

## \* Terminals :

vtype, addsub, lbrace, multdiv, comma, return, rparen  
identifier, lparen, assign, if, else, while, semi, literal  
rbrace, comparison, integer

## \* Nonterminals :

STMT, COND, BLOCK, VDECL, ARG, MOREARS, CODE, EXPR,  
RETURN, FACTOR, TERM, FDECL, RHS

## \* Grammar :

- ①  $\text{CODE}' \rightarrow \text{CODE}$
- ②  $\text{CODE} \rightarrow \text{VDECL } \text{CODE}$
- ③  $\text{CODE} \rightarrow \text{FDECL } \text{CODE}$
- ④  $\text{CODE} \rightarrow \text{FDECL}$
- ⑤  $\text{CODE} \rightarrow \text{VDECL}$
- ⑥  $\text{VDECL} \rightarrow \text{vtype } \text{identifier } \text{semi}$
- ⑦  $\text{FDECL} \rightarrow \text{vtype } \text{identifier } \text{lparen } \text{ARG}$
- ⑧  $\text{ARG} \rightarrow \text{vtype } \text{identifier } \text{MOREARS}$
- ⑨  $\text{ARG} \rightarrow \text{rparen } \text{lbrace } \text{BLOCK}$
- ⑩  $\text{MOREARS} \rightarrow \text{comma } \text{vtype } \text{identifier } \text{MOREARS}$
- ⑪  $\text{MOREARS} \rightarrow \text{rparen } \text{lbrace } \text{BLOCK}$

- ⑫ BLOCK → STMT BLOCK  
 ⑬ BLOCK → RETURN rbrace  
 ⑭ BLOCK → rbrace  
 ⑮ BLOCK → rbrace else lbrace BLOCK  
 ⑯ STMT → VDECL  
 ⑰ STMT → identifier assign RHS semi  
 ⑱ STMT → if lparen COND rparen lbrace BLOCK  
 ⑲ STMT → while lparen COND rparen lbrace BLOCK  
 ⑳ RHS → EXPR  
 ㉑ RHS → literal  
 ㉒ EXPR → TERM addsub EXPR  
 ㉓ EXPR → TERM  
 ㉔ TERM → FACTOR multdiv TERM  
 ㉕ FACTOR → lparen EXPR rparen  
 ㉖ FACTOR → identifier  
 ㉗ FACTOR → integer  
 ㉘ COND → FACTOR comparison FACTOR  
 ㉙ RETURN → return FACTOR semi

## \* First :

CODE' = { vtype }

CODE = { vtype }

VDECL = { vtype }

FDECL = { vtype }

ARG = { vtype, rparen }

MOREARS = { rparen, comma }

BLOCK = { vtype, return, identifier, if, while, rbrace }

STMT = { vtype, identifier, if, while }

RHS = { literal, identifier, lparen, integer } .

EXPR = { identifier, lparen, integer }

TERM = { identifier, lparen, integer }

FACTOR = { identifier, lparen, integer }

COND = { identifier, lparen, integer }

RETURN = { return }

## \* Follow :

CODE' = { \$ }

CODE = { \$ } .

VDECL = { vtype, return, identifier, if, while, rbrace, \$ }

FDECL = { vtype, \$ }

ARG = { vtype, \$ }

MOREARS = { vtype, \$ }

BLOCK = { vtype, return, identifier, if, while, rbrace, \$ }

STMT = { vtype, identifier, if, while, rbrace, return }

RHS = { semi }

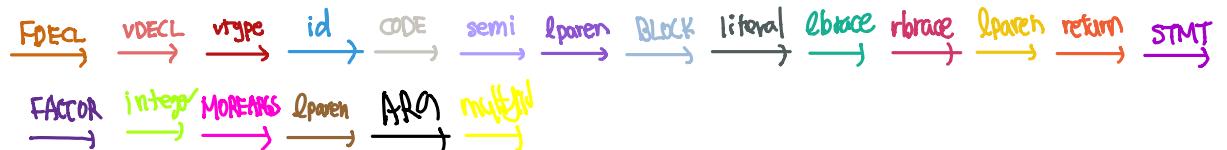
EXPR = { semi, rparen }

TERM =  $\epsilon$  semi, addsub, rparen $^g$

FACTOR =  $\epsilon$  multdiv, addsub, semi, comparison rparen $^g$

COND =  $\epsilon$  rparen $^g$

RETURN = { rbrace $^g$



## \* DFA

So:

