CSE 401 - LL Parsing and FIRST/FOLLOW/nullable Worksheet - Week 4

1. Compute the FIRST, FOLLOW, and nullable sets for each non-terminal in the following grammar:

```
A ::= x C B y
B ::= z | ε
C ::= y | B x
```

Non-Terminal	FIRST	FOLLOW	nullable
A			
B			
C			

2. For each of the following grammars, identify whether or not the grammar satisfies the LL(1) condition. If the grammar is not LL(1), explain the problem. *Hint*: Although you are not required to follow the formal algorithm, you may find it helpful to examine the grammar in terms of the FIRST, FOLLOW, and nullable sets.

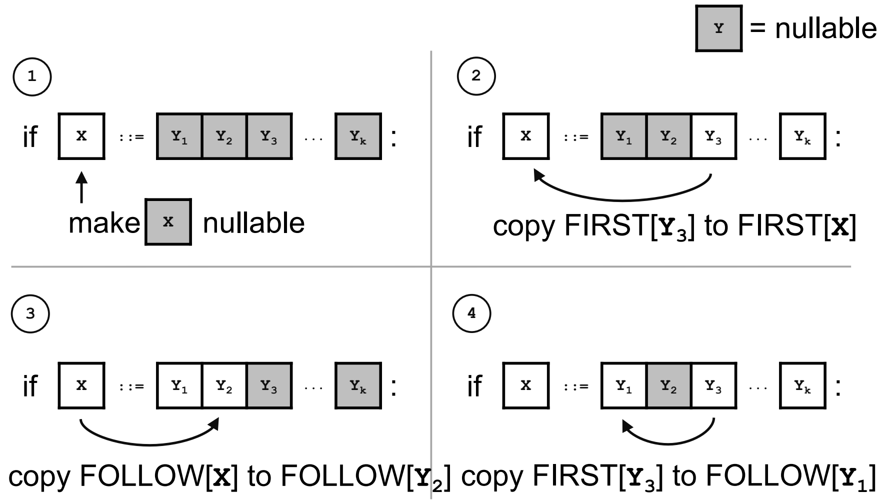
```
a) X ::= a Y | Z
   Y ::= a | c
   Z ::= b Y
```

```
b) P ::= d R
   R ::= o | S
   S ::= g | o g
```

```
c) J ::= a K L
   K ::= c | ε
   L ::= c
```

```
d) J ::= a K L
   K ::= c | ε
   L ::= b
```

Computing FIRST, FOLLOW, & nullable (3)



Computing FIRST, FOLLOW, and nullable

repeat
for each production $X := Y_1\ Y_2\ \ldots\ Y_k$
if $Y_1 \ldots Y_k$ are all nullable (or if $k = 0$)
set nullable[X] = true
for each i from 1 to k and each j from i +1 to k
if $Y_1 \ldots Y_{i-1}$ are all nullable (or if $i = 1$)
add FIRST[Y_i] to FIRST[X]
if $Y_{i+1} \ldots Y_k$ are all nullable (or if $i = k$)
add FOLLOW[X] to FOLLOW[Y_i]
if $Y_{i+1} \ldots Y_{j-1}$ are all nullable (or if i+1=j)
add FIRST[Y_j] to FOLLOW[Y_i]
Until FIRST, FOLLOW, and nullable do not change

Canonical FIRST & FIRST FOLLOW conflicts & their solutions:

FIRST Conflict:
Both productions of A have α in their FIRST sets
0. A ::= αβ | αγ

Solution:
Factor out the prefix (α)
0. A ::= α Tail
1. Tail ::= β | γ

FIRST FOLLOW Conflict:
B is nullable, α in FIRST & FOLLOW
0. A ::= B α
1. B ::= α | ε

Solution:
Substitute B into A
0. A ::= αα | α
Factor out the prefix (α)
0. A ::= α Tail
1. Tail ::= α | ε