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Lab Cycle 2 - Experiment 9

Convert the BNF rules into YACC form and write code to generate abstract syntax tree.

Code:

syn_tree.l :

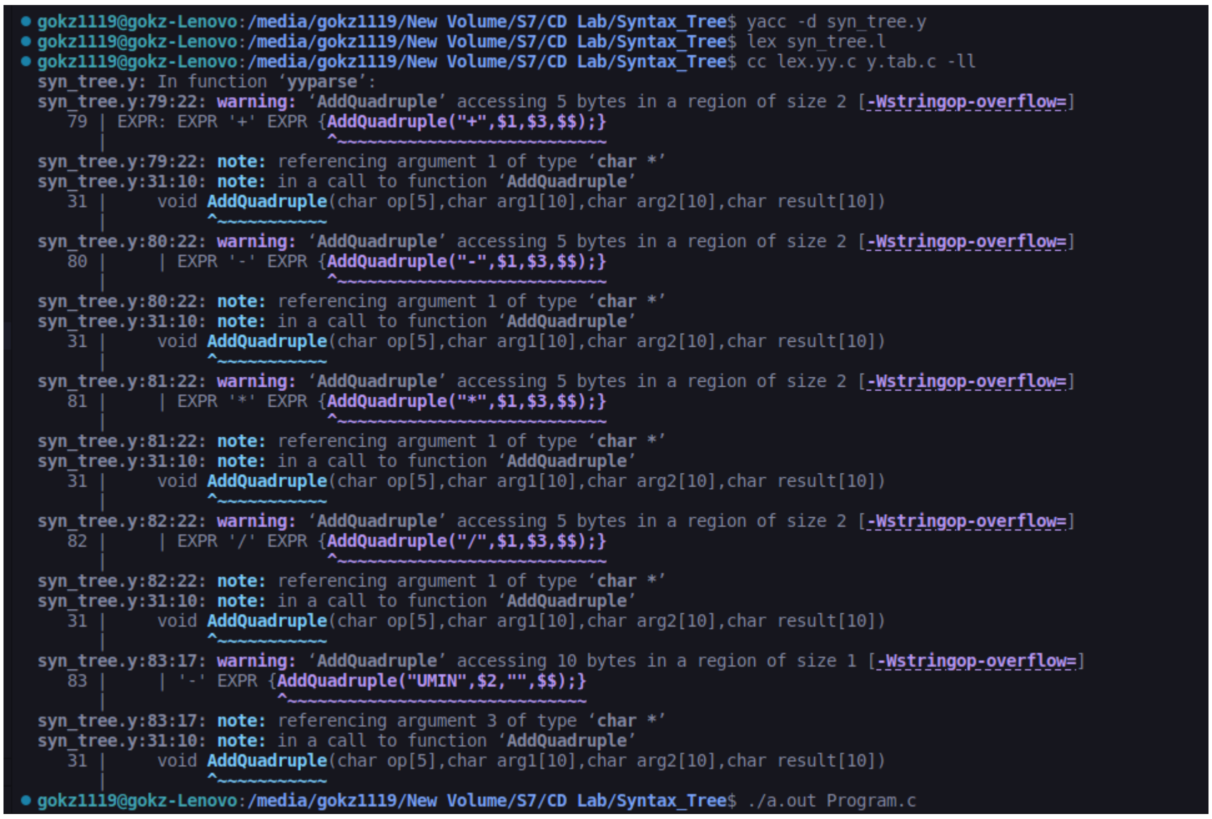
```
%{
#include "y.tab.h"
#include <stdio.h>
#include <string.h>
int LineNo=1;
%}
identifier [a-zA-Z][_a-zA-Z0-9]*
number [0-9]+|([0-9]*\.[0-9]+)
%%
main\(\) return MAIN;
if return IF;
else return ELSE;
while return WHILE;
int |
char |
float return TYPE;
{identifier} {strcpy(yylval.var,yytext);
               return VAR;}
{number} {strcpy(yylval.var,yytext);
return NUM;}
\< |
\> |
\>= |
\<= |
== {strcpy(yylval.var,yytext);
return RELOP;}
[ \t] ;
\n LineNo++;
. return yytext[0];
%%
int yywrap(void){};
```

syn_tree.y :

