CS 361 – Homework 6

Total possible points: 60

1. (15 points) Use a **set notation** to **define** the language generated by the following grammar

R→TT|U

T→0T|T0|#

U→0U00|#

Consider the following strings. If they are in L(G), derive them.

a) 00#0000

b) ϵ

a. R -> U -> 0U00 -> 00U0000 -> 00#0000

b. They are not in L(G)

2. (15 points) Let A = {$0^n1^m0^n1^m$ | m, n > 0 and m ≠ n}. If A is a context free language, then build the corresponding PDA or CFG. If not, prove that B is not a context-free language using the pumping lemma.

Lets assume that A is context-free and let m be the critical length of the pumping lemma.
Let's pick any string s=$0^m1^{m+1}0^m1^{m+1}$, where s ϵ L with length |s|= m + m + 1 + m + m + 1>=m. s mayb e divided in 5 parts like s = uvxyz, where | vy | <= m.

Case 1 – vxy is in the first 0^m, where p >= k >= 1
: when i = 2, uv^2xy^2z = $0^{m+k}1^{m+1}0^m1^{m+1}$. It is not in A because the first 0 is not same with the second 0. So, it is a contradiction!

Case 2 - vxy is in the second 0^m, where p >= k >= 1
: when i = 2, uv^2xy^2z = $0^m1^{m+1}0^{m+k}1^{m+1}$. It is not in A because the first 0's is not same with the second 0's. So, it is a contradiction!

Case 3 - vxy is in the first 1^{m+1}, where p >= k >= 1
: when i = 2, uv^2xy^2z = $0^m1^{m+1+k}0^m1^{m+1}$. It is not in A because the first 1's is not same with the second 1's. So, it is a contradiction!

Case 4 - vxy is in the second 1^{m+1}, where p >= k >= 1
: when i = 2, uv^2xy^2z = $0^m1^{m+1}0^m1^{m+1+k}$. It is not in A because the first 1's is not same with the second 1's. So, it is a contradiction!

Case 5 - vxy is in the first 0^m1^{m+1}, where p >= k >= 1
: when i = 2, uv^2xy^2z = $0^{m+k}1^{m+1+k}0^m1^{m+1}$. It is not in A because the first 0 is not

same with the second 0, and the second 1's is not same with the second 1's. So, it is a contradiction!

Case 6 - vxy is on the middle of $1^{m+1}0^{m}$, where p >= k >= 1

: when i = 2, uv^2xy^2z = $0^m1^{m+1+k}0^{m+k}1^{m+1}$. It is not in A because the first 0's is not same with the second 0's, and the second 1's is not same with the second 1's. So, it is a contradiction!

Case 7 - vxy is in the second 0^m1^{m+1}, where p >= k >= 1

: when i = 2, uv^2xy^2z = $0^m1^{m+1}0^{m+k}1^{m+1+k}$. It is not in A because the first 0's is not same with the second 0's, and the first 1's is not same with the second 1's. So, it is a contradiction!

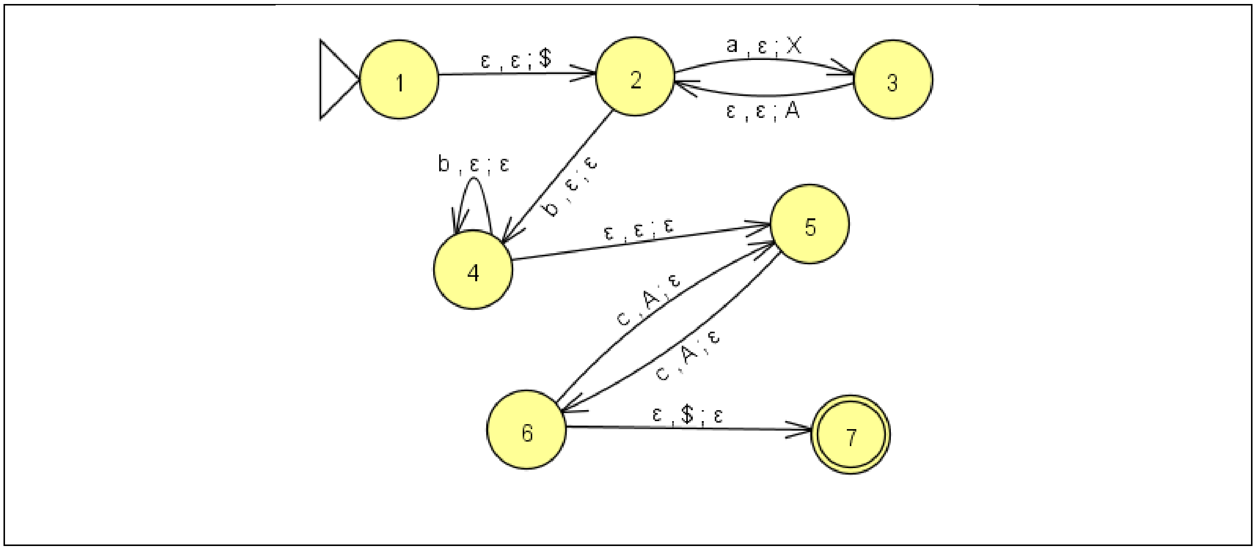
Above, it showed that all cases are not including in A. So, my assumption was wrong, and A is not context-free.

3. (15 points) Let B = {*a*#*b*#*c* | *a*, *b*, *c* are sequences of 1's; |c|=|a|+|b|; |a|≥ 0; and |b| >0 }. If B is a context free language, then build the corresponding CFG. If not, use the pumping lemma to show that B is not a context-free language.

S -> aAc | bBc
A -> aAc |#B | ε
B -> bBc | # | ε

4. (15 points) Let C = {$a^nb^mc^{2n}$| m, n > 0}. If C is a context free language, then build the corresponding PDA. If not, use the pumping lemma to show that C is not a context-free language.

C is a context-free language
S -> aScc | aBcc
B -> bB | b


1
ε , ε ; $
2
a , ε ; X
3
ε , ε ; A
b , ε ; ε
b , ε ; ε
4
ε , ε ; ε
5
c , A ; ε
c , A ; ε
6
ε , $; ε
7