Introduction to Flexc++ and Bisonc++

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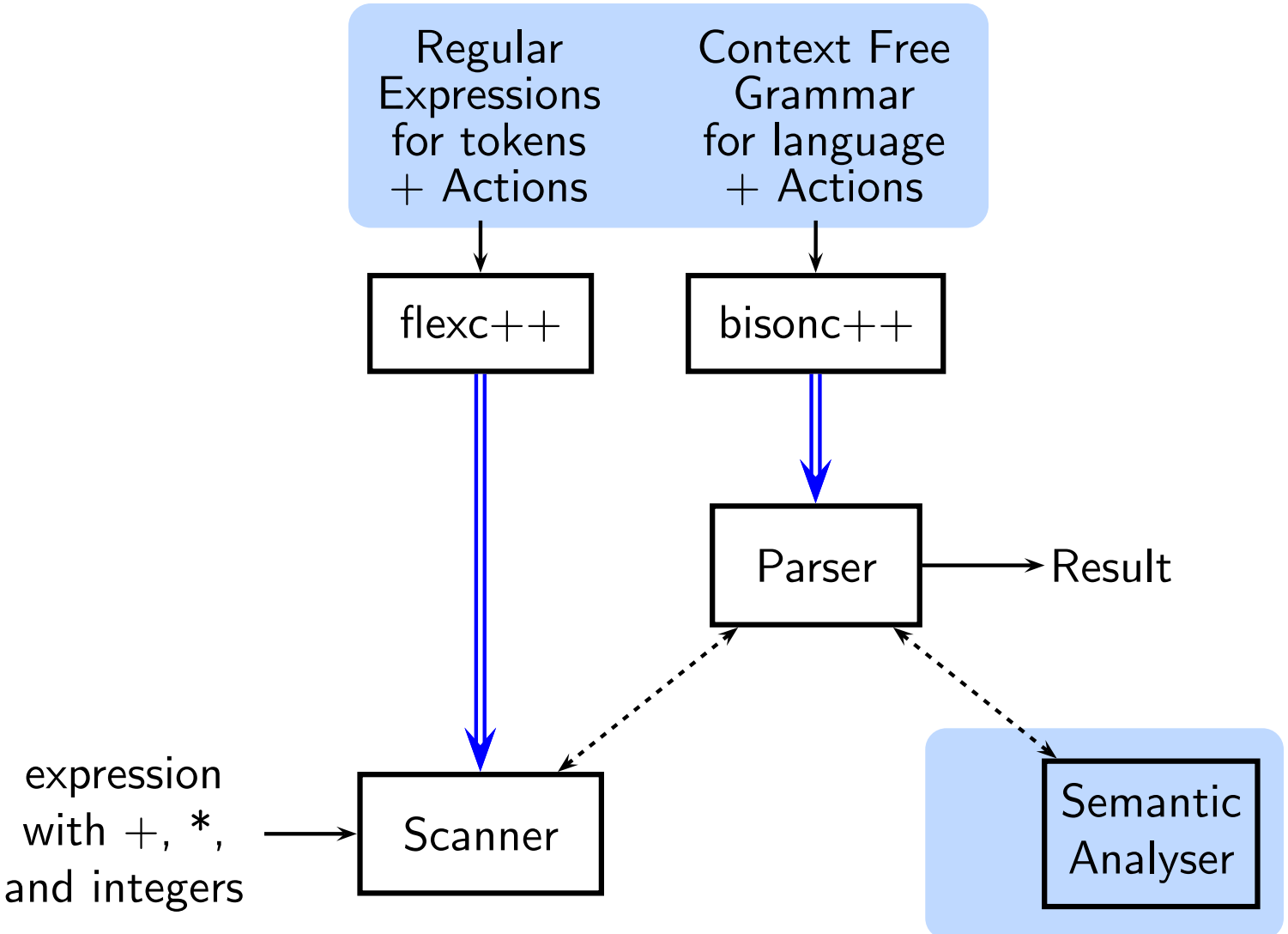
simCalc: A Simple Calculator



Introduction to Lex and Yacc

- lex script num.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

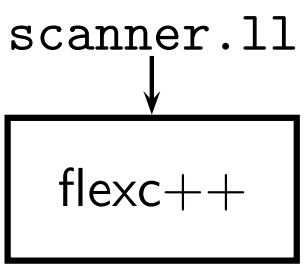
- Grammar

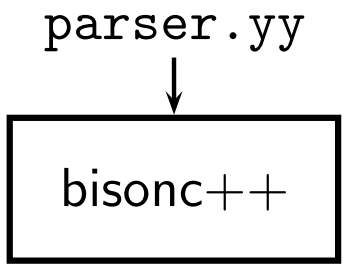
```
Expr   :   Expr '+' Expr
       |   Expr '*' Expr
       |   NUM
```

- 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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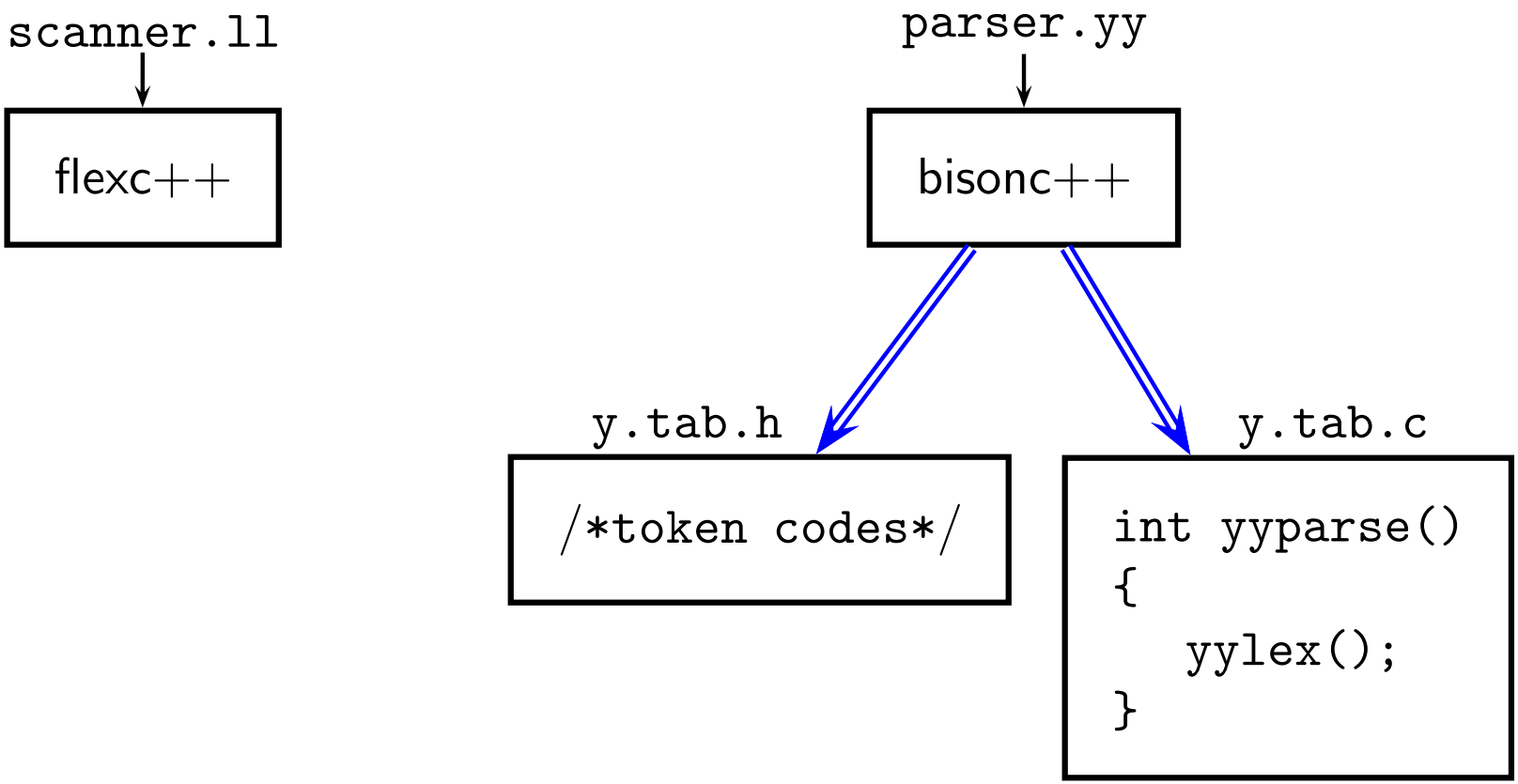

