16.3 rework

a) $w \vDash \neg[(\Box A \wedge \Diamond B) \Rightarrow \Diamond(A \wedge B)]$

(1) $w \vDash \Box A \wedge \Diamond B$

(2) $w \vDash \neg\Diamond(A \wedge B)$

(3), (4) $\}$ z(1)

(3) $w \vDash \Diamond B$

(4) $w \vDash \Box A$

(5) z (2)

$w \vDash \Box \neg(A \wedge B)$

$w_2 \vDash B \quad \exists w_2 \in \Gamma(w)$

$w_1 \vDash A \quad \forall w_1 \in \Gamma(w)$

$w_3 \vDash \neg(A \wedge B) \quad \forall w_3 \in \Gamma(w)$

$w_3 \vDash \neg A \vee \neg B$

$w_3 \vDash \neg A$ X

$w_3 \vDash \neg B$ X

Ton.

$w \models \neg$ b) $(\Diamond \neg A \wedge \Box B) \Rightarrow \Box(a \Rightarrow B)$

$w \models \Diamond \neg A \wedge \Box B$

$w \models \neg \Box (A \Rightarrow B)$

$w \models \Diamond \neg A$

$w \models \Box B$

$w \models \Diamond \neg (A \Rightarrow B)$

$(\exists)$ $w_1 \models \neg A$ $\exists w_1 \in \Gamma(w)$

$(\forall)$ $w_2 \models B$ $\forall w_2 \in \Gamma(w)$

$(\exists)$ $w_3 \models \neg (A \Rightarrow B)$ $\exists w_3 \in \Gamma(w)$

$w_3 \models A$

$w_3 \models \neg B$

$\times$

$w \models \neg$ [c) $\Diamond(A \vee B) \Leftrightarrow (\Diamond A \vee \Diamond B)$]

$w \models \Diamond(A \vee B)$ | $w \models \neg\Diamond(A \vee B)$

$w \models \neg(\Diamond A \vee \Diamond B)$ | $w \models \Diamond A \vee \Diamond B$

$(\exists)\ w_1 \models A \vee B$ | $w \models \Box\neg(A \vee B)$

$w \models \Box\neg A \wedge \Box\neg B$ | $w \models \Diamond A \vee \Diamond B$

$w_1 \models A \vee B$ | $(\forall)\ w_4 \models \neg(A \vee B)$

$(\forall)\ w_2 \models \neg A$ | $w_4 \models \neg A \wedge \neg B$

$(\forall)\ w_3 \models \neg B$ | $w_4 \models \neg A$, $w_4 \models \neg B$

$w_1 \models A$ X | $w_1 \models B$ X | $(\exists)\ w_5 \models A$ X | $(\exists)\ w_6 \models B$ X

$w \not\models$ [d) $\Diamond(A \wedge B) \Rightarrow (\Diamond A \wedge \Diamond B)$]

$w \models \Diamond(A \wedge B)$

$w \not\models \Box A \wedge \Box B$

$w \not\models \Box A \vee \Box B$

$\exists\ w_1 \not\models A$

$w_1 \not\models B$

$\forall\ w_2 \not\models A$ $\qquad$ $\forall\ w_2 \not\models B$

X $\qquad$ X

$w \models \neg$ [e) $(\Box(A \Rightarrow B) \wedge \Box A) \Rightarrow \Box B$]

$w \models \Box(A \Rightarrow B) \wedge \Box A$

$w \models \neg \Box B$

$w \models \Box(A \Rightarrow B)$

$w \models \Box A$

$w \models \Diamond \neg B$

$\forall$ $w_1 \models A \Rightarrow B$

$\forall$ $w_2 \models A$

$\exists$ $w_3 \models \neg B$

$w_1 \models \neg A \vee B$

$w_1 \models \neg A$ — X

$w_1 \models B$ — X

$W \models \neg$ [f) $(\Box(A \Rightarrow B) \wedge \Diamond A) \Rightarrow \Diamond B$]

$w \models \Box(A \Rightarrow B)$

$w \models \Diamond A$

$w \models \neg \Diamond B$

$w \models \Box \neg B$

$\forall$ $w_1 \models A \Rightarrow B$

$\exists$ $w_2 \models A$

$\forall$ $w_3 \models \neg B$

$W_1 \models \neg A \vee B$

$w_1 \models \neg A$ ✗

$w_1 \models B$ ✗

$w \not\models$ [g) $(\Diamond(A \Rightarrow B) \wedge \Box A) \Rightarrow \Diamond B$]

$w \models \Diamond(A \Rightarrow B)$

$w \models \Box A$

$w \models \Box \neg B$

$\exists\ w_1 \models \neg A \vee B$

$\forall\ w_2 \models A$

$\forall\ w_3 \models \neg B$

$w_1 \models \neg A$ $\quad$ $w_1 \models B$

h) $(\Box A \wedge \Diamond B) \Rightarrow (\Diamond A \vee \Box B)$

$w \not\models \neg[(\Box A \wedge \Diamond B) \Rightarrow (\Diamond A \vee \Box B)]$

$w \models \Box A$

$w \models \Diamond B$

$w \not\models \neg(\Diamond A \vee \Box B)$

$\forall \; w_1 \models A$

$\exists \; w_2 \models B$

$w \models \Box \neg A \wedge \Diamond \neg B$

$w \models \Box \neg A$

$w \models \Diamond \neg B$

$\forall \; w_3 \models \neg A$

$\exists \; w_4 \models \neg B$

$w \models \neg$ [i) $(\Box A \vee \Box B) \Rightarrow \Box(A \vee B)$]

$w \models \Box A \vee \Box B$

$w \models \Diamond \neg (A \wedge B)$

$\equiv w_1 \models \neg A \wedge \neg B$

$w_1 \models \neg A$

$w_1 \models \neg B$

$w \models \Box A$ | $w \models \Box B$

$\forall w_2 \models A$ | $\forall w_2 \models B$

✗ | ✗

$\nu \not\models$ [j) $\Box(A \vee B) \Rightarrow (\Box A \vee \Box A)$]

$w \models \Box(A \vee B)$

$w \models \neg(\Box A \vee \Box A)$

$\forall w_1 \models A \vee B$

$w \models \Diamond \neg A \wedge \Diamond \neg A$

$\exists \quad w_1 \models \Diamond \neg A$

$\exists \quad w_2 \models \Diamond \neg A$

$w_1 \models A$ X

$w_1 \models B$ O ?