

$$\frac{\neg(P \supset U)}{\neg(P \supset U)} \text{ (E)} \quad \frac{\neg(P \supset U)}{\neg(P \supset U)} \text{ (E)}$$

$$\frac{U}{P \supset U} \text{ (I)}$$

$$\frac{U}{P} \text{ (E)} \quad \frac{[\neg \neg P \supset \neg \neg U]}{\neg P} \text{ (MT)} \quad \frac{\neg U}{\neg U} \text{ (MT)}$$

$$\frac{\neg U}{U} \text{ (E)}$$

$$\frac{\neg(P \supset U)}{\neg(P \supset U)} \text{ (E)}$$

$$\frac{P \supset U}{P \supset U} \text{ (E)}$$

$$1) \quad \frac{\neg \neg(P \supset U)}{\neg \neg(P \supset U)} \text{ (I)}$$

$$\begin{array}{c} W \\ \hline \neg(\neg\neg P \rightarrow P) \text{ (e1)} \end{array} \quad \begin{array}{c} TP \text{ (i1)} \\ \hline \neg\neg P \rightarrow P \end{array} \quad \begin{array}{c} \text{intro} \\ \hline \text{(e2)} \end{array}$$

$$\begin{array}{c} U \\ \hline \neg\neg P \text{ (e1)} \end{array} \quad \begin{array}{c} \perp \text{ (i1)} \\ \hline \neg P \text{ (e1)} \end{array} \quad T$$

$$\begin{array}{c} \perp \\ \hline \text{(ex falso)} \\ \hline P \text{ (i1)} \end{array}$$

$$\begin{array}{c} W \\ \hline \neg(\neg\neg\neg P \rightarrow \neg P) \text{ (e1)} \end{array} \quad \begin{array}{c} U \\ \hline \neg\neg P \rightarrow P \text{ (e2)} \end{array}$$

$$\begin{array}{c} \perp \text{ (i2)} \\ \hline W \\ \hline \neg\neg\neg\neg P \rightarrow \neg\neg P \end{array}$$

2)

$$\frac{W}{\neg((P \rightarrow U) \rightarrow P) \rightarrow P}$$

$$\frac{U}{\frac{P}{(P \rightarrow U) \rightarrow P} \rightarrow P}$$

$$\frac{\perp}{U}$$

$$\frac{X}{(P \rightarrow U) \rightarrow P}$$

$$\frac{U}{P \rightarrow U}$$

$$\frac{W}{\neg((P \rightarrow U) \rightarrow P) \rightarrow P}$$

$$\frac{P}{((P \rightarrow U) \rightarrow P) \rightarrow P} X$$

$$\frac{\perp}{(e1)}$$

$$3) \frac{W}{\neg((P \rightarrow U) \rightarrow P) \rightarrow P}$$