1/4/2022

Experiment 9 : Construction of LR(0) itemsets

Aim : To perform LR(0) itemset calculation.

Algorithm :

1. start
2. Create a structure for production with LHS and RHS.
3. Get input from user in the form of A → B
4. Build state 0 from augmented grammar start production S' → S $ ~~start~~ and put dot symbol before S.
5. If dot symbol is before a non terminal, add grammar law that this is in left Hand side of that law and set dot in before of first part of Right Hand side.
6. If state exists (a state with this laws and same Dot position), use that instead.
7. Now find set of terminals and non terminals in which Dot exist in before.
8. If step 7 set is non empty, go to 9 else go to 10.
9. For each terminal / non terminal in set step 7 create new state by using all grammar law that Dot position is before by increasing Dot point to next part in RHS of that laws.
10. Go to step 5.

11. End of state building.
12. Display the output.
13. End.

Manual Working :

Input grammar :

$E \rightarrow E + T$

$E \rightarrow T$

$T \rightarrow T * F$

$T \rightarrow F$

$F \rightarrow (E)$

$F \rightarrow i$

Output :
Calculating Goto and closure.

1. Augment the grammar

$S' \rightarrow E$

2. Constructing itemsets

I_0 :

$S' \rightarrow .E$

$E \rightarrow .E + T \mid .T$

$T \rightarrow .T * F \mid .F$

$F \rightarrow .(E) \mid .i$

I_1 : $S' \rightarrow E \cdot$

$E \rightarrow E \cdot + T$

I_2 : $E \rightarrow T \cdot$

$T \rightarrow T \cdot * F$

I_3 : $T \rightarrow F \cdot$

I_4 : $F \rightarrow (\cdot E)$

$E \rightarrow \cdot E + T \mid \cdot T$

$T \rightarrow \cdot T * F \mid \cdot F$

$F \rightarrow \cdot (E) \mid \cdot i$

I_5 : $F \rightarrow i \cdot$

I_6 : $E \rightarrow E + \cdot T$

$T \rightarrow \cdot T * F \mid \cdot F$

$F \rightarrow \cdot (E) \mid \cdot i$

I_7 : $T \rightarrow T * \cdot F$

$F \rightarrow \cdot (E) \mid \cdot i$

I_8 : $F \rightarrow (E \cdot)$

$E \rightarrow E \cdot + T$

I_9 : $E \rightarrow E + T.$

$T \rightarrow T. * F$

I_{10} : $T \rightarrow T * F.$

I_{11} : $F \rightarrow (E).$

Sashrika Surya
RA1911027010092
Section N2
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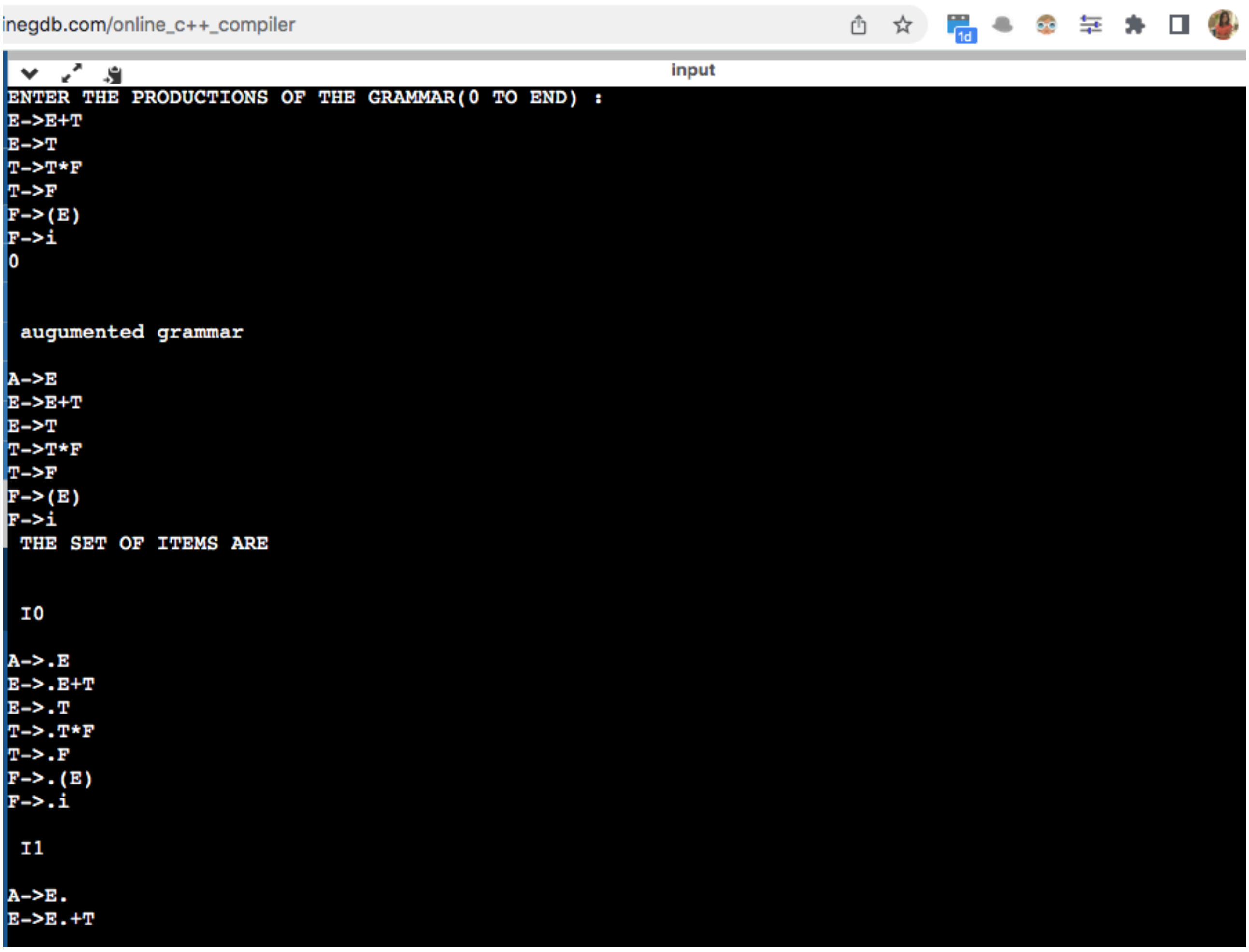
Lab9: Construction of LR(0) Itemsets

