EXP:6: CONSTRUCTION OF PREDICTIVE PARSING TABLE

AIM: To Design a code to construct predictive parsing table.

LANGUAGE USED: Python 3

ALGORITHM/PROCEDURE: -

- Epsilon is represented by ‘e’.
- Productions are of the form A=B, where ‘A’ is a single Non-Terminal and ‘B’ can be any combination of Terminals and Non- Terminals.
- L.H.S. of the first production rule is the start symbol.
- Grammar is not left recursive.
- Each production of a non-terminal is entered on a different line.
- Only Upper-Case letters are Non-Terminals and everything else is a terminal.
- Do not use ‘!’ or ‘$’ as they are reserved for special purposes.

EXPLANATION:

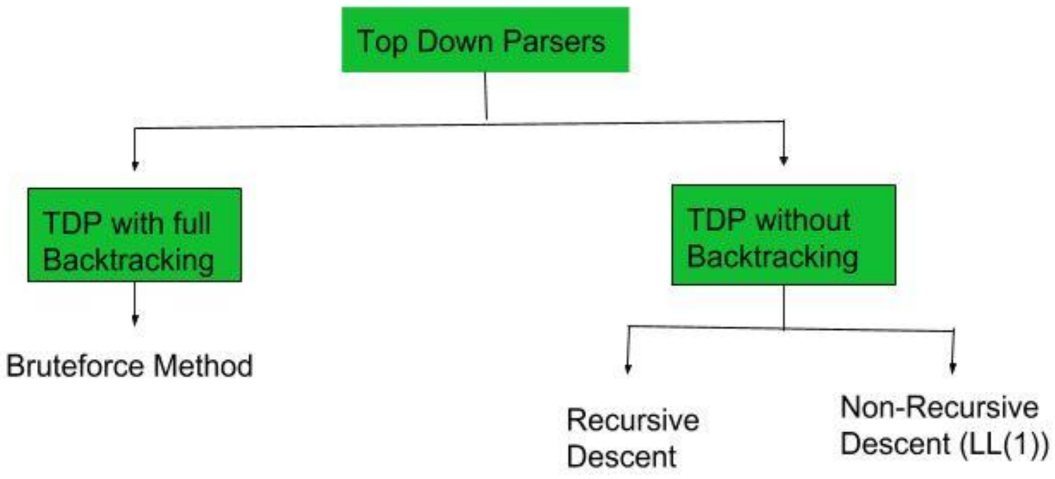
1: **First()**: If there is a variable, and from that variable if we try to drive all the strings then the beginning Terminal Symbol is called the first.

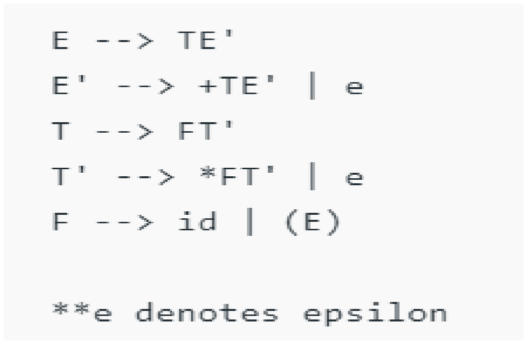
2: **Follow()**: What is the Terminal Symbol which follow a variable in the process of derivation.

Now, after computing the First and Follow set for each Non-Terminal symbol we have to construct the Parsing table. In the table Rows will contain the Non-Terminals and the column will contain the Terminal Symbols.
All the Null Productions of the Grammars will go under the Follow elements and the remaining productions will lie under the elements of First set.

Note: Every grammar is not feasible for Predictive Parsing table. It may be possible that one cell may contain more than one production.

