

$$\begin{array}{c}
\frac{}{\vdash \textcolor{red}{p}^\perp \Downarrow [\cdot][\cdot]p; \cdot} \text{I} \\
\hline
\vdash [\cdot][1 : p]\cdot; \cdot //^1 \vdash [\cdot][\cdot]p^\perp; \cdot \quad \text{K} \\
\hline
\vdash [\cdot][1 : p]\cdot; \cdot //^1 \vdash [\cdot][\cdot]\cdot; p^\perp \quad * \\
\hline
\vdash \textcolor{red}{!}^1 p^\perp \Downarrow [\cdot][1 : p]\cdot; \cdot \quad ! \\
\hline
\vdash [\cdot][2 : \textcolor{red}{!}^1 p^\perp]\cdot; \cdot //^2 \vdash [\cdot][\cdot]\cdot; ?^1 p \quad \text{K} \\
\hline
\vdash [\cdot][2 : \textcolor{red}{!}^1 p^\perp]\cdot; \cdot //^2 \vdash [\cdot][\cdot]\cdot; ?^1 p \quad * \\
\hline
\vdash [\cdot][2 : ?^1 p, 2 : \textcolor{red}{!}^1 p^\perp]\cdot; \cdot \quad \text{D} \\
\hline
\vdash [\cdot][\cdot]\cdot; ?^2 ?^1 p, ?^2 \textcolor{red}{!}^1 p^\perp \quad *
\end{array}$$