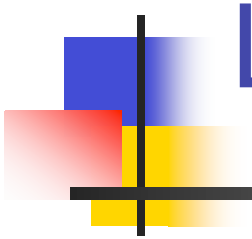
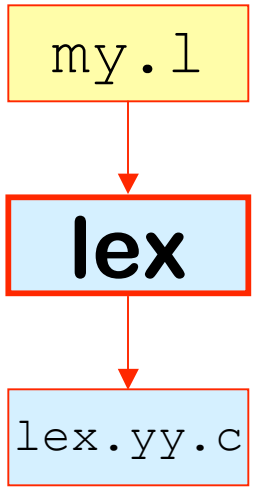


Lex and Yacc

A Quick Tour

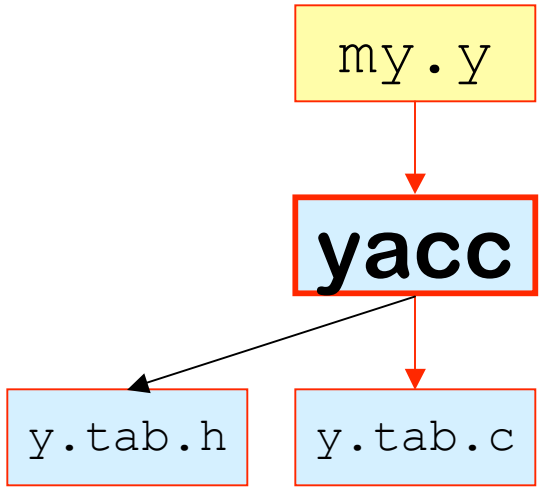
Lex (& Flex): A Lexical Analyzer Generator

- Input:
  - Regular exprs defining "tokens"
  - Fragments of C decls & code
- Output:
  - A C program "lex.yy.c"
- Use:
  - Compile & link with your main()
  - Calls to yylex() return successive tokens.



Yacc (& Bison & Byacc…): A Parser Generator

- Input:
  - A context-free grammar
  - Fragments of C declarations & code
- Output:
  - A C program & some header files
- Use:
  - Compile & link it with your main()
  - Call yyparse() to parse the entire input file
  - yyparse() calls yylex() to get successive tokens



Lex Input: "mylexer.l"

```
%{
   #include …
   int myglobal;
   …
%}
%%
[a-zA-Z]+    {handleit(); return 42; }
[ \t\n]      {; /* skip whitespace */}
…
%%
void handleit() {…}
…
```