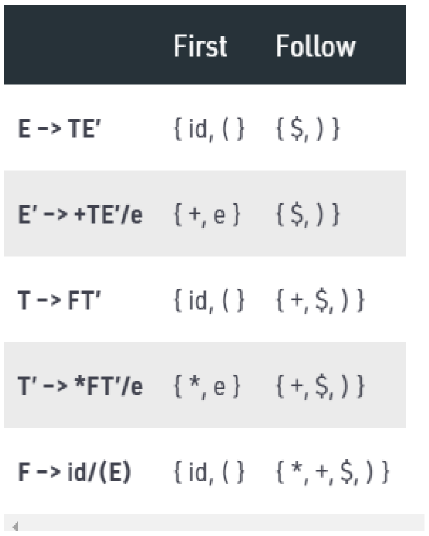
SPACE TREE DIAGRAM/ EXPLANATION:



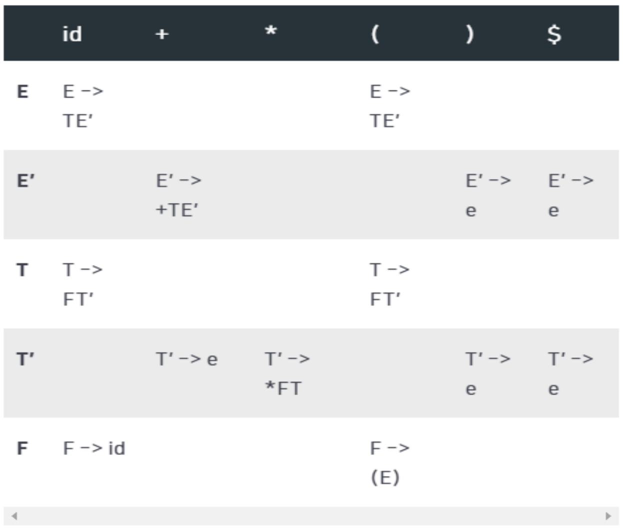


```
E --> TE'
E' --> +TE' | e
T --> FT'
T' --> *FT' | e
F --> id | (E)

**e denotes epsilon
```



	First	Follow
E -> TE'	{ id, (}	{ $,) }
E' -> +TE'/e	{ +, e }	{ $,) }
T -> FT'	{ id, (}	{ +, $,) }
T' -> *FT'/e	{ *, e }	{ +, $,) }
F -> id/(E)	{ id, (}	{ *, +, $,) }



	id	**+**	*****	**(**	**)**	**$**
E	E -> TE'			E -> TE'		
E'		E' -> +TE'			E' -> e	E' -> e
T	T -> FT'			T -> FT'		
T'		T' -> e	T' -> *FT		T' -> e	T' -> e
F	F -> id			F -> (E)		

SOURCE CODE: -

```
gram = {
	"E":["E+T","e"],
	"T":["T*F","F"],
	"F":["(E)","i"],
 }
def removeDirectLR(gramA, A):
        """gramA is dictonary"""
        temp = gramA[A]
        tempCr = []
        tempInCr = []
        for i in temp:
                if i[0] == A:
                        tempInCr.append(i[1:]+[A+"'"])
                else:
                        tempCr.append(i+[A+"'"])
        tempInCr.append(["e"])
        gramA[A] = tempCr
        gramA[A+"'"] = tempInCr
        return gramA
def checkForIndirect(gramA, a, ai):
        if ai not in gramA:
                return False
        if a == ai:
                return True
        for i in gramA[ai]:
                if i[0] == ai:
                        return False
                if i[0] in gramA:
                        return checkForIndirect(gramA, a, i[0])
        return False


def rep(gramA, A):
        temp = gramA[A]
        newTemp = []
        for i in temp:
                if checkForIndirect(gramA, A, i[0]):
                        t = []
                for k in gramA[i[0]]:
                    t=[]
                    t+=k
                    t+=i[1:]
                    newTemp.append(t)
            else:
                newTemp.append(i)
        gramA[A] = newTemp
        return gramA
def rem(gram):
    c = 1
    conv = {}
    gramA = {}
    revconv = {}
    for j in gram:
        conv[j] = "A"+str(c)
        gramA["A"+str(c)] = []
        c+=1
    for i in gram:
        for j in gram[i]:
            temp = []
            for k in j:
                if k in conv:
                    temp.append(conv[k])
                else:

                    temp.append(k)
            gramA[conv[i]].append(temp)
    for i in range(c-1,0,-1):
        ai = "A"+str(i)
        for j in range(0,i):
            aj = gramA[ai][0][0]
            if ai!=aj :
                if aj in gramA and checkForIndirect(gramA,ai,aj):
                    gramA = rep(gramA, ai)
    for i in range(1,c):
        ai = "A"+str(i)
        for j in gramA[ai]:
            if ai==j[0]:
                gramA = removeDirectLR(gramA, ai)
                break
    op = {}
    for i in gramA:
        a = str(i)
        for j in conv:
            a = a.replace(conv[j],j)
        revconv[i] = a
    for i in gramA:
        l = []
        for j in gramA[i]:
            k = []
            for m in j:
                if m in revconv:
                    k.append(m.replace(m,revconv[m]))
                else:
                    k.append(m)
            l.append(k)

        op[revconv[i]] = l
    return op
result = rem(gram)
terminals = []
for i in result:
    for j in result[i]:
        for k in j:
            if k not in result:
                terminals+=[k]
terminals = list(set(terminals))
```

