

Plan for Today

Building the LR Parsing Table for LR(1)

- First and Follow sets
- building the table

Debugging shift/reduce and reduce/reduce errors

CS453 Lecture

Building LR(1) Parse Tables

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FIRST and FOLLOW sets

FIRST(γ)

- γ is a string of terminals and nonterminals
- FIRST(γ) is any nonterminals that can start a string derived from γ

nullable(X)

- X is a nonterminal
- nullable(X) is true if X can derive the empty string

FOLLOW(X)

- X is a nonterminal
- FOLLOW(X) is all terminals that can immediately follow X

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Building the LR Parse Table for LR(1), Grammar 3.23 in book

```
(0) S -> E $
(1) E -> T + E
(2) E -> T
(3) T -> x
```

Symbol	FIRST
x	x
+	+
T	x
E	x
S	x

State	Action			Goto	
	x	+	\$	T	E
0	s3			g2	g1
1			accept		
2		s4	r2		
3		r3	r3		
4	s3			g2	g5
5			r1		

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Example Ambiguous Grammars: SableCC errors

```
Productions
stm = exp ;
exp =
    {minus_rule} exp minus exp
    | {num_rule} num
    ;
```

Verifying identifiers.
java.lang.RuntimeException: [30,35] Redefinition of AMinusRuleExp.Exp.

```
Productions
stm = exp ;
exp =
    {minus_rule} [left]:exp minus [right]:exp
    | {num_rule} num
    ;
```

shift/reduce conflict in state [stack: PExp TMinus PExp *] on TMinus in {
[PExp = PExp * TMinus PExp] (shift),
[PExp = PExp TMinus PExp *] followed by TMinus (reduce)
}

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