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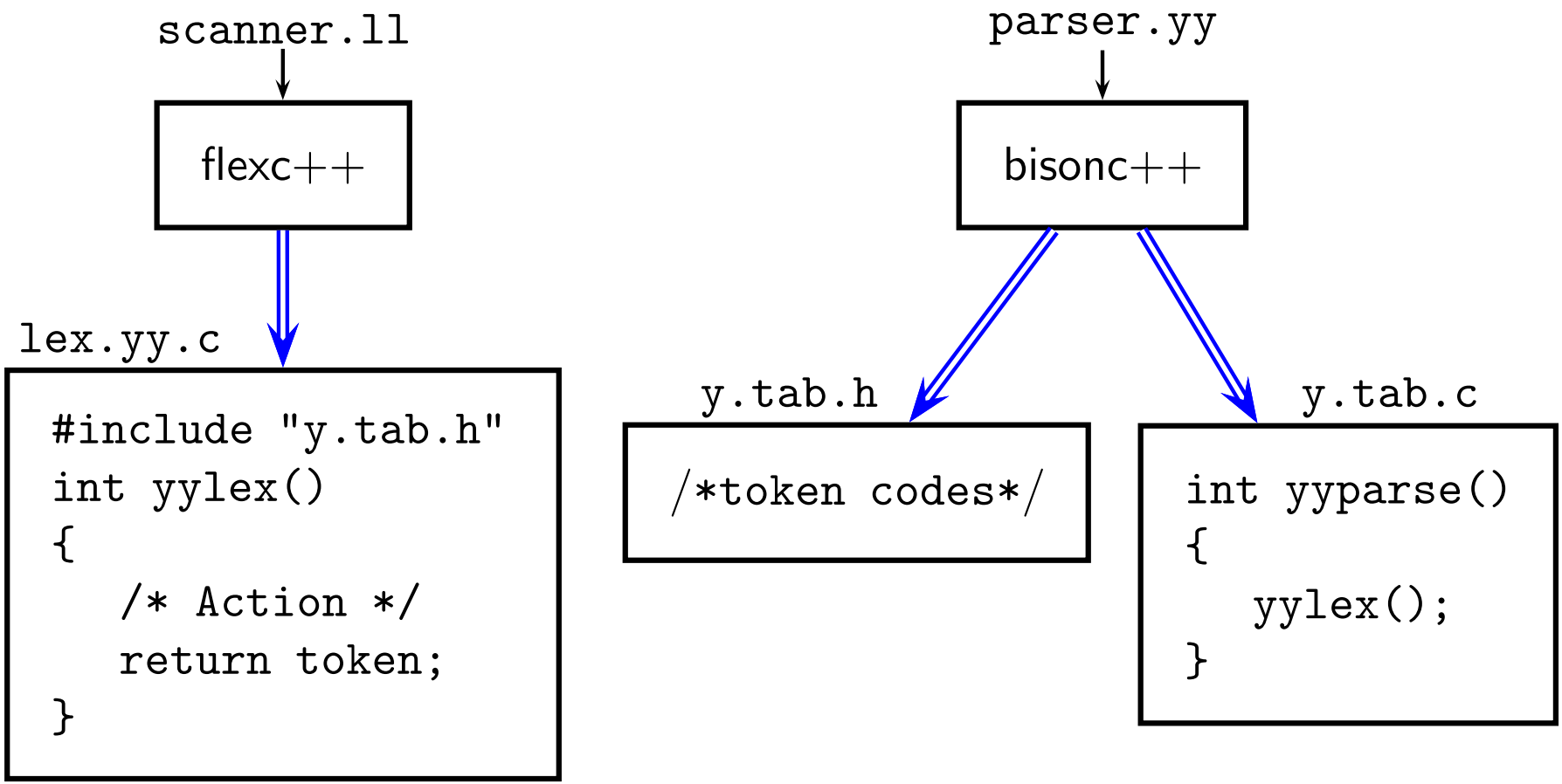

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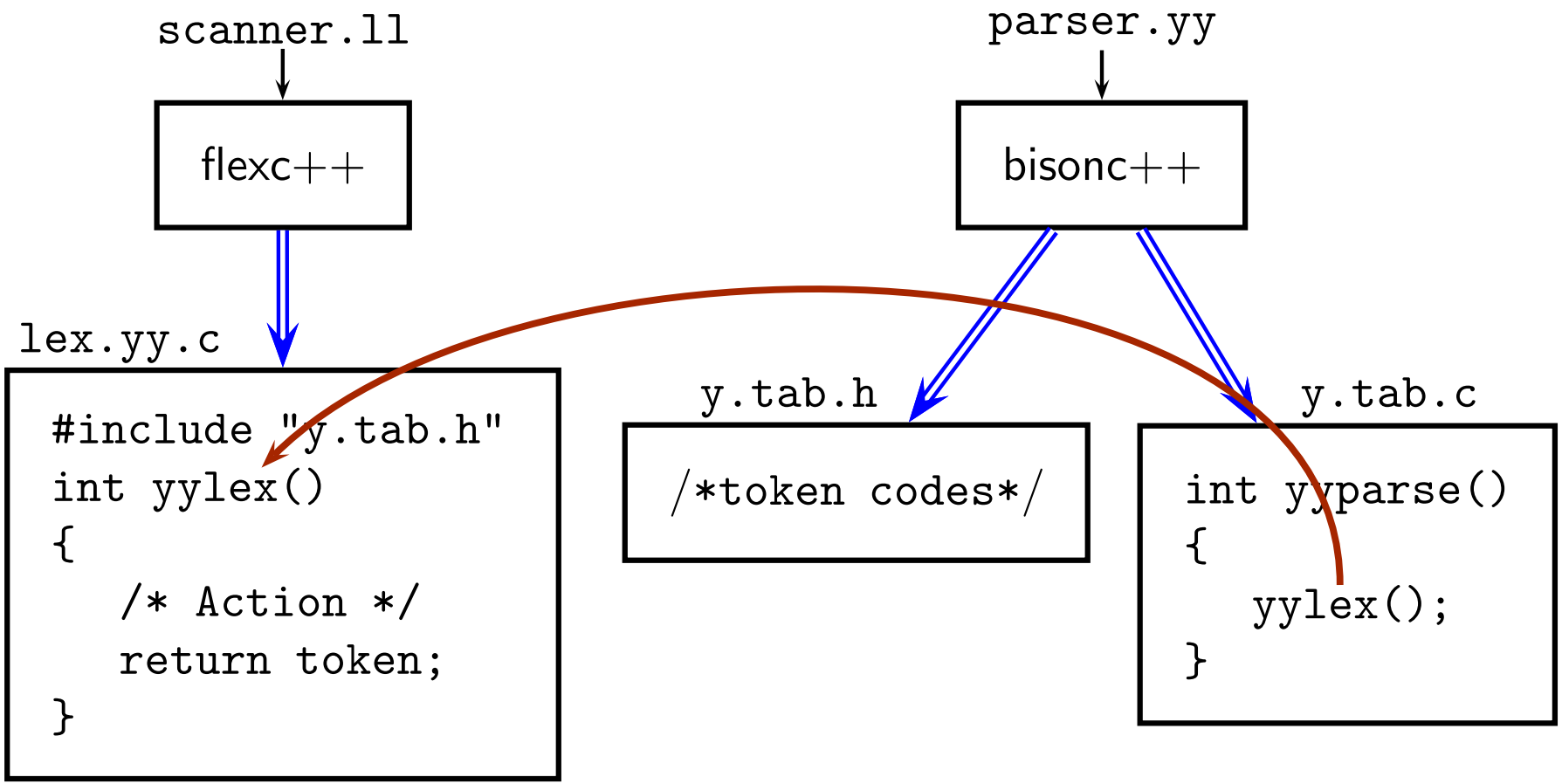

