

Feedback — Week 4: PDA's and CFL Properties

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You submitted this homework on **Sun 18 Oct 2015 1:40 AM CEST**. You got a score of **5.00** out of **6.00**. You can [attempt again](#), if you'd like.

Question 1

The language $L = \{ss \mid s \text{ is a string of a's and b's}\}$ is not a context-free language. In order to prove that L is not context-free we need to show that for every integer n , there is some string z in L , of length at least n , such that no matter how we break z up as $z = uvwxy$, subject to the constraints $|vwx| \leq n$ and $|vx| > 0$, there is some $i \geq 0$ such that uv^iwx^iy is not in L .

Let us focus on a particular $z = aabaaaba$ and $n = 7$. It turns out that this is the wrong choice of z for $n = 7$, since there are some ways to break z up for which we can find the desired i , and for others, we cannot. Identify from the list below the choice of u,v,w,x,y for which there is an i that makes uv^iwx^iy not be in L . We show the breakup of $aabaaaba$ by placing four $|$'s among the a's and b's. The resulting five pieces (some of which may be empty), are the five strings. For instance, $aa|b||aaaba|$ means $u=aa$, $v=b$, $w=\epsilon$, $x=aaaba$, and $y=\epsilon$.

Your Answer	Score	Explanation
<input checked="" type="radio"/> $a ab aaa ba $	✗ 0.00	If we pump v and x i times, we get the string $a(ab)^i aaa (ba)^i$, which we can rewrite as $a(ab)^i aa(ab)^i a$ by regrouping the last a . All these strings are $a(ab)^i a$ repeated.
<input type="radio"/> $ a ab a aaba$		
<input type="radio"/> $ aa b aa aba$		
<input type="radio"/> $aab a a a ba$		
Total	0.00 / 1.00	

Question 2

Apply the CYK algorithm to the input ababaa and the grammar:

S → AB | BC
A → BA | a
B → CC | b
C → AB | a

Compute the table of entries X_{ij} = the set of nonterminals that derive positions i through j , inclusive, of the string ababaa. Then, identify a true assertion about one of the X_{ij} 's in the list below.

Your Answer	Score	Explanation
<input type="radio"/> $X_{16} = \{S,A,C\}$		
<input checked="" type="radio"/> $X_{15} = \{S,A,C\}$	✓ 1.00	
<input type="radio"/> $X_{15} = \{S,C\}$		
<input type="radio"/> $X_{15} = \{B\}$		
Total	1.00 / 1.00	

Question 3

Consider the pushdown automaton with the following transition rules:

- 1. $\delta(q,0,Z_0) = \{(q,XZ_0)\}$
- 2. $\delta(q,0,X) = \{(q,XX)\}$
- 3. $\delta(q,1,X) = \{(q,X)\}$
- 4. $\delta(q,\epsilon,X) = \{(p,\epsilon)\}$
- 5. $\delta(p,\epsilon,X) = \{(p,\epsilon)\}$
- 6. $\delta(p,1,X) = \{(p,XX)\}$
- 7. $\delta(p,1,Z_0) = \{(p,\epsilon)\}$

The start state is q . For which of the following inputs can the PDA first enter state p with the input empty and the stack containing XXZ_0 [i.e., the ID (p,ϵ,XXZ_0)]?

Your Answer	Score	Explanation
<input type="radio"/> 1100101		

<input type="radio"/> 1001101		
<input type="radio"/> 111001		
<input checked="" type="radio"/> 001110	✓	1.00
Total		1.00 / 1.00

Question 4

Consider the pushdown automaton with the following transition rules:

- 1. $\delta(q,0,Z_0) = \{(q,XZ_0)\}$
- 2. $\delta(q,0,X) = \{(q,XX)\}$
- 3. $\delta(q,1,X) = \{(q,X)\}$
- 4. $\delta(q,\epsilon,X) = \{(p,\epsilon)\}$
- 5. $\delta(p,\epsilon,X) = \{(p,\epsilon)\}$
- 6. $\delta(p,1,X) = \{(p,XX)\}$
- 7. $\delta(p,1,Z_0) = \{(p,\epsilon)\}$

From the ID $(p,1101,XXZ_0)$, which of the following ID's can NOT be reached?

Your Answer	Score	Explanation
<input checked="" type="radio"/> $(p,01,XXXXXXZ_0)$	✓ 1.00	Notice that consuming a 1 from the input can only increase the number of X's on the stack by 1.
<input type="radio"/> $(p,01,Z_0)$		
<input type="radio"/> $(p,01,XZ_0)$		
<input type="radio"/> $(p,1101,XZ_0)$		
Total	1.00 / 1.00	

Question 5

Here are the transitions of a pushdown automaton. The start state is q_0 , and f is the accepting state.

State-Symbol	a	b	ϵ
q_0-Z_0	(q_1,AAZ_0)	(q_2,BZ_0)	(f,ϵ)

q_1-A	(q_1,AAA)	(q_1,ϵ)	-
q_1-Z_0	-	-	(q_0,Z_0)
q_2-B	(q_3,ϵ)	(q_2,BB)	-
q_2-Z_0	-	-	(q_0,Z_0)
q_3-B	-	-	(q_2,ϵ)
q_3-Z_0	-	-	(q_1,AZ_0)

Describe informally what this PDA does. Then, identify below the one input string that the PDA accepts.

Your Answer	Score	Explanation
<input type="radio"/> bbaa		
<input type="radio"/> bababba		
<input type="radio"/> abbbbaa		
<input checked="" type="radio"/> bbbaababb	1.00	
Total	1.00 / 1.00	

Question 6

If we convert the context-free grammar G:

$S \rightarrow AS \mid A$
$A \rightarrow \emptyset A \mid 1B \mid 1$
$B \rightarrow \emptyset B \mid \emptyset$

to a pushdown automaton that accepts $L(G)$ by empty stack, using the construction given in the slides. which of the following would be a rule of the PDA?

Your Answer	Score	Explanation
<input checked="" type="radio"/> $\delta(q,\epsilon,S) = \{(q,AS), (q,A)\}$	1.00	
<input type="radio"/> $\delta(q,\epsilon,S) = \{(q,SA), (q,A)\}$		
<input type="radio"/> $\delta(q,0,A) = \{(q,A)\}$		
<input type="radio"/> $\delta(q,0,B) = \{(q,B), (q,\epsilon)\}$		
Total	1.00 / 1.00	

