

Homework 6

Started: Apr 13 at 2:14pm

Quiz Instructions

Although this is called a quiz by Canvas, it is just a part of your homework.

This work is untimed and you can retake it as many times as you want. Each time you submit, Canvas will show you your score.

You may collaborate with *one or two* other students on this homework if you wish, or work alone. Collaboration must be true collaboration however, which means that the work put into each problem should be roughly equal and all parties should come away understanding the solution.



Question 1

1 pts

Consider the context-free grammar

$$S \rightarrow ASA \mid A$$
$$A \rightarrow aA \mid ab$$

When following the CFG-to-PDA conversion process learned in class, there is only one state in the resulting PDA that has a self-loop.

How many PDA triples are there on this self-loop?



Question 2

1 pts

Consider the context-free grammar

$$S \rightarrow ASA \mid A$$
$$A \rightarrow aA \mid ab$$

When following the CFG-to-PDA conversion process learned in class, there is only one state in the resulting PDA that has a self-loop.

Of all the PDA triples on this self-loop, write the longest one in the box below (if there is more than one longest, write any of them).

Do not write any spaces. If you need a lambda or empty stack symbol, write exactly "lambda" or "emptystack" in its place. For this problem, the length of a triple is the number of characters in the triple when written down on paper, so a,b,emptystack is five characters long (including the commas).



Question 3

1 pts

Consider the context-free grammar

$$S \rightarrow ASA \mid A$$
$$A \rightarrow aA \mid ab$$

When following the CFG-to-PDA conversion process learned in class, there is only one state in the resulting PDA that has a self-loop.

Of all the PDA triples on this self-loop, write the shortest one that contains an "a" or a "b" anywhere in the triple in the box below (if there is more than one shortest, write any of them).

Do not write any spaces. If you need a lambda or empty stack symbol, write exactly "lambda" or "emptystack" in its place. For this problem, the length of a triple is the number of characters in the triple when written down on paper, so a,b,emptystack is five characters long (including the commas).



Question 4

1 pts

Consider the context-free grammar $S \rightarrow (S)S \mid \lambda$

Give a leftmost derivation of the string "(())"

Your derivations should begin with S, end with (()), and only make one substitution per step. Do not include any spaces, quotes, or lambdas in your answer. Use the ">" character to represent the right arrow. For example, $S \rightarrow aSb \rightarrow ab$ might be a legal derivation for a string in another language.

Hint: > should appear five times in your answer.



Question 5

1 pts

Consider the ambiguous grammar

$$S \rightarrow BC \mid \lambda$$
$$B \rightarrow bbB \mid C \mid \lambda$$
$$C \rightarrow cC \mid c$$

What is the shortest string in $L(S)$ that can be used to show the grammar is ambiguous? Write the string without any spaces or quotation marks.

Now show the grammar ambiguous by giving two derivations for the string (each derivation should have a particular important property learned in class). Give the two shortest derivations you can find. Write the derivation that uses the fewest characters in the first box (for autograding purposes).

Your derivations should begin with S, end with your chosen string, and only make one substitution per step. Do not include any spaces, quotes, or lambdas in your answer. Use the ">" character to represent the right arrow. For example, $S \rightarrow aSb \rightarrow ab$ might be a legal derivation for a string in another language.



Question 6

1 pts

The language $L = \{ a^n b^m \mid n > m \}$ can be represented by a context-free grammar with three productions. Give the two missing productions by filling in the blanks below.

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

Put the shorter answer in the first blank. Do not include any spaces in your answer.

Hint: The first blank should have two characters and the second should have three.

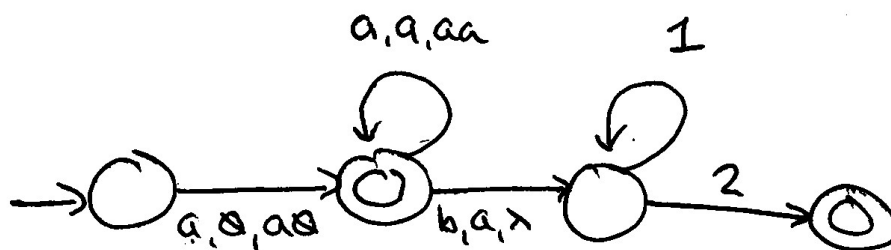


Question 7

1 pts

Below is a nearly complete PDA for the language $L = \{ a^n b^m \mid n > m \}$. Two more triples are needed to finish it, on the transition arrows labeled "1" and "2". In the boxes write the triples that will complete the PDA.

If you need a lambda, type exactly the word "lambda". If you need the empty stack symbol, type exactly the word "emptystack". Do not include any spaces in your answer.



1:

2:

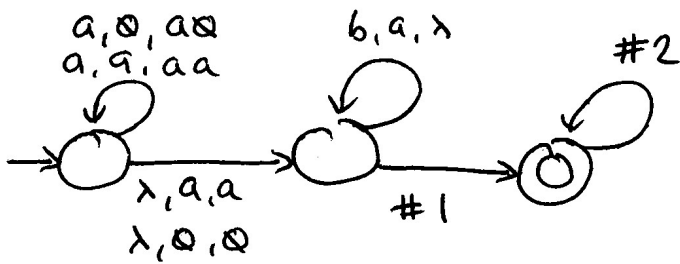


Question 8

1 pts

The following PDA is supposed to recognize the language $L = \{ a^m b^n \mid n > m \}$. It can be completed in two more triples, one at each of the arrows labeled 1 and 2.

Write a pair of triples to finish the PDA. Do not write any spaces. If you need a lambda or empty stack symbol, write exactly "lambda" or "emptystack" in its place



1:

2:

Quiz saved at 2:14pm

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