Declarations: To front of C program

Token code

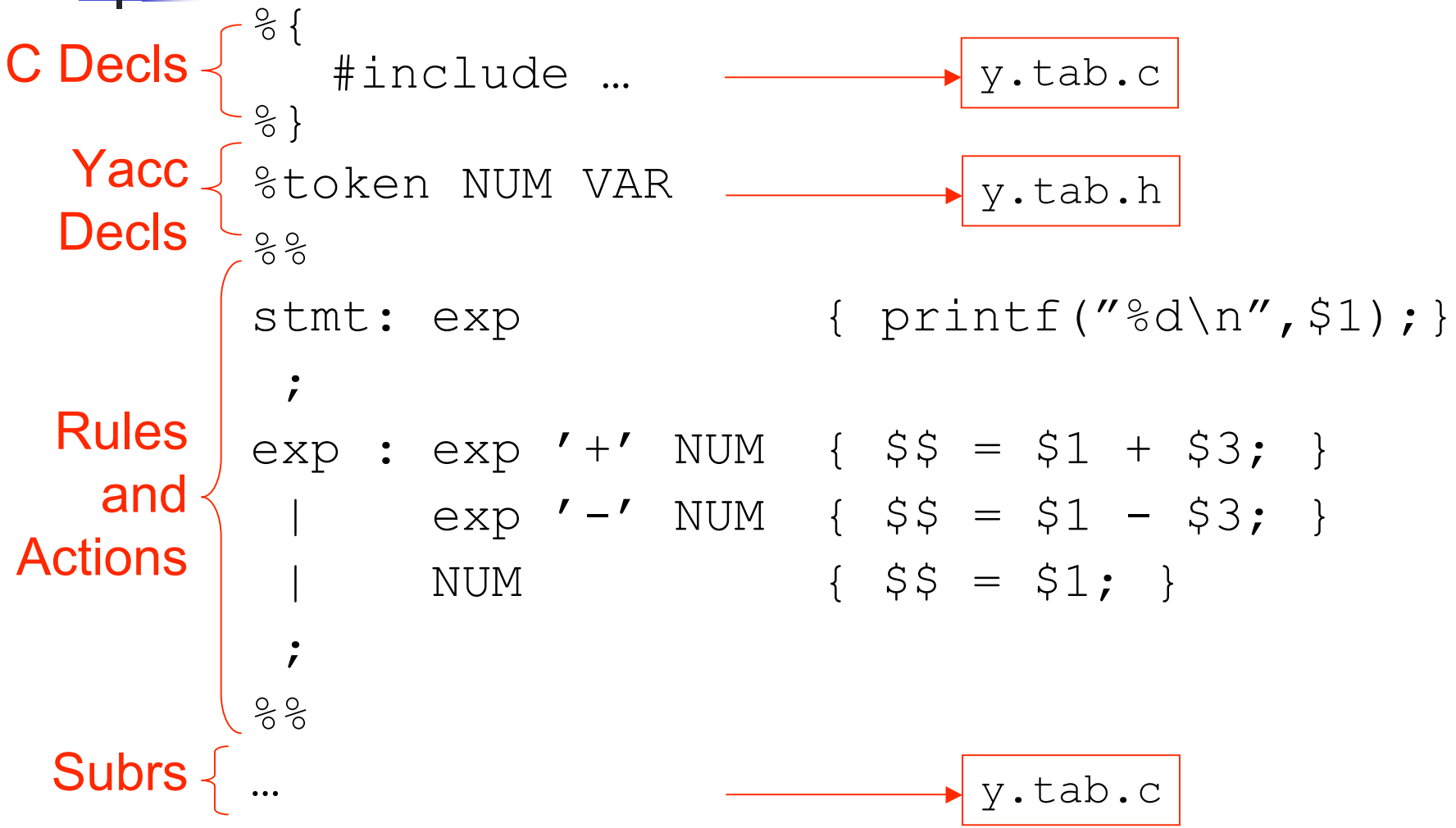
Rules and Actions

Subroutines: To end of C program

S → E

E → E+n | E-n | n

Yacc Input: “expr.y”



