CD Lab 9

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Roll -58

batch 9

Q1.

```
// RDP parser

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <stdbool.h>
#include <ctype.h>
#include "la2.c"

struct token s;
FILE * fa;

void declartions();
void assign_stat();
bool datatype();
void identifier_list();
void identifier_list_prime();
void identifier_list_prime_prime();
void statement();
void statement_list();
void expn();
void eprime();
void term();
void tprime();
void factor();
void relop();
```

```
void relop_prime();
void addop();
void mulop();
void simple_expn();
void seprime();
void decision_stat();
void dprime();
void looping_stat();


void report_error(){
	printf("\n\nerror at line:%d and col:%d , expected :",s.row,s.col );
}

void Program(){
	s=getnextToken(fa); printtok(s);
	// printf("token - %s\n",s.lexeme);
	if(!strcmp(s.lexeme,"main")){
		// printf("here %s\n","i am" );
		s=getnextToken(fa); printtok(s);
		if(!strcmp(s.lexeme,"(")){
			s=getnextToken(fa); printtok(s);
			if(!strcmp(s.lexeme,")") ){
				s=getnextToken(fa); printtok(s);
				if(!strcmp(s.lexeme,"{")){
					declartions();
					statement_list();
					s=getnextToken(fa); printtok(s);
					if(!strcmp(s.lexeme,"}")){
						// printf("line 39\n");
						return ;
					}else{
						report_error(); printf("}\n");
						exit(0);
					}
				}else{
				report_error(); printf("{\n");
				exit(0);
				}
```

```
                }
                else{
                        report_error(); printf(")\n");
                        exit(0);
                }
        }
        else{
                report_error(); printf("(\n");
                exit(0);
        }
    }else{
        report_error(); printf("main\n");
        exit(0);
    }
}

void declartions(){
    s=getnextToken(fa); printtok(s);
    if(!strcmp(s.lexeme,"int") || !strcmp(s.lexeme,"char")){
        identifier_list();
        s=getnextToken(fa); printtok(s);
        if(!strcmp(s.lexeme,";")){
            declartions();
        }else{
            report_error(); printf(";\n");
            exit(0);
        }
    }
    else{
        sanitize(s,fa);
    }
}

void identifier_list(){
    s=getnextToken(fa); printtok(s);
    if(s.lexeme[0]=='i'&&s.lexeme[1]=='d'&&s.lexeme[2]==' '){
        identifier_list_prime();
    }
    else{
```

```
                report_error(); printf(" identifier \n");
                exit(0);
        }
}

void identifier_list_prime(){
        s=getnextToken(fa); printtok(s);
        if(!strcmp(s.lexeme,",")){
                identifier_list();
        }
        else if(!strcmp(s.lexeme,"[")){
                identifier_list_prime_prime();
        }
        else{
                sanitize(s,fa);
        }
}

void identifier_list_prime_prime(){
        s=getnextToken(fa); printtok(s);
        if(!strcmp(s.lexeme,"num")){
                s=getnextToken(fa); printtok(s);
                if(!strcmp(s.lexeme,"]")){
                        s=getnextToken(fa); printtok(s);
                        if(!strcmp(s.lexeme,","))
                                identifier_list();
                        else{
                                sanitize(s,fa);
                        }
                }
                else{
                        report_error(); printf("]\n");
                        exit(0);
                }
        }
}

void statement_list(){
        s=getnextToken(fa);
```

```
	if(s.lexeme[0]=='i'&&s.lexeme[1]=='d'&&s.lexeme[2]==' '|| !
strcmp(s.lexeme,"for") || !strcmp(s.lexeme,"while") || !