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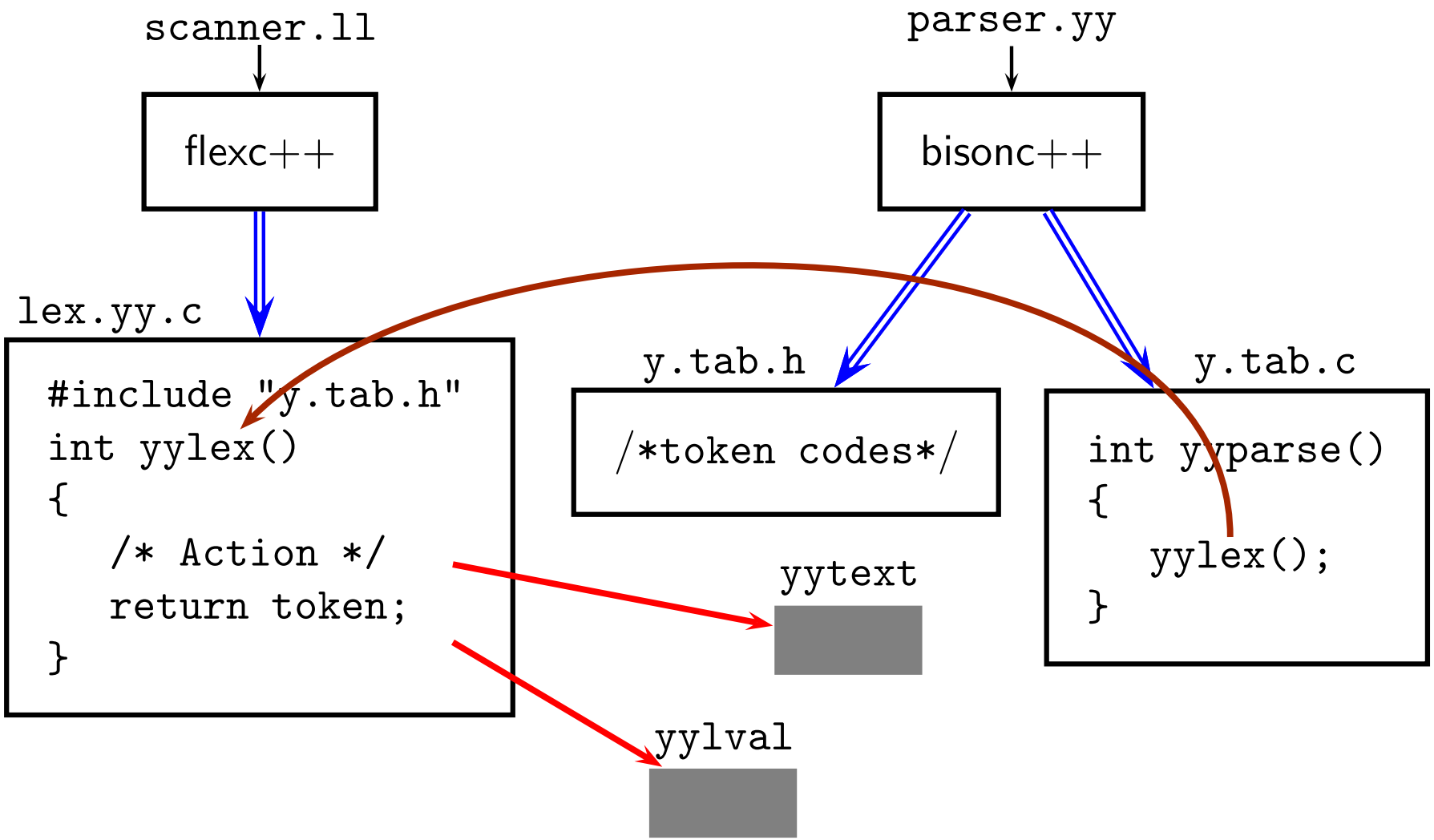

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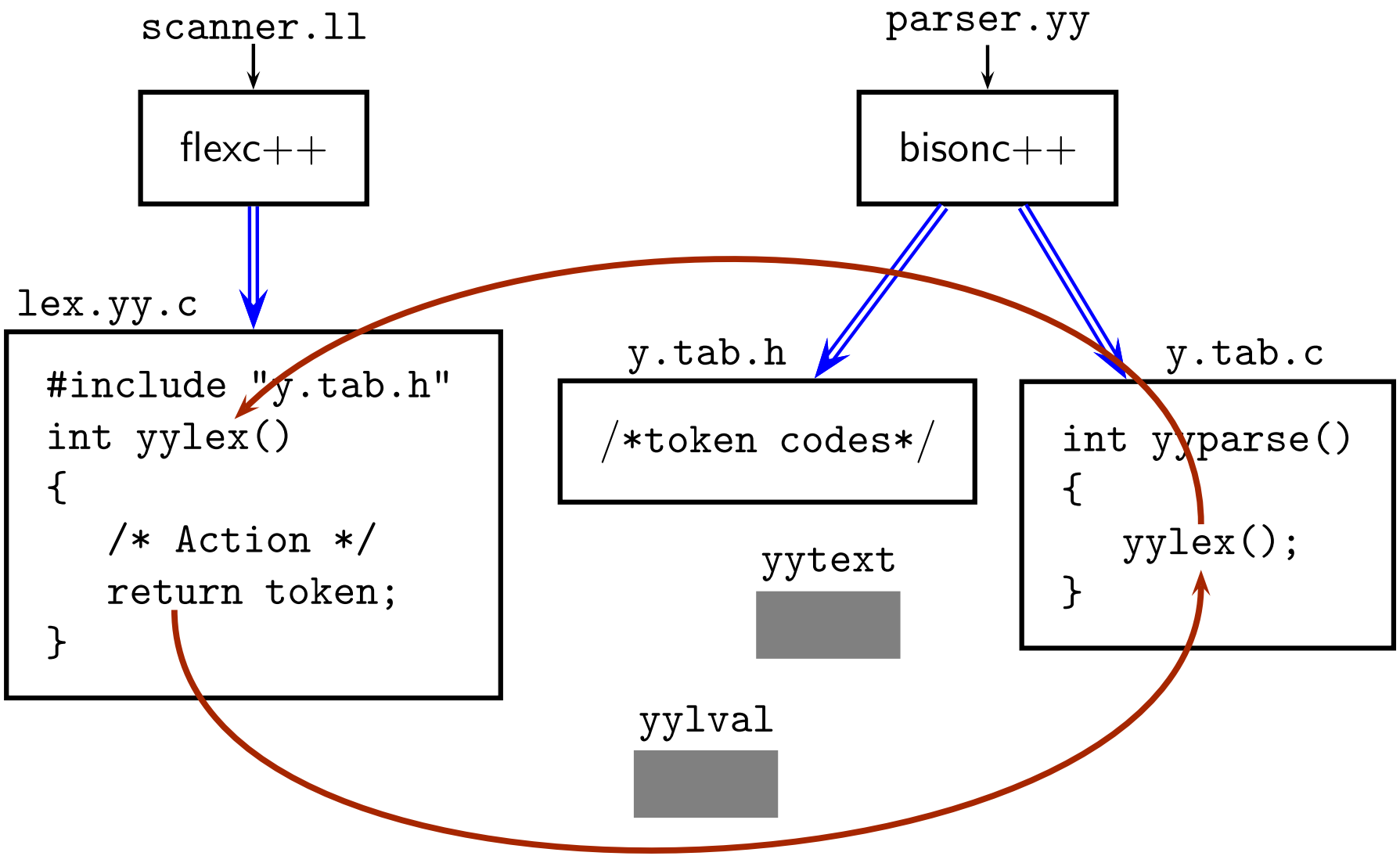

