Introduction to Parsing Using Lex/Flex and Yacc/Bison

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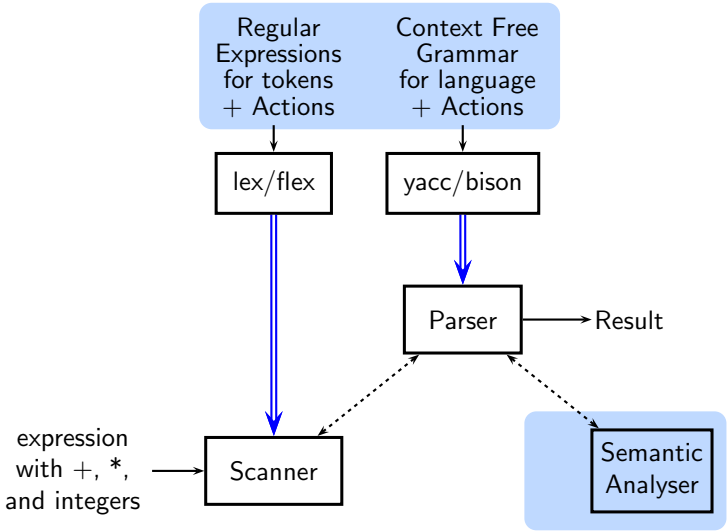
simCalc: A Simple Calculator



Introduction to Lex and Yacc

- lex script exp.l to show token identification
- exp1.y to show a simple expression. Use the lex script exp.l
- exp2.y to show construction of a PLUS expression
  Interesting input: `1 + 2 + 3 + 4 + 5 + 6`
- exp3.y fixes the problem by making + left associative
- exp4.y includes + and *
  Interesting inputs: 1 + 2 * 3 and 1 * 2 + 3
- exp5.y fixes the above problem

