

# CSE340 Spring 2019 - Homework 1

Due: Friday January 18 by 11:59 PM on Blackboard

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.

You should write your solutions in order. Solution to problem 1 should be first, then solution to problem 2, and finally solution to problem 3.

**Problem 1.** Consider the grammar

$$S \rightarrow Y X X Y$$

$$X \rightarrow a X \mid Y$$

$$Y \rightarrow b b Y \mid X \mid \epsilon$$

Draw a parse tree for input string bbabbabbbba

**Problem 2.** Consider the grammar

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

$$S \rightarrow b S a \mid B$$

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

$$B \rightarrow b a B \mid b a$$

1. What are the non-terminals?
2. What is the start symbol?
3. What are the terminals?
4. Show that this grammar is ambiguous by giving a string that starts with b and that has two parse trees
5. Show that this grammar is ambiguous by giving a string that starts with a and that has two parse trees

**Problem 3.** Consider the grammar

$$S \rightarrow A \mid B$$
$$A \rightarrow a A b \mid c$$
$$B \rightarrow b B \mid b$$

Write a recursive descent parser for this grammar. You can assume that the function `parse_B()` is already written for you. You only need to write `parse_S()` and `parse_A()`.

I encourage you to try to write a complete parser in C++ and to execute it on a number of inputs to get a better understanding of recursive descent parsers, but that is not required and for the homework solution I only need the two functions `parse_S()` and `parse_A()`.

For all questions, you should explain your answers.