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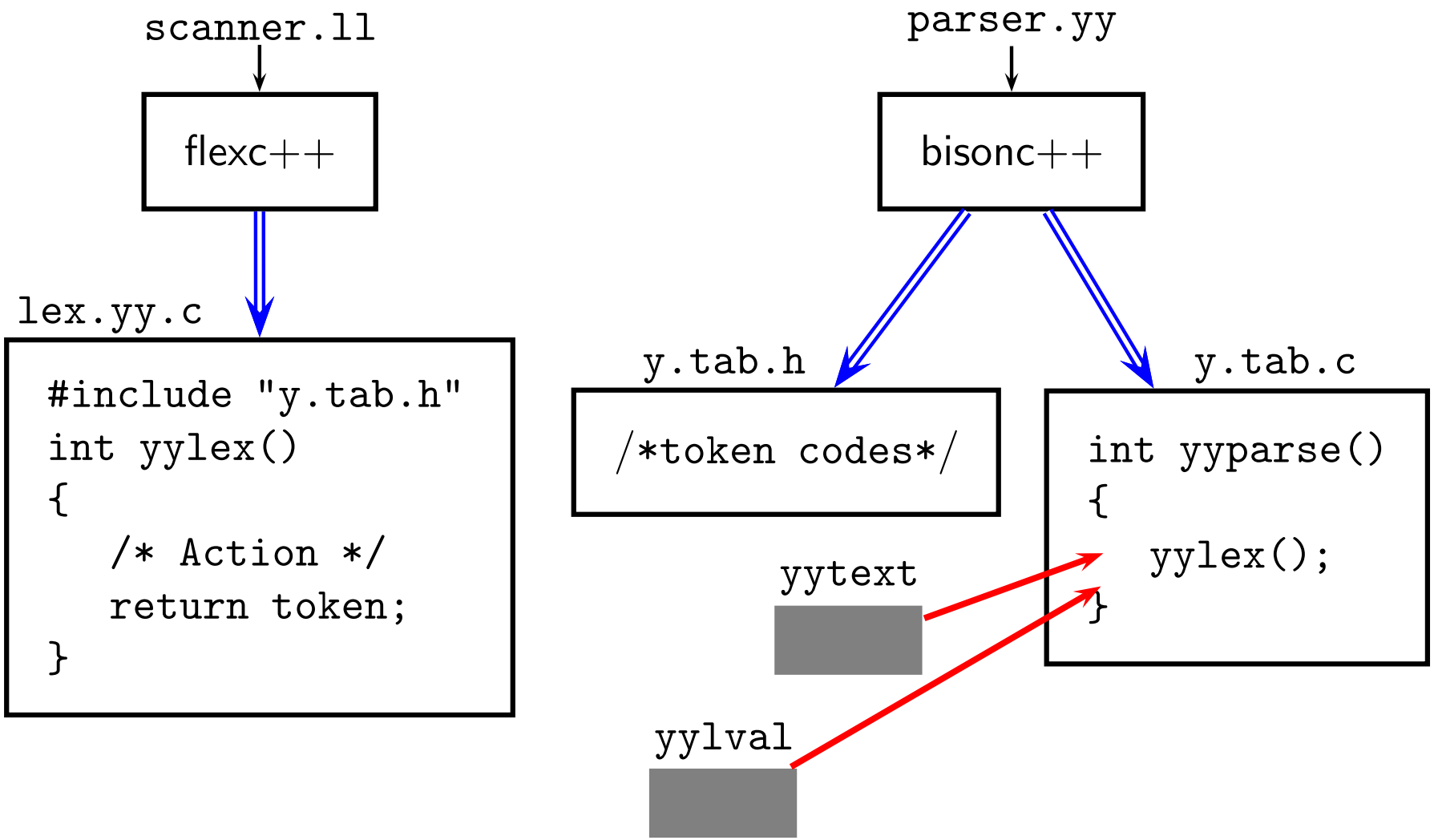

Some Issues in the Simple Calculator

- Syntax: Precedences and associativities
- Semantics: Values of
  - Terminals (from scanner)
  - Non-terminals (in the parser)
- Unit testing:

  Use of `#if SCANTEST` to test the scanner

Notes

- Sample inputs

  a 20 + b 3

- Use of "."
  - If a string can match two patterns, the first is chosen.
  - If a string can match a pattern and its prefix can also match a pattern, the prefix matching is ignored in favour of the longer string.

- The Lex and Yacc Page

  `http://dinosaur.compilertools.net/`

Passing Values From Scanner to the Parser

parser.h

```
class Parser:
      public ParserBase
{
  Scanner d_scanner;
  public:




  private:
    int parse();



};
```

scanner.h

```
class Scanner:
    public ScannerBase
{
  public:
    Scanner(...); /* explicit? */

    int lex();




  private:
    ...

};
```