The Interaction Between Scanner and Parser

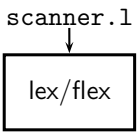
- Grammar

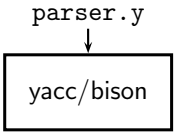
```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- Terminals and non-terminals get defined by the grammar
- Scanner identifies the tokens and communicates the details to the parser

Token Name	Token Lexemes	Token Value	Token Code
Number	"10" "345" "03"	10 345 3	NUM
+ operator	"+"		'+'
* operator	"*"		'*'

The Interaction Between Scanner and Parser





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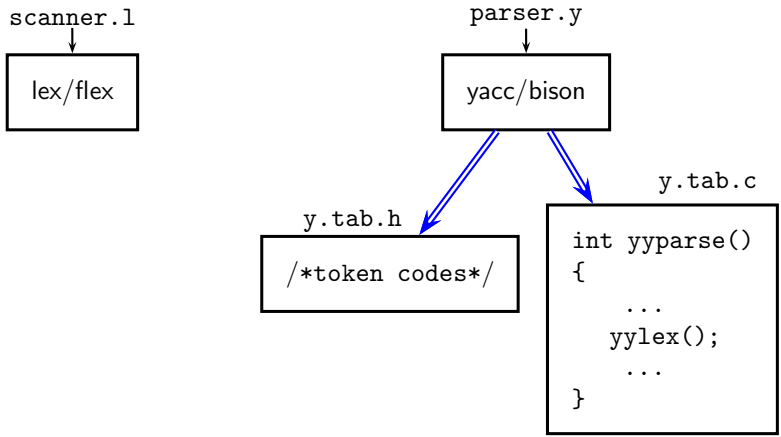

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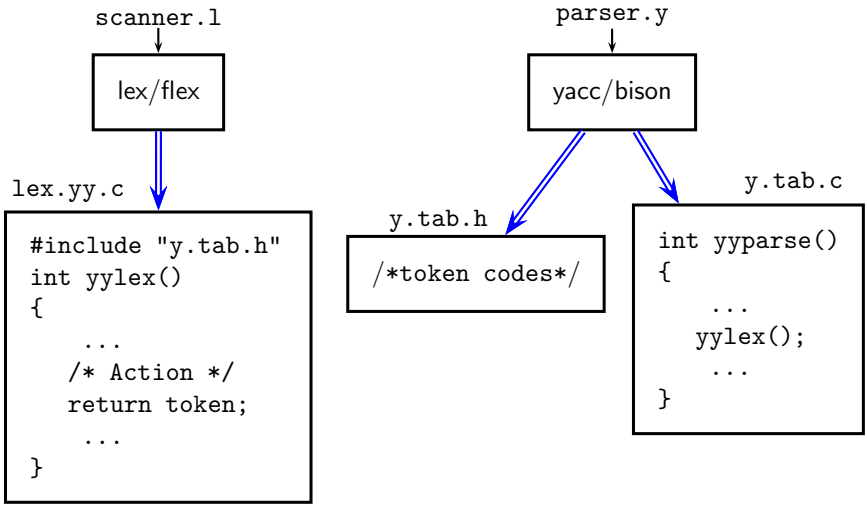

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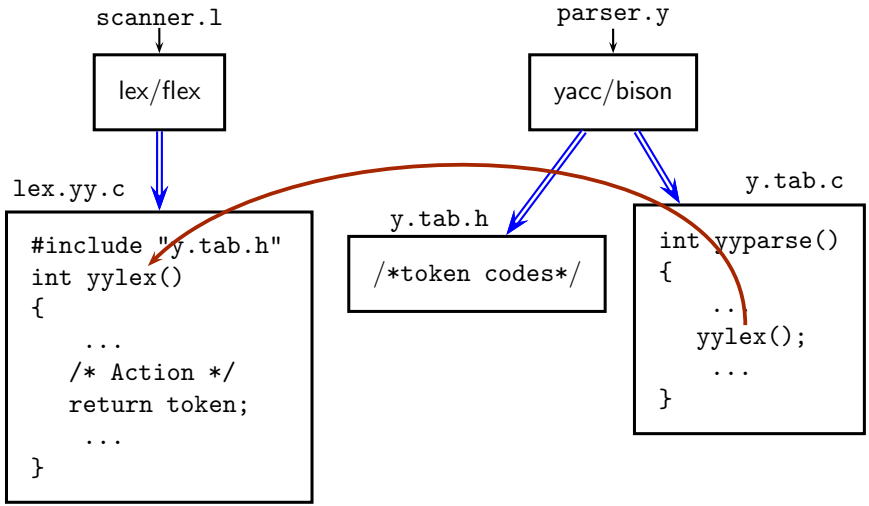

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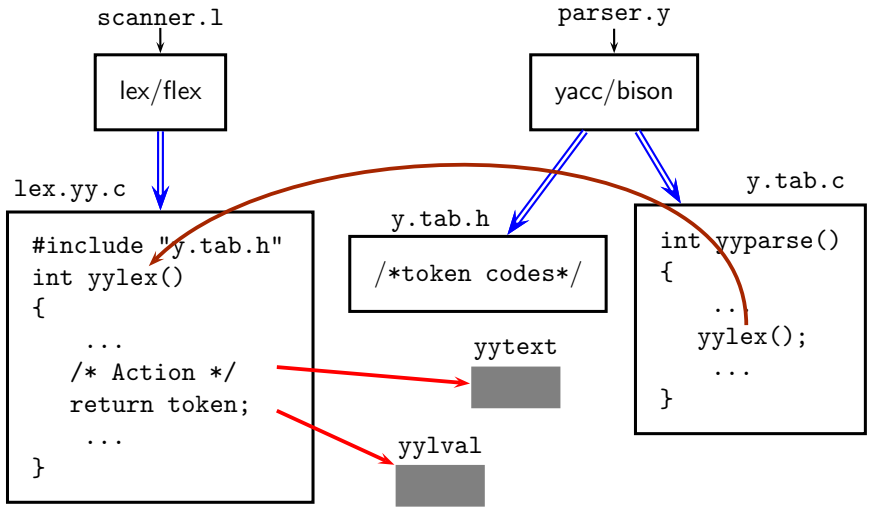

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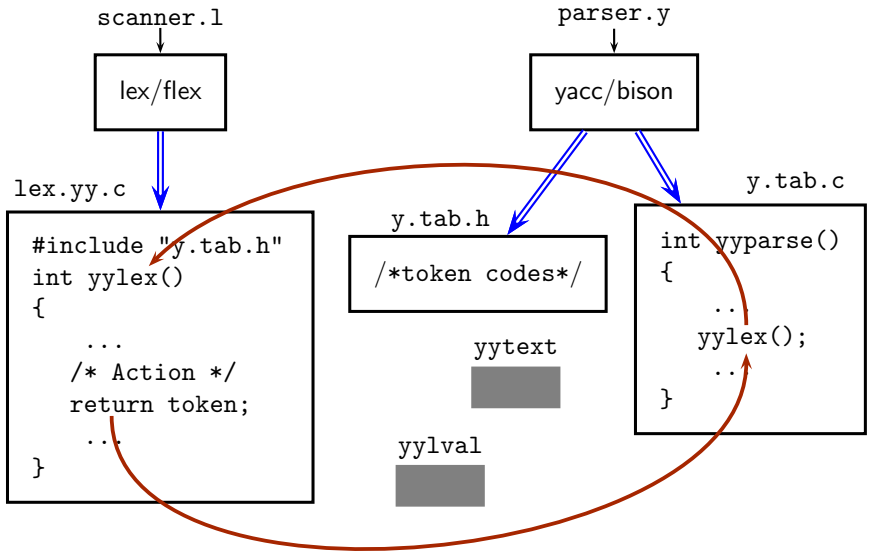

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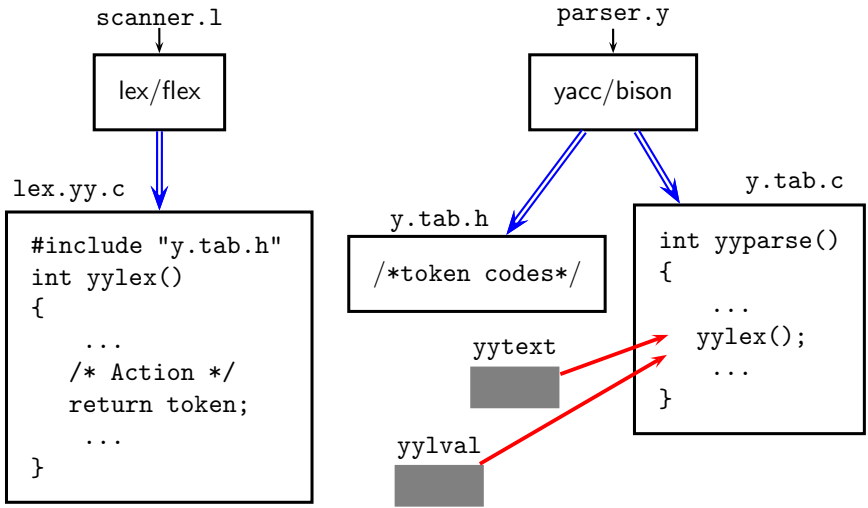


An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

10	+	20	*	3	eof
NUM					

Parsing Stack

Action: Shift NUM

An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

10 + 20 * 3 eof

+

top → | NUM |

Parsing Stack

Action: Reduce by "Expr: NUM"