CODE → . FDECL CODE

CODE' → . CODE

CODE → . FDECL

CODE → . VDECL CODE

FDECL → . vtype identifier lparen ARG

VDECL → . vtype identifier semi

CODE → . VDECL

S1:

CODE → . FDECL CODE

CODE → . FDECL

CODE → . VDECL CODE

FDECL → . vtype identifier lparen ARG

CODE → FDECL . CODE

CODE → FDECL .

VDECL → . vtype identifier semi

CODE → . VDECL

S2:

FDECL → vtype . identifier lparen ARG

VDECL → vtype . identifier semi

S3:

CODE → . FDECL CODE

CODE → . FDECL

CODE → . VDECL CODE  
FDECL → . vtype identifier (paren ARG  
CODE → VDECL . CODE  
CODE → VDECL .  
VDECL → . vtype identifier semi  
CODE → . VDECL

S4:

CODE' → CODE.

S5:

CODE' → FDECL CODE.

S6:

VDECL → vtype identifier . semi  
FDECL → vtype identifier . (paren ARG

S7:

CODE → VDECL CODE.

S8:

FDECL → vtype identifier (paren . ARG  
ARG → . vtype identifier MOREARGS  
ARG → . rparen {brace BLOCK

S9:

VDECL → vtype identifier semi .

S10:

FDECL → vtype identifier (paren ARG .

S11:

ARG → vtype . identifier MOREARGS

S12:

ARG → rparen . {brace BLOCK

S13:

ARG → vtype identifier . MOREARGS  
MOREARGS → . rparen {brace BLOCK

MOREARGS → . comma vtype identifier MOREARGS

S14:

BLOCK → . rbrace else lbrace BLOCK  
STMT → . VDECL  
STMT → . while lparen COND rparen lbrace BLOCK  
BLOCK → . RETURN rbrace  
RETURN → . return FACTOR semi  
BLOCK → . rbrace  
STMT → . identifier assign RHS semi  
BLOCK → . STMT BLOCK  
ARG → lparen . lbrace . BLOCK  
VDECL → . vtype identifier semi  
STMT → . if lparen COND rparen lbrace BLOCK

S15:

MOREARGS → . comma . vtype identifier MOREARGS

S16:

MOREARG → lparen . lbrace BLOCK

S17:

ARG → . vtype identifier MOREARGS .

S18:

FACTOR → . lparen Expr rparen  
RETURN → . return . FACTOR semi  
FACTOR → . integer  
FACTOR → . identifier

S19:

ARG → lparen lbrace BLOCK .

S20:

STMT → . identifier assign RHS semi

S21:

STMT → . if . lparen COND rparen lbrace BLOCK

S22:

STMT → . while . lparen COND rparen lbrace BLOCK

S23:

BLOCK  $\rightarrow$  lbrace else rbrace BLOCK  
BLOCK  $\rightarrow$  rbrace .

S24:

VDECL  $\rightarrow$  vtype identifier semi

S25:

BLOCK  $\rightarrow$  rbrace else lbrace BLOCK  
STMT  $\rightarrow$  . VDECL  
BLOCK  $\rightarrow$  . RETURN rbrace  
BLOCK  $\rightarrow$  STMT . BLOCK  
STMT  $\rightarrow$  . while lparen COND rparen lbrace BLOCK  
RETURN  $\rightarrow$  . return FACTOR semi  
BLOCK  $\rightarrow$  . rbrace  
STMT  $\rightarrow$  . identifier assign RHS semi  
BLOCK  $\rightarrow$  . STMT BLOCK  
VDECL  $\rightarrow$  . vtype identifier semi  
STMT  $\rightarrow$  . if lparen COND rparen lbrace BLOCK

S26:

STMT  $\rightarrow$  VDECL .