strcmp(s.lexeme,"if") ){
		sanitize(s,fa);
		statement();
		statement_list();
	}
	else
		sanitize(s,fa);
}

void statement()
{
	s=getnextToken(fa);
	if(s.lexeme[0]=='i'&&s.lexeme[1]=='d'&&s.lexeme[2]==' '){
		sanitize(s,fa);
		assign_stat();
		s=getnextToken(fa);
		if(!strcmp(s.lexeme,";")){
			return;
		}
		else{
			report_error(); printf(";\n");
			exit(0);
		}
	}
	else if(!strcmp(s.lexeme,"if")){
		sanitize(s,fa);
		decision_stat();
	}
	else if(!strcmp(s.lexeme,"for") || !strcmp(s.lexeme,"while") ){
		sanitize(s,fa);
		looping_stat();
	}
	else
		sanitize(s,fa);
}

void assign_stat(){
```

```
	s=getnextToken(fa); printtok(s);
	if(s.lexeme[0]=='i'&&s.lexeme[1]=='d'&&s.lexeme[2]==' '){
		s=getnextToken(fa); printtok(s);
		if(!strcmp(s.lexeme,"=")){
			expn();
		}
		else{
			report_error(); printf("=\n");
			exit(0);
		}
	}
	else{
		report_error(); printf("identifier \n");
		exit(0);
	}
}

void expn(){
	simple_expn();
	eprime();
}

void eprime(){
	s=getnextToken(fa); printtok(s);
	if(!strcmp(s.lexeme,"==")||!strcmp(s.lexeme,"!=")||!
strcmp(s.lexeme,"<=")||!strcmp(s.lexeme,">=")||!strcmp(s.lexeme,"<")||!
strcmp(s.lexeme,">")){
		sanitize(s,fa);
		relop();
		simple_expn();
	}
	else
		sanitize(s,fa);
}
void simple_expn(){
	term();
	seprime();
}
```

```
void seprime(){
	s=getnextToken(fa); printtok(s);
	if(!strcmp(s.lexeme,"+")||!strcmp(s.lexeme,"-")){
		sanitize(s,fa);
		addop();
		term();
		seprime();
	}
	else
		sanitize(s,fa);
}

void term(){
	factor();
	tprime();
}

void tprime(){
	s=getnextToken(fa); printtok(s);
	if(!strcmp(s.lexeme,"*")||!strcmp(s.lexeme,"/")||!
strcmp(s.lexeme,"%")){
		sanitize(s,fa);
		mulop();
		factor();
		tprime();
	}
	else
		sanitize(s,fa);
}

void factor(){
	s=getnextToken(fa); printtok(s);
	if((s.lexeme[0]=='i'&&s.lexeme[1]=='d'&&s.lexeme[2]==' ')|| !
	strcmp(s.lexeme,"num") ){
	return;
	}
	else{
	report_error(); printf("identifier or number \n");
	exit(0);
```

```
	}
}

void decision_stat(){
	s=getnextToken(fa); printtok(s);
	if(!strcmp(s.lexeme,"if")){
		s=getnextToken(fa); printtok(s);
		if(!strcmp(s.lexeme,"(")){
			expn();
			s=getnextToken(fa); printtok(s);
			if(!strcmp(s.lexeme,")")){
				s=getnextToken(fa); printtok(s);
				if(!strcmp(s.lexeme,"{")){
					statement_list();
					s=getnextToken(fa); printtok(s);
					if(!strcmp(s.lexeme,"}")){
						dprime();
					}
					else{
						report_error(); printf("}\n");
						exit(0);
					}
				}
				else{
					report_error(); printf("{\n");
					exit(0);
				}
			}
			else{
				report_error(); printf(")\n");
				exit(0);
			}
		}
		else{
			report_error(); printf("(\n");
			exit(0);
		}
	}
	else{
```

```
                report_error(); printf("if \n");
                exit(0);
        }
}

void dprime(){
        s=getnextToken(fa); printtok(s);
        if(!strcmp(s.lexeme,"else")){
                s=getnextToken(fa); printtok(s);
                if(!strcmp(s.lexeme,"{")){
                        statement_list();
                        s=getnextToken(fa); printtok(s);
                        if(!strcmp(s.lexeme,"}")){
                                return;
                        }else{
                                report_error(); printf("}\n");
                                exit(0);
                        }
                }
                else{
                        report_error(); printf("{\n");
                        exit(0);
                }
        }
        else
                sanitize(s,fa);
}

void looping_stat(){
        s=getnextToken(fa); printtok(s);

        if(!strcmp(s.lexeme,"for")){
                s=getnextToken(fa); printtok(s);

                if(!strcmp(s.lexeme,"(")){
                        assign_stat();
                        s=getnextToken(fa); printtok(s);
                        if(!strcmp(s.lexeme,";")){
                                expn();
```

```
                s=getnextToken(fa); printtok(s);
                if(!strcmp(s.lexeme,";")){
                        assign_stat();
                        s=getnextToken(fa); printtok(s);
                        if(!strcmp(s.lexeme,")")){
                                s=getnextToken(fa); printtok(s);
                                if(!strcmp(s.lexeme,"{")){
                                        statement_list();
                                        s=getnextToken(fa); printtok(s);
                                        if(!strcmp(s.lexeme,"}")){
                                                return ;
                                        }
                                        else{
                                                report_error(); printf("}\n");
                                                exit(0);
                                        }
                                }
                                else{
                                        report_error(); printf("{\n");
