Example of computing a *CLOSURE* of a set of items

Question

$\underline{s}$	$\rightarrow$	$\underline{e}$
$\underline{e}$	$\rightarrow$	$\underline{e} + \underline{v}$
	$\mid$	$\underline{v}$
$\underline{v}$	$\rightarrow$	x
	$\mid$	y

What is *CLOSURE*($\{ \underline{s} \rightarrow \cdot \underline{e} \}$)?

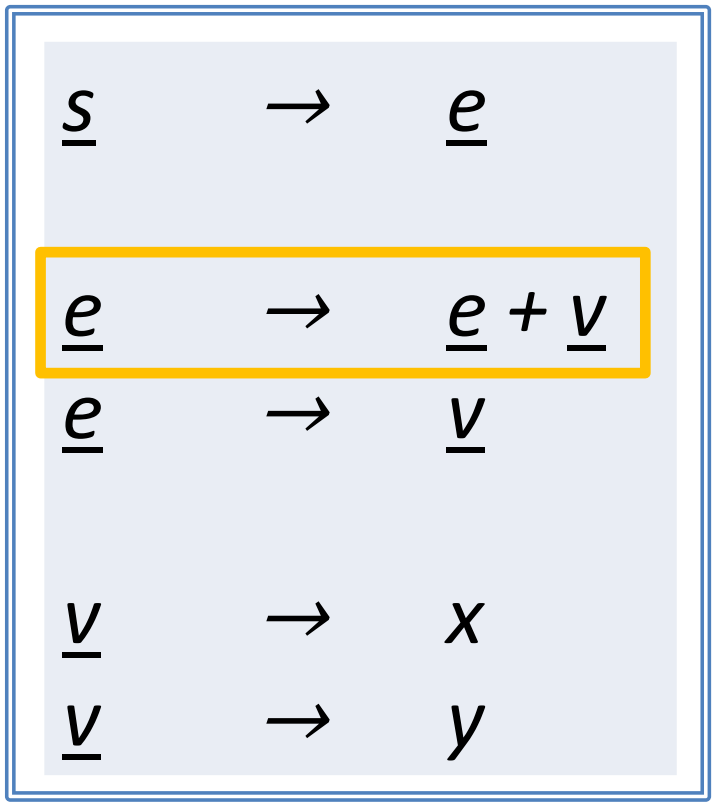
First iteration

$\underline{s}$	$\rightarrow$	$\underline{e}$
$\underline{e}$	$\rightarrow$	$\underline{e} + \underline{v}$
	/	$\underline{v}$
$\underline{v}$	$\rightarrow$	x
	/	y

$$\textit{CLOSURE}(\{\ \underline{s} \rightarrow \cdot \underline{e}\ \})$$

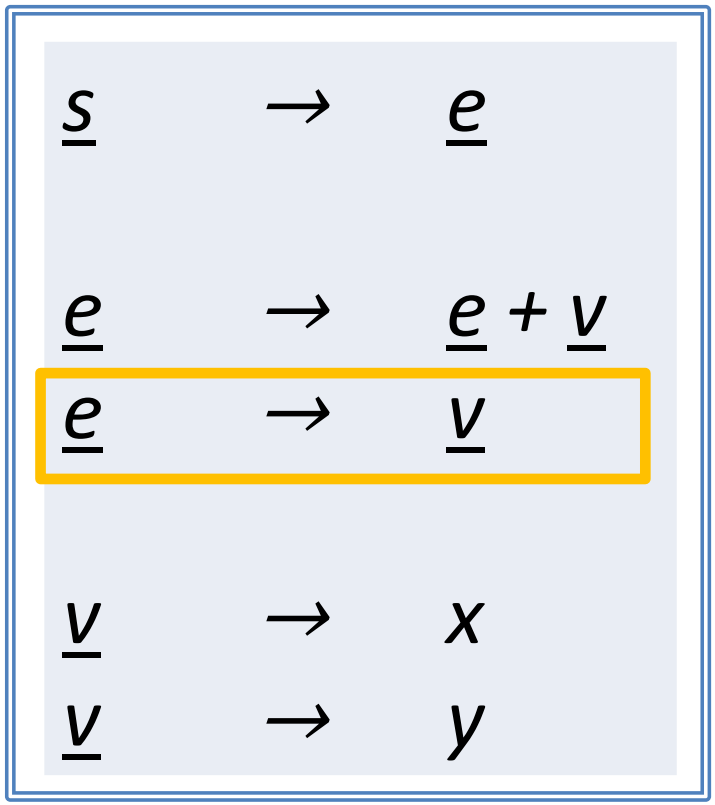
$$= \{\quad \underline{s} \rightarrow \cdot \underline{e} \qquad \}$$