An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

$$10 \quad + \quad 20 \quad * \quad 3 \quad \boxed{\text{eof}}$$
$$+$$

top $\rightarrow$ $\boxed{\text{Expr}}$ Parsing Stack

Action: Shift $+$

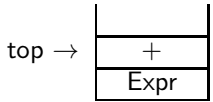
An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

10	+	20	*	3	eof
		NUM			



Action: Shift NUM

An Overview of Shift Reduce Parsing

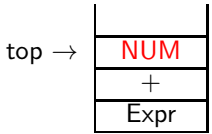
- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

10 + 20 * 3 eof

*



Action: Reduce by "Expr: NUM"

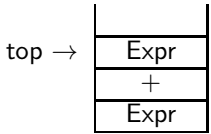
An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

10	+	20	*	3	eof
			*		



Action: Shift $*$ or Reduce by "Expr: Expr $+$ Expr"?

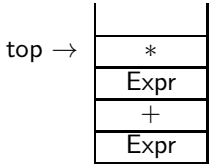
An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

10 + 20 * 3 eof
NUM



Action: Shift NUM

An Overview of Shift Reduce Parsing

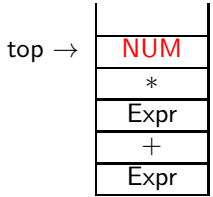
- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

10 + 20 * 3 | eof

EOF



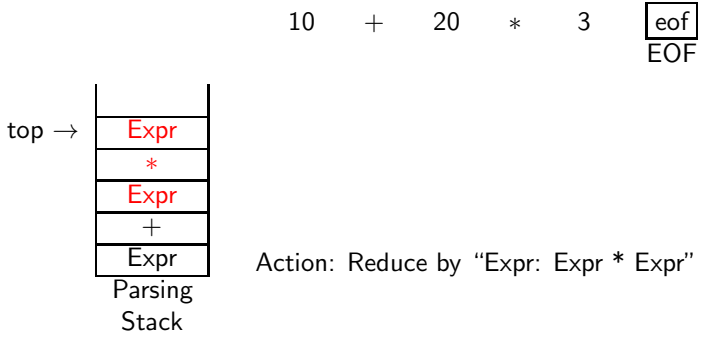
Action: Reduce by "Expr: NUM"

An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing



An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
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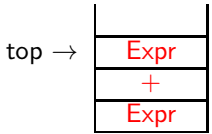
      |  NUM
```