                                        exit(0);
                                }
                        }
                        else{
                                report_error(); printf(")\n");
                                exit(0);
                        }

                }
                else{
                        report_error(); printf(";\n");
                        exit(0);
                }
        }
        else{
                report_error(); printf(";\n");
                exit(0);
        }
}
else{
```

```
                report_error(); printf("(\n");
                exit(0);
        }
}
else if(!strcmp(s.lexeme,"while")){
        s=getnextToken(fa); printtok(s);
        if(!strcmp(s.lexeme,"(")){
                expn();
                s=getnextToken(fa); printtok(s);
                if(!strcmp(s.lexeme,")")){
                        s=getnextToken(fa);
                        if(!strcmp(s.lexeme,"{")){
                                statement_list();
                                s=getnextToken(fa); printtok(s);
                                if(!strcmp(s.lexeme,"}")){
                                        return;
                                }else{
                                        report_error(); printf("}\n");
                                        exit(0);
                                }
                        }
                        else{
                                report_error(); printf("{\n");
                                exit(0);
                        }
                }
                else{
                        report_error(); printf(")\n");
                        exit(0);
                }
        }
        else{
                report_error(); printf("(\n");
                exit(0);
        }
}
else{
        report_error(); printf("loop\n");
        exit(0);
```

```
        }
}

void relop(){
        s=getnextToken(fa); printtok(s);
        if(!strcmp(s.lexeme,"==") || !strcmp(s.lexeme,"!=") || !
        strcmp(s.lexeme,"<=") || !strcmp(s.lexeme,">=") || !
strcmp(s.lexeme,"<") || !strcmp(s.lexeme,">") ){
                return;
        }
        else{
                report_error(); printf(" relational operator \n");
                exit(0);
        }
}

void addop(){
        s=getnextToken(fa); printtok(s);
        if(strcmp(s.lexeme,"+")||strcmp(s.lexeme,"-")){
                return;
        }
        else{
                report_error(); printf(" + or - \n");
                exit(0);
        }
}

void mulop(){
        s=getnextToken(fa); printtok(s);
        if( !strcmp(s.lexeme,"*") || !strcmp(s.lexeme,"/") || !
                strcmp(s.lexeme,"%")){
                return;
        }
        else{
                report_error(); printf(" multiply and divide operator\n");
                exit(0);
        }
}
```

```
int main(){
	fa = fopen("in.txt","r");
	if(fa==NULL){
		perror("fopen");exit(0);
	}
	Program();
	s=getnextToken(fa); printtok(s);
	if(!strcmp(s.lexeme,"end")){
		printf("\n successfully parsed \n");
	}
}
```

// token generator

```
//test

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <stdbool.h>
#include <ctype.h>
#include <errno.h>
#define SZ 20
struct token{
char tok_type[SZ];
char lexeme[SZ];
int row,col,idx;
int sz;
};
struct ListElement{
struct token tok;
struct ListElement *next;
};
struct ListElement *TABLE[SZ];
int row=1,col=1,val=-1,TableLength = 0;
char dbuff[SZ];
bool FILENOTENDED=true;
char keyword[34][10]={"printf","scanf","auto","double","int",
```

```
"struct","break","else","long","switch","case","enum","register","typedef",
"char","extern","return","union","continue",
"for","signed","void","do","if","static","while","default","goto",
"sizeof","volatile","const","float","short","unsigned"};
bool iskeyword(char* buf){
for(int i=0;i<34;i++){
if(strcmp(keyword[i],buf)==0)
return true;
}
return false;
}
bool isDelimiter(char ch){
if (ch == ',' || ch == ';' || ch == '(' || ch == ')' || ch == '[' || ch == ']' || ch ==
'{' || ch == '}')
return true;
return false;
}
bool isArithmetic_operator(char ch)
{
if (ch == '%' || ch == '+' || ch == '-' || ch == '*' ||
ch == '/' )
return true;
return false;
}
void printtok(struct token t){
printf("<%s,%d,%d> ",t.lexeme,t.row,t.col-1);
}
int SEARCH(struct token tk){
//printf("s\n");
struct ListElement * cur;
for(int i=0;i<=val;i++){
cur = TABLE[i];
if(cur&&strcmp(tk.tok_type,"func")==0){
if(strcmp((cur->tok).lexeme,tk.lexeme)==0){
return 1;
}
}else{
while(cur){
```

```
if(strcmp((cur->tok).lexeme,tk.lexeme)==0&&strcmp((cur-
>tok).tok_type,tk.tok_type)==0&&(cur->tok).idx==tk.idx){
return 1;
}
cur=cur->next;
}
}
}
return 0;
}
void INSERT(struct token tk){
if(strcmp(tk.tok_type,"func")!=0&&SEARCH(tk)==1){
return;
}
struct ListElement* cur = malloc(sizeof(struct ListElement));
cur->tok = tk;
cur->next = NULL;
if(TABLE[val]==NULL){
TABLE[val] = cur; // No collosion.
