

CS 131 Compilers: Discussion 5: Shift-Reduce Parsing

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1 Shift-Reduce Parsing the Lambda Calculus.

We'll look again at the lambda calculus grammar:

```
var  : ID ;
expr : var
      | '(' 'λ' var '.' expr ')'
      | '(' expr expr ')' ;
```

1. Is this grammar LL(1)?
2. We'll now use the following LR(1) parsing table to parse some strings with this grammar.
3. Is this grammar LR(0)?

Answer:

2 Altering the Lambda Calculus.

Suppose we want to add an optional extension that allows raising a variable to a power. We define the grammar as

```
expr : var
      | var '-' NUM
      | '(' 'λ' var '.' expr ')'
      | '(' expr expr ')' ;
var  : ID ;
```

1. Is this grammar LR(0)?
2. Which state in the parsing table would we need to modify to parse this grammar?

Answer:

3 Stack in Shift-Reduce Parsing.

Suppose it is given that shift-reduce parsing is equivalent to finding the rightmost derivation in reverse. Prove that during shift-reduce parsing, we can only reduce the topmost items in the stack (i.e. we don't need to worry about reducing something in the middle; hence the usage of a stack is justified)

4 Exercises

Consider the following CFG, which has the set of terminals $T = \{\mathbf{a}, \mathbf{b}\}$

$$S \rightarrow X\mathbf{a}$$

$$X \rightarrow \mathbf{a} \mid \mathbf{a}X\mathbf{b}$$

1. Construct a DFA for viable prefixes of this grammar using LR(0) items.
2. Identify a shift-reduce conflict in this grammar under the SLR(1) rules.
3. Assuming that an SLR(1) parser resolves shift-reduce conflicts by choosing to shift, show the operation of such a parser on the input string **aaba**.
4. Suppose that the production $X \leftarrow \epsilon$ is added to this grammar. Identify a reduce-reduce conflict in the resulting grammar under the SLR(1) rules.

Answer: