Example of constructing ***first*** sets

Grammar:

$$
\begin{array}{lcl}
\underline{e} & \rightarrow & \underline{t}\ \underline{e'} \\
\underline{e'} & \rightarrow & + \underline{t}\ \underline{e'} \\
\underline{e'} & \rightarrow & \varepsilon \\
 & & \\
\underline{t} & \rightarrow & \underline{f}\ \underline{t'} \\
\underline{t'} & \rightarrow & * \underline{f}\ \underline{t'} \\
\underline{t'} & \rightarrow & \varepsilon \\
 & & \\
\underline{f} & \rightarrow & (\ \underline{e}\ ) \\
\underline{f} & \rightarrow & x \\
\underline{f} & \rightarrow & y
\end{array}
$$

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	
$\underline{t}$	
$\underline{t'}$	
$\underline{f}$	

Grammar:

$\underline{e}$	$\rightarrow$	$\underline{t}\ \underline{e'}$
$\underline{e'}$	$\rightarrow$	$+\ \underline{t}\ \underline{e'}$
$\underline{e'}$	$\rightarrow$	ε
$\underline{t}$	$\rightarrow$	$\underline{f}\ \underline{t'}$
$\underline{t'}$	$\rightarrow$	$*\ \underline{f}\ \underline{t'}$
$\underline{t'}$	$\rightarrow$	ε
$\underline{f}$	$\rightarrow$	$(\ \underline{e}\ )$
$\underline{f}$	$\rightarrow$	x
$\underline{f}$	$\rightarrow$	y

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	$\{\ \varepsilon\ \}$
$\underline{t}$	
$\underline{t'}$	
$\underline{f}$	

Grammar:

$$
\begin{array}{lcl}
\underline{e} & \rightarrow & \underline{t}\ \underline{e'} \\
\underline{e'} & \rightarrow & + \underline{t}\ \underline{e'} \\
 & & \\
 & & \\
\underline{t} & \rightarrow & \underline{f}\ \underline{t'} \\
\underline{t'} & \rightarrow & * \underline{f}\ \underline{t'} \\
\underline{t'} & \rightarrow & \varepsilon \\
 & & \\
\underline{f} & \rightarrow & (\ \underline{e}\ ) \\
\underline{f} & \rightarrow & x \\
\underline{f} & \rightarrow & y
\end{array}
$$

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	$\{ \varepsilon \}$
$\underline{t}$	
$\underline{t'}$	$\{ \varepsilon \}$
$\underline{f}$	

Grammar:

$$
\begin{array}{lcl}
\underline{e} & \rightarrow & \underline{t}\ \underline{e'} \\
\underline{e'} & \rightarrow & + \underline{t}\ \underline{e'} \\
 & & \\
\underline{t} & \rightarrow & \underline{f}\ \underline{t'} \\
\underline{t'} & \rightarrow & * \underline{f}\ \underline{t'} \\
 & & \\
\underline{f} & \rightarrow & (\ \underline{e}\ ) \\
\underline{f} & \rightarrow & x \\
\underline{f} & \rightarrow & y
\end{array}
$$

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	$\{ \varepsilon \}$
$\underline{t}$	
$\underline{t'}$	$\{ \varepsilon \}$
$\underline{f}$	$\{ \text{'y'} \}$

Grammar:

$$
\begin{array}{lcl}
\underline{e} & \rightarrow & \underline{t}\ \underline{e'} \\
\underline{e'} & \rightarrow & + \underline{t}\ \underline{e'} \\
 & & \\
\underline{t} & \rightarrow & \underline{f}\ \underline{t'} \\
\underline{t'} & \rightarrow & * \underline{f}\ \underline{t'} \\
 & & \\
\underline{f} & \rightarrow & (\ \underline{e}\ ) \\
\underline{f} & \rightarrow & x
\end{array}
$$

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	$\{ \varepsilon \}$
$\underline{t}$	
$\underline{t'}$	$\{ \varepsilon \}$
$\underline{f}$	{ ‘y’, ‘x’ }

Grammar:

$$
\begin{aligned}
\underline{e} &\rightarrow \underline{t}\ \underline{e'} \\
\underline{e'} &\rightarrow + \underline{t}\ \underline{e'} \\
\\
\underline{t} &\rightarrow \underline{f}\ \underline{t'} \\
\underline{t'} &\rightarrow * \underline{f}\ \underline{t'} \\
\\
\underline{f} &\rightarrow (\underline{e})
\end{aligned}
$$

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	$\{ \varepsilon \}$
$\underline{t}$	
$\underline{t'}$	$\{ \varepsilon \}$
$\underline{f}$	{ ‘y’, ‘x’, ‘(’ }

Grammar:

$$
\begin{aligned}
\underline{e} &\rightarrow \underline{t}\ \underline{e'} \\
\underline{e'} &\rightarrow + \underline{t}\ \underline{e'} \\
\\
\underline{t} &\rightarrow \underline{f}\ \underline{t'} \\
\underline{t'} &\rightarrow * \underline{f}\ \underline{t'}
\end{aligned}
$$

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	$\{ \varepsilon \}$
$\underline{t}$	
$\underline{t'}$	$\{ \varepsilon, \text{'*'} \}$
$\underline{f}$	$\{ \text{'y'}, \text{'x'}, \text{'('} \}$

Grammar:

$\underline{e} \rightarrow \underline{t}\ \underline{e'}$

$\underline{e'} \rightarrow + \underline{t}\ \underline{e'}$

$\underline{t} \rightarrow \underline{f}\ \underline{t'}$

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	$\{ \varepsilon \}$
$\underline{t}$	{ ‘y’, ‘x’, ‘(’ }
$\underline{t'}$	$\{ \varepsilon,$ ‘*’ }
$\underline{f}$	{ ‘y’, ‘x’, ‘(’ }

Grammar:

$\underline{e} \rightarrow \underline{t}\ \underline{e'}$

$\underline{e'} \rightarrow + \underline{t}\ \underline{e'}$

first sets:

Non-terminal	*first* set
$\underline{e}$	
$\underline{e'}$	{ ε, '+' }
$\underline{t}$	{ 'y', 'x', '(' }
$\underline{t'}$	{ ε, '*' }
$\underline{f}$	{ 'y', 'x', '(' }

Grammar:

$\underline{e} \rightarrow \underline{t}\ \underline{e'}$

first sets:

Non-terminal	*first* set
$\underline{e}$	{ ‘y’, ‘x’, ‘(’ }
$\underline{e'}$	{ ε, ‘+’ }
$\underline{t}$	{ ‘y’, ‘x’, ‘(’ }
$\underline{t'}$	{ ε, ‘*’ }
$\underline{f}$	{ ‘y’, ‘x’, ‘(’ }