**Exp. No. 1**

**Develop a lexical Analyzer to identify identifiers, constants, operators using C program.**

**Program:**

#include<stdio.h>

#include<ctype.h>

#include<string.h>

int main()

{

int i,ic=0,m,cc=0,oc=0,j;

char b[30],operators[30],identifiers[30],constants[30];

printf("enter the string : ");

scanf("%[^\n]s",&b);

for(i=0;i<strlen(b);i++)

{

if(isspace(b[i]))

{

continue;

}

else if(isalpha(b[i]))

{

identifiers[ic] =b[i];

ic++;

}

else if(isdigit(b[i]))

{

m=(b[i]-'0');

i=i+1;

while(isdigit(b[i]))

{

m=m\*10 + (b[i]-'0');

i++;

}

i=i-1;

constants[cc]=m;

cc++;

}

else

{

if(b[i]=='\*')

{

operators[oc]='\*';

oc++;

}

else if(b[i]=='-')

{

operators[oc]='-';

oc++;

}

else if(b[i]=='+')

{

operators[oc]='+';

oc++;

}

else if(b[i]=='=')

{

operators[oc]='=';

oc++;

}

}

}

printf(" identifiers : ");

for(j=0;j<ic;j++)

{

printf("%c ",identifiers[j]);

}

printf("\n constants : ");

for(j=0;j<cc;j++)

{

printf("%d ",constants[j]);

}

printf("\n operators : ");

for(j=0;j<oc;j++)

{

printf("%c ",operators[j]);

}

}

**Output:**

enter the string : a = b + c \* e + 100

identifiers : a b c e

constants : 100

operators : = + \* +

**Exp. No. 2**

**Develop a lexical Analyzer to identify whether a given line is a comment or not using C**

**Program:**

#include<stdio.h>

#include<conio.h>

int main()

{

char com[30];

int i=2,a=0;

printf("\n Enter comment:");

gets(com);

if(com[0]=='/')

{

if(com[1]=='/')

printf("\n It is a comment");

else if(com[1]=='\*')

{

for(i=2;i<=30;i++)

{

if(com[i]=='\*'&&com[i+1]=='/')

{

printf("\n It is a comment");

a=1;

break;

}

else

continue;

}

if(a==0)

printf("\n It is not a comment");

}

else

printf("\n It is not a comment");

}

else

printf("\n It is not a comment");

}

**Output:**

**Input:** Enter comment: //hello

**Output**: It is a comment

**Input:** Enter comment: hello

**Output**: It is not a comment

**Exp. No. 3**

**Design a lexical Analyzer for given language should ignore the redundant spaces, tabs and new lines and ignore comments using C**

**Program:**

#include<stdio.h>

#include<stdlib.h>

#include<string.h>

#include<ctype.h>

int isKeyword(char buffer[]){

char keywords[32][10] = {"main","auto","break","case","char","const","continue","default",

"do","double","else","enum","extern","float","for","goto",

"if","int","long","register","return","short","signed",

"sizeof","static","struct","switch","typedef",

"unsigned","void","printf","while"};

int i, flag = 0;

for(i = 0; i < 32; ++i){

if(strcmp(keywords[i], buffer) == 0){

flag = 1;

break;

}

}

return flag;

}

int main(){

char ch, buffer[15], operators[] = "+-\*/%=";

FILE \*fp;

int i,j=0;

fp = fopen("3lex\_input.txt","r");

if(fp == NULL){

printf("error while opening the file\n");

exit(0);

}

while((ch = fgetc(fp)) != EOF){

for(i = 0; i < 6; ++i){

if(ch == operators[i])

printf("%c is operator\n", ch);

}

if(isalnum(ch)){

buffer[j++] = ch;

}

else if((ch == ' ' || ch == '\n') && (j != 0)){

buffer[j] = '\0';

j = 0;

if(isKeyword(buffer) == 1)

printf("%s is keyword\n", buffer);

else

printf("%s is identifier\n", buffer);

}

}

fclose(fp);

return 0;

}

**Input:** 3lex\_input.txt

main ( )

{

int a, b, c ;

c = b + c;

printf ( "%d" ,c ) ;

}

**Output:**

main is keyword

int is keyword

a is indentifier

b is indentifier

c is indentifier

c is indentifier

= is operator

b is indentifier

+ is operator

c is indentifier

printf is keyword

% is operator

d is indentifier

c is indentifier

**Exp. No. 4**

**Design a lexical Analyzer to validate operators to recognize the operators +,-,\*,/ using regular arithmetic operators using C**