Passing Values From Scanner to the Parser

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class Parser:
     public ParserBase
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   STYPE__    d_val__;
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```
class Scanner:
    public ScannerBase
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  public:
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  private:
    ...
    ParserBase::STYPE_ * dval;
};
```

Passing Values From Scanner to the Parser

parser.h

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class Parser:
     public ParserBase
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  Scanner d_scanner;
  public:
    Parser()
    { d_scanner.setSval(
                  &d_val__);
    }

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class Scanner:
    public ScannerBase
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    int lex();
    void setSval(
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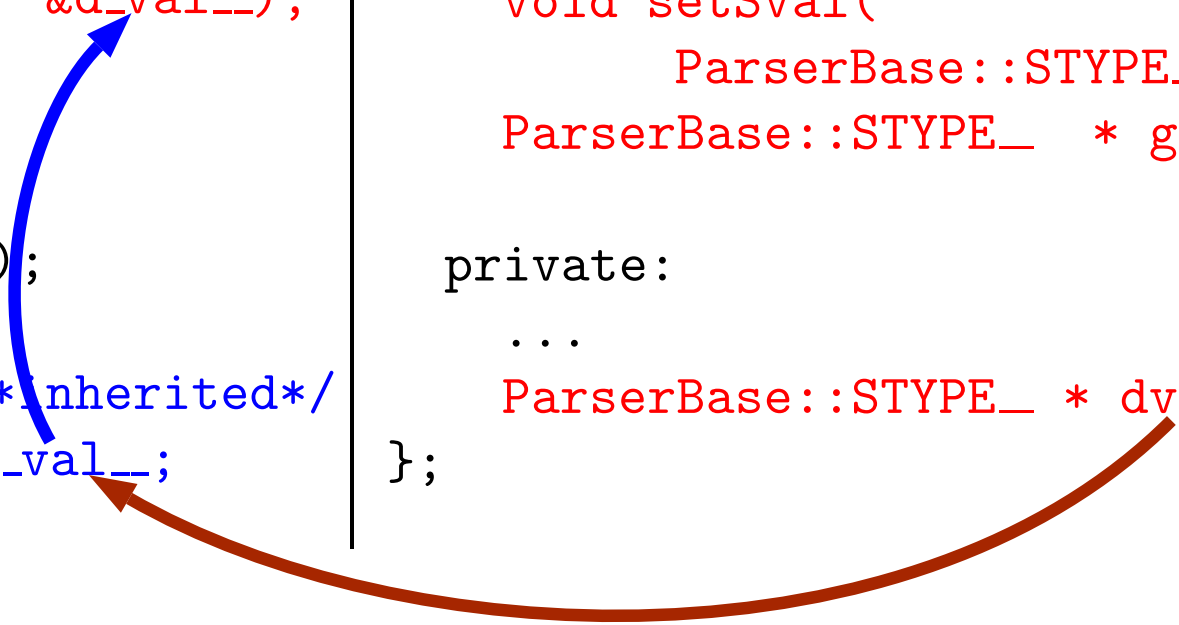

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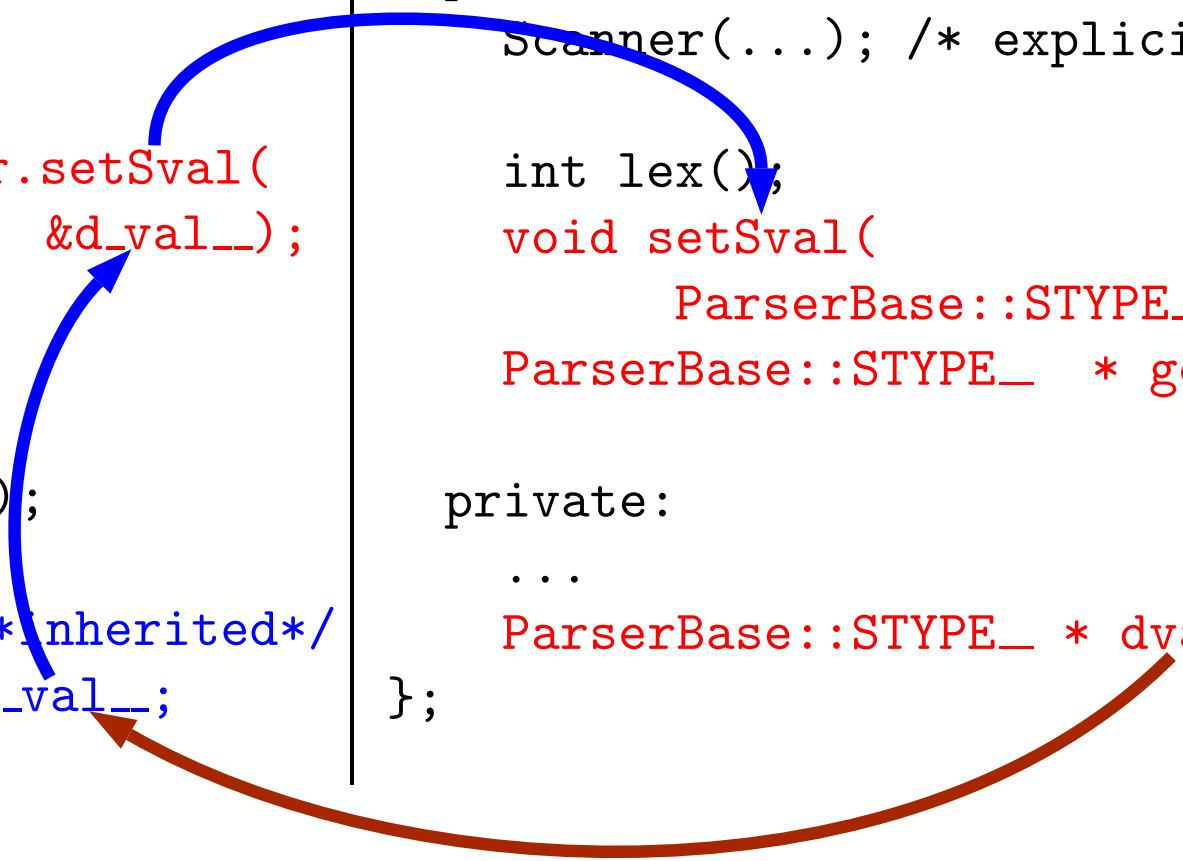

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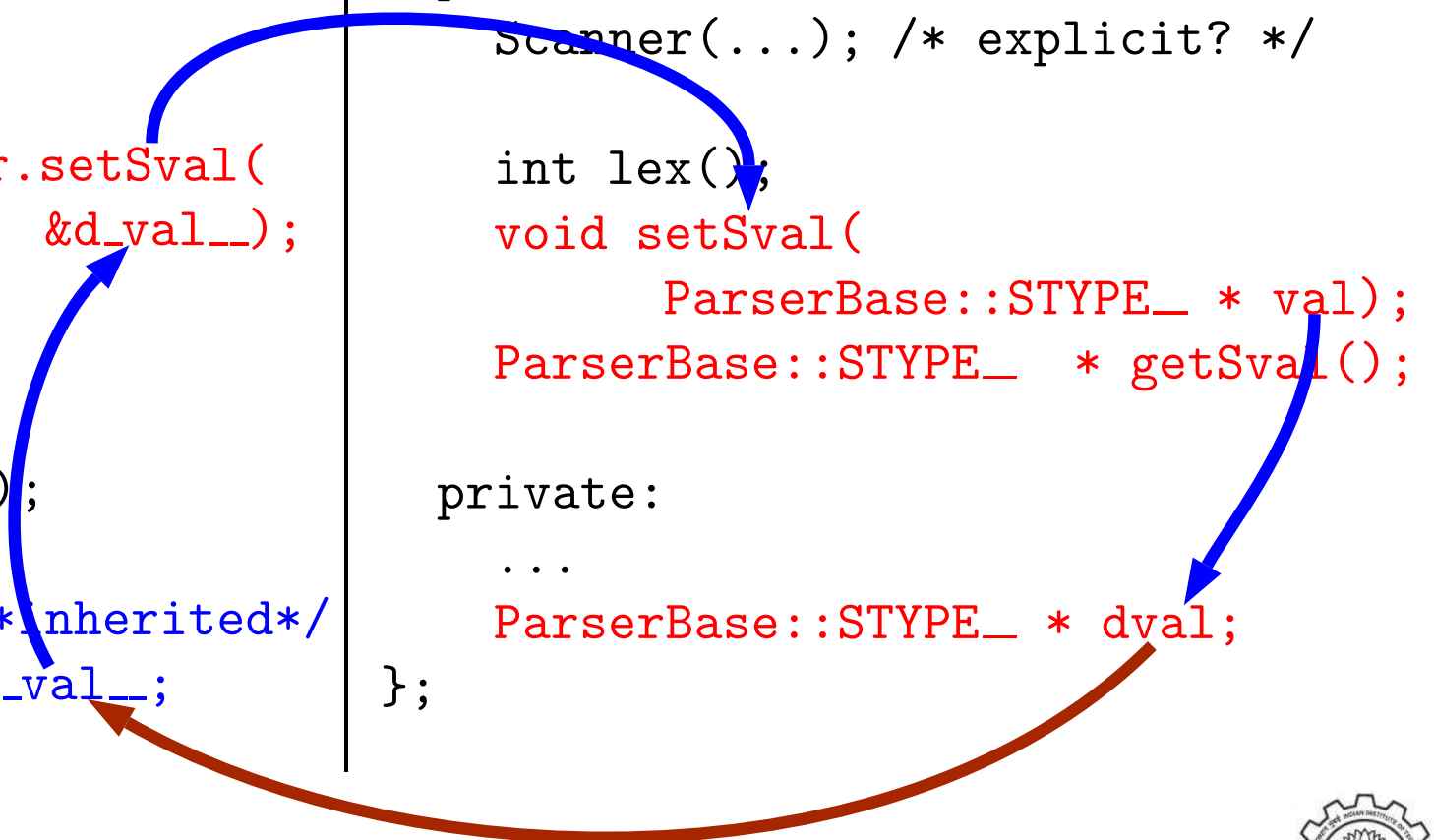


An Overview of Shift Reduce Parsing

- Grammar

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

- The process of parsing

10	+	20	*	3	eof
NUM					

Parsing Stack

Action: Shift NUM

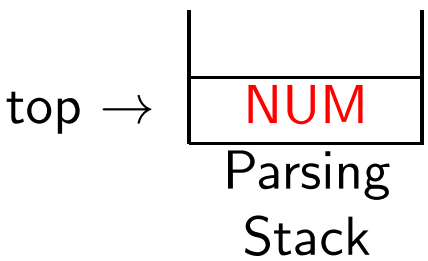
An Overview of Shift Reduce Parsing

- Grammar

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

- The process of parsing

10	+	20	*	3	eof
	+				



Action: Reduce by "Expr: NUM"

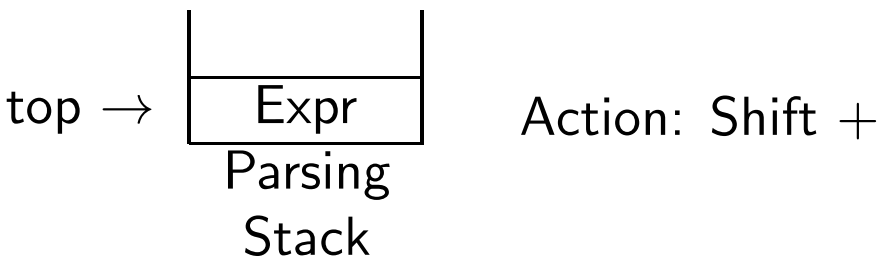
An Overview of Shift Reduce Parsing

- Grammar

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

- The process of parsing

10	+	20	*	3	eof
	+				



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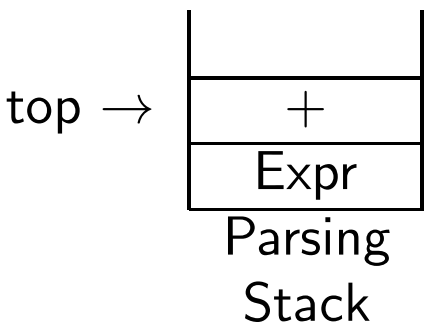

Action: Shift NUM

An Overview of Shift Reduce Parsing

- Grammar

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       |   NUM
```

- The process of parsing

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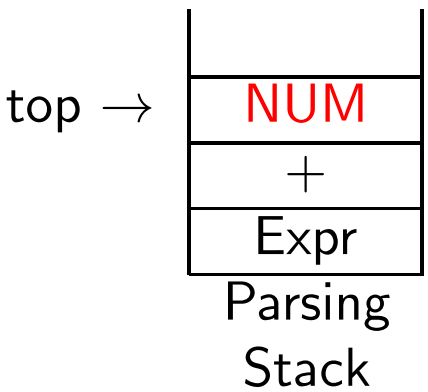
			*		



Action: Reduce by "Expr: NUM"

