FIRST AND FOLLOW

EX. NO. 5 **Anas Ahmed Ather (RA2011031010006)**

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AIM: To write a program to perform first and follow using any language.

ALGORITHM:

For computing the first:

1. If X is a terminal then FIRST(X) = {X}

Example: F -> I | id

We can write it as FIRST(F) -> { (, id)

2. If X is a non-terminal like E -> T then to get FIRSTI substitute T with other productions until you get a terminal as the first symbol

3. If X -> ε then add ε to FIRST(X).

For computing the follow:

1. Always check the right side of the productions for a non-terminal, whose FOLLOW set is being found. (never see the left side).

2. (a) If that non-terminal (S,A,B…) is followed by any terminal (a,b…,*,+,(,)…) , then add that terminal into the FOLLOW set.

(b) If that non-terminal is followed by any other non-terminal then add FIRST of other nonterminal into the FOLLOW set.

CODE :

```
#include<bits/stdc++.h>
using namespace std;

set<char> ss;
bool dfs(char i, char org, char last, map<char,vector<vector<char>>> &mp){
    bool rtake = false;
    for(auto r : mp[i]){
        bool take = true;
        for(auto s : r){
            if(s == i) break;
            if(!take) break;
            if(!(s>='A'&&s<='Z')&&s!='e'){
                ss.insert(s);
                break;
            }
            else if(s == 'e'){
                if(org == i||i == last)
                ss.insert(s);
                rtake = true;
                break;
            }
            else{
                take = dfs(s,org,r[r.size()-1],mp);
                rtake |= take;
            }
        }
    }
    return rtake;
}

int main(){
    int i,j;
    ifstream fin("inputfirstfollow.txt");
    string num;
    vector<int> fs;
    vector<vector<int>> a;
    map<char,vector<vector<char>>> mp;
    char start;
    bool flag = 0;
    cout<<"Grammar: "<<'\n';
    while(getline(fin,num)){
        if(flag == 0) start = num[0],flag = 1;
        cout<<num<<'\n';
        vector<char> temp;
        char s = num[0];
        for(i=3;i<num.size();i++){
            if(num[i] == '|'){
                mp[s].push_back(temp);
                temp.clear();
```

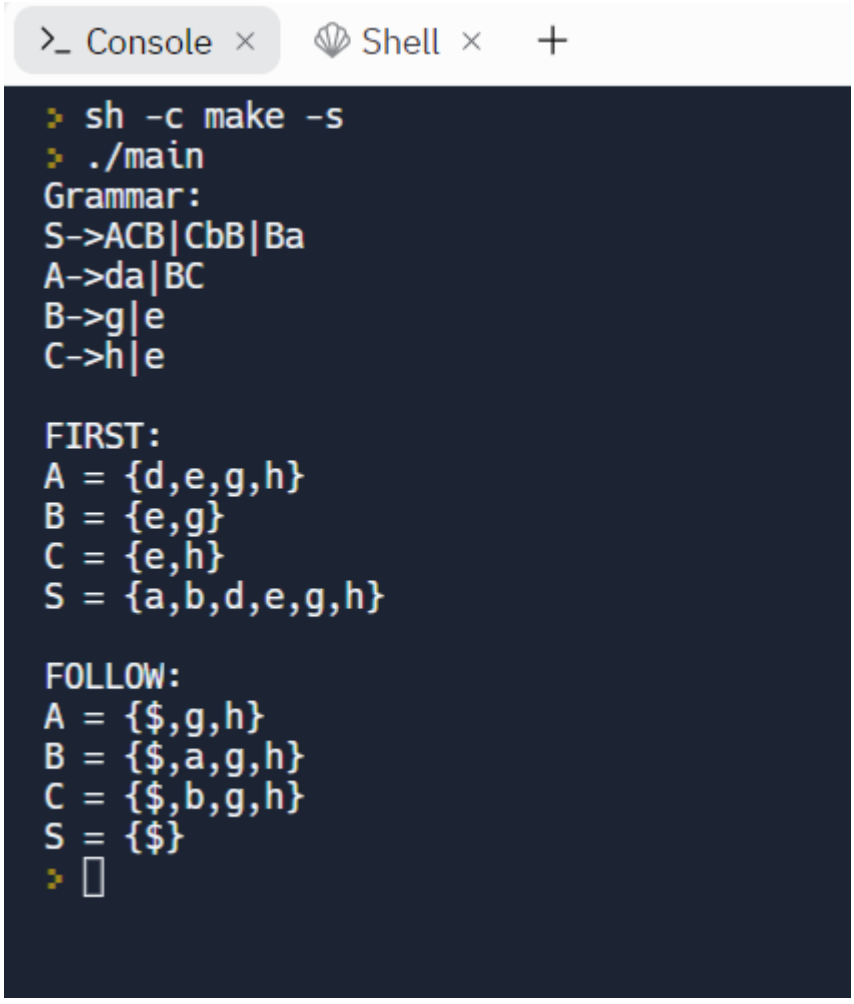
```
        }
        else temp.push_back(num[i]);
    }
    mp[s].push_back(temp);
}
map<char,set<char>> fmp;
for(auto q : mp){
    ss.clear();
    dfs(q.first,q.first,q.first,mp);
    for(auto g : ss) fmp[q.first].insert(g);
}

cout<<'\n';
cout<<"FIRST: "<<'\n';
for(auto q : fmp){
    string ans = "";
    ans += q.first;
    ans += " = {";
    for(char r : q.second){
        ans += r;
        ans += ',';
    }
    ans.pop_back();
    ans+="}";
    cout<<ans<<'\n';
}

map<char,set<char>> gmp;
gmp[start].insert('$');
int count = 10;
while(count--){
    for(auto q : mp){
        for(auto r : q.second){
            for(i=0;i<r.size()-1;i++){
                if(r[i]>='A'&&r[i]<='Z'){
                    if(!(r[i+1]>='A'&&r[i+1]<='Z')) gmp[r[i]].insert(r[i+1]);
                    else {
                        char temp = r[i+1];
                        int j = i+1;
                        while(temp>='A'&&temp<='Z'){
                            if(*fmp[temp].begin()=='e'){
                                for(auto g : fmp[temp]){
                                    if(g=='e') continue;
                                    gmp[r[i]].insert(g);
                                }
                                j++;
                                if(j<r.size()){
                                    temp = r[j];
                                    if(!(temp>='A'&&temp<='Z')){
                                        gmp[r[i]].insert(temp);
```

```
                        break;

                    }
                }
                else{
                    for(auto g : gmp[q.first]) gmp[r[i]].insert(g);
                    break;
                }
            }
            else{
                for(auto g : fmp[temp]){
                    gmp[r[i]].insert(g);
                }
                break;
            }
        }
    }
    if(r[r.size()-1]>='A'&&r[r.size()-1]<='Z'){
        for(auto g : gmp[q.first]) gmp[r[i]].insert(g);
    }
  }
 }
}

cout<<'\n';
cout<<"FOLLOW: "<<'\n';
for(auto q : gmp){
    string ans = "";
    ans += q.first;
    ans += " = {";
    for(char r : q.second){
        ans += r;
        ans += ',';
    }
    ans.pop_back();
    ans+="}";
    cout<<ans<<'\n';
}
return 0;
}
```

inputfirstfollow

S->ACB|CbB|Ba
A->da|BC
B->g|e
C->h|e

OUTPUT :



RESULT: The FIRST and FOLLOW sets of the non-terminals of a grammar were found successfully using C++ language.