**Program:**

#include<stdio.h>

#include<conio.h>

int main()

{

char s[5];

printf("\n Enter any operator:");

gets(s);

switch(s[0])

{

case'>':

if(s[1]=='=')

printf("\n Greater than or equal");

else

printf("\n Greater than");

break;

case'<':

if(s[1]=='=')

printf("\n Less than or equal");

else

printf("\nLess than");

break;

case'=':

if(s[1]=='=')

printf("\nEqual to");

else

printf("\nAssignment");

break;

case'!':

if(s[1]=='=')

printf("\nNot Equal");

else

printf("\n Bit Not");

break;

case'&':

if(s[1]=='&')

printf("\nLogical AND");

else

printf("\n Bitwise AND");

break;

case'|':

if(s[1]=='|')

printf("\nLogical OR");

else

printf("\nBitwise OR");

break;

case'+':

printf("\n Addition");

break;

case'-':

printf("\nSubstraction");

break;

case'\*':

printf("\nMultiplication");

break;

case'/':

printf("\nDivision");

break;

case'%':

printf("Modulus");

break;

default:

printf("\n Not a operator");

}

}

**Output:**

Enter any operator:<=

Less than or equal

**Exp. No. 5**

**Design a lexical Analyzer to find the number of whitespaces and newline characters using C.**

**Program:**

#include <stdio.h>

int main()

{

char str[100];//input string with size 100

int words=0,newline=0,characters=0; // counter variables

scanf("%[^~]",&str);//scanf formatting

for(int i=0;str[i]!='\0';i++)

{

if(str[i] == ' ')

{

words++;

}

else if(str[i] == '\n')

{

newline++;

words++;//since with every next line new words start. corner case 1

}

else if(str[i] != ' ' && str[i] != '\n'){

characters++;

}

}

if(characters > 0)//Corner case 2,3.

{

words++;

newline++;

}

printf("Total number of words : %d\n",words);

printf("Total number of lines : %d\n",newline);

printf("Total number of characters : %d\n",characters);

return 0;

}

**Output:**

void main()

{

int a;

int b;

a = b + c;

c = d \* e;

}Total number of words : 18

Total number of lines : 7

**Exp. No. 6**

**Develop a lexical Analyzer to test whether a given identifier is valid or not using C.**

**Program:**

#include<stdio.h>

#include<conio.h>

#include<ctype.h>

int main()

{

char a[10];

int flag, i=1;

printf("\n Enter an identifier:");

gets(a);

if(isalpha(a[0]))

flag=1;

else

printf("\n Not a valid identifier");

while(a[i]!='\0')

{

if(!isdigit(a[i])&&!isalpha(a[i]))

{

flag=0;

break;

} i++;

}

if(flag==1)

printf("\n Valid identifier");

}

**Output:**

Enter an identifier:abc123

Valid identifier

**Exp. No. 7**

**Write a C program to find FIRST( ) - predictive parser for the given grammar**

S → AaAb / BbBa

A → ∈

B → ∈

**Program:**

#include<stdio.h>

#include<ctype.h>

void FIRST(char[],char );

void addToResultSet(char[],char);

int numOfProductions;

char productionSet[10][10];

int main()

{

int i;

char choice;

char c;

char result[20];

printf("How many number of productions ? :");

scanf(" %d",&numOfProductions);

for(i=0;i<numOfProductions;i++)//read production string eg: E=E+T

{

printf("Enter productions Number %d : ",i+1);

scanf(" %s",productionSet[i]);

}

do

{

printf("\n Find the FIRST of :");

scanf(" %c",&c);

FIRST(result,c); //Compute FIRST; Get Answer in 'result' array

printf("\n FIRST(%c)= { ",c);

for(i=0;result[i]!='\0';i++)

printf(" %c ",result[i]); //Display result

printf("}\n");

printf("press 'y' to continue : ");

scanf(" %c",&choice);

}

while(choice=='y'||choice =='Y');

}

/\*

\*Function FIRST:

\*Compute the elements in FIRST(c) and write them

\*in Result Array.

