CS 330 HW3 – CFG and PDA name:____Stuart Lech_____

This assignment is due Thursday **(2/15) at 10 PM.** Complete your work in word file, save as pdf and submit your softcopy on Moodle. The assignment is worth **100 points** and will be graded based on both effort and correctness. Late submission will be accepted until 10 PM Sunday (2/18). Standard late penalty applies.

Part I. Free Points - Consider the following CFG for Expression:

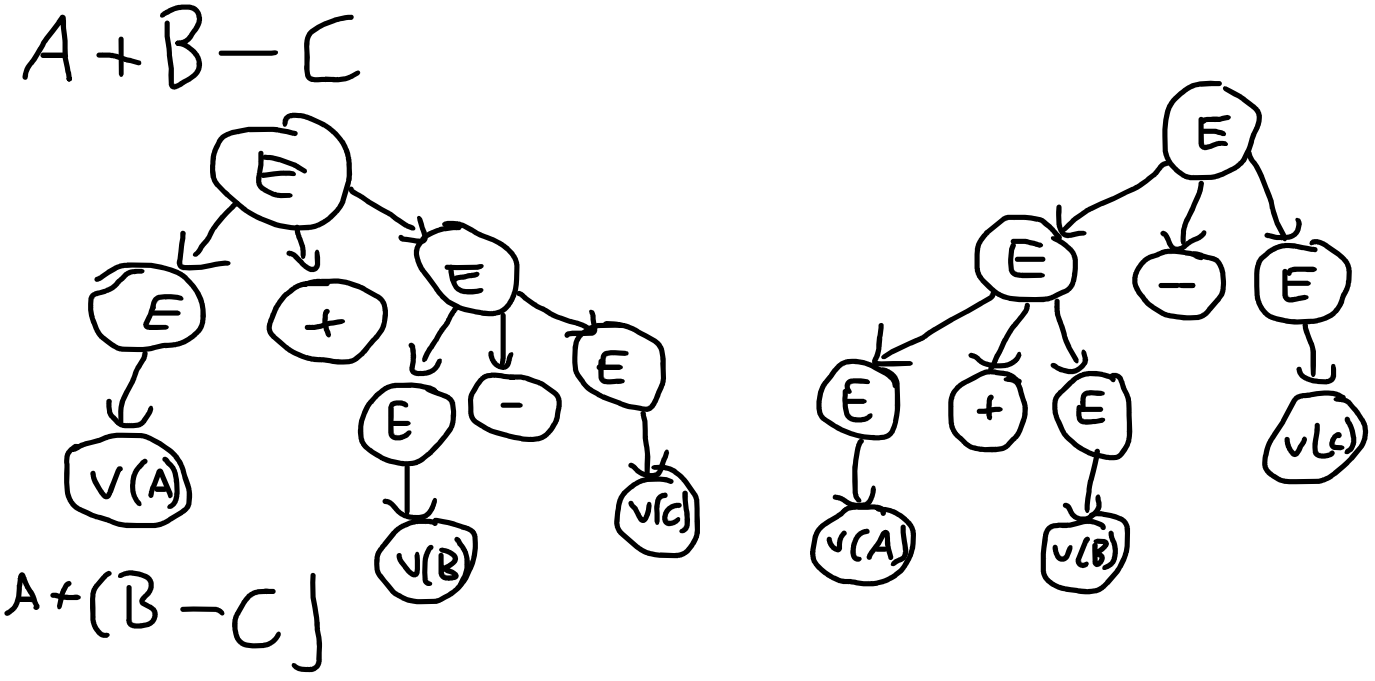
E→ E * E | E / E | //
E + E | E – E |
E ^ E | // ^ represents exponent
(E) |
V

V →a..z

Where *E*, V are non-terminals with E being the start symbol, and *a* through *z* are terminals.

This is grammar is ambiguous in two aspects:
(a) Undefined operator precedence (* vs + vs ^, etc.)
(b) Undefined associativity (left vs right)

Draw two (2) parse trees for the same sentence of your choice to show that the grammar is indeed ambiguous. (6 points)



(A+B) -C

Rewrite the Expression grammar so that it is unambiguous with (a) precedence order of () over ^ over * and / over + and -, (b) left associative for +, -, *, /, (d) right associative for ^. Give the completed new grammar in the space below. (14 points)

<expr> -> <term> <expr'>
<expr'> -> + <term> <expr'> | - <term> <expr'> | ε
<term> -> <factor> <term'>
<term'> -> * <factor> <term'> | / <factor> <term'> | ε
<factor> -> <expo> <factor'>
<factor'>-> ^ <expo> <factor'> | ε
<expo> -> <id> | (<expr>)
<id> -> a | b | c | ... | z

Part II. CT Review - The following problems are from CT book, on pages 154-156. points. Do any 3 of the 4. (3X13=39 points)

1. CT 2.3
2. CT 2.6 c
3. CT 2.10
4. CT 2.12

2.3
a. R,X,S,T
b. a,b
c. R
d. ab, ba, aab
e. a, b, ε
f. False
g. True
h. False
i. True
j. True
k. False
l. True
m. True
n. False
o. L(G) consists of all strings over a and b that

