Mixed Counterfactuals

For practice you might do the following. Assuming Stalnaker's semantics, give a falsifying model for every invalid wff, and a semantic validity proof for every valid wff. If changing to Lewis's semantics would change the status of a wff, indicate this.

1. $[P \mathbin{\square\!\!\rightarrow} (Q \vee R)] \rightarrow [(P \mathbin{\square\!\!\rightarrow} Q) \vee (P \mathbin{\square\!\!\rightarrow} R)]$
2. $\sim(P \mathbin{\square\!\!\rightarrow} Q) \rightarrow (P \mathbin{\square\!\!\rightarrow} \sim Q)$
3. $[(P \wedge Q) \mathbin{\square\!\!\rightarrow} R] \rightarrow [P \mathbin{\square\!\!\rightarrow} (Q \mathbin{\square\!\!\rightarrow} R)]$
4. $\Diamond P \rightarrow [(P \mathbin{\square\!\!\rightarrow} Q) \leftrightarrow \sim(P \mathbin{\square\!\!\rightarrow} \sim Q)]$
5. $[(P \mathbin{\square\!\!\rightarrow} Q) \wedge (Q \mathbin{\square\!\!\rightarrow} R)] \rightarrow (P \mathbin{\square\!\!\rightarrow} R)$
6. $(P \wedge Q) \rightarrow (P \mathbin{\square\!\!\rightarrow} Q)$
7. $\Box(P \rightarrow Q) \rightarrow (P \mathbin{\square\!\!\rightarrow} Q)$
8. $(P \mathbin{\square\!\!\rightarrow} Q) \rightarrow (P \rightarrow Q)$
9. $[(P \vee Q) \mathbin{\square\!\!\rightarrow} R] \rightarrow [(P \mathbin{\square\!\!\rightarrow} R) \vee (Q \mathbin{\square\!\!\rightarrow} R)]$
10. $[P \mathbin{\square\!\!\rightarrow} (Q \rightarrow R)] \rightarrow [(P \wedge Q) \mathbin{\square\!\!\rightarrow} R]$
11. $P \rightarrow [(P \mathbin{\square\!\!\rightarrow} Q) \leftrightarrow Q]$
12. $Q \rightarrow [P \rightarrow (P \mathbin{\square\!\!\rightarrow} Q)]$
13. $[P \wedge (P \mathbin{\square\!\!\rightarrow} Q)] \rightarrow Q$
14. $[(P \mathbin{\square\!\!\rightarrow} Q) \wedge \sim Q] \rightarrow \sim P$
15. $[(P \mathbin{\square\!\!\rightarrow} Q) \wedge ([P \wedge Q] \mathbin{\square\!\!\rightarrow} R)] \rightarrow (P \mathbin{\square\!\!\rightarrow} R)$
16. $[P \mathbin{\square\!\!\rightarrow} Q] \rightarrow [(P \wedge R) \mathbin{\square\!\!\rightarrow} Q]$
17. $[(P \wedge Q) \mathbin{\square\!\!\rightarrow} R] \rightarrow [P \mathbin{\square\!\!\rightarrow} (Q \rightarrow R)]$

18. $\sim\Diamond P\rightarrow(P\Box\rightarrow Q)$

19. $(P\wedge\sim P)\Box\rightarrow Q$

20. $[P\Box\rightarrow(Q\rightarrow R)]\rightarrow[(P\wedge Q)\Box\rightarrow R]$

21. $(P\Box\rightarrow Q)\rightarrow(\sim Q\Box\rightarrow\sim P)$

22. $(P\Box\rightarrow Q)\rightarrow(\sim Q\rightarrow\sim P)$

23. $\sim(P\Box\rightarrow Q)\rightarrow\Diamond P$

24. $[P\Box\rightarrow(Q\Box\rightarrow R)]\rightarrow[Q\Box\rightarrow(P\Box\rightarrow R)]$