\*/

void FIRST(char\* Result,char c)

{

int i,j,k;

char subResult[20];

int foundEpsilon;

subResult[0]='\0';

Result[0]='\0';

//If X is terminal, FIRST(X) = {X}.

if(!(isupper(c)))

{

addToResultSet(Result,c);

return ;

}

//If X is non terminal

//Read each production

for(i=0;i<numOfProductions;i++)

{

//Find production with X as LHS

if(productionSet[i][0]==c)

{

//If X → ε is a production, then add ε to FIRST(X).

if(productionSet[i][2]=='$') addToResultSet(Result,'$');

//If X is a non-terminal, and X → Y1 Y2 … Yk

//is a production, then add a to FIRST(X)

//if for some i, a is in FIRST(Yi),

//and ε is in all of FIRST(Y1), …, FIRST(Yi-1).

else

{

j=2;

while(productionSet[i][j]!='\0')

{

foundEpsilon=0;

FIRST(subResult,productionSet[i][j]);

for(k=0;subResult[k]!='\0';k++)

addToResultSet(Result,subResult[k]);

for(k=0;subResult[k]!='\0';k++)

if(subResult[k]=='$')

{

foundEpsilon=1;

break;

}

//No ε found, no need to check next element

if(!foundEpsilon)

break;

j++;

}

}

}

}

return ;

}

/\* addToResultSet adds the computed

\*element to result set.

\*This code avoids multiple inclusion of elements

\*/

void addToResultSet(char Result[],char val)

{

int k;

for(k=0 ;Result[k]!='\0';k++)

if(Result[k]==val)

return;

Result[k]=val;

Result[k+1]='\0';

}

**Output:**

How many number of productions ? :4

Enter productions Number 1 : S=AaAb

Enter productions Number 2 : S=BbBa

Enter productions Number 3 : A=$

Enter productions Number 4 : B=$

Find the FIRST of :S

FIRST(S)= { $ a b }

press 'y' to continue : y

Find the FIRST of :A

FIRST(A)= { $ }

press 'y' to continue : y

Find the FIRST of :B

FIRST(B)= { $ }

press 'y' to continue : n

**Exp. No. 8**

**Write a C program to find FOLLOW( )** **- predictive parser for the given grammar**

S → AaAb / BbBa

A → ∈

B → ∈

**Program:**

#include<stdio.h>

#include<ctype.h>

#include<string.h>

int limit, x = 0;

char production[10][10], array[10];

void find\_first(char ch);

void find\_follow(char ch);

void Array\_Manipulation(char ch);

int main()

{

int count;

char option, ch;

printf("\nEnter Total Number of Productions:\t");

scanf("%d", &limit);

for(count = 0; count < limit; count++)

{

printf("\nValue of Production Number [%d]:\t", count + 1);

scanf("%s", production[count]);

}

do

{

x = 0;

printf("\nEnter production Value to Find Follow:\t");

scanf(" %c", &ch);

find\_follow(ch);

printf("\nFollow Value of %c:\t{ ", ch);

for(count = 0; count < x; count++)

{

printf("%c ", array[count]);

}

printf("}\n");

printf("To Continue, Press Y:\t");

scanf(" %c", &option);

}while(option == 'y' || option == 'Y');

return 0;

}

void find\_follow(char ch)

{

int i, j;

int length = strlen(production[i]);

if(production[0][0] == ch)

{

Array\_Manipulation('$');

}

for(i = 0; i < limit; i++)

{

for(j = 2; j < length; j++)

{

if(production[i][j] == ch)

{

if(production[i][j + 1] != '\0')

{

find\_first(production[i][j + 1]);

}

if(production[i][j + 1] == '\0' && ch != production[i][0])

{

find\_follow(production[i][0]);

}

}

}

}

}

void find\_first(char ch)

{

int i, k;

if(!(isupper(ch)))

{

Array\_Manipulation(ch);

}

for(k = 0; k < limit; k++)

{

if(production[k][0] == ch)

{

if(production[k][2] == '$')

{

find\_follow(production[i][0]);

}

else if(islower(production[k][2]))

{

Array\_Manipulation(production[k][2]);

}

else

{

find\_first(production[k][2]);

}

}

}

}

void Array\_Manipulation(char ch)

{

int count;

for(count = 0; count <= x; count++)

{

if(array[count] == ch)

{

return;

}

}

array[x++] = ch;

