ELIMINATION OF LEFT RECURSION

EX. NO. 4(a)

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AIM: A program for Elimination of Left Recursion.

ALGORITHM:

1. Start the program.
2. Initialize the arrays for taking input from the user.
3. Prompt the user to input the no. of non-terminals having left recursion and no. of productions for these non-terminals.
4. Prompt the user to input the production for non-terminals.
5. Eliminate left recursion using the following rules:-

   A->Aα1| Aα2 | . . . . . |Aαm

   A->β1| β2| . . . . .| βn

   Then replace it by

   A-> βi A' i=1,2,3,…..m

   A'-> αj A' j=1,2,3,…..n

   A'-> Ɛ
6. After eliminating the left recursion by applying these rules, display the productions without left recursion.
7. Stop.

PROGRAM:

```
#include <iostream>
#include <vector>
#include <string>
using namespace std;

int main()
{
```

```
    int n;
    cout<<"\nEnter number of non terminals: ";
    cin>>n;
    cout<<"\nEnter non terminals one by one: ";
    int i;
    vector<string> nonter(n);
    vector<int> leftrecr(n,0);
    for(i=0;i<n;++i) {
          cout<<"\nNon terminal "<<i+1<<" : ";
       cin>>nonter[i];
    }
    vector<vector<string> > prod;
    cout<<"\nEnter '^' for null";
    for(i=0;i<n;++i) {
       cout<<"\nNumber of "<<nonter[i]<<" productions: ";
       int k;
       cin>>k;
       int j;
       cout<<"\nOne by one enter all "<<nonter[i]<<" productions";
       vector<string> temp(k);
       for(j=0;j<k;++j) {
          cout<<"\nRHS of production "<<j+1<<": ";
          string abc;
          cin>>abc;
          temp[j]=abc;

if(nonter[i].length()<=abc.length()&&nonter[i].compare(abc.substr(0,nonter[i].length()))==0)
              leftrecr[i]=1;
       }
       prod.push_back(temp);
    }
```

```
    for(i=0;i<n;++i) {
        cout<<leftrecr[i];
    }
    for(i=0;i<n;++i) {
        if(leftrecr[i]==0)
            continue;
        int j;
        nonter.push_back(nonter[i]+"'");
        vector<string> temp;
        for(j=0;j<prod[i].size();++j) {

if(nonter[i].length()<=prod[i][j].length()&&nonter[i].compare(prod[i][j].substr(0,nonter[i].length
()))==0) {
                string
abc=prod[i][j].substr(nonter[i].length(),prod[i][j].length()-nonter[i].length())+nonter[i]+"'";
                temp.push_back(abc);
                prod[i].erase(prod[i].begin()+j);
                --j;
            }
            else {
                prod[i][j]+=nonter[i]+"'";
            }
        }
        temp.push_back("^");
        prod.push_back(temp);
    }
    cout<<"\n\n";
    cout<<"\nNew set of non-terminals: ";
    for(i=0;i<nonter.size();++i)
        cout<<nonter[i]<<" ";
    cout<<"\n\nNew set of productions: ";
```

```
    for(i=0;i<nonter.size();++i) {
        int j;
        for(j=0;j<prod[i].size();++j) {
            cout<<"\n"<<nonter[i]<<" -> "<<prod[i][j];
        }
    }
    return 0;
}
```

OUTPUT :

```
Enter number of non terminals: 3

Enter non terminals one by one:
Non terminal 1 : E

Non terminal 2 : T

Non terminal 3 : F

Enter '^' for null
Number of E productions: 2

One by one enter all E productions
RHS of production 1: E+T

RHS of production 2: T

Number of T productions: 2

One by one enter all T productions
RHS of production 1: T*F

RHS of production 2: F

Number of F productions: 2

One by one enter all F productions
RHS of production 1: (E)

RHS of production 2: i
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New set of non-terminals: E T F E' T'

New set of productions:
E -> TE'
T -> FT'
F -> (E)
F -> i
E' -> +TE'
E' -> ^
T' -> *FT'
T' -> ^
```

RESULT :

A program for Elimination of Left Recursion was run successfully.

LEFT FACTORING

EX. NO. 4(b)

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AIM : A program for implementation Of Left Factoring

ALGORITHM :

1. Start
2. Ask the user to enter the set of productions
3. Check for common symbols in the given set of productions by comparing with:

   A->aB1|aB2
4. If found, replace the particular productions with:

   A->aA’

   A’->B1 | B2|ε
5. Display the output
6. Exit

CODE :

```
#include <iostream>
#include <math.h>
#include <vector>
#include <string>
#include <stdlib.h>
using namespace std;

int main()
{
   cout<<"\nEnter number of productions: ";
   int p;
   cin>>p;
   vector<string> prodleft(p),prodright(p);
```

