18CSC304J/ Compiler Design

Submitted By:- ANANNYA P. NEOG (RA1911003010367)

Exp-6: Predictive Parsing Table

Aim:- To write code to construct Predictive Parsing Table

Codes:-

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

       # "A":["A+B","B"],
       # "B":["B*C","C"],
       # "C":["(A)","id"]
}

def removeDirectLR(gramA, A):
   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)


    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))

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

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)
```

Run Debug Stop Share Save { } Beautify Language Python 3

main.py

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

#    "A":["A+B","B"],
#      "B":["B*C","C"],
#      "C":["(A)","id"]
}

def removeDirectLR(gramA, A):
    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

```

Run Debug Stop Share Save { } Beautify Language Python 3

main.py

```
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)

```

Run | Debug | Stop | Share | Save | { } Beautify | Language Python 3

main.py

```
    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

```

Run | Debug | Stop | Share | Save | { } Beautify | Language Python 3

main.py

```
    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)
    print(f'First({i}): ',firsts[i])

```

Run | Debug | Stop | Share | Save | { } Beautify | Language Python 3

main.py

```
133
134 def follow(gram, term):
135     a = []
136     for rule in gram:
137         for i in gram[rule]:
138             if term in i:
139                 temp = i
140                 indx = i.index(term)
141                 if indx+1!=len(i):
142                     if i[-1] in firsts:
143                         a+=firsts[i[-1]]
144                     else:
145                         a+=[i[-1]]
146                 else:
147                     a+=["e"]
148                 if rule != term and "e" in a:
149                     a+= follow(gram,rule)
150     return a
151
152 follows = {}
153 for i in result:
154     follows[i] = list(set(follow(result,i)))
155     if "e" in follows[i]:
156         follows[i].pop(follows[i].index("e"))
157     follows[i]+=["$"]
158     print(f'Follow({i}): ',follows[i])
159
160 resMod = {}
161 for i in result:
162     l = []
163     for j in result[i]:
164         temp = ""
165         for k in j:
166             temp+=k
167         l.append(temp)
168     resMod[i] = l
169
```

Run | Debug | Stop | Share | Save | { } Beautify | Language Python 3

main.py

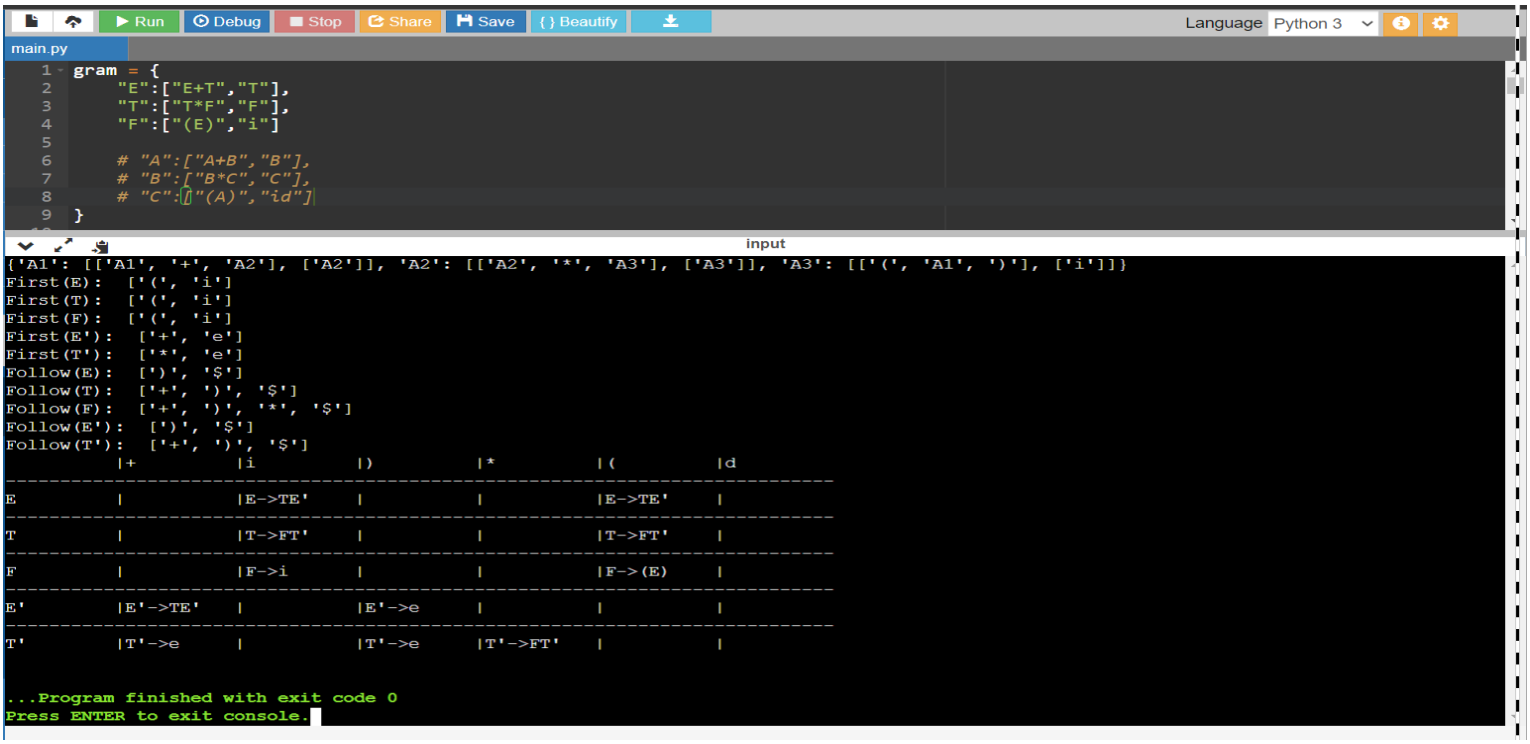
```
169
170 tterm = list(terminals)
171 tterm.pop(tterm.index("e"))
172 tterm+=["d"]
173 pptable = {}
174 for i in result:
175     for j in tterm:
176         if j in firsts[i]:
177             pptable[(i,j)]=resMod[i[0]][0]
178         else:
179             pptable[(i,j)]=""
180     if "e" in firsts[i]:
181         for j in tterm:
182             if j in follows[i]:
183                 pptable[(i,j)]="e"
184 pptable[("F","i")] = "i"
185 toprint = f'{"": <10}'
186 for i in tterm:
187     toprint+= f'|{i: <10}'
188 print(toprint)
189 for i in result:
190     toprint = f'{i: <10}'
191     for j in tterm:
192         if pptable[(i,j)]!="":
193             toprint+=f'|{i+"->"+pptable[(i,j)]: <10}'
194         else:
195             toprint+=f'|{pptable[(i,j)]: <10}'
196     print(f'{"-":-<76}')
197     print(toprint)
198
```

Output:-

i) When input is:

"E":["E+T","T"],
"T":["T*F","F"],
"F":["(E)","i"]

as shown in the following output



ii) When input is:

"A":["A+B","B"],
"B":["B*C","C"],
"C":["(A)","id"]

as shown in the following output