}

**Output:**

Enter Total Number of Productions: 4

Value of Production Number [1]: S=AaAb

Value of Production Number [2]: S=BbBa

Value of Production Number [3]: A=$

Value of Production Number [4]: B=$

Enter production Value to Find Follow: S

Follow Value of S: { $ }

To Continue, Press Y: y

Enter production Value to Find Follow: A

Follow Value of A: { a b }

To Continue, Press Y: y

Enter production Value to Find Follow: B

Follow Value of B: { b a }

To Continue, Press Y: n

**Exp. No. 9**

**Implement a C program to eliminate left recursion from a given CFG.**

S → (L) / a

L → L , S / S

**Program:**

#include<stdio.h>

#include<string.h>

#define SIZE 10

int main () {

char non\_terminal;

char beta,alpha;

int num;

char production[10][SIZE];

int index=3; /\* starting of the string following "->" \*/

printf("Enter Number of Production : ");

scanf("%d",&num);

printf("Enter the grammar as E->E-A :\n");

for(int i=0;i<num;i++){

scanf("%s",production[i]);

}

for(int i=0;i<num;i++){

printf("\nGRAMMAR : : : %s",production[i]);

non\_terminal=production[i][0];

if(non\_terminal==production[i][index]) {

alpha=production[i][index+1];

printf(" is left recursive.\n");

while(production[i][index]!=0 && production[i][index]!='|')

index++;

if(production[i][index]!=0) {

beta=production[i][index+1];

printf("Grammar without left recursion:\n");

printf("%c->%c%c\'",non\_terminal,beta,non\_terminal);

printf("\n%c\'->%c%c\'|E\n",non\_terminal,alpha,non\_terminal);

}

else

printf(" can't be reduced\n");

}

else

printf(" is not left recursive.\n");

index=3;

}

}

**Output:**

Enter Number of Production : 2

Enter the grammar as E->E-A :

S->(L)|a

L->L,S|S

GRAMMAR : : : S->(L)|a is not left recursive.

GRAMMAR : : : L->L,S|S is left recursive.

Grammar without left recursion:

L->SL'

L'->,L'|E

**Exp. No. 10**

**Implement a C program to eliminate left factoring from a given CFG.**

S → iEtS / iEtSeS / a

E → b

**Program:**

#include<stdio.h>

#include<string.h>

int main()

{

char gram[20],part1[20],part2[20],modifiedGram[20],newGram[20],tempGram[20];

int i,j=0,k=0,l=0,pos;

printf("Enter Production : S->");

gets(gram);

for(i=0;gram[i]!='|';i++,j++)

part1[j]=gram[i];

part1[j]='\0';

for(j=++i,i=0;gram[j]!='\0';j++,i++)

part2[i]=gram[j];

part2[i]='\0';

for(i=0;i<strlen(part1)||i<strlen(part2);i++)

{

if(part1[i]==part2[i])

{

modifiedGram[k]=part1[i];

k++;

pos=i+1;

}

}

for(i=pos,j=0;part1[i]!='\0';i++,j++){

newGram[j]=part1[i];

}

newGram[j++]='|';

for(i=pos;part2[i]!='\0';i++,j++){

newGram[j]=part2[i];

}

modifiedGram[k]='X';

modifiedGram[++k]='\0';

newGram[j]='\0';

printf("\n S->%s",modifiedGram);

printf("\n X->%s\n",newGram);

}

**Output:**

Enter Production : S->iEtS|iEtSeS|a

S->iEtSX

X->|eS|a

**Exp. No. 11**

Implement a C program to perform symbol table operations.

**Program:**

#include<stdio.h>

#include<stdlib.h>

#include<string.h>

int cnt=0;

struct symtab

{

char label[20];

int addr;

}

sy[50];

void insert();

int search(char \*);

void display();

void modify();

int main()

{

int ch,val;

char lab[10];

do

{

printf("\n1.insert\n2.display\n3.search\n4.modify\n5.exit\n");

scanf("%d",&ch);

switch(ch)

{

case 1:

insert();

break;

case 2:

display();

break;

case 3:

printf("enter the label");

scanf("%s",lab);

val=search(lab);

if(val==1)

printf("label is found");

else

printf("label is not found");

break;

case 4:

modify();

break;

case 5:

exit(0);

break;

}

}while(ch<5);

}

void insert()

{

int val;

char lab[10];

int symbol;

printf("enter the label");

scanf("%s",lab);

val=search(lab);

if(val==1)

printf("duplicate symbol");

else

{

strcpy(sy[cnt].label,lab);

printf("enter the address");

scanf("%d",&sy[cnt].addr);

cnt++;