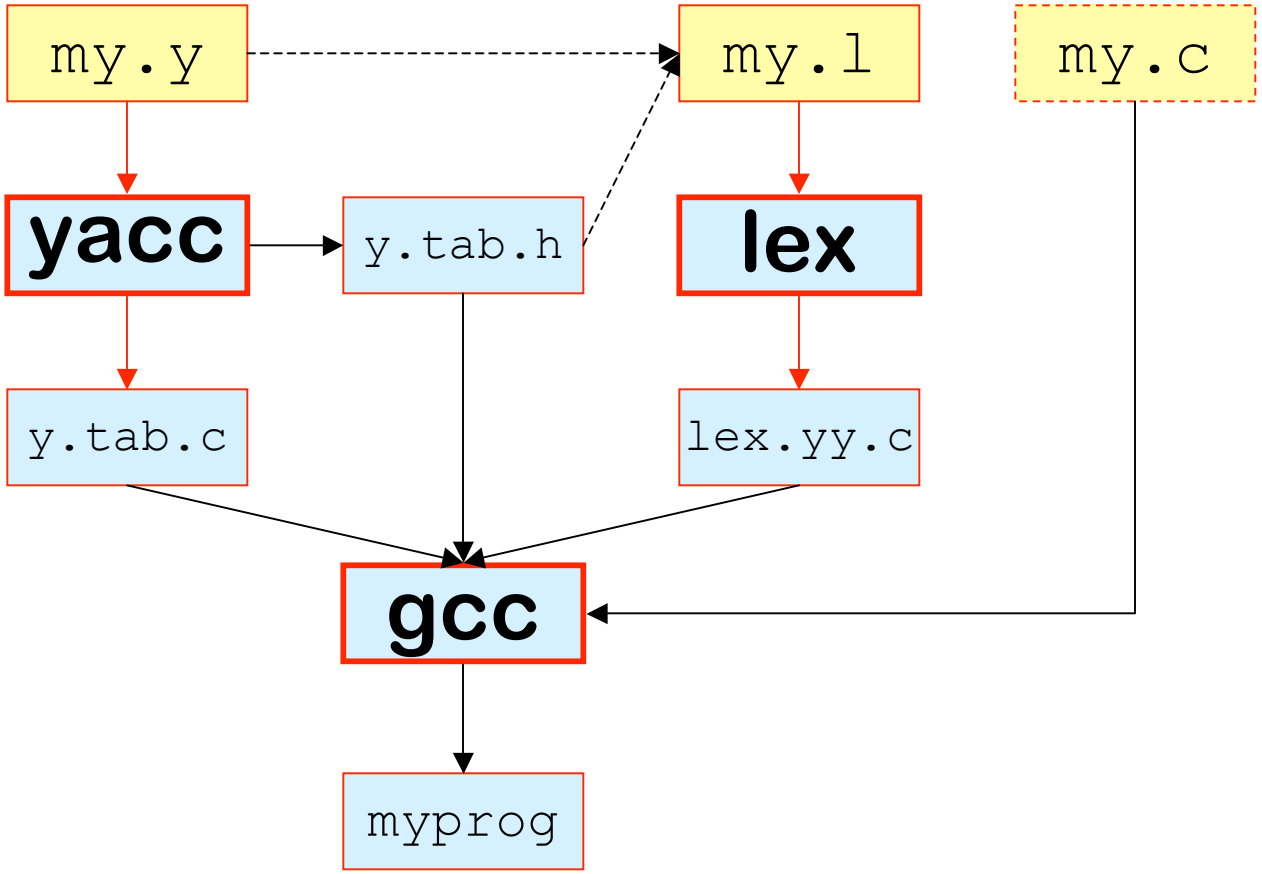
Expression lexer: “expr.l”

```
%{
#include "y.tab.h"

%}
%%
[0-9]+       { yylval = atoi(yytext); return NUM;}
[ \t]        {           /* ignore whitespace */ }
\n           { return 0;       /* logical EOF */ }
.            { return yytext[0]; /* +-*, etc. */ }
%%
yyerror(char *msg){printf("%s,%s\n",msg,yytext);}
int yywrap(){return 1;}
```

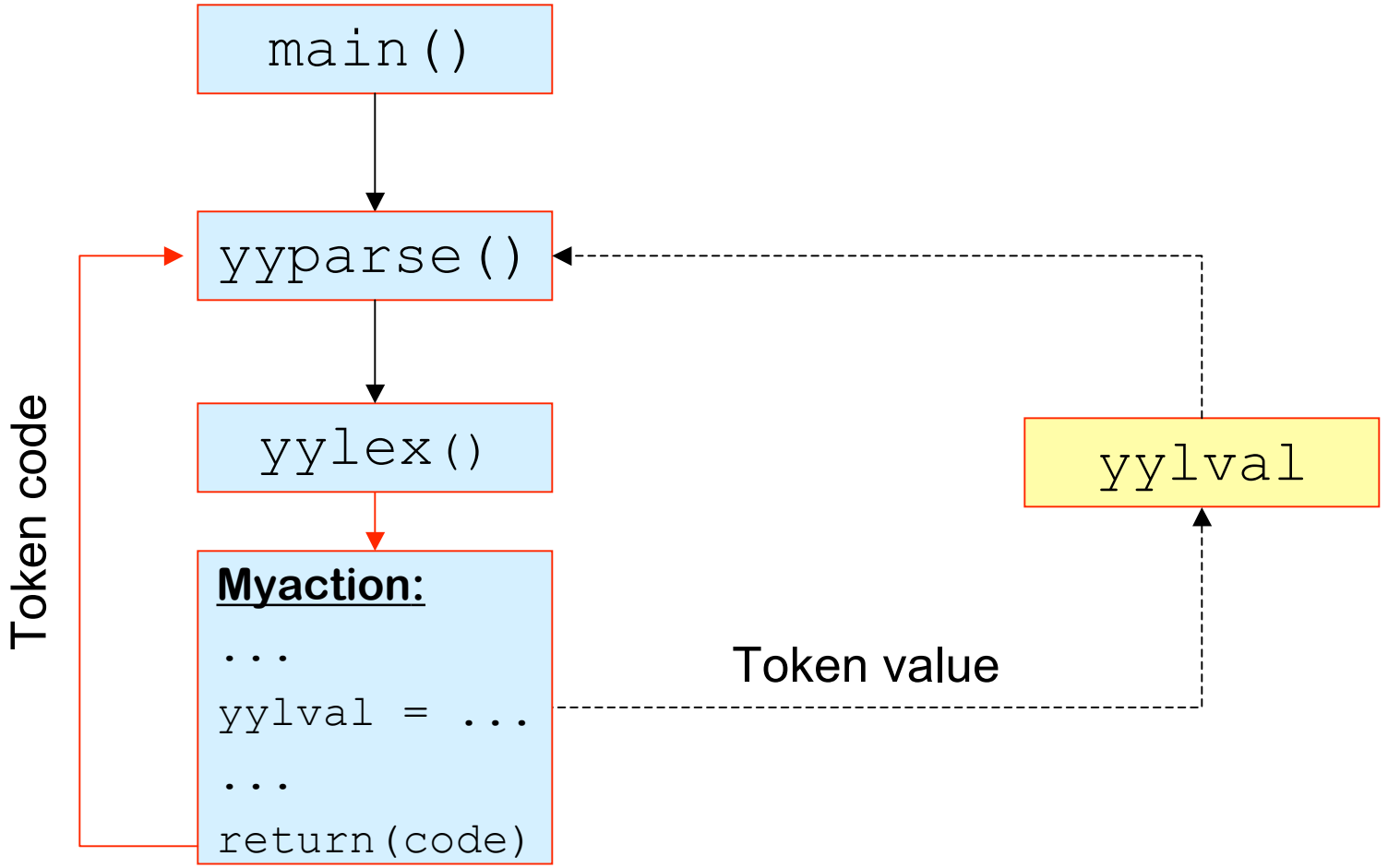
y.tab.h:

