Feedback — Week 4: PDA's and CFL Properties

You submitted this homework on **Sun 18 Oct 2015 2:11 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 | s 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| ≤ n and |vx| > 0, there is some $i ≥ 0$ 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=ε, x=aaaba, and y=ε.

Your Answer	Score	Explanation
○ a|ab|aaa|ba|		
○ a|aba|a|aba|		
○ a|ab|aaa|b|a		
⦿ |a|abaa|a|ba	✖ 0.00	When we pump this v and x, all the strings have exactly two b's. In order to be sure that $(a)^iabaa(a)^iba$ is always of the form ss, we have to be sure that the number of a's between the b's is the same as the sum of the numbers of a's before the first b and after the second b. Here, both these numbers are $i+2$.
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.

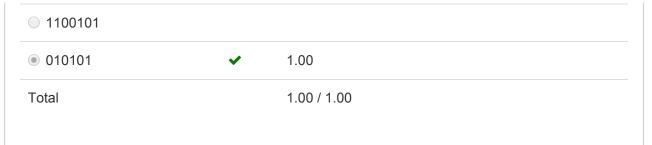| Your Answer	Score	Explanation
◯ X_{23} = {S}		
◯ X_{15} = {S,C}		
⦿ X_{16} = {B} ✔	1.00	
◯ X_{26} = {B}		
Total	1.00 / 1.00	

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. $\delta(q,\varepsilon,X) = \{(p,\varepsilon)\}$
5. $\delta(p,\varepsilon,X) = \{(p,\varepsilon)\}$
6. $\delta(p,1,X) = \{(p,XX)\}$
7. $\delta(p,1,Z_0) = \{(p,\varepsilon)\}$

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
◯ 0011100		
◯ 0111011		

○ 1100101

◉ 010101   ✔   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. $\delta(q,\varepsilon,X) = \{(p,\varepsilon)\}$
5. $\delta(p,\varepsilon,X) = \{(p,\varepsilon)\}$
6. $\delta(p,1,X) = \{(p,XX)\}$
7. $\delta(p,1,Z_0) = \{(p,\varepsilon)\}$

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

Your Answer	Score	Explanation
○ $(p,101,XZ_0)$		
○ $(p,1101,XZ_0)$		
◉ $(p,101,XXXXZ_0)$	✔ 1.00	Notice that consuming a 1 from the input can only increase the number of X's on the stack by 1.
○ $(p,1101,Z_0)$		
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
○ bbbaabbb			
○ bbbab			
○ bababba			
◉ abbbab	✔	1.00	
Total		1.00 / 1.00	

Question 6

If we convert the context-free grammar G:

```
S → AS | A
A → 0A | 1B | 1
B → 0B | 0
```

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
◉ δ(q,0,0) = {(q,ε)}	✔	1.00	
○ δ(q,ε,B) = {(q,0B)}			
○ δ(q,ε,S) = {(q,SA), (q,A)}			
○ δ(q,ε,S) = {(q,A)}			
Total		1.00 / 1.00	