}

}

int search(char \*s)

{

int flag=0,i; for(i=0;i<cnt;i++)

{

if(strcmp(sy[i].label,s)==0)

flag=1;

}

return flag;

}

void modify()

{

int val,ad,i;

char lab[10];

printf("enter the labe:");

scanf("%s",lab);

val=search(lab);

if(val==0)

printf("no such symbol");

else

{

printf("label is found \n");

printf("enter the address");

scanf("%d",&ad);

for(i=0;i<cnt;i++)

{

if(strcmp(sy[i].label,lab)==0)

sy[i].addr=ad;

}

}

}

void display()

{

int i;

for(i=0;i<cnt;i++)

printf("%s\t%d\n",sy[i].label,sy[i].addr);

}

**Output:**

1.insert

2.display

3.search

4.modify

5.exit

1

enter the label a

enter the address 100

1.insert

2.display

3.search

4.modify

5.exit

2

a 100

1.insert

2.display

3.search

4.modify

5.exit

3

enter the label a

label is found

1.insert

2.display

3.search

4.modify

5.exit

4

enter the labe: a

label is found

enter the address 200

1.insert

2.display

3.search

4.modify

5.exit

2

a 200

1.insert

2.display

3.search

4.modify

5.exit

5

**Exp. No. 12**

Write a C program to construct recursive descent parsing for the given grammar

E → TE’

E’ → +TE’ / ∈

T → FT’

T’ → \*FT’ / ∈

F → ( E ) / id

**Program:**

#include<stdio.h>

#include<conio.h>

#include<string.h>

char input[100];

int i,l;

void main()

{

//clrscr();

printf("\nRecursive descent parsing for the following grammar\n"); printf("\nE->TE'\nE'->+TE'/@\nT->FT'\nT'->\*FT'/@\nF->(E)/ID\n"); printf("\nEnter the string to be checked:"); gets(input);

if(E())

{

if(input[i+1]=='\0')

printf("\nString is accepted");

else

printf("\nString is not accepted");

}

else

printf("\nString not accepted");

getch();

}

E()

{

if(T())

{

if(EP())

return(1);

else

return(0);

}

else

return(0);

}

EP()

{

if(input[i]=='+')

{

i++;

if(T())

{

if(EP())

return(1);

else

return(0);

}

else

return(0);

}

else

return(1);

}

T()

{

if(F())

{

if(TP())

return(1);

else

return(0);

}

else

return(0);

}

TP()

{

if(input[i]=='\*')

{

i++;

if(F())

{

if(TP())

return(1);

else

return(0);

}

else

return(0);

}

else

return(1);

}

F()

{

if(input[i]=='(')

{

i++;

if(E())

{

if(input[i]==')')

{

i++;

return(1);

}

else

return(0);

}

else

return(0);

}

else if(input[i]>='a'&&input[i]<='z'||input[i]>='A'&&input[i]<='Z')

{

i++;

return(1);

}

else

return(0);

}

**Output:**

Recursive descent parsing for the following grammar

E->TE'

E'->+TE'/@

T->FT'

T'->\*FT'/@

F->(E)/ID

Enter the string to be checked: (a+b)\*c

String is accepted

Enter the string to be checked: a/c+d

String is not accepted

**Exp. No. 13**

Write a C program to implement either Top Down parsing technique or Bottom Up Parsing technique to check whether the given input string is satisfying the grammar or not.

**Program:**

#include<stdio.h>

#include<conio.h>

#include<string.h>

int main() {

char string[50];

int flag,count=0;

printf("The grammar is: S->aS, S->Sb, S->ab\n");

printf("Enter the string to be checked:\n");

gets(string);

if(string[0]=='a') {

flag=0;

for (count=1;string[count-1]!='\0';count++) {

if(string[count]=='b') {

flag=1;

continue;

} else if((flag==1)&&(string[count]=='a')) {

printf("The string does not belong to the specified grammar");

break;

} else if(string[count]=='a')

continue; else if((flag==1)&&(string[count]='\0')) {

printf("String not accepted…..!!!!");

break;

} else {

printf("String accepted");

}

}

}

}

**Output:**

The grammar is: S->aS, S->Sb, S->ab

Enter the string to be checked:

abb

String accepted