CSE 401/M501 – Compilers

Section 2: Project Infrastructure

Nate Yazdani & Aaron Johnston

Spring 2018

Welcome

- The guy talking is Nate
  - O.H. 2-3pm Mon./Fri. in CSE 220
- The other fellow is Aaron
  - O.H. 1:30-2:30pm Tue. in CSE 021 and 12-1pm Thurs. in CSE 220
- We'll be leading most sections this quarter

Agenda

- Quick refresher on `git` revision control
  - See handouts/references on website for more
- Walk through the starter code
- Practice with ambiguity of formal grammars

Git Review – SSH Keys

- An SSH key lets a `git` server remember a specific client computer
- If `git` asks for a password to push or pull, you need to setup an SSH key
- Typically just need to do the following:
  - `ssh-keygen -t rsa -C "you@cs.washington.edu" -b 4096`
  - Copy `~/.ssh/id_rsa.pub` into your GitLab account
- Full setup and troubleshooting instructions: https://gitlab.cs.washington.edu/help/ssh/README

Git Review – Revision Control

- The “official” repo (a.k.a., the **remote**) lives on the CSE GitLab server
- **Cloning** a repo gives you a private, local *copy*
- **Committing** saves *local* changes into the *local* repo’s revision history
- **Push** to send *local* commits to *remote* repo
- **Pull** to bring *remote* commits to *local* repo
- Beware **merge conflicts** – pull frequently

Git Review – The Team Repository

- Each project pair is given a repo to collaborate
  - Starts out empty, unlike CSE 331, 333, *etc*.
  - Tagging is how you submit project phases, like CSE 331
- One person from each pair should download the starter code and push it to the shared repo
  - Then the other person pulls to get the starter code

MiniJava Project – Getting Started

- On course website, go to "Compiler project" → "Starter code" (at top) to grab starter code
  - Or just pull your team repo, if already pushed ☺
- One person from each pair should download the starter code and push it to their team's repo
  - Then the other person pulls to get the starter code
- Everybody have a local copy of the starter code?

MiniJava Project – Walk Through

Together, we're going to do the following:

1. Unarchive starter code and push to repo*
2. Try out the demo scanner
3. Get to know the CUP/JFlex infrastructure
4. Run a main program as in the scanner phase
5. Try making some changes to lexical spec.

* if applicable

Ambiguity of a Formal Grammar

- Recall from lecture:
  - A formal grammar is *ambiguous* when a sentence in the language has multiple leftmost (or rightmost) derivations (*i.e.*, multiple parse trees).
- Now some exercises selected from a past exam…

Ambiguity – 4.a (15wi midterm)

Question 4. Context-free grammars (14 points) Consider the following syntax for expressions involving addition and field selection:

expr ::= *expr* + *field*
expr ::= *field*
field ::= *expr* `.` `id`
field ::= `id`

(a) (8 points) Show that this grammar is ambiguous.

Ambiguity – 4.b (15wi midterm)

Question 4. Context-free grammars (14 points) Consider the following syntax for expressions involving addition and field selection:

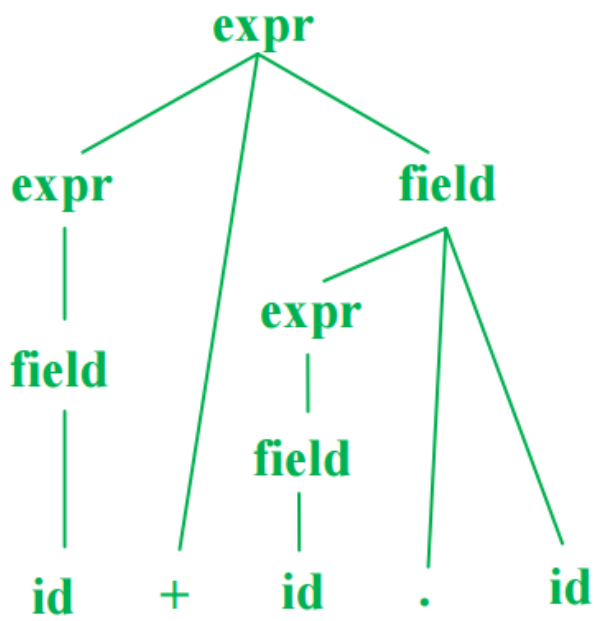
expr ::= *expr* + *field*
expr ::= *field*
field ::= *expr* `.` `id`
field ::= `id`

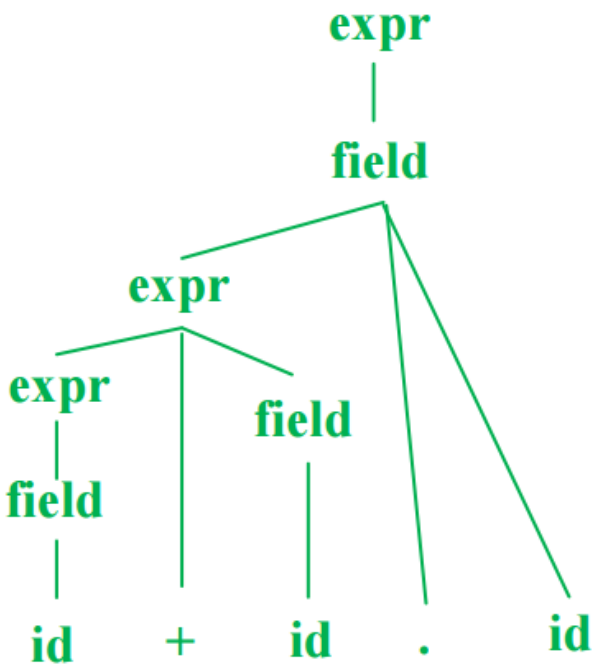
(b) (6 points) Give an unambiguous context-free grammar that fixes the problem(s) with the grammar in part (a) and generates expressions with `id`, field selection and addition. As in Java, field selection should have higher precedence than addition and both field selection and addition should be left-associative (i.e., a+b+c means (a+b)+c).

Ambiguity – 4.a solution (example)

(a) (8 points) Show that this grammar is ambiguous.

Here are two derivations of id+id.id:





Ambiguity – 4.b solution (example)

(b) (6 points) Give an unambiguous context-free grammar that fixes the problem(s) with the grammar in part (a) and generates expressions with `id`, field selection and addition. As in Java, field selection should have higher precedence than addition and both field selection and addition should be left-associative (i.e., a+b+c means (a+b)+c).

The problem is in the first rule for *field*, which creates an ambiguous precedence. Here is a reasonably simple fix.

expr ::= ***expr*** + ***field***
expr ::= ***field***
field ::= ***field*** . `id`
field ::= `id`

Ambiguity in Practice

- Comes down to the existence of multiple, legal derivation alternatives for some sentences
  - *e.g.*, do we pick *expr* ::= *field* or *expr* ::= *expr* + *field*?
- Frequent cause of shift/reduce and reduce/reduce conflicts
- Typically just need to incorporate precedence and/or associativity