CSE340 Spring 2020 - Homework 1

Due: Friday February 7 2020 by 11:59 PM on Gradescope

All submissions should be typed. Exception can only be made for drawing parse trees, which can be hand drawn and scanned in the submitted document.

When you submit your solution on Gradescope, you should indicate for each problem the page on which the solution is.

NOTE: Included epsilon in derivations and parse trees for readability but removed them at the end because answer required for a sequence of tokens.

Problem 1. Consider the grammar

S → Y X Y

X → a Y | Y

Y → b b Y | X | ε

where a and b are tokens. Remember that ε represent the empty string. Y → ε means that Y does not have to match any tokens.

1. Give a leftmost derivation for the string (sequence of tokens): bbabbabb

S->Y X Y->b b Y X Y->b b ε X Y->b b ε a Y Y->b b ε a b b Y Y

->b b ε a b b X Y->b b ε a b b a Y Y->b b ε a b b a ε Y

->b b ε a b b a ε b b Y->b b ε a b b a ε b b ε->b b a b b a b b

2. Give a rightmost derivation for the string (sequence of tokens): bbabbabb

S->Y X Y->Y X X->Y X a Y->Y X a b b Y->Y X a b b ε->Y a Y a b b ε

->Y a b b Y a b b ε->Y a b b ε a b b ε->b b Y a b b ε a b b ε

->b b ε a b b ε a b b ε-> b b a b b a b b

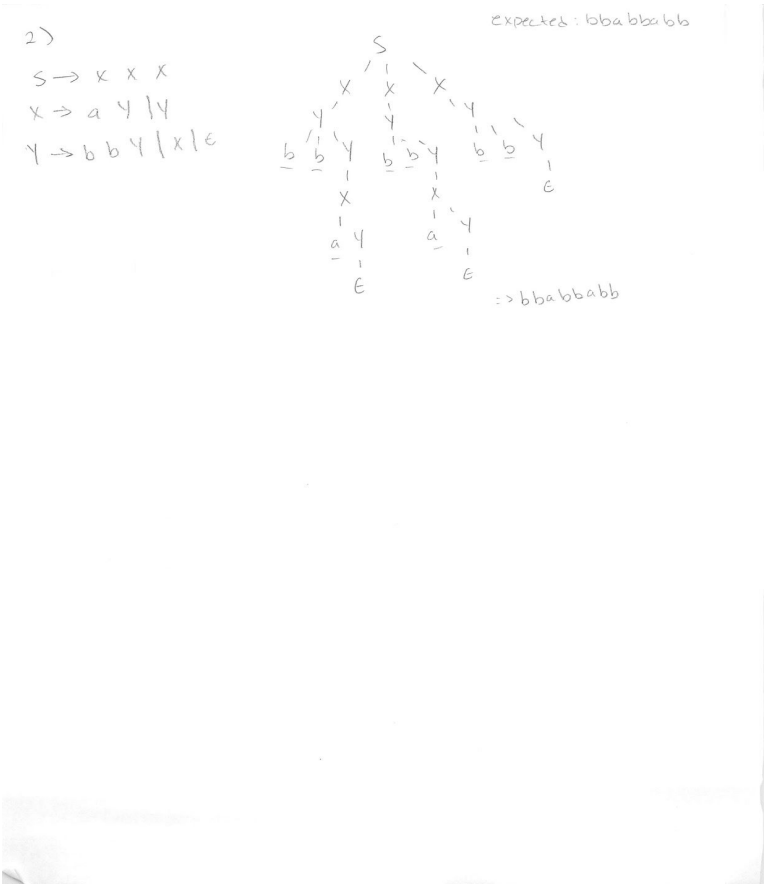
Problem 2. Consider the grammar

$S \rightarrow X\ X\ X$

$X \rightarrow a\ Y \mid Y$

$Y \rightarrow b\ b\ Y \mid X \mid \varepsilon$

Draw a parse tree for the sequence of tokens bbabbabb



The parse tree should have height less than or equal to 5.

Problem 3. Consider the grammar

$S \rightarrow a\ S\ b\ S\ c\ S$

$S \rightarrow A$

$A \rightarrow a\ S\ b\ S$

$A \rightarrow d$

1. What are the non-terminals? S and A are NT because they are on the left side of the rule.

2. What is the start symbol? S is the start symbol because it is a NT and is the first rule.

3. What are the terminals? a b c d are terminals because it is on the right side of the rule and it is not a non-terminal.

Problem 4. Show that the following grammar is ambiguous by giving a string that has two different leftmost derivations

$S \rightarrow A\ D \mid B\ C$

$A \rightarrow a\ A \mid b\ C$

$B \rightarrow A\ C\ D$

$C \rightarrow c\ C \mid D \mid \varepsilon$

$D \rightarrow C\ D \mid D\ D \mid a$

You should give the two derivations for the string you propose.

Proposed string: aba

S->A D->a A D->a b C D->a b ε D-> a b ε a->a b a

S->B C->A C D C->a A C D C->a b C C D C-> a b ε C D C-> a b ε ε D C

->a b ε ε a C->a b ε ε a ε-> a b a