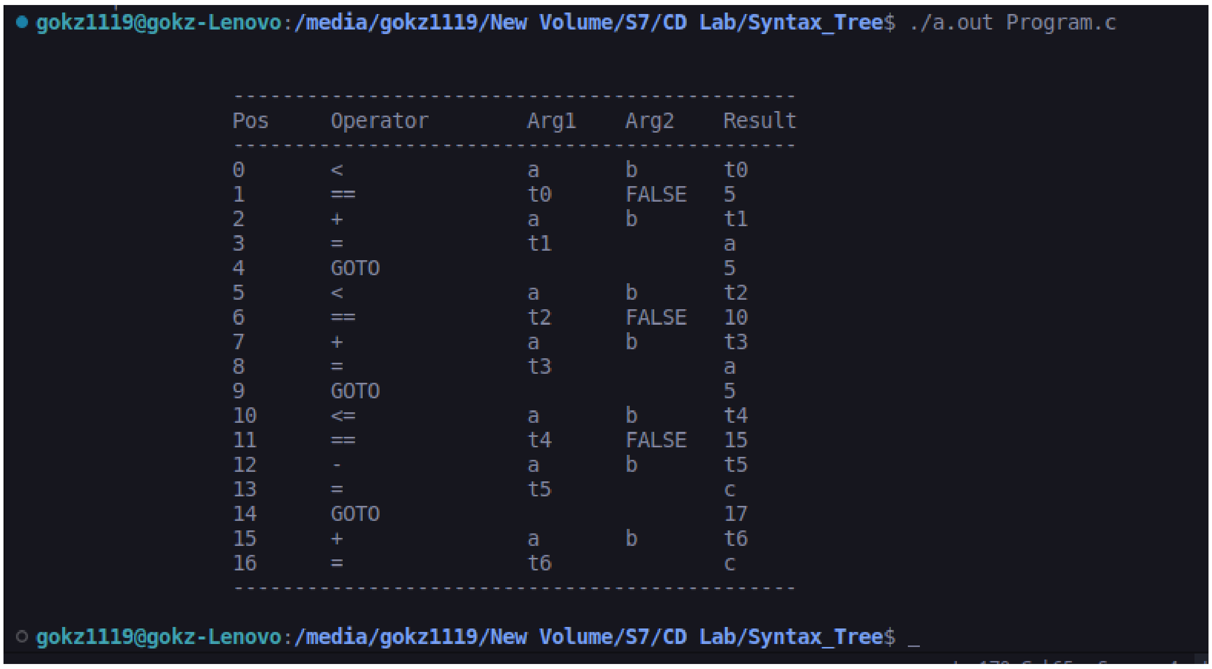
```
%{
   #include<string.h>
   #include<stdio.h>
   #include<stdlib.h>
   int yylex();
   int yyerror();
   struct quad
   {
       char op[5];
       char arg1[10];
       char arg2[10];
   char result[10];
   } QUAD[30];
   struct stack
   {
       int items[100];
       int top;
   } stk;
   int Index=0,tIndex=0,StNo,Ind,tInd;
   extern int LineNo;
   void push(int data)
   {
       stk.top++;
       if(stk.top==100)
       {
           printf("\n Stack overflow\n");
           exit(0);
       }
       stk.items[stk.top]=data;
   }
   void AddQuadruple(char op[5],char arg1[10],char arg2[10],char
result[10])
   {
       strcpy(QUAD[Index].op,op);
       strcpy(QUAD[Index].arg1,arg1);
       strcpy(QUAD[Index].arg2,arg2);
       sprintf(QUAD[Index].result,"t%d",tIndex++);
       strcpy(result,QUAD[Index++].result);
   }
   int pop()
   {
       int data;
       if(stk.top==-1)
       {
           printf("\n Stack underflow\n");
           exit(0);
       }
       data=stk.items[stk.top--];
       return data;
   }
   int yyerror()
   {
       printf("\n Error on line no:%d",LineNo);
   }
%}
%union
{
   char var[10];
}
%token <var> NUM VAR RELOP
%token MAIN IF ELSE WHILE TYPE
%type <var> EXPR ASSIGNMENT CONDITION IFST ELSEST
WHILELOOP
%left '-' '+'
%left '*' '/'
%%
PROGRAM : MAIN BLOCK ;
BLOCK: '{' CODE '}' ;
CODE: BLOCK | STATEMENT CODE | STATEMENT ;
STATEMENT: DESCT ';' | ASSIGNMENT ';' | CONDST | WHILEST ;
DESCT: TYPE VARLIST ;
VARLIST: VAR ',' VARLIST | VAR ;
ASSIGNMENT: VAR '=' EXPR {
   strcpy(QUAD[Index].op,"=");
   strcpy(QUAD[Index].arg1,$3);
   strcpy(QUAD[Index].arg2,"");
   strcpy(QUAD[Index].result,$1);
   strcpy($$,QUAD[Index++].result);
};
EXPR: EXPR '+' EXPR {AddQuadruple("+",$1,$3,$$);}
   | EXPR '-' EXPR {AddQuadruple("-",$1,$3,$$);}
   | EXPR '*' EXPR {AddQuadruple("*",$1,$3,$$);}
   | EXPR '/' EXPR {AddQuadruple("/",$1,$3,$$);}
   | '-' EXPR {AddQuadruple("UMIN",$2,"",$$);}