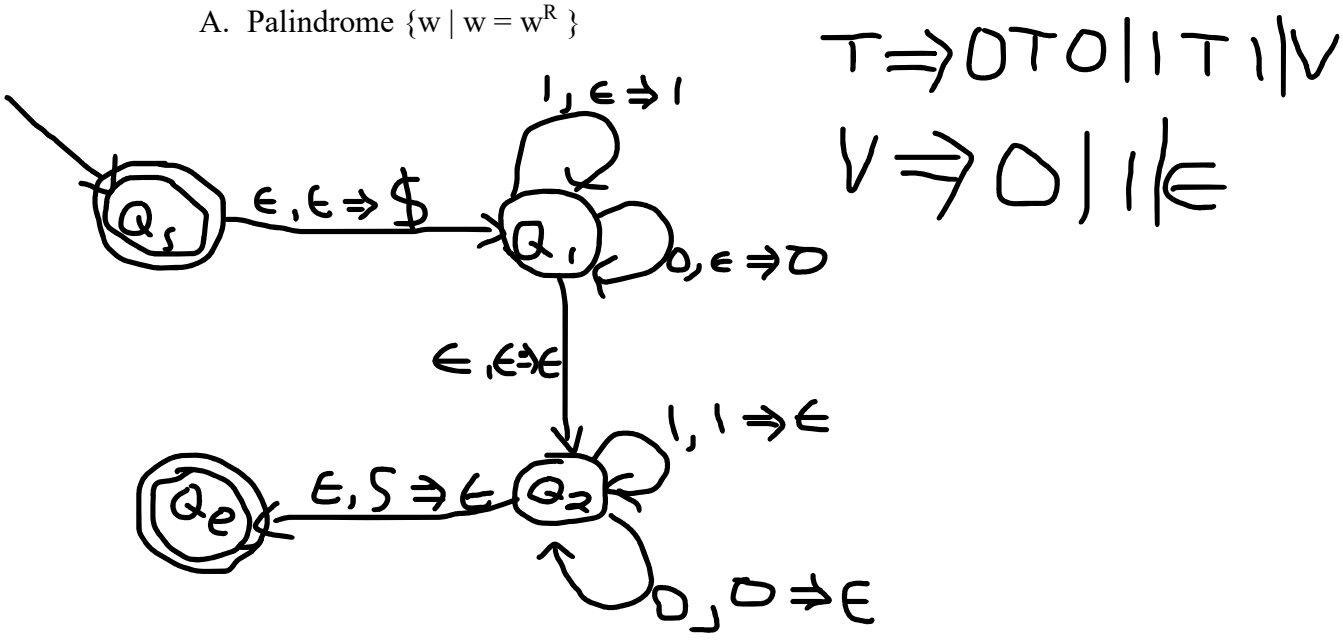
2.6
c. S -> TX
  T -> 0T0 | 1T1 | #X
  X -> 0X | 1X | ε

2.10

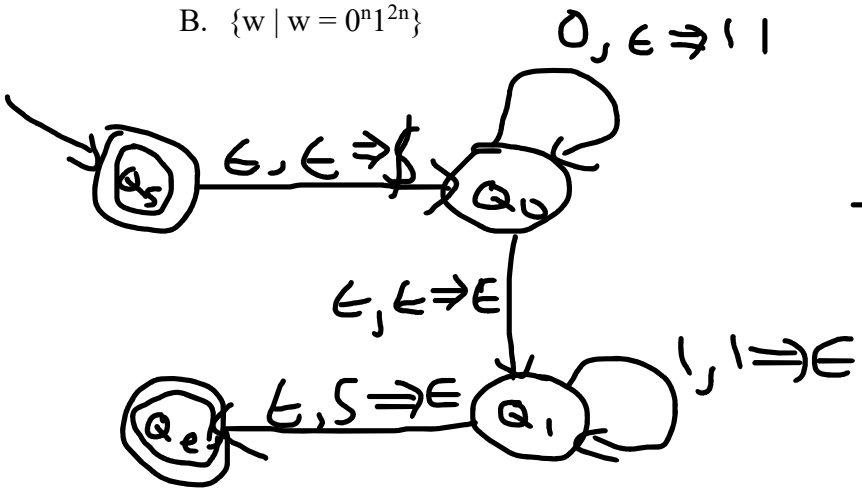
1. Read a. If it's finish on input, accept. If c's finish and stack's empty, accept. If c's not finish, pop b's.
2. Nondeterministically branch to either step 3 or stage 6.
3. Read a's. If it's finish on input, accept. If c's finish and stack's empty, accept. If c's not finish, pop b's.
4. SKIP c's. If c's finish on input and stack's empty, accept.
5. Read b's. If b's finish on input, accept.
6. SKIP b's. If b's finish on input and stack's empty, accept.
7. Read c's. If c's finish on input and stack's empty, accept.
8. SKIP a's. If a's finish on input and stack's empty, accept.

Part III. Give CFGs and draw PDA for each of the following languages, on alphabet Σ = {0,1} (20X2=40 points)

A. Palindrome {w | w = w^R }



B. $\{w \mid w = 0^n 1^{2n}\}$



$T \Rightarrow 0T11 \mid \epsilon$