Code:

```
// LR(0) itemsets
#include<iostream>
#include<conio.h>
#include<string.h>

using namespace std;

char prod[20][20],listofvar[26]="ABCDEFGHIJKLMNOPQR";
int novar=1,i=0,j=0,k=0,n=0,m=0,arr[30];
int noitem=0;

struct Grammar
{
   char lhs;
   char rhs[8];
}g[20],item[20],clos[20][10];

int isvariable(char variable)
{
   for(int i=0;i<novar;i++)
      if(g[i].lhs==variable)
         return i+1;
   return 0;
}
void findclosure(int z, char a)
{
   int n=0,i=0,j=0,k=0,l=0;
   for(i=0;i<arr[z];i++)
   {
      for(j=0;j<strlen(clos[z][i].rhs);j++)
      {
         if(clos[z][i].rhs[j]=='.' && clos[z][i].rhs[j+1]==a)
         {
            clos[noitem][n].lhs=clos[z][i].lhs;
            strcpy(clos[noitem][n].rhs,clos[z][i].rhs);
            char temp=clos[noitem][n].rhs[j];
```

```
                clos[noitem][n].rhs[j]=clos[noitem][n].rhs[j+1];
                clos[noitem][n].rhs[j+1]=temp;
                n=n+1;
            }
        }
    }
    for(i=0;i<n;i++)
    {
        for(j=0;j<strlen(clos[noitem][i].rhs);j++)
        {
            if(clos[noitem][i].rhs[j]=='.' && isvariable(clos[noitem][i].rhs[j+1])>0)
            {
                for(k=0;k<novar;k++)
                {
                    if(clos[noitem][i].rhs[j+1]==clos[0][k].lhs)
                    {
                        for(l=0;l<n;l++)
                            if(clos[noitem][l].lhs==clos[0][k].lhs && strcmp(clos[noitem]
[l].rhs,clos[0][k].rhs)==0)
                                break;
                        if(l==n)
                        {
                            clos[noitem][n].lhs=clos[0][k].lhs;
                        strcpy(clos[noitem][n].rhs,clos[0][k].rhs);
                            n=n+1;
                        }
                    }
                }
            }
        }
    }
    arr[noitem]=n;
    int flag=0;
    for(i=0;i<noitem;i++)
    {
        if(arr[i]==n)
        {
            for(j=0;j<arr[i];j++)
            {
                int c=0;
                for(k=0;k<arr[i];k++)
                    if(clos[noitem][k].lhs==clos[i][k].lhs && strcmp(clos[noitem][k].rhs,clos[i]
[k].rhs)==0)
                        c=c+1;
                if(c==arr[i])
                {
                    flag=1;
                    goto exit;
                }
            }
        }
    }
    exit:;
    if(flag==0)
        arr[noitem++]=n;
}

int main()
{
    cout<<"ENTER THE PRODUCTIONS OF THE GRAMMAR(0 TO END) :\n";
    do
    {
        cin>>prod[i++];
    }while(strcmp(prod[i-1],"0")!=0);
    for(n=0;n<i-1;n++)
    {
        m=0;
        j=novar;
        g[novar++].lhs=prod[n][0];
        for(k=3;k<strlen(prod[n]);k++)
        {
            if(prod[n][k] != '|')
            g[j].rhs[m++]=prod[n][k];
            if(prod[n][k]=='|')
            {
                g[j].rhs[m]='\0';
                m=0;
                j=novar;
                g[novar++].lhs=prod[n][0];
            }
        }
    }
    for(i=0;i<26;i++)
        if(!isvariable(listofvar[i]))
            break;
    g[0].lhs=listofvar[i];
    char temp[2]={g[1].lhs,'\0'};
    strcat(g[0].rhs,temp);
    cout<<"\n\n augumented grammar \n";
    for(i=0;i<novar;i++)
        cout<<endl<<g[i].lhs<<"->"<<g[i].rhs<<" ";

    for(i=0;i<novar;i++)
    {
        clos[noitem][i].lhs=g[i].lhs;
        strcpy(clos[noitem][i].rhs,g[i].rhs);
        if(strcmp(clos[noitem][i].rhs,"ε")==0)
            strcpy(clos[noitem][i].rhs,".");
        else
        {
            for(int j=strlen(clos[noitem][i].rhs)+1;j>=0;j--)
                clos[noitem][i].rhs[j]=clos[noitem][i].rhs[j-1];
            clos[noitem][i].rhs[0]='.';
        }
    }
    arr[noitem++]=novar;
    for(int z=0;z<noitem;z++)
    {
        char list[10];
        int l=0;
        for(j=0;j<arr[z];j++)
        {
            for(k=0;k<strlen(clos[z][j].rhs)-1;k++)
            {
                if(clos[z][j].rhs[k]=='.')
                {
                    for(m=0;m<l;m++)
                        if(list[m]==clos[z][j].rhs[k+1])
                            break;
                    if(m==l)
                        list[l++]=clos[z][j].rhs[k+1];
                }
            }
        }
        for(int x=0;x<l;x++)
            findclosure(z,list[x]);
    }
    cout<<"\n THE SET OF ITEMS ARE \n\n";
    for(int z=0; z<noitem; z++)
    {
        cout<<"\n I"<<z<<"\n\n";
        for(j=0;j<arr[z];j++)
            cout<<clos[z][j].lhs<<"->"<<clos[z][j].rhs<<"\n";

    }}
```

