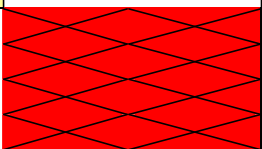
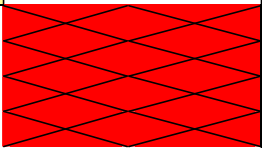


&I	$\begin{array}{c} \mathcal{A} \quad \mathcal{A} \\ B \quad B \\ \hline \mathcal{A} \& B \quad B \& \mathcal{A} \end{array}$	&O	$\begin{array}{c} \mathcal{A} \& B \quad \mathcal{A} \& B \\ \hline \mathcal{A} \quad B \end{array}$	\sim&O	$\begin{array}{c} \sim(\mathcal{A} \& B) \\ \hline \mathcal{A} \rightarrow \sim B \end{array}$	&D	$\begin{array}{l} \text{SHOW: } \mathcal{A} \& B \\ \text{SHOW: } \mathcal{A} \\ \\ \text{SHOW: } B \end{array}$
\veeI	$\begin{array}{c} \mathcal{A} \quad \mathcal{A} \\ \hline \mathcal{A} \vee B \quad B \vee \mathcal{A} \end{array}$	\veeO	$\begin{array}{c} \mathcal{A} \vee B \quad \mathcal{A} \vee B \\ \sim \mathcal{A} \quad \sim B \\ \hline B \quad \mathcal{A} \end{array}$	$\sim$$\vee$O	$\begin{array}{c} \sim(\mathcal{A} \vee B) \\ \hline \sim \mathcal{A} \\ \sim B \end{array}$	\veeD	$\begin{array}{l} \text{(ID)} \\ \text{SHOW: } \mathcal{A} \vee B \\ \sim(\mathcal{A} \vee B) \\ \text{SHOW: } \times \end{array}$
\leftrightarrowI	$\begin{array}{c} \mathcal{A} \rightarrow B \quad \mathcal{A} \rightarrow B \\ B \rightarrow \mathcal{A} \quad B \rightarrow \mathcal{A} \\ \hline \mathcal{A} \leftrightarrow B \quad B \leftrightarrow \mathcal{A} \end{array}$	\leftrightarrowO	$\begin{array}{c} \mathcal{A} \leftrightarrow B \quad \mathcal{A} \leftrightarrow B \\ \hline \mathcal{A} \rightarrow B \quad B \rightarrow \mathcal{A} \end{array}$	$\sim$$\leftrightarrow$O	$\begin{array}{c} \sim(\mathcal{A} \leftrightarrow B) \\ \hline \sim \mathcal{A} \leftrightarrow B \end{array}$	\leftrightarrowD	$\begin{array}{l} \text{SHOW: } \mathcal{A} \leftrightarrow B \\ \text{SHOW: } \mathcal{A} \rightarrow B \\ \\ \text{SHOW: } B \rightarrow \mathcal{A} \end{array}$
\rightarrowI	see CD 	\rightarrowO	$\begin{array}{c} \mathcal{A} \rightarrow C \quad \mathcal{A} \rightarrow C \\ \mathcal{A} \quad \sim C \\ \hline C \quad \sim \mathcal{A} \end{array}$	$\sim$$\rightarrow$O	$\begin{array}{c} \sim(\mathcal{A} \rightarrow C) \\ \hline \mathcal{A} \& \sim C \end{array}$	CD	$\begin{array}{l} \text{SHOW: } \mathcal{A} \rightarrow C \\ \mathcal{A} \\ \text{SHOW: } C \end{array}$
DN	$\begin{array}{c} \mathcal{A} \\ \hline \sim \sim \mathcal{A} \end{array}$	DN	$\begin{array}{c} \sim \sim \mathcal{A} \\ \hline \mathcal{A} \end{array}$	Rep	$\begin{array}{c} \mathcal{A} \\ \hline \mathcal{A} \end{array}$	\simD	$\begin{array}{l} \text{SHOW: } \sim \mathcal{A} \\ \mathcal{A} \\ \text{SHOW: } \times \end{array}$
\timesI	$\begin{array}{c} \mathcal{A} \\ \sim \mathcal{A} \\ \hline \times \end{array}$	\timesO	$\begin{array}{c} \times \\ \hline \mathcal{A} \end{array}$	DD	$\begin{array}{l} \text{SHOW: } \mathcal{A} \\ \\ \mathcal{A} \end{array}$	ID	$\begin{array}{l} \text{SHOW: } \mathcal{A} \\ \sim \mathcal{A} \\ \text{SHOW: } \times \end{array}$

PREDICATE LOGIC

In the following, v is any variable; $F[v]$ is any formula in which v occurs free;
 $F[o]$ results by substituting o for every free occurrence of v , where o is any **old name**.
 $F[n]$ results by substituting n for every free occurrence of v , where n is any **new name**.
 A name counts as **old** if it occurs in a line that is neither boxed nor cancelled;
 otherwise it counts as **new**.

\forallI	see UD 	\forallO	$\begin{array}{c} \forall v F[v] \\ \hline F[o] \quad \text{old} \end{array}$	$\sim$$\forall$O	$\begin{array}{c} \sim \forall v \Phi \\ \hline \exists v \sim \Phi \end{array}$	\forallD	$\begin{array}{l} \text{SHOW: } \forall v F[v] \\ \text{new} \\ \text{SHOW: } F[n] \end{array}$
\existsI	$\begin{array}{c} F[o] \quad \text{old} \\ \hline \exists v F[v] \end{array}$	\existsO	$\begin{array}{c} \exists v F[v] \\ \hline F[n] \quad \text{new} \end{array}$	$\sim$$\exists$O	$\begin{array}{c} \sim \exists v \Phi \\ \hline \forall v \sim \Phi \end{array}$	\existsD	$\begin{array}{l} \text{(ID)} \\ \text{SHOW: } \exists v F[v] \\ \sim \exists v F[v] \\ \text{SHOW: } \times \end{array}$