- The process of parsing

10 + 20 * 3 [eof]

EOF



Action: Reduce by "Expr: Expr + Expr"

An Overview of Shift Reduce Parsing

- Grammar

```
Expr  :  Expr '+' Expr
      |  Expr '*' Expr
      |  NUM
```

- The process of parsing

10 + 20 * 3 | eof

EOF

top → | Expr |

Parsing Stack

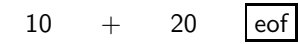
Action: Accept

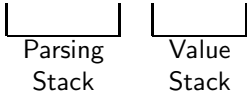
An Overview of Attribute Evaluation

- Grammar and the associated actions

```
Expr  :  Expr '+' Expr    { $$ = $1 + $3;}
      |  NUM
```

- The process of parsing and attribute evaluation





An Overview of Attribute Evaluation

- Grammar and the associated actions

```
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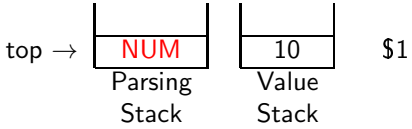
```

- The process of parsing and attribute evaluation

10 + 20 eof

+



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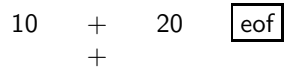

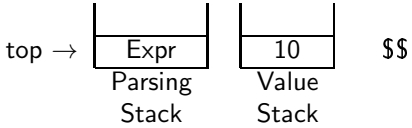

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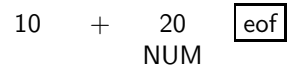

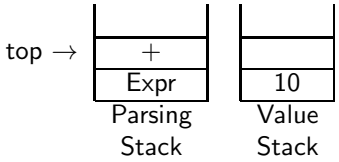

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- Grammar and the associated actions

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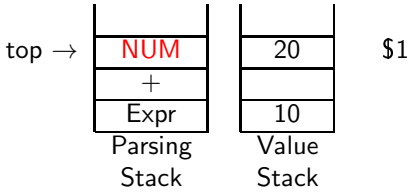
      |  NUM
```

- The process of parsing and attribute evaluation

10 + 20 eof

EOF



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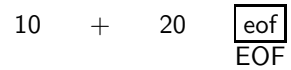

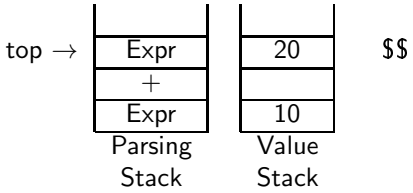

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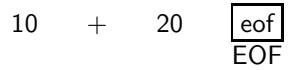

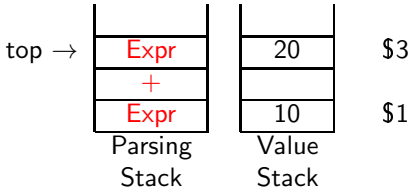

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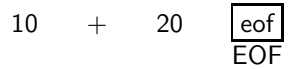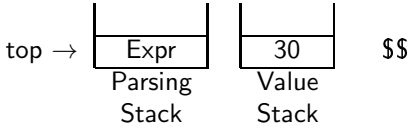
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