S27:

BLOCK  $\rightarrow$  RETURN . rbrace

S28:

MOREARGS  $\rightarrow$  comma vtype identifier MOREARGS

S29:

BLOCK  $\rightarrow$  . rbrace else lbrace BLOCK  
STMT  $\rightarrow$  . VDECL  
STMT  $\rightarrow$  . while lparen COND rparen lbrace BLOCK  
BLOCK  $\rightarrow$  . RETURN rbrace  
RETURN  $\rightarrow$  . return FACTOR semi  
BLOCK  $\rightarrow$  . rbrace  
STMT  $\rightarrow$  . identifier assign RHS semi  
BLOCK  $\rightarrow$  . STMT BLOCK  
MOREARGS  $\rightarrow$  lparen rbrace . BLOCK  
VDECL  $\rightarrow$  . vtype identifier semi  
STMT  $\rightarrow$  . if lparen COND rparen lbrace BLOCK

S30:

FACTOR → identifier .

S31:

EXPR → . TERM  
FACTOR → lparen . EXPR rparen  
TERM → . FACTOR  
TERM → . FACTOR multdiv TERM  
FACTOR → lparen EXPR rparen  
EXPR → . TERM addsub EXPR  
FACTOR → . identifier  
FACTOR → . integer

S32:

RETURN → return FACTOR . semi

S33:

FACTOR → integer .

S34:

STMT → identifier assign . RHS semi  
RHS → . EXPR  
EXPR → . TERM  
TERM → . FACTOR  
RHS → . literal  
TERM → . FACTOR multdiv TERM  
FACTOR → . lparen EXPR rparen  
EXPR → . TERM addsub EXPR  
FACTOR → . identifier  
FACTOR → . integer

S35:

STMT → if lparen . COND rparen lbrace BLOCK  
FACTOR → . integer  
COND → . FACTOR comparison FACTOR  
FACTOR → . identifier  
FACTOR → . lparen EXPR rparen

S36:

STMT → while lparen . COND rparen lbrace BLOCK  
FACTOR → . integer  
COND → . FACTOR comparison FACTOR  
FACTOR → . identifier

FACTOR → . lparen EXPR rparen

S30:

BLOCK → {brace else . }brace BLOCK

S31:

VDECL → vtype identifier . semi

S32:

BLOCK → STMT BLOCK.

S40:

BLOCK → RETURN {brace . }

S41:

MOREARGS → , vtype identifier . MOREARGS  
MOREARGS → . lparen {brace BLOCK  
MOREARGS → , , vtype identifier MOREARGS

S42:

MOREARGS → rparen {brace BLOCK . }

S43:

FACTOR → {brace Expr . rparen

S44:

TERM → FACTOR . mult div TERM  
TERM → FACTOR .

S45:

EXPR → TERM . addsub EXPR  
EXPR → TERM .

S46:

RETURN → return FACTOR semi .

S47:

AHS → EXPR .

Step:

RHS → literal.

Step:

STMT → identifier assign RHS . semi

Step:

STMT → if lparen COND rparen lbrace BLOCK

Step:

COND → FACTOR . comparison FACTOR

Step:

STMT → while lparen COND rparen lbrace BLOCK

Step:

BLOCK → rbrace else lbrace BLOCK  
STMT → VDECL  
STMT → while lparen COND rparen lbrace BLOCK  
BLOCK → RETURN rbrace  
RETURN → return FACTOR semi  
BLOCK → rbrace  
STMT → identifier  
BLOCK → STMT BLOCK  
VDECL → vtype identifier semi  
STMT → if lparen COND rparen lbrace BLOCK  
BLOCK → rbrace else lbrace . BLOCK

Step:

MOREARGS → comma vtype identifier MOREARGS.