Second iteration



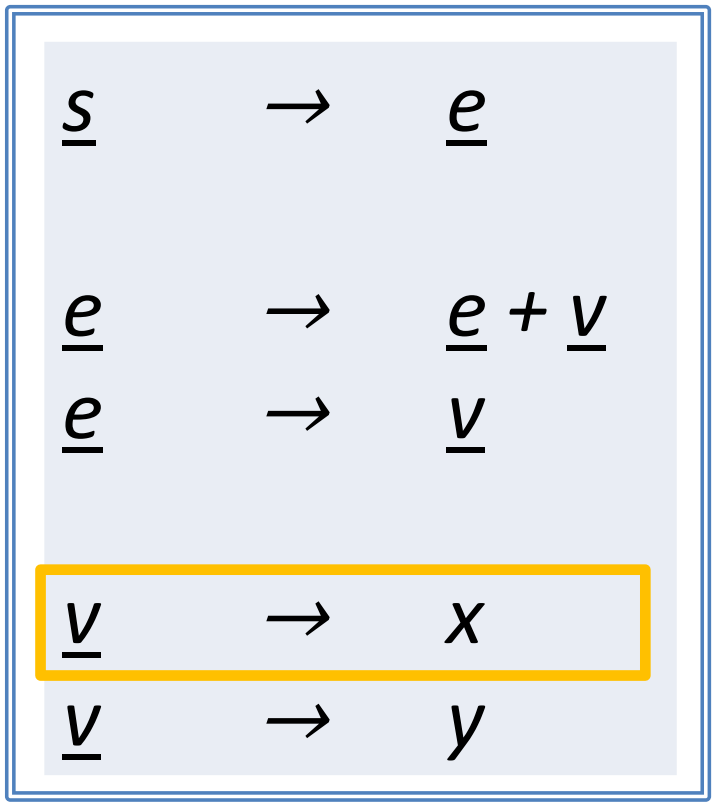
$$\begin{aligned} &\textsc{Closure}(\{\, \underline{s} \rightarrow \cdot\, \underline{e} \,\}) \\ = \{ \;& \underline{s} \rightarrow \cdot\, \underline{e} \\ , \;& \underline{e} \rightarrow \cdot\, \underline{e} + \underline{v} \\ \} \end{aligned}$$

Second iteration



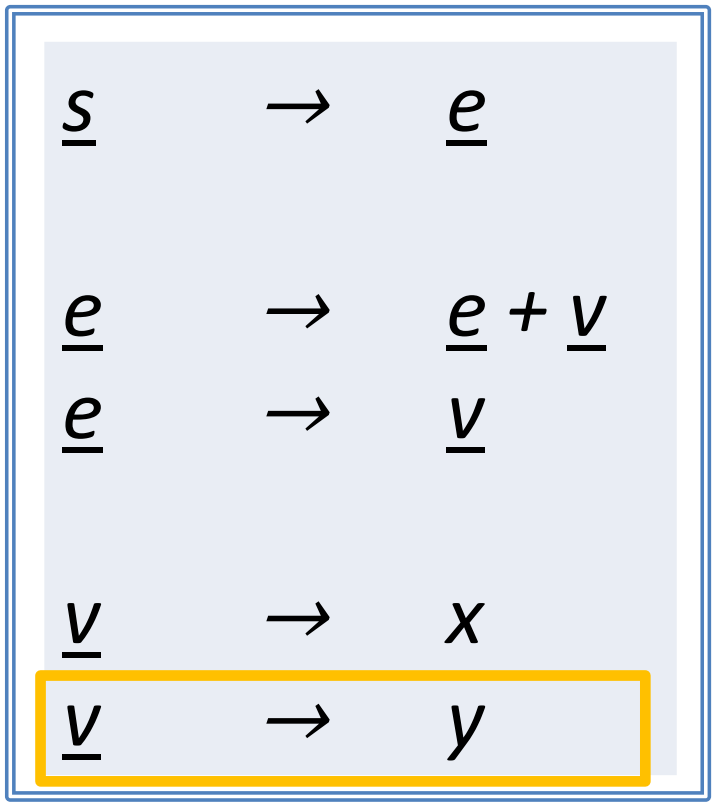
$$
\begin{aligned}
&\textsc{Closure}(\{\ \underline{s} \rightarrow \cdot\, \underline{e}\ \}) \\
= \{\ &\underline{s} \rightarrow \cdot\, \underline{e} \\
, \ &\underline{e} \rightarrow \cdot\, \underline{e} + \underline{v} \\
, \ &\underline{e} \rightarrow \cdot\, \underline{v} \\
\}&
\end{aligned}
$$

Third iteration



$$
\begin{aligned}
&\textsc{Closure}(\{\ \underline{S} \rightarrow \cdot\, \underline{E}\ \}) \\
= \{\ &\underline{S} \rightarrow \cdot\, \underline{E} \\
, \ &\underline{E} \rightarrow \cdot\, \underline{E} + \underline{V} \\
, \ &\underline{E} \rightarrow \cdot\, \underline{V} \\
, \ &\underline{V} \rightarrow \cdot\, x \\
\}\ &
\end{aligned}
$$

Third iteration



$$
\begin{aligned}
&\textsc{Closure}(\{\ \underline{s} \rightarrow \cdot\, \underline{e}\ \}) \\
= \{\ &\underline{s} \rightarrow \cdot\, \underline{e} \\
, \ &\underline{e} \rightarrow \cdot\, \underline{e} + \underline{v} \\
, \ &\underline{e} \rightarrow \cdot\, \underline{v} \\
, \ &\underline{v} \rightarrow \cdot\, x \\
, \ &\underline{v} \rightarrow \cdot\, y \\
\}\ &
\end{aligned}
$$

Final result

$\underline{s}$	$\rightarrow$	$\underline{e}$
$\underline{e}$	$\rightarrow$	$\underline{e} + \underline{v}$
$\underline{e}$	$\rightarrow$	$\underline{v}$
$\underline{v}$	$\rightarrow$	x
$\underline{v}$	$\rightarrow$	y

$$
\begin{aligned}
&\textit{CLOSURE}(\{\ \underline{s} \rightarrow \cdot \underline{e}\ \}) \\
= \{\ & \underline{s} \rightarrow \cdot \underline{e} \\
, \ & \underline{e} \rightarrow \cdot \underline{e} + \underline{v} \\
, \ & \underline{e} \rightarrow \cdot \underline{v} \\
, \ & \underline{v} \rightarrow \cdot x \\
, \ & \underline{v} \rightarrow \cdot y \\
\}\ &
\end{aligned}
$$