   | '(' EXPR ')' {strcpy($$,$2);}
   | VAR
   | NUM
;
CONDST: IFST {
   Ind=pop();
   sprintf(QUAD[Ind].result,"%d",Index);
   Ind=pop();
   sprintf(QUAD[Ind].result,"%d",Index);
}
| IFST ELSEST ;
IFST: IF '(' CONDITION ')' {
   strcpy(QUAD[Index].op,"==");
   strcpy(QUAD[Index].arg1,$3);
   strcpy(QUAD[Index].arg2,"FALSE");
   strcpy(QUAD[Index].result,"-1");
   push(Index);
   Index++;
}
BLOCK {
   strcpy(QUAD[Index].op,"GOTO");
   strcpy(QUAD[Index].arg1,"");
   strcpy(QUAD[Index].arg2,"");
   strcpy(QUAD[Index].result,"-1");
   push(Index);
   Index++;
};
ELSEST: ELSE{
   tInd=pop();
   Ind=pop();
   push(tInd);
   sprintf(QUAD[Ind].result,"%d",Index);
}
BLOCK {
   Ind=pop();
   sprintf(QUAD[Ind].result,"%d",Index);
};
CONDITION: VAR RELOP VAR {
   AddQuadruple($2,$1,$3,$$);
   StNo=Index-1;
}
| VAR
| NUM
;
WHILEST: WHILELOOP{
   Ind=pop();
   sprintf(QUAD[Ind].result,"%d",StNo);
   Ind=pop();
   sprintf(QUAD[Ind].result,"%d",Index);
}
;
WHILELOOP: WHILE '(' CONDITION ')' {
   strcpy(QUAD[Index].op,"==");
   strcpy(QUAD[Index].arg1,$3);
   strcpy(QUAD[Index].arg2,"FALSE");
   strcpy(QUAD[Index].result,"-1");
   push(Index);
   Index++;
}
BLOCK {
   strcpy(QUAD[Index].op,"GOTO");
   strcpy(QUAD[Index].arg1,"");
   strcpy(QUAD[Index].arg2,"");
   strcpy(QUAD[Index].result,"-1");
   push(Index);
   Index++;
}
;
%%
extern FILE *yyin;
int main(int argc,char *argv[]) {
   FILE *fp;
   int i;
   if(argc>1) {
       fp=fopen(argv[1],"r");
       if(!fp) {
           printf("\n File not found");
           exit(0);
       }
       yyin=fp;
   }
   yyparse();

printf("\n\n\t\t----------------------------------------------\n\t\tPos
\tOperator\tArg1\tArg2\tResult\n\t\t-----------------------------------
-----------");
   for(i=0;i<Index;i++) {

printf("\n\t\t%d\t%s\t\t%s\t%s\t%s",i,QUAD[i].op,QUAD[i].arg1,QUAD[i].a
rg2,QUAD[i].result);
   }
```

```
    printf("\n\t\t---------------------------------------------");
    printf("\n\n");
    return 0;
}
```