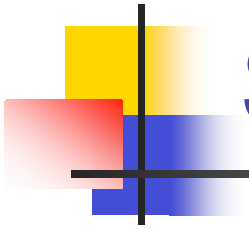
```
#define NUM     258
#define VAR     259
#define YYSTYPE int
extern  YYSTYPE yylval;
```

Lex/Yacc Interface: Compile Time



Lex/Yacc Interface: Run Time





Some C Tidbits

Enums

```
enum kind {
   title_kind,center_kind};
typedef struct node_s{
    enum kind k;
    struct node_s
      *lchild,*rchild;
    char *text;
  } node_t;
node_t root;
root.k = title_kind;
if(root.k==title_kind){…}
```

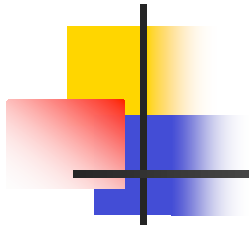
Malloc

```
root.rchild = (node_t*)
 malloc(sizeof(node_t));
```

Unions

```
typedef union {
      double d;
      int i;
 } YYSTYPE;
extern YYSTYPE yylval;
yylval.d = 3.14;
yylval.i = 3;
```

More Yacc Declarations



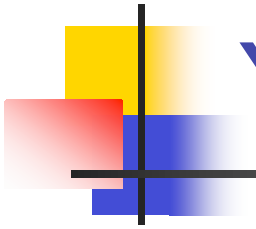
```
%union {
    node_t *node;
    char   *str; }

%token <str> BHTML BHEAD BTITLE BBODY BCENTER
%token <str> EHTML EHEAD ETITLE EBODY ECENTER
%token <str> P BR LI TEXT

%type <node> page head title words body
%type <node> heading list center item items

%start page
```

Type of yylval

Token names & types

Nonterm names & types

Start sym



Yacc In Action

PDA stack: alternates between "states" and symbols from (V ∪ Σ).

```
initially, push state 0
while not done {
   let S be the state on top of the stack;
   let i be the next input symbol (i in Σ);
   look at the the action defined in S for i:
      if "accept", halt and accept;
      if "error", halt and signal a syntax error;
      if "shift to state T", push i then T onto the stack;
      if "reduce via rule r (A → α )", then:
          pop exactly 2*|α| symbols
            (the 1st, 3rd, ... will be states, and
             the 2nd, 4th, ... will be the letters of α);
          let T = the state now exposed on top of the stack;
          T's action for A is "goto state U" for some U;
          push A, then U onto the stack.
}
```

Implementation note: given the tables, it's deterministic, and fast -- just table lookups, push/pop.