}
else{
struct ListElement * ele= TABLE[val];
while(ele->next!=NULL){
ele = ele->next; // Add the element at the End in the case of a collision.
}
ele->next = cur;
}
}
void sanitize(struct token s,FILE * fa){
int len;
if(s.lexeme[0]=='i'&&s.lexeme[1]=='d'&&s.lexeme[2]==' ')
len=strlen(s.lexeme)-3;
else len=strlen(s.lexeme);
fseek(fa,-1*len,SEEK_CUR);
}struct token getnextToken(FILE *fa){
char ca,cb;
int i,j;
char buf[SZ],temp[SZ];
struct token s;
```

```
ca=fgetc(fa);
while(ca!=EOF){
//newline
if(ca=='\n'){
row++;
col=1;
//printf("\n");
}
//blank space and tabs
else if(ca==' '||ca=='\t'){
col++;
while(ca==' '||ca=='\t')
ca=fgetc(fa);
fseek(fa,-1,SEEK_CUR);
}
//comments
else if(ca=='/'){
col++;
cb=fgetc(fa);
if(cb=='/'){
while(ca!='\n')
ca=fgetc(fa);
fseek(fa,-1,SEEK_CUR);
}
else if(cb=='*'){
do{
while(ca!='*')
ca = fgetc(fa);
ca = fgetc(fa);
}while(ca!='/');
}
else{
i=0;
while(ca!='\n'){
temp[i++] = ca;
ca = fgetc(fa);
}temp[i]='\0';
strcpy(s.lexeme,"syntax error");
s.row=row;
```

```
s.col=col;
fseek(fa,-1,SEEK_CUR);
return s;
}
}
//preprocessor
else if(ca=='#'){
i=0;
while(ca!='\n'){
temp[i++]=ca;
ca=fgetc(fa);
}
temp[i]='\0';
fseek(fa,-1,SEEK_CUR);
if(strstr(temp,"#include")==NULL && strstr(temp,"#define")==NULL)
{//not working
printf("include\n");
strcpy(s.lexeme,"syntax error");
s.row=row;
// row++;
s.col=col;
return s;
}
}
//keywords and identifiers
else if(isalpha(ca)||ca=='_'){
i=0;
while(isalnum(ca)||ca=='_'){
buf[i++]=ca;
ca=fgetc(fa);
col++;
}
buf[i]='\0';
fseek(fa,-1,SEEK_CUR);
if(iskeyword(buf)){
strcpy(s.lexeme,buf);
strcpy(dbuff,buf);
s.row=row;s.col=col-strlen(buf)+1;
return s;
```

```
}
else{
if(ca=='('){
strcpy(s.lexeme,buf);
strcpy(s.tok_type,"func");
s.sz=-1;
if(SEARCH(s)==0){
val++;
}
s.idx = val;
INSERT(s);
return s;
}
char w[10]="";
strcat(w,"id ");
strcat(w,buf);
strcpy(s.lexeme,w);