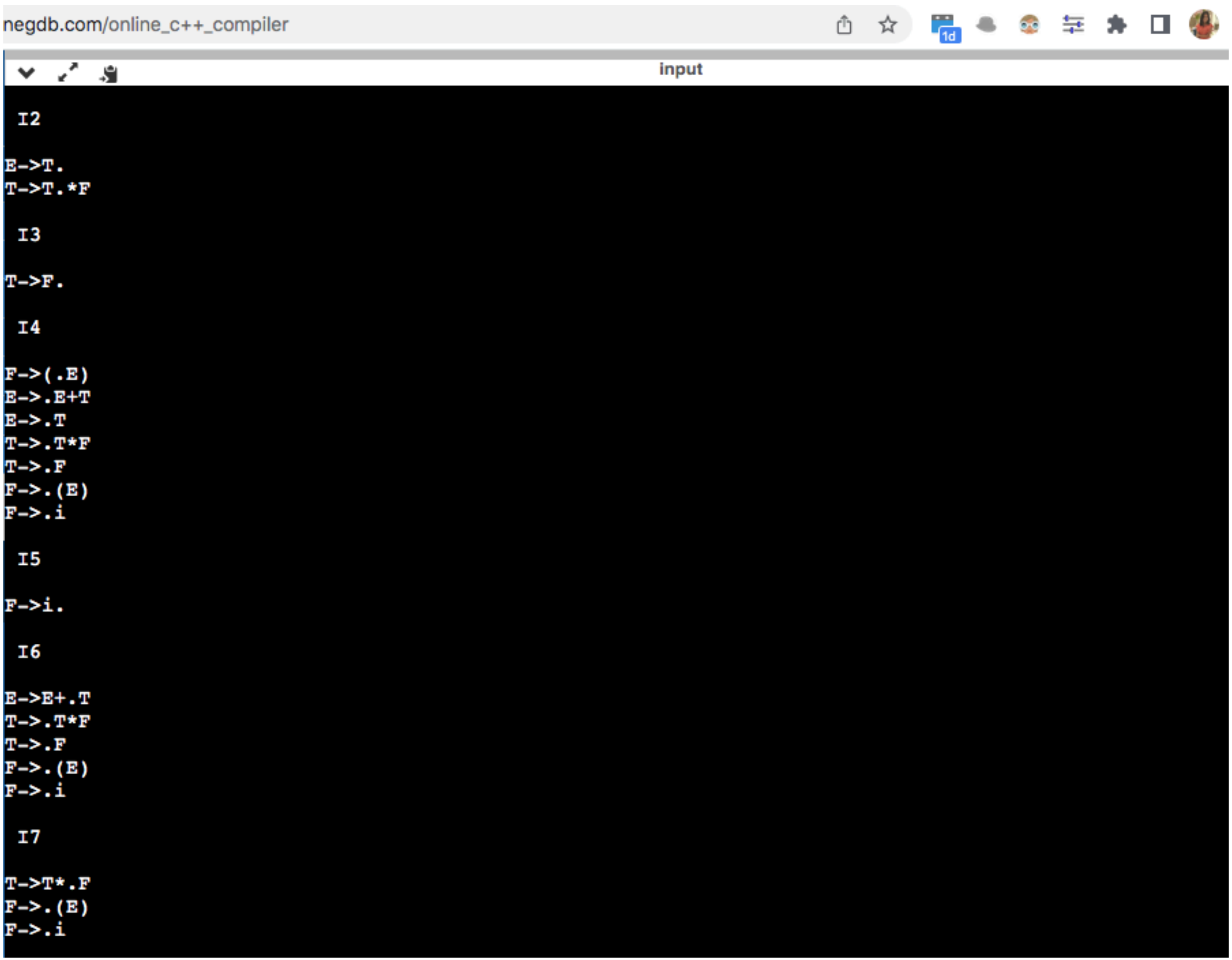
Output:



