in Chapter 7 of the fifth edition.

4. Let  $L$  be the language accepted by the PDA diagrammed below. What is  $L$ ? You can either describe  $L$  in a **few** words, or give a context-free grammar for  $L$ .



5. Let  $L$  be the language generated by the following context-free grammar,  $G$ . The DPDA, which we call  $P$ , shown is actually a parser for  $G$ . Its output is a derivation of its input string. Each arc has four labels: “read/pop/push/output.” The input alphabet is  $\{a, b, c, +, \$\}$ , where “\$” is basically an end-of-file symbol, so that the parser can tell that it’s reached the end of the input string.



(a) Show that  $G$  is ambiguous.

(c) Despite the ambiguity of  $G$ ,  $P$  is deterministic and will build a unique parse tree for any  $w \in L$ .  
 Draw the parse tree for the input  $a+abc+bc\$$ .

(b) Walk through the computation of  $P$  with input  $b+abc+bc\$$ . Here is what your answer should look like. I’ve filled in the first few lines. The output stream grows while the input stream shrinks.

read	pop	push	input	output	state
			$b + abc + bc\$$		0
$b$	$z$	$z$	$+abc + bc\$$	4	1
$+$	$z$	$z$	$abc + bc\$$	4	2
$a$	$z$	$z$	$bc + bc\$$	43	3
$b$					
$c$					
$+$					
$b$					
$c$					
$\$$					