strcpy(s.tok_type,dbuff);
s.row=row;
s.col=col-strlen(buf)+1;
if(strcmp(dbuff,"int")==0)
s.sz=sizeof(int);
else if(strcmp(dbuff,"char")==0)
s.sz=sizeof(char);
else if(strcmp(dbuff,"bool")==0)
s.sz=sizeof(bool);
else
s.sz=0;
if(strcmp(dbuff,"return")==0||strcmp(dbuff,"if")==0||
strcmp(dbuff,"scanf")==0||strcmp(dbuff,"printf")==0||
strcmp(dbuff,"for")==0)
return s;
s.idx=val;
INSERT(s);
return s;
}
}
//relational operator
else if(ca=='='||ca=='>'||ca=='<'||ca=='!'){cb=fgetc(fa);
```

```
i=0;
temp[i++]=ca;
col++;
if(cb=='='){
temp[i++] = cb;
temp[i] = '\0';
strcpy(s.lexeme,temp);
s.row=row;
s.col=col;
col++;
return s;
}
else{
temp[i]='\0';
strcpy(s.lexeme,temp);
s.row=row;
s.col=col;
fseek(fa,-1,SEEK_CUR);
return s;
}
}
//string
else if(ca==""){
i=0;
do{
col++;
i++;
ca=fgetc(fa);
}while(ca!="");
col++;
strcpy(s.lexeme,"string literal");
s.row=row;
s.col=col-i;
return s;
}
//delimiters
else if(isDelimiter(ca)){
i=0;
temp[i++]=ca;
```

```
temp[i]='\0';col++;
strcpy(s.lexeme,temp);
s.row=row;
s.col=col;
return s;
}
//numeric constants
else if(isdigit(ca)){
i=0;
while(isdigit(ca)){
col++;
i++;
ca=fgetc(fa);
}
fseek(fa,-1,SEEK_CUR);
strcpy(s.lexeme,"num");
s.row=row;
s.col=col-i+1;
return s;
}
//arithmetic op
else if(isArithmetic_operator(ca)){
i=0;
temp[i++]=ca;
temp[i]='\0';
col++;
strcpy(s.lexeme,temp);
s.row=row;
s.col=col;
return s;
}
ca=fgetc(fa);
}
strcpy(s.lexeme,"end");
return s;
}
void Initialize(){
for(int i=0;i<SZ;i++){
TABLE[i] = NULL;
```

```
}
}
void Display(){
//iterate through the linked list and display
for(int i=0;i<=val;i++){
struct ListElement * cur = TABLE[i];
printf("%d %s %s\n\n",i+1,(cur->tok).lexeme,(cur->tok).tok_type);
cur=cur->next;
while(cur){
printf("%s %s %d\n",(cur->tok).lexeme, (cur->tok).tok_type,(cur-
>tok).sz);
cur=cur->next;
}
printf("**********\n");
}
}
```

