Lab task 6

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10 points

Due Feb 18, 11:59 PM

[Lab 6.docx](Lab%206.docx)
Microsoft Word

Class comments

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```python
from collections import defaultdict

def find(grammar):
    first = defaultdict(set)

    def first_rec(sym):
        if sym in first and first[sym]:
            return first[sym]

        if sym not in grammar:
            return {sym}

        result = set()
        for prods in grammar[sym]:
            if prods == "ε":
                result.add("ε")
            else:
                empty = True
                for i, part in enumerate(prods.split()):
                    part_first = first_rec(part)
                    result.update(part_first - {"ε"})
                    if "ε" not in part_first:
                        empty = False
                        break

                if empty:
                    result.add("ε")

        first[sym] = result
        return result

    for non_terminal in grammar:
        first_rec(non_terminal)

    return {k: first[k] for k in grammar}
```

```python
grammar = {
        "S": [" A "],
        "A": [" B C "],
        "B": [" x "," ε "],
        "C": [" y "," ε "],
    }
for x,y in grammar.items():
    print(x,"\t",y)
first_sets = find(grammar)

for variable, first_set in first_sets.items():
    print(f"FIRST({variable}) = {first_set}")
```

OUTPUT

```
PS C:\Users\Samar Mittal\Desktop\Compiler
thon.exe" "c:/Users/Samar Mittal/Desktop/
E        ["T E'"]
E'       ["+ T E'", ' ε ']
T        ["F T'"]
T'       ["* F T'", ' ε ']
F        ['id', '( E )']
FIRST(E) = {'id', '('}
FIRST(E') = {'ε', '+'}
FIRST(T) = {'id', '('}
FIRST(T') = {'*', 'ε'}
FIRST(F) = {'id', '('}
```

TEST CASE 1

```
PS C:\Users\Samar Mittal\Desktop\Compiler LAb\
thon.exe" "c:/Users/Samar Mittal/Desktop/Compi
S        ['A B C']
A        [' a ', ' ε ']
B        [' b ', ' ε ']
C        [' c ']
FIRST(S) = {'b', 'a', 'c'}
FIRST(A) = {'ε', 'a'}
FIRST(B) = {'b', 'ε'}
FIRST(C) = {'c'}
```

TEST CASE 2

TEST CASE 3

TEST CASE 4

```
PS C:\Users\Samar Mittal\Desktop\Compi
thon.exe" "c:/Users/Samar Mittal/Deskt
S        ['A B C']
A        [' a ', ' ε ']
B        [' b ', ' ε ']
C        [' c ']
FIRST(S) = {'b', 'a', 'c'}
FIRST(A) = {'a', 'ε'}
FIRST(B) = {'b', 'ε'}
FIRST(C) = {'c'}
```

```
PS C:\Users\Samar Mittal\Desktop\Co
thon.exe" "c:/Users/Samar Mittal/De
S        [' A ']
A        [' B C ']
B        [' x ', ' ε ']
C        [' y ', ' z ']
FIRST(S) = {'x', 'z', 'y'}
FIRST(A) = {'x', 'z', 'y'}
FIRST(B) = {'ε', 'x'}
FIRST(C) = {'z', 'y'}
```