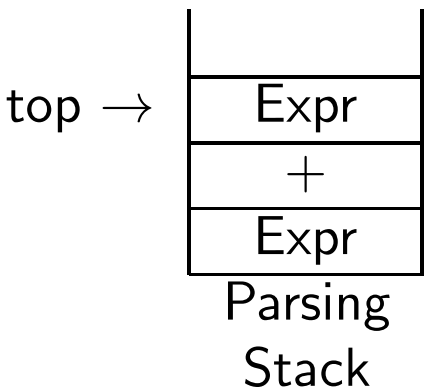
An Overview of Shift Reduce Parsing

- 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

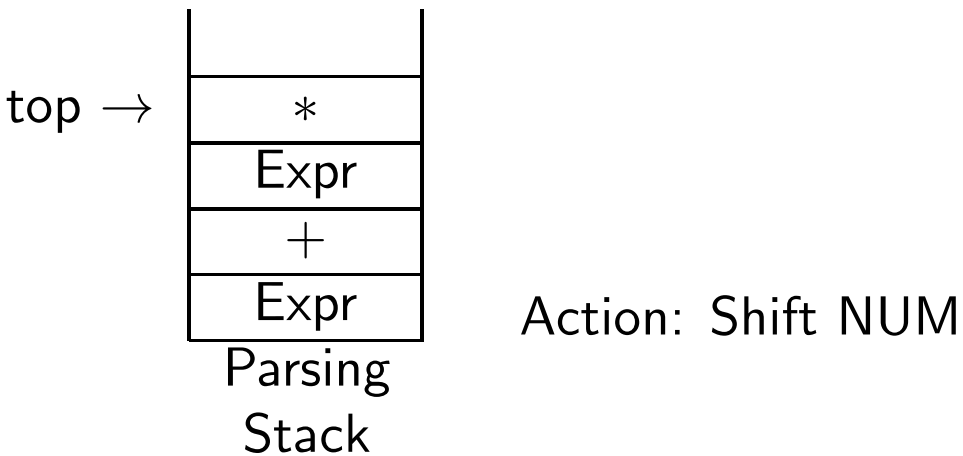
- Grammar

```
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

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Expr   :   Expr '+' Expr
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```
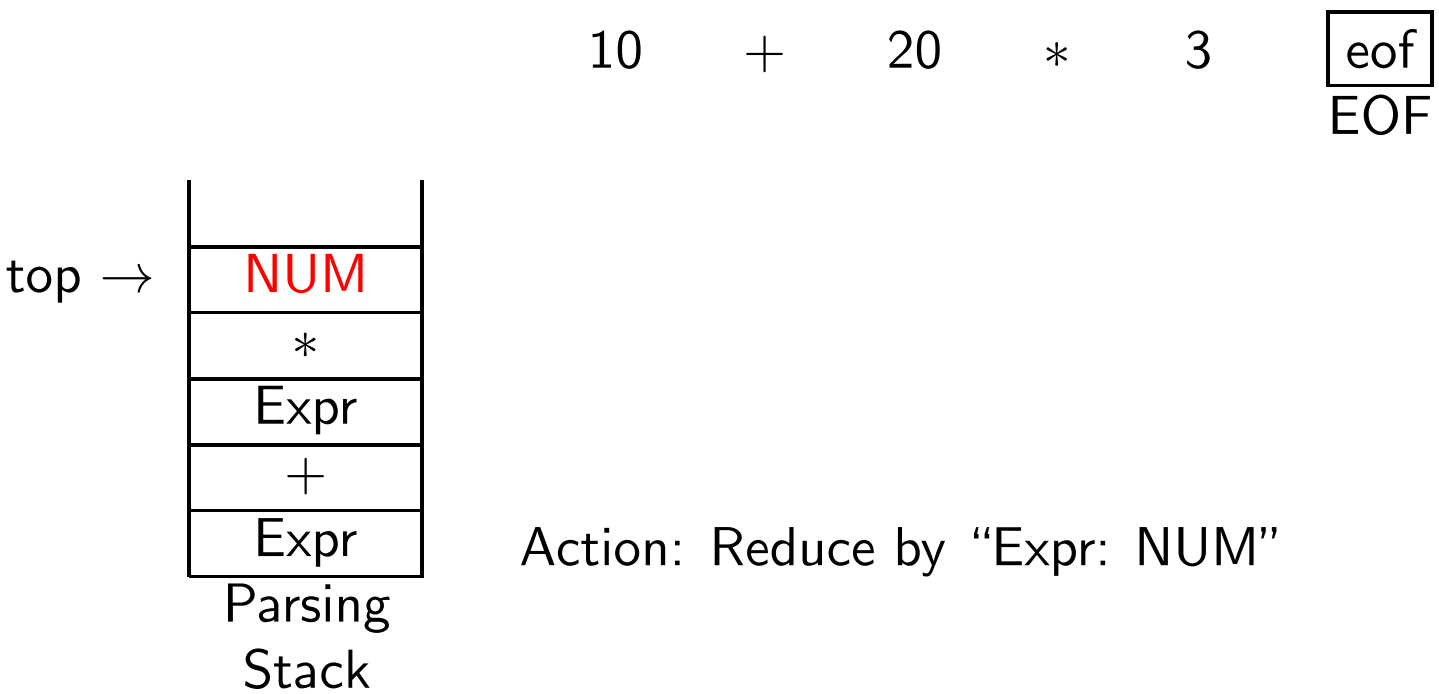

- The process of parsing



An Overview of Shift Reduce Parsing

- Grammar

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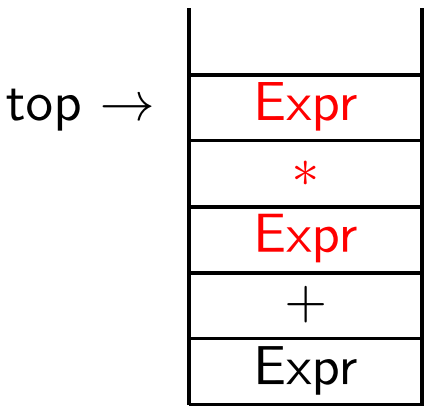
```

- The process of parsing

10 + 20 * 3 | eof

EOF



Action: Reduce by "Expr: Expr * Expr"

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- Grammar

```
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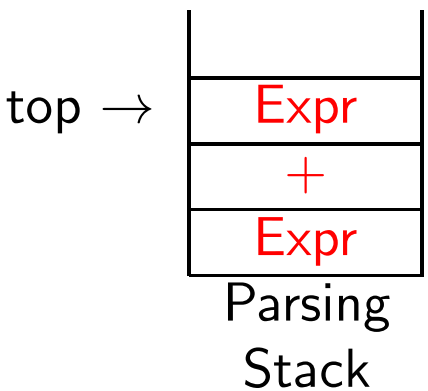
       |   NUM
```

- The process of parsing



Action: Reduce by "Expr: Expr + Expr"