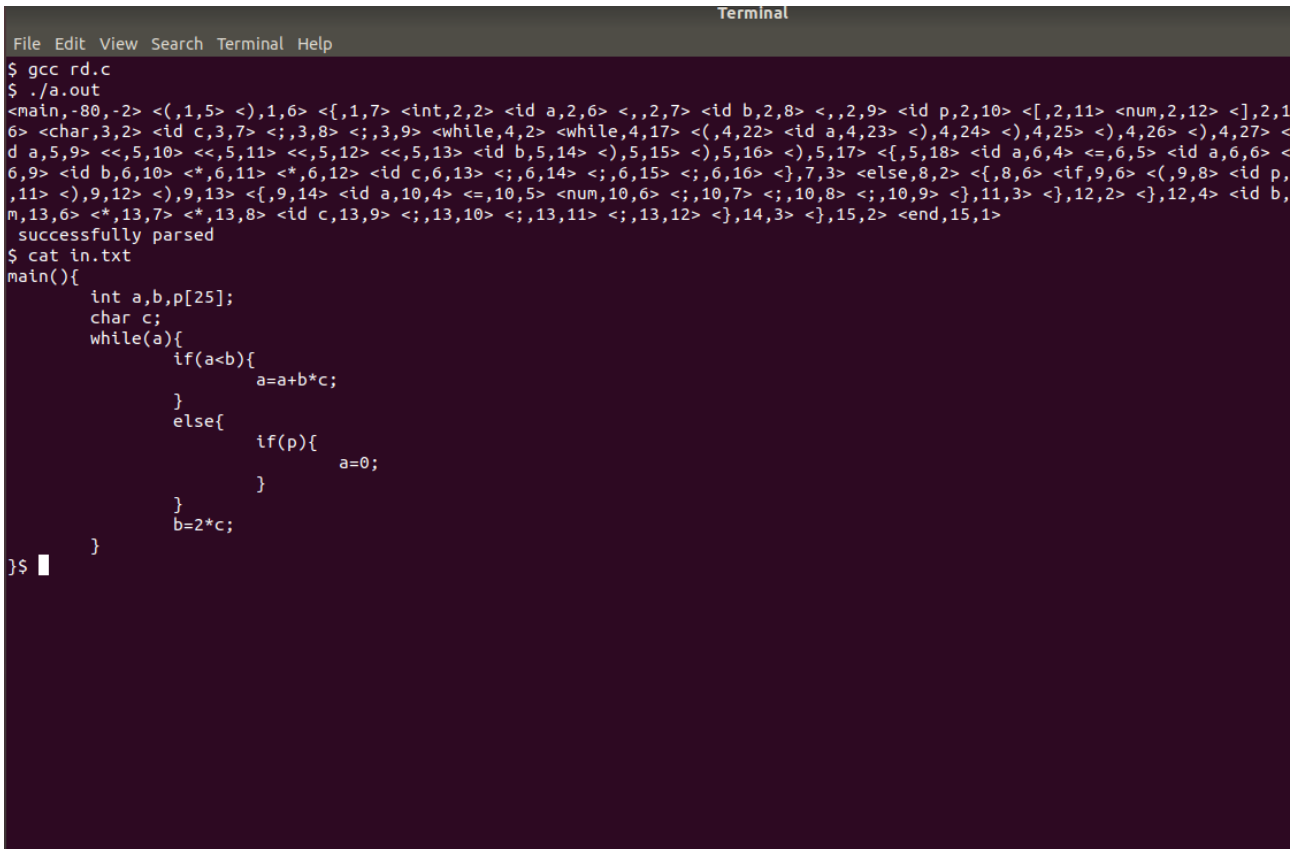
Input output -

error- expected ;

```
$ gcc rd.c
$ ./a.out
<main,-80,-2> <(,1,5> <),1,6> <{,1,7> <int,2,2> <id a,2,6> <,,2,7> <id b,2,8> <,,2,9> <id p,2,10> <[,2,11> <num,2,12> <],2,14> <;,2,15> <;,2,1
6> <char,3,2> <id c,3,7> <;,3,8> <;,3,9> <while,4,2> <while,4,17> <(,4,22> <id a,4,23> <),4,24> <),4,25> <),4,26> <),4,27> <if,5,6> <(,5,8> <i
d a,5,9> <<,5,10> <<,5,11> <<,5,12> <<,5,13> <id b,5,14> <),5,15> <),5,16> <),5,17> <{,5,18> <id a,6,4> <=,6,5> <id a,6,6> <id b,6,8> <id b,6,
9> <id b,6,10>

error at line:6 and col:12 , expected :;
$ cat in.txt
main(){
        int a,b,p[25];
        char c;
        while(a){
                if(a<b){
                        a=a b*c;
                }
                else{
                        if(p){
                                a=0;
                        }
                }
                b=2*c;
        }
}$
```

successful parse -


Terminal
File Edit View Search Terminal Help
$ gcc rd.c
$ ./a.out
<main,-80,-2> <(,1,5> <),1,6> <{,1,7> <int,2,2> <id a,2,6> <,,2,7> <id b,2,8> <,,2,9> <id p,2,10> <[,2,11> <num,2,12> <],2,1
6> <char,3,2> <id c,3,7> <;,3,8> <;,3,9> <while,4,2> <while,4,17> <(,4,22> <id a,4,23> <),4,24> <),4,25> <),4,26> <),4,27> <
d a,5,9> <<,5,10> <<,5,11> <<,5,12> <<,5,13> <id b,5,14> <),5,15> <),5,16> <),5,17> <{,5,18> <id a,6,4> <=,6,5> <id a,6,6> <
6,9> <id b,6,10> <*,6,11> <*,6,12> <id c,6,13> <;,6,14> <;,6,15> <;,6,16> <},7,3> <else,8,2> <{,8,6> <if,9,6> <(,9,8> <id p,
,11> <),9,12> <),9,13> <{,9,14> <id a,10,4> <=,10,5> <num,10,6> <;,10,7> <;,10,8> <;,10,9> <},11,3> <},12,2> <},12,4> <id b,
m,13,6> <*,13,7> <*,13,8> <id c,13,9> <;,13,10> <;,13,11> <;,13,12> <},14,3> <},15,2> <end,15,1>
successfully parsed
$ cat in.txt
main(){
int a,b,p[25];
char c;
while(a){
if(a<b){
a=a+b*c;
}
else{
if(p){
a=0;
}
}
b=2*c;
}
}$