

(Ax)

$$\frac{\neg P \rightarrow \perp, \neg P \vdash \neg P \rightarrow \perp}{\neg P \rightarrow \perp} (e \rightarrow)$$

$$\frac{\neg P \rightarrow \perp, \neg P \vdash \neg P}{\neg P} (e \rightarrow)$$

$$\frac{\neg P \rightarrow \perp, \neg P \vdash \perp}{\neg P} (i \neg)$$

$$\frac{\neg P \rightarrow \perp \vdash \neg \neg P}{\neg \neg P} (i \neg \neg)$$

$$\neg P \rightarrow \perp \vdash P$$

2)

$$\frac{\neg \neg P, \neg P \vdash \neg \neg P}{\neg \neg P} (e \neg)$$

$$\frac{\neg \neg P, \neg P \vdash \neg P}{\neg \neg P} (e \neg)$$

$$\frac{\neg \neg P, \neg P \vdash \perp}{\neg \neg P} (PBC)$$

$$\neg \neg P \vdash P$$

1)

$$\frac{W, \neg P, P \vdash P \text{ (e}\neg\text{)}}{P, W, \neg P \vdash \neg P \text{ (e}\neg\text{)}}$$

$$\frac{P, W, \neg P \vdash \perp \text{ (E}\neg\text{)}}{P, W, \neg P \vdash U \text{ (i}\neg\text{)}}$$

$$\frac{P, W, \neg P \vdash U \text{ (i}\neg\text{)}}{W, \neg P \vdash P \rightarrow U \text{ (e}\rightarrow\text{)}}$$

$$\frac{7P, W \vdash W \text{ (e}\neg\text{)}}{W, \neg P \vdash P \text{ (e}\neg\text{)}}$$

$$\frac{W, \neg P \vdash P \rightarrow U \text{ (e}\rightarrow\text{)}}{W, \neg P \vdash P \text{ (e}\neg\text{)}}$$

$$\frac{W, \neg P \vdash \neg P \text{ (e}\neg\text{)}}{W, \neg P \vdash \perp \text{ (PBC)}}$$

$$\frac{W \vdash P \text{ (i}\neg\text{)}}{W \vdash P \text{ (i}\neg\text{)}}$$

$$\frac{W \vdash P \text{ (i}\neg\text{)}}{W \vdash P \text{ (i}\neg\text{)}}$$

$$\vdash (P \rightarrow U) \rightarrow P \rightarrow P$$

4)

(Ax)

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$$\frac{P, W, \neg P \vdash P \text{ (e}\neg\text{)}}{P, W, \neg P \vdash \neg P \text{ (e}\neg\text{)}}$$

$$\frac{P, W, \neg P \vdash \neg P \text{ (e}\neg\text{)}}{P, W, \neg P \vdash \perp \text{ (E}\neg\text{)}}$$

$$\frac{P, W, \neg P \vdash \perp \text{ (E}\neg\text{)}}{P, W, \neg P \vdash U \text{ (i}\neg\text{)}}$$

$$\frac{W \vdash W \text{ (e}\neg\text{)}}{W, \neg P \vdash P \rightarrow U \text{ (e}\rightarrow\text{)}}$$

$$\frac{W, \neg P \vdash P \rightarrow U \text{ (e}\rightarrow\text{)}}{W, \neg P \vdash P \text{ (e}\neg\text{)}}$$

$$\frac{W, \neg P \vdash \neg P \text{ (e}\neg\text{)}}{W, \neg P \vdash \perp \text{ (PBC)}}$$

$$\frac{W, \neg P \vdash P \text{ (e}\neg\text{)}}{W, \neg P \vdash \perp \text{ (PBC)}}$$

$$\frac{W, \neg P \vdash \perp \text{ (PBC)}}{W \vdash \neg \neg P \text{ (i}\neg\text{)}}$$

$$\frac{W \vdash \neg \neg P \text{ (i}\neg\text{)}}{W \vdash P \text{ (i}\neg\text{)}}$$

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

$$\vdash (P \rightarrow U) \rightarrow P \rightarrow P$$

3)

$$\frac{[(A \vee \neg A) \rightarrow \neg A]^U}{(A \vee \neg A) \rightarrow \neg A}$$

$$\frac{[A]^{\exists}}{A \vee \neg A}$$

$$\neg A$$

$$[A]^{\exists}$$

$$\frac{\perp}{(\neg i)^{\exists}}$$

$$\frac{\neg A}{(\vee i)}$$

$$\frac{A \vee \neg A}{(\neg i)^U}$$

(LP)

$$\frac{((A \vee \neg A) \rightarrow A) \rightarrow ((A \vee \neg A) \rightarrow (A \vee \neg A))}{((A \vee \neg A) \rightarrow A) \rightarrow ((A \vee \neg A) \rightarrow (A \vee \neg A))}$$

(6)

$$A \vee \neg A$$

(ca)