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```

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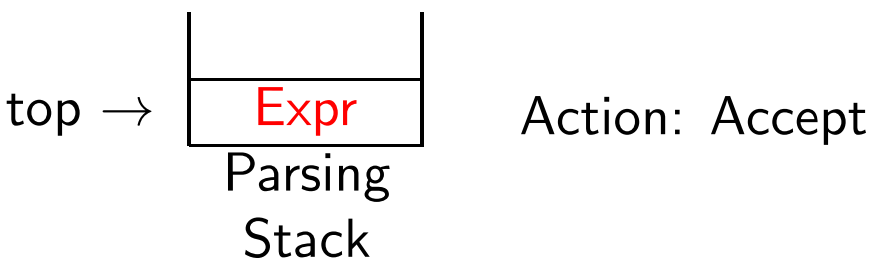
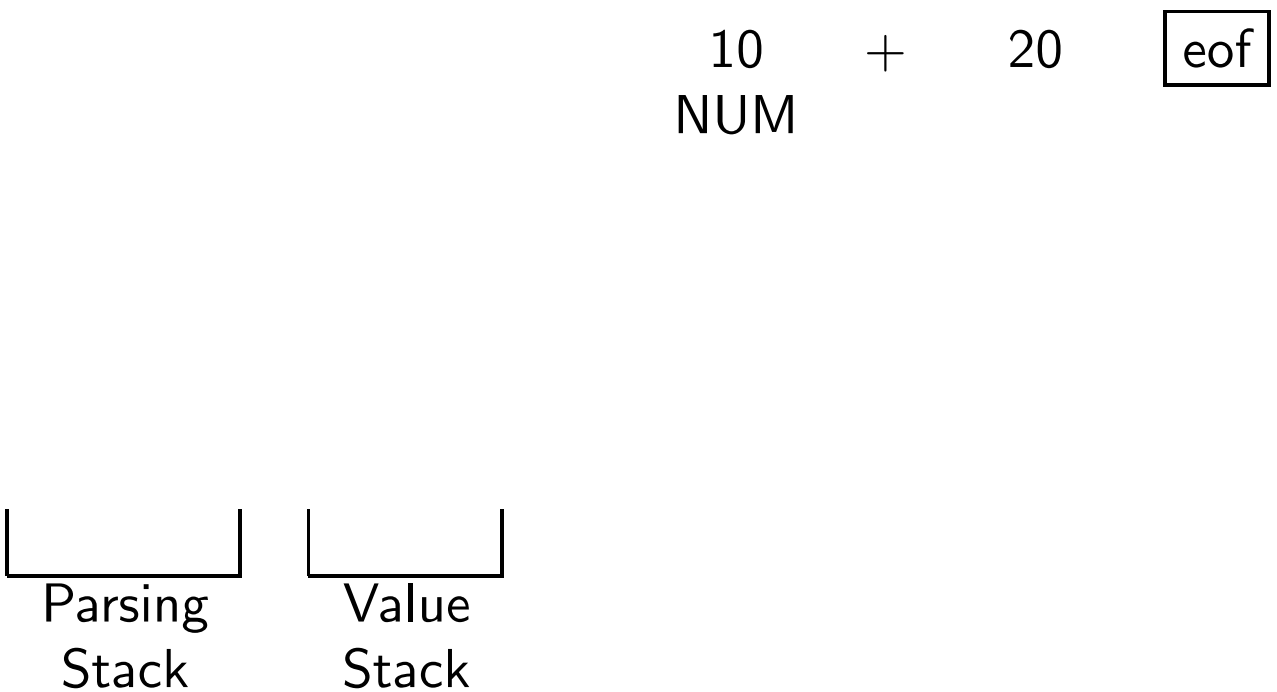


An Overview of Attribute Evaluation

- Grammar and the associated actions

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

- The process of parsing and attribute evaluation



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10 + 20 eof

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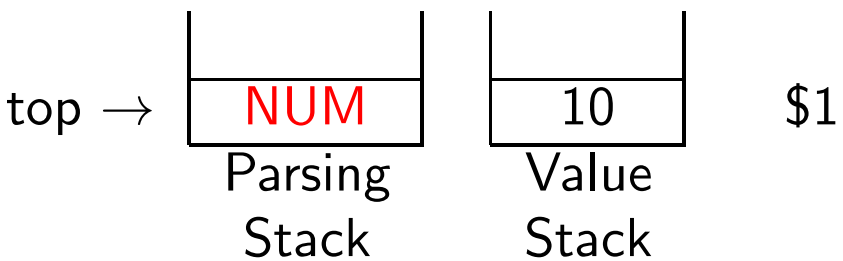

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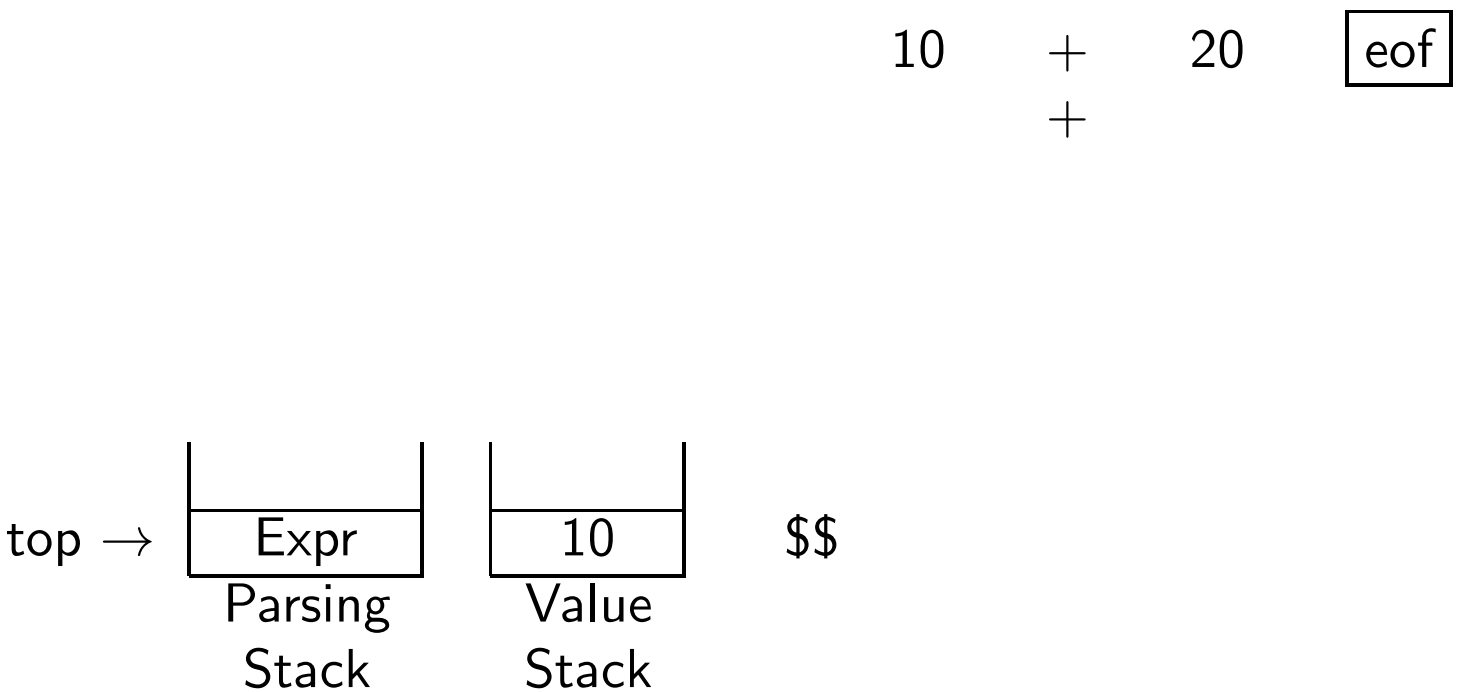

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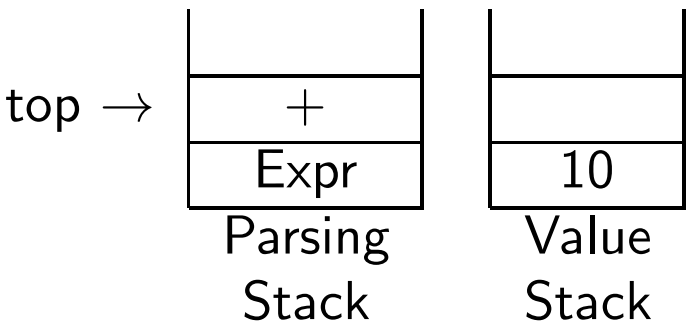

