Ex: FIRST sets calculation

$$
\begin{array}{lcl}
E & \rightarrow & T\ E' \\
E' & \rightarrow & \epsilon \mid \mathbf{+}\ E \\
T & \rightarrow & P\ T' \\
T' & \rightarrow & \epsilon \mid \mathbf{*}\ T \\
P & \rightarrow & \mathbf{id} \mid \mathbf{(}\ E\ \mathbf{)}
\end{array}
$$

$fsts_0$:

E	
E'	
T	
T'	
P	

$fsts_1$:

E	
E'	
T	
T'	
P	

$fsts_2$:

E	
E'	
T	
T'	
P	

$fsts_3$:

E	
E'	
T	
T'	
P	

$fsts_4$:

E	
E'	
T	
T'	
P	

Ex: FIRST sets calculation

$$
\begin{array}{lcl}
S & \rightarrow & A\ \mathbf{b} \\
A & \rightarrow & \mathbf{a} \mid B \mid \epsilon \\
B & \rightarrow & \mathbf{b} \mid \epsilon
\end{array}
$$

$fsts_0$:

S	
A	
B	

$fsts_1$:

s	
A	
B	

$fsts_2$:

S	
A	
B	

$fsts_3$:

S	
A	
B	

Ex: FOLLOW sets calculation

$$
\begin{array}{lcl}
E & \rightarrow & T\ E' \\
E' & \rightarrow & \epsilon \mid + \ E \\
T & \rightarrow & P\ T' \\
T' & \rightarrow & \epsilon \mid * \ T \\
P & \rightarrow & \textbf{id} \mid (\ E\ )
\end{array}
$$

$FIRST$:

E	**id, (**
E'	**•, +**
T	**id, (**
T'	**•, +**
P	**id, (**

$flws_0$:

E	
E'	
T	
T'	
P	

$flws_1$:

E	
E'	
T	
T'	
P	

$flws_2$:

E	
E'	
T	
T'	
P	

$flws_3$:

E	
E'	
T	
T'	
P	

Ex: FOLLOW sets calculation

$$
\begin{array}{lcl}
S & \rightarrow & A\ \mathbf{b} \\
A & \rightarrow & \mathbf{a} \mid B \mid \epsilon \\
B & \rightarrow & \mathbf{b} \mid \epsilon
\end{array}
$$

$flws_0$:

S	
A	
B	

$flws_1$:

S	
A	
B	

$flws_2$:

S	
A	
B	

$flws_3$:

S	
A	
B	

Putting it all together (cont.)

- **Calculate set F for each right-hand side:**

$F_{E,1} = \{ \qquad \}$

$F_{E',1} = \{ \qquad \}$ $F_{E',2} = \{ \qquad \}$

$F_{T,1} = \{ \qquad \}$

$F_{T',1} = \{ \qquad \}$ $F_{T',2} = \{ \qquad \}$

$F_{P,1} = \{ \qquad \}$ $F_{P,2} = \{ \qquad \}$

- **Is this grammar LL(1)?**

Another example: FIRST sets

$$
\begin{array}{lcl}
S & \rightarrow & A\ B\ A \mid \textbf{c}\ C \\
A & \rightarrow & \textbf{a} \mid \epsilon \\
B & \rightarrow & \textbf{b}\ D \mid \epsilon \\
C & \rightarrow & A\ D \mid \textbf{b} \\
D & \rightarrow & \textbf{a}\ A \mid \textbf{c}
\end{array}
$$

$fsts_0$:

S	
A	
B	
C	
D	

$fsts_1$:

S	
A	
B	
C	
D	

$fsts_2$:

S	
A	
B	
C	
D	

$fsts_3$:

S	
A	
B	
C	
D	

Another example (cont.): FOLLOW sets

$$
\begin{array}{lcl}
S & \rightarrow & A\ B\ A \mid \mathbf{c}\ C \\
A & \rightarrow & \mathbf{a} \mid \epsilon \\
B & \rightarrow & \mathbf{b}\ D \mid \epsilon \\
C & \rightarrow & A\ D \mid \mathbf{b} \\
D & \rightarrow & \mathbf{a}\ A \mid \mathbf{c}
\end{array}
$$

$FIRST$:

S	
A	
B	
C	
D	

$flws_0$:

S	
A	
B	
C	
D	

$flws_1$:

S	
A	
B	
C	
D	

$flws_2$:

S	
A	
B	
C	
D	

$flws_3$:

S	
A	
B	
C	
D	