inegdb.com/online_c++_compiler

input

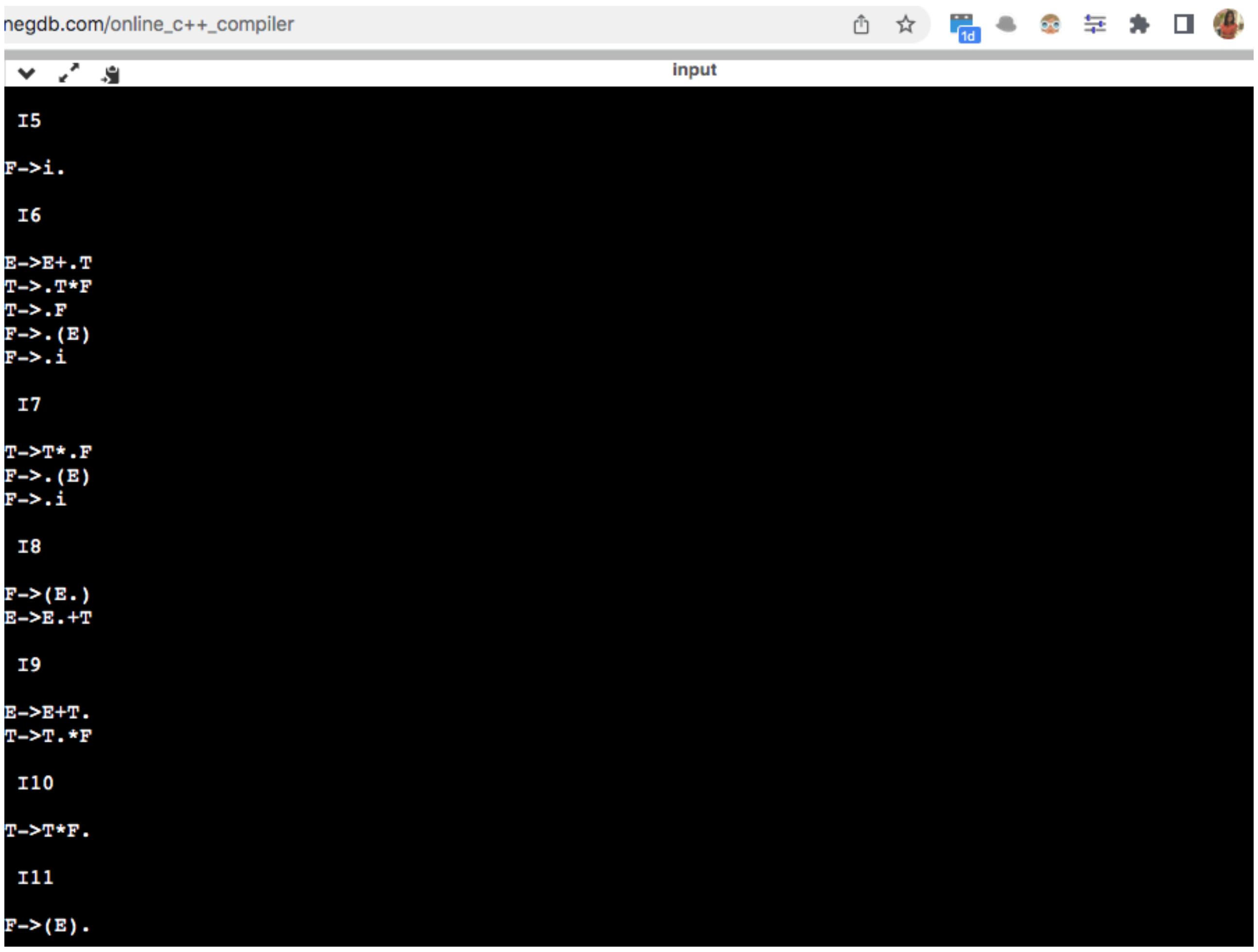
```
ENTER THE PRODUCTIONS OF THE GRAMMAR(0 TO END) :
E->E+T
E->T
T->T*F
T->F
F->(E)
F->i
0


 augumented grammar

A->E
E->E+T
E->T
T->T*F
T->F
F->(E)
F->i
 THE SET OF ITEMS ARE


 I0

A->.E
E->.E+T
E->.T
T->.T*F
T->.F
F->.(E)
F->.i

 I1

A->E.
E->E.+T
```



negdb.com/online_c++_compiler

input

```
 I2

E->T.
T->T.*F

 I3

T->F.

 I4

F->(.E)
E->.E+T
E->.T
T->.T*F
T->.F
F->.(E)
F->.i

 I5

F->i.

 I6

E->E+.T
T->.T*F
T->.F
F->.(E)
F->.i

 I7

T->T*.F
F->.(E)
F->.i
```


negdb.com/online_c++_compiler

input

```
 I5

F->i.

 I6

E->E+.T
T->.T*F
T->.F
F->.(E)
F->.i

 I7

T->T*.F
F->.(E)
F->.i

 I8

F->(E.)
E->E.+T

 I9

E->E+T.
T->T.*F

 I10

T->T*F.

 I11

F->(E).
```

Result:
Hence, LR(0) itemsets were constructed for the given productions.