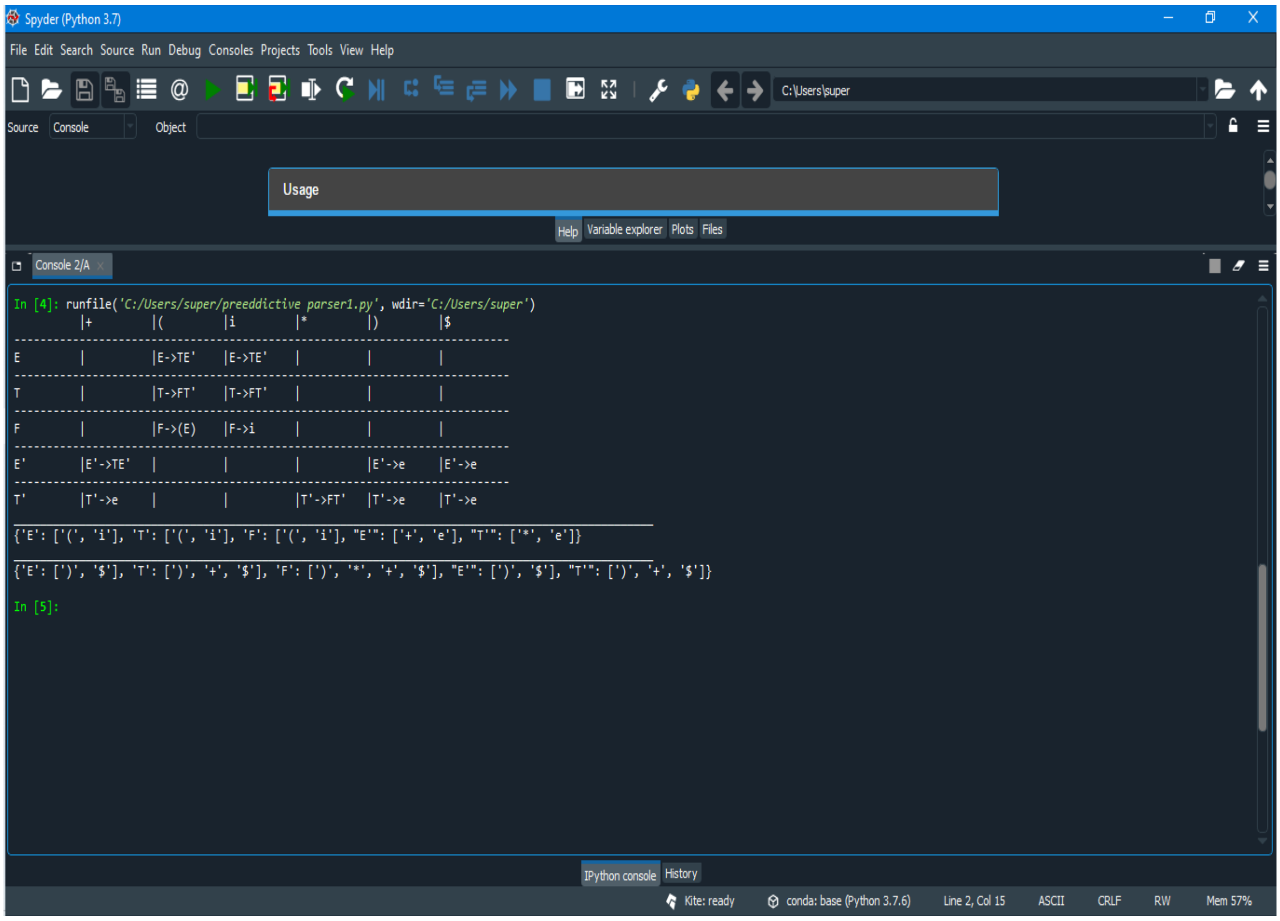
```
def first(gram, term):
    a = []
    if term not in gram:
        return [term]
    for i in gram[term]:
        if i[0] not in gram:
            a.append(i[0])
        elif i[0] in gram:
            a += first(gram, i[0])
    return a
firsts = {}
for i in result:
    firsts[i] = first(result,i)
def follow(gram, term):
    a = []
    for rule in gram:
        for i in gram[rule]:
            if term in i:
                temp = i
                indx = i.index(term)
                if indx+1!=len(i):

                    if i[-1] in firsts:
                        a+=firsts[i[-1]]
                    else:
                        a+=[i[-1]]
                else:
                    a+=["e"]
                if rule != term and "e" in a:
                    a+= follow(gram,rule)
    return a
follows = {}
for i in result:
    follows[i] = list(set(follow(result,i)))
```

```
        if "e" in follows[i]:
                follows[i].pop(follows[i].index("e"))
        follows[i]+=["$"]
resMod = {}
for i in result:
        l = []
        for j in result[i]:
                temp = ""
                for k in j:
                        temp+=k
                l.append(temp)
        resMod[i] = l
tterm = list(terminals)
tterm.pop(tterm.index("e"))
tterm+=["$"]
pptable = {}
for i in result:
        for j in tterm:
                if j in firsts[i]:

                        pptable[(i,j)]=resMod[i[0]][0]
                else:
                        pptable[(i,j)]=""
        if "e" in firsts[i]:
                for j in tterm:
                        if j in follows[i]:
                                pptable[(i,j)]="e"
pptable[("F","i")] = "i"
toprint = f'{"": <10}'
for i in tterm:
        toprint+= f'|{i: <10}'
print(toprint)
for i in result:
        toprint = f'{i: <10}'
