

MIXED MODAL PROPOSITIONAL LOGIC WFFS

Directions Give a falsifying model for every system in which the wff is not valid, and give a semantic validity proof for every system in which the wff is valid.

1. $\Box[P \rightarrow \Diamond(Q \rightarrow R)] \rightarrow \Diamond[Q \rightarrow (\Box P \rightarrow \Diamond R)]$
2. $\Box(P \vee \Diamond Q) \rightarrow (\Box P \vee \Diamond Q)$
3. $\Diamond(P \wedge \Diamond Q) \rightarrow (\Box \Diamond P \rightarrow \Diamond \Box P)$
4. $\Box(\Diamond P \leftrightarrow \Diamond Q) \rightarrow \Box(P \leftrightarrow \Box Q)$
5. $\Diamond(\Diamond P \wedge \sim Q) \vee \Box(P \rightarrow \Box Q)$
6. $[\Box P \wedge \Box(\sim P \vee Q)] \rightarrow \Diamond Q$
7. $\Diamond \Box \Diamond \Box P \rightarrow \Diamond \Box P$
8. $\Diamond \Box P \rightarrow \Diamond(Q \rightarrow P)$
9. $(\Box P \wedge \Box Q) \rightarrow \Box(P \leftrightarrow Q)$
10. $\Diamond \Box P \rightarrow \Diamond \Box \Diamond \Box P$
11. $[\Diamond(P \wedge Q) \vee \Diamond(P \wedge R)] \rightarrow \Diamond P$
12. $\Diamond(P \vee \sim P) \rightarrow (P \wedge \sim P)$
13. $\Box(P \leftrightarrow Q) \rightarrow (\Box P \leftrightarrow \Box Q)$
14. $\Box(P \leftrightarrow Q) \rightarrow \Box(\Box P \leftrightarrow \Box Q)$
15. $\Box(P \wedge Q) \rightarrow \Box \Box(\Diamond P \rightarrow \Diamond Q)$
16. $\Box \Diamond P \rightarrow \Diamond \Box P$
17. $\Diamond(\Diamond P \wedge \sim Q) \vee \Box(P \rightarrow \Box Q)$
18. $\Diamond \Box P \leftrightarrow \Box \Diamond P$
19. $\Box(\Box P \rightarrow Q) \vee \Box(\Box Q \rightarrow P)$
20. $\Box(\Box P \rightarrow Q) \rightarrow \Box(\Box P \rightarrow \Box Q)$
21. $\Diamond \Diamond \Box P \leftrightarrow \Box P$
22. $\Diamond \Diamond P \rightarrow \Box \Diamond P$
23. $\Box[P \rightarrow \Box(Q \rightarrow R)] \rightarrow [Q \rightarrow \Box(P \rightarrow R)]$
24. $\Box[\Box(P \leftrightarrow Q) \rightarrow \Diamond Q] \rightarrow \Box[\Box(P \leftrightarrow Q) \rightarrow Q]$
25. $\Box[\Box(P \rightarrow \Box P) \rightarrow \Box P] \rightarrow (\Diamond \Box P \rightarrow \Box P)$