
CS 421 --- Ambiguous Grammars / First and Follow Sets

Manager	Keeps team on track	
Recorder	Records decisions / QC	
Reporter	Reports to class	
Reflector	Assesses team performance	

Please write your name/netid legibly in dark ink. Hand in one copy per team. Do not staple or mangle the corners.

Part 1 --- Ambiguous Grammars

Consider the following ambiguous grammar.

Example 1)

$$\begin{array}{l} E \rightarrow E + E \\ \quad | E * E \\ \quad | - E \\ \quad | i \end{array}$$

Problem 1) Prove that this grammar is ambiguous by giving an input with two parse trees.

Problem 2) The instructor will give you a version of this grammar that is not ambiguous. We will let $*$ and $+$ have their usual precedences, and associate to the left. Unary minus binds most tightly. Show that your input has only one parse tree now.

$$\begin{array}{l} E \rightarrow E + F \mid F \\ F \rightarrow F * U \mid U \\ U \rightarrow - U \mid i \end{array}$$

Problem 3) Stratification removed the ambiguities. How did it do that?

Here is a new grammar for you.

$$\begin{array}{l} E \rightarrow E a E \\ \quad | E b E \\ \quad | E x E \\ \quad | E y E \\ \quad | i \end{array}$$

Problem 4) Prove that this grammar is ambiguous by giving an input that has two parse trees.

Problem 5) Stratify the grammar to remove ambiguity. Let a have highest precedence, associating to the left. Next is b , associating to the left. Then we have y associating to the right. Let x have the lowest precedence, and associate to the right. Show that your sentence has only one parse tree.

Part 2 --- First and Follow Sets

Calculate the first and follow sets for these grammars.

Example 2)

$$\begin{array}{l} S \rightarrow a E b \\ \quad | \quad x \\ E \rightarrow x y \\ \quad | \quad \epsilon \end{array}$$

Problem 6)

$$\begin{array}{l} S \rightarrow a E F b \\ \quad | \quad x E F \\ E \rightarrow x y \\ \quad | \quad \epsilon \\ F \rightarrow E z q \\ \quad | \quad w S \end{array}$$

Problem 7)

$$\begin{array}{l} S \rightarrow a F E b \\ \quad | \quad x F E \\ E \rightarrow x y \\ \quad | \quad \epsilon \\ F \rightarrow E z q \\ \quad | \quad w S \end{array}$$

Ambiguous Grammars / First and Follow Sets--- Reflector's Report

Manager	Keeps team on track	
Recorder	Records decisions	
Reporter	Reports to Class	
Reflector	Assesses team performance	

1. What was a strength of your team's performance for this activity?
2. What could you do next time to increase your team's performance?
3. What insights did you have about the activity or your team's interaction today?

Ambiguous Grammars / First and Follow Sets --- Team's Assessment (SII)

Manager or Reflector: Consider the objectives of this activity and your team's experience with it, and then answer the following questions after consulting with your team.

1. What was a **strength** of this activity? List one aspect that helped it achieve its purpose.
2. What is one thing we could do to **improve** this activity to make it more effective?
3. What **insights** did you have about the activity, either the content or at the meta level?