Step:

FACTOR → lparen EXPR rparen.

Step:

TERM → . FACTOR multdiv TERM  
TERM → . FACTOR  
FACTOR → . Identifier  
FACTOR → . lparen EXPR rparen  
TERM → . FACTOR multdiv . TERM  
FACTOR → . integer

S51:

EXPR → TERM  
TERM → FACTOR  
TERM → FACTOR multdiv TERM  
FACTOR → lparen EXPR rparen  
EXPR → TERM addsub EXPR  
EXPR → TERM addsub EXPR  
FACTOR → identifier  
FACTOR → integer

S52:

STMT → identifier assign RHS semi.

S59:

STMT → if lparen COND rparen {BLOCK}

S60:

FACTOR → lparen EXPR rparen  
COND → FACTOR comparison FACTOR  
FACTOR → integer  
FACTOR → identifier

S61:

STMT → while lparen COND rparen {BLOCK}

S62:

BLOCK → rbrace else {BLOCK}

S63:

TERM → FACTOR multdiv TERM.

S64:

EXPR → TERM addsub EXPR.

S65:

VDECL → vtype identifier semi  
STMT → identifier assign RHS semi.  
STMT → if lparen COND rparen {BLOCK}  
BLOCK → RETURN rbrace  
BLOCK → rbrace

$\text{RETURN} \rightarrow \cdot \text{return } \text{FACTOR semi}$   
 $\text{STMT} \rightarrow \cdot \text{while lparen COND rparen lbrace BLOCK}$   
 $\text{BLOCK} \rightarrow \cdot \text{lbrace else rbrace BLOCK}$   
 $\text{STMT} \rightarrow \cdot \text{VDECL}$   
 $\text{STMT} \rightarrow \cdot \text{if lparen COND rparen lbrace BLOCK}$   
 $\text{BLOCK} \rightarrow \cdot \text{STMT BLOCK}$

566:

$\text{COND} \rightarrow \text{FACTOR comparison FACTOR}$

567:

$\text{VDECL} \rightarrow \cdot \text{vtype identifier semi}$   
 $\text{STMT} \rightarrow \cdot \text{identifier assign RHS semi}$   
 $\text{BLOCK} \rightarrow \cdot \text{RETURN lbrace}$   
 $\text{BLOCK} \rightarrow \cdot \text{lbrace}$   
 $\text{STMT} \rightarrow \cdot \text{while lparen COND rparen lbrace BLOCK}$   
 $\text{RETURN} \rightarrow \cdot \text{return FACTOR semi}$   
 $\text{STMT} \rightarrow \cdot \text{VDECL}$   
 $\text{STMT} \rightarrow \cdot \text{if lparen COND rparen lbrace BLOCK}$   
 $\text{BLOCK} \rightarrow \cdot \text{STMT BLOCK}$

568:

$\text{STMT} \rightarrow \cdot \text{if lparen COND rparen lbrace BLOCK}$

569:

$\text{STMT} \rightarrow \cdot \text{while lparen COND rparen lbrace BLOCK}$

# \* Parsing Table.

46	r24	r24	stop	r24								
47				r24								
48			s59									
49	s60											
50			s61									
51				r19								
52				s62								
53				r20								
54					r9		r9					
55	r14			r14	r14	r14	r14	r14	r14			
56	r25		r25	r25	r25							
57		s93			s95			s94			45	46
58		s33			s35			s34			47	46
59			s65									
60		s33			s35			s34				66
61			s67									
62	r16			r16	r16	r16	r16	r16				
63			r21	r24								
64			r21	r23		r23						
65	s24			s27	s19	s24	j22	s23		18	68	25
66			r28									20
67	s24			s27	s19	s21	s22	s23		18	69	26
68	r17			r17	r17	r17	r17	r17				
69	r18			r18	r18	r18	r18	r18				20