Output:



```
● gokz1119@gokz-Lenovo:/media/gokz1119/New Volume/S7/CD Lab/Syntax_Tree$ yacc -d syn_tree.y
● gokz1119@gokz-Lenovo:/media/gokz1119/New Volume/S7/CD Lab/Syntax_Tree$ lex syn_tree.l
● gokz1119@gokz-Lenovo:/media/gokz1119/New Volume/S7/CD Lab/Syntax_Tree$ cc lex.yy.c y.tab.c -ll
  syn_tree.y: In function ‘yyparse’:
  syn_tree.y:79:22: warning: ‘AddQuadruple’ accessing 5 bytes in a region of size 2 [-Wstringop-overflow=]
     79 | EXPR: EXPR '+' EXPR {AddQuadruple("+",$1,$3,$$);}
        |                      ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  syn_tree.y:79:22: note: referencing argument 1 of type ‘char *’
  syn_tree.y:31:10: note: in a call to function ‘AddQuadruple’
     31 |     void AddQuadruple(char op[5],char arg1[10],char arg2[10],char result[10])
        |          ^~~~~~~~~~~~
  syn_tree.y:80:22: warning: ‘AddQuadruple’ accessing 5 bytes in a region of size 2 [-Wstringop-overflow=]
     80 |     | EXPR '-' EXPR {AddQuadruple("-",$1,$3,$$);}
        |                      ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  syn_tree.y:80:22: note: referencing argument 1 of type ‘char *’
  syn_tree.y:31:10: note: in a call to function ‘AddQuadruple’
     31 |     void AddQuadruple(char op[5],char arg1[10],char arg2[10],char result[10])
        |          ^~~~~~~~~~~~
  syn_tree.y:81:22: warning: ‘AddQuadruple’ accessing 5 bytes in a region of size 2 [-Wstringop-overflow=]
     81 |     | EXPR '*' EXPR {AddQuadruple("*",$1,$3,$$);}
        |                      ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  syn_tree.y:81:22: note: referencing argument 1 of type ‘char *’
  syn_tree.y:31:10: note: in a call to function ‘AddQuadruple’
     31 |     void AddQuadruple(char op[5],char arg1[10],char arg2[10],char result[10])
        |          ^~~~~~~~~~~~
  syn_tree.y:82:22: warning: ‘AddQuadruple’ accessing 5 bytes in a region of size 2 [-Wstringop-overflow=]
     82 |     | EXPR '/' EXPR {AddQuadruple("/",$1,$3,$$);}
        |                      ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  syn_tree.y:82:22: note: referencing argument 1 of type ‘char *’
  syn_tree.y:31:10: note: in a call to function ‘AddQuadruple’
     31 |     void AddQuadruple(char op[5],char arg1[10],char arg2[10],char result[10])
        |          ^~~~~~~~~~~~
  syn_tree.y:83:17: warning: ‘AddQuadruple’ accessing 10 bytes in a region of size 1 [-Wstringop-overflow=]
     83 |     | '-' EXPR {AddQuadruple("UMIN",$2,"",$$);}
        |                 ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  syn_tree.y:83:17: note: referencing argument 3 of type ‘char *’
  syn_tree.y:31:10: note: in a call to function ‘AddQuadruple’
     31 |     void AddQuadruple(char op[5],char arg1[10],char arg2[10],char result[10])
        |          ^~~~~~~~~~~~
● gokz1119@gokz-Lenovo:/media/gokz1119/New Volume/S7/CD Lab/Syntax_Tree$ ./a.out Program.c
```



```
● gokz1119@gokz-Lenovo:/media/gokz1119/New Volume/S7/CD Lab/Syntax_Tree$ ./a.out Program.c


                ---------------------------------------------
                Pos     Operator        Arg1    Arg2    Result
                ---------------------------------------------
                0       <               a       b       t0
                1       ==              t0      FALSE   5
                2       +               a       b       t1
                3       =               t1              a
                4       GOTO                            5
                5       <               a       b       t2
                6       ==              t2      FALSE   10
                7       +               a       b       t3
                8       =               t3              a
                9       GOTO                            5
                10      <=              a       b       t4
                11      ==              t4      FALSE   15
                12      -               a       b       t5
                13      =               t5              c
                14      GOTO                            17
                15      +               a       b       t6
                16      =               t6              c
                ---------------------------------------------

○ gokz1119@gokz-Lenovo:/media/gokz1119/New Volume/S7/CD Lab/Syntax_Tree$ _
```