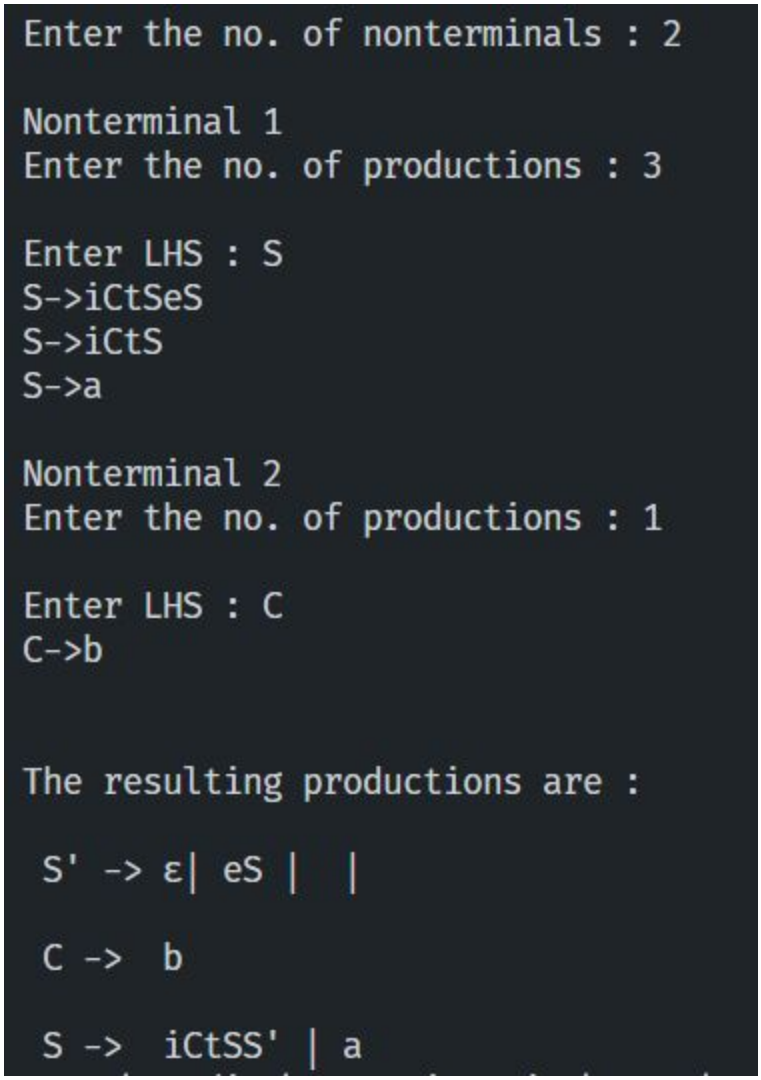
```
cout<<"\nEnter productions one by one: ";
int i;
for(i=0;i<p;++i) {
   cout<<"\nLeft of production "<<i+1<<": ";
   cin>>prodleft[i];
   cout<<"\nRight of production "<<i+1<<": ";
   cin>>prodright[i];
}
int j;
int e=1;
for(i=0;i<p;++i) {
   for(j=i+1;j<p;++j) {
      if(prodleft[j]==prodleft[i]) {
         int k=0;
         string com="";

while(k<prodright[i].length()&&k<prodright[j].length()&&prodright[i][k]==prodright[j][k]) {
            com+=prodright[i][k];
            ++k;
         }
         if(k==0)
            continue;
         char* buffer;
         string comleft=prodleft[i];
         if(k==prodright[i].length()) {
            prodleft[i]+=string(itoa(e,buffer,10));
            prodleft[j]+=string(itoa(e,buffer,10));
            prodright[i]="^";
            prodright[j]=prodright[j].substr(k,prodright[j].length()-k);
         }
         else if(k==prodright[j].length()) {
```

```
            prodleft[i]+=string(itoa(e,buffer,10));
            prodleft[j]+=string(itoa(e,buffer,10));
            prodright[j]="^";
            prodright[i]=prodright[i].substr(k,prodright[i].length()-k);
          }
          else {
            prodleft[i]+=string(itoa(e,buffer,10));
            prodleft[j]+=string(itoa(e,buffer,10));
            prodright[j]=prodright[j].substr(k,prodright[j].length()-k);
            prodright[i]=prodright[i].substr(k,prodright[i].length()-k);
          }
          int l;
          for(l=j+1;l<p;++l) {

if(comleft==prodleft[l]&&com==prodright[l].substr(0,fmin(k,prodright[l].length()))) {
              prodleft[l]+=string(itoa(e,buffer,10));
              prodright[l]=prodright[l].substr(k,prodright[l].length()-k);
            }
          }
          prodleft.push_back(comleft);
          prodright.push_back(com+prodleft[i]);
          ++p;
          ++e;
        }
      }
    }
    cout<<"\n\nNew productions";
    for(i=0;i<p;++i) {
      cout<<"\n"<<prodleft[i]<<"->"<<prodright[i];
    }
    return 0; }
```

OUTPUT :



RESULT : A program for implementation Of Left Factoring was compiled and run successfully