        for j in tterm:
            if pptable[(i,j)]!="":
                toprint+=f'|{i+"->"+pptable[(i,j)]: <10}'
            else:
                toprint+=f'|{pptable[(i,j)]: <10}'
        print(f'{"-":-<76}')
        print(toprint)
print("______________________________________________________________________________________________________________")
print(firsts)
print("______________________________________________________________________________________________________________")
print(follows)
```

OUTPUT:



```
In [4]: runfile('C:/Users/super/preeddictive parser1.py', wdir='C:/Users/super')
          |+        |(        |i        |*        |)        |$
----------------------------------------------------------------------
E         |         |E->TE'   |E->TE'   |         |         |
----------------------------------------------------------------------
T         |         |T->FT'   |T->FT'   |         |         |
----------------------------------------------------------------------
F         |         |F->(E)   |F->i     |         |         |
----------------------------------------------------------------------
E'        |E'->TE'  |         |         |         |E'->e    |E'->e
----------------------------------------------------------------------
T'        |T'->e    |         |         |T'->FT'  |T'->e    |T'->e
__________________________________________________________________________________________
{'E': ['(', 'i'], 'T': ['(', 'i'], 'F': ['(', 'i'], "E'": ['+', 'e'], "T'": ['*', 'e']}
__________________________________________________________________________________________
{'E': [')', '$'], 'T': [')', '+', '$'], 'F': [')', '*', '+', '$'], "E'": [')', '$'], "T'": [')', '+', '$']}

In [5]:
```

RESULT: Therefore, we successfully implemented a code for constructing predictive parsing table for the given grammar.