Week 8: Predictive Parser

Implement Predictive Parser for the Expression Grammar

E -> TE’
E’ -> +TE’ | ε
T -> FT’
T’ -> *FT’ | ε
F -> (E) | d

Code:

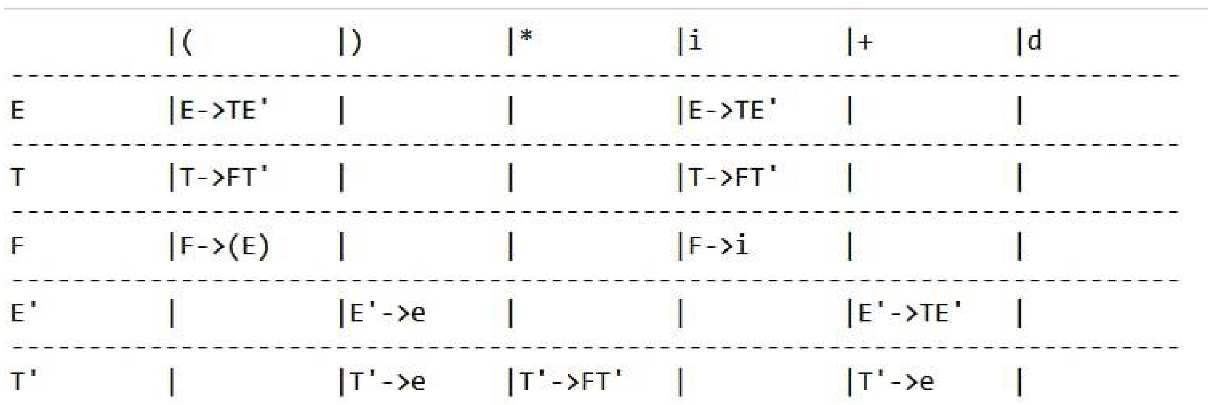
```
gram = {
	"E":["E+T","T"],
	"T":["T*F","F"],
	"F":["(E)","i"],
}

def removeDirectLR(gramA, A):
	"""gramA is dictonary"""
	temp = gramA[A]
	tempCr = []
	tempInCr = []
	for i in temp:
		if i[0] == A:
			#tempInCr.append(i[1:])
			tempInCr.append(i[1:]+[A+"'"])
		else:
			#tempCr.append(i)
			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)


#print(gramA)
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))
#print(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)
#   print(f'First({i}):',firsts[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]+=["$"]
#   print(f'Follow({i}):',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

# create predictive parsing table
tterm = list(terminals)
tterm.pop(tterm.index("e"))
tterm+=["d"]
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)
```

Output:



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