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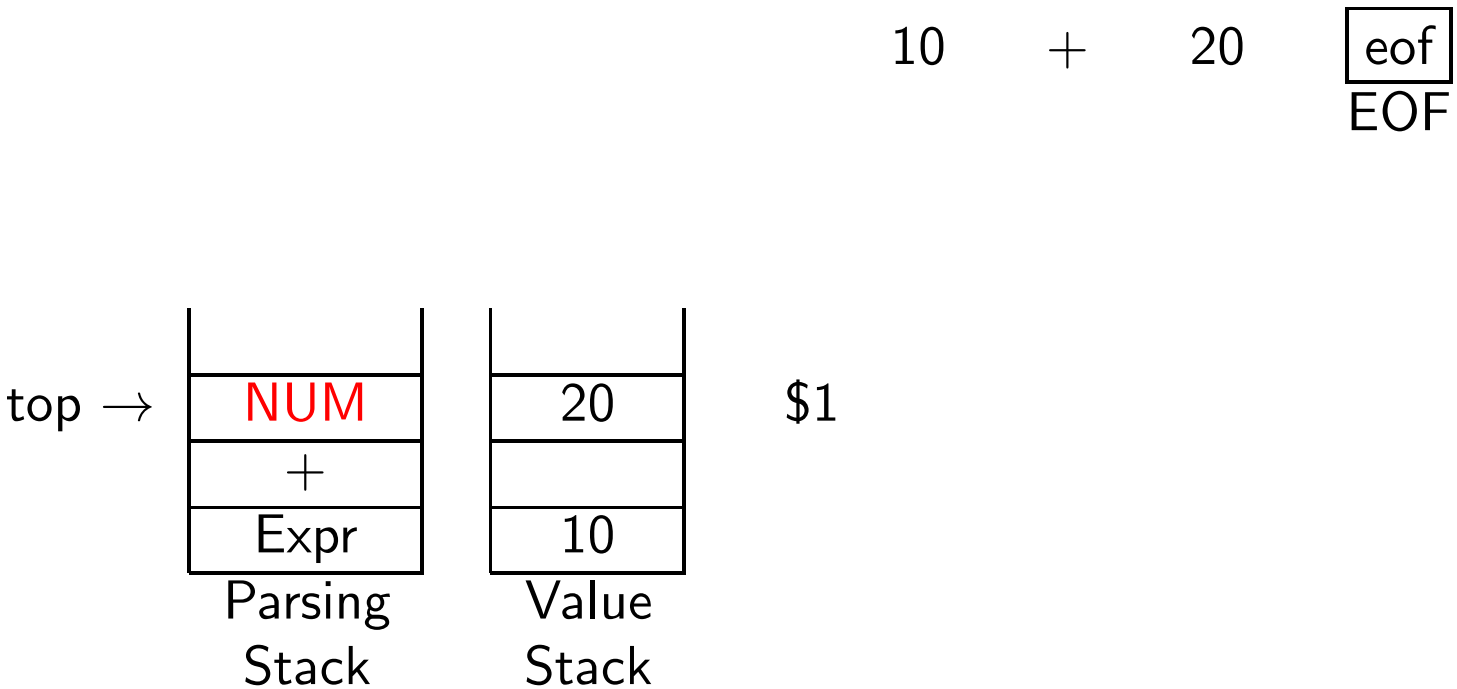

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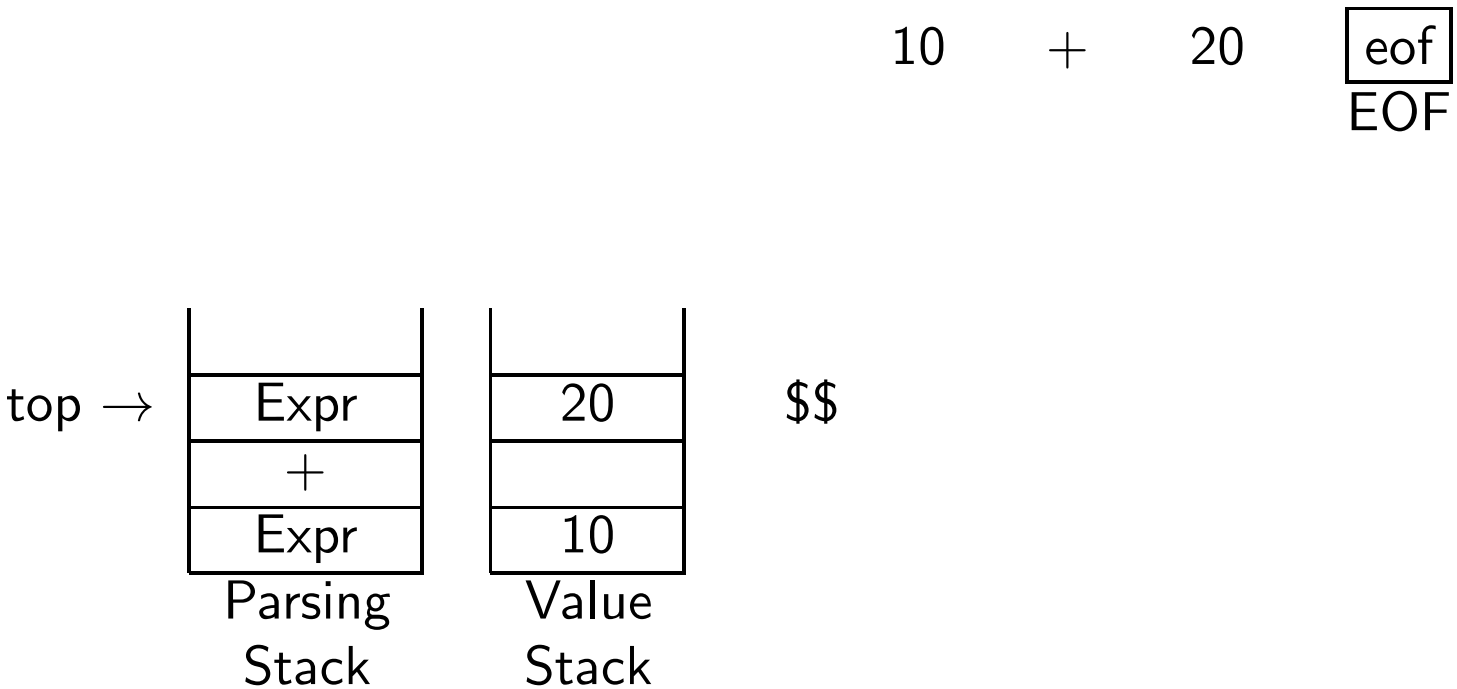

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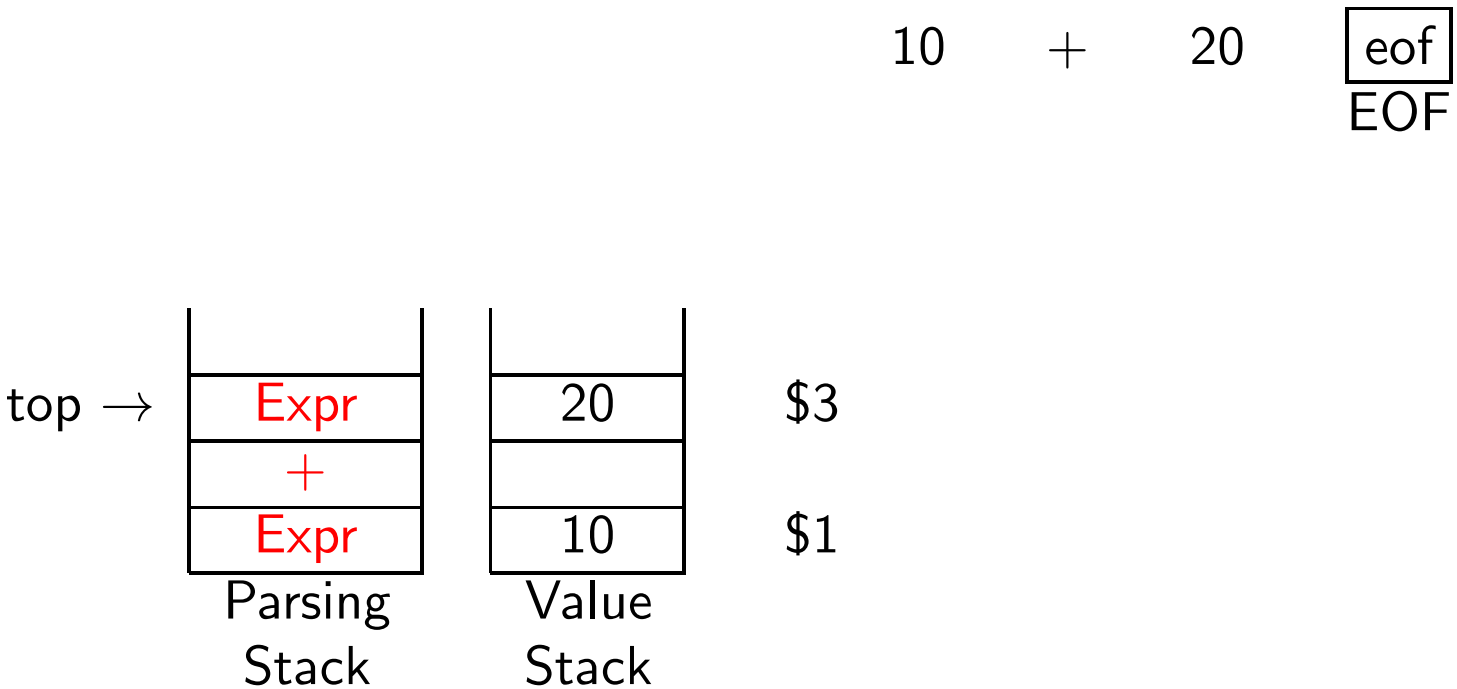

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- The process of parsing and attribute evaluation