Opgave 5.31

(g)
$$p \wedge (q \vee r) \vdash (p \wedge q) \vee (p \wedge r)$$

1	$p \wedge (q \vee r)$	ass
2	p	$\wedge E$, 1
3	$(q \lor r)$	$\wedge E$, 1
4	<u> </u>	ass
5	$(p \land q)$ $(p \land q) \lor (q \lor r)$	$\wedge I, 2, 4$
6		$\vee I, 5$
7		ass
8	$(p \wedge r)$	$\land I, 2, 7$
9	$(p \wedge r)$ $(p \wedge q) \vee (q \vee r)$	∨I, 8
10	$(p \land q) \lor (q \lor r)$	$\forall I, 1, 6, 9$

Opgave 5.32

(2)
$$p \wedge (q \wedge r) \vdash r \wedge p$$

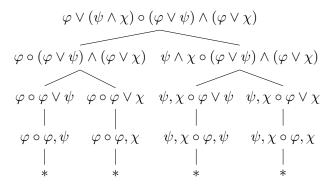
(3)
$$p \to (q \land r), q \to s, p \vdash s$$

$$\begin{array}{c|cccc} 1 & p \rightarrow (q \wedge r) & \text{ass} \\ 2 & q \rightarrow s & \text{ass} \\ 3 & p & \text{ass} \\ 4 & (q \wedge r) & \Rightarrow \text{E, 1, 3} \\ 5 & q & \wedge \text{E, 4} \\ 6 & s & \Rightarrow \text{E, 2, 5} \end{array}$$

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Opgave 5.33

(2)
$$\varphi \lor (\psi \land \chi); (\varphi \lor \psi) \land (\varphi \lor \chi)$$



Opgave 5.37

(2)
$$\varphi \leftrightarrow \psi$$
; $(\varphi \rightarrow \psi) \land (\psi \rightarrow \varphi)$

$$\varphi \leftrightarrow \psi \circ (\varphi \to \psi) \land (\psi \to \varphi)$$

$$\varphi, \psi \circ (\varphi \to \psi) \land (\psi \to \varphi) \qquad \circ \varphi, \psi, (\varphi \to \psi) \land (\psi \to \varphi)$$

$$\varphi, \psi \circ \varphi \to \psi \quad \varphi, \psi \circ \psi \to \varphi \quad \circ \varphi, \psi, \varphi \to \psi \quad \circ \varphi, \psi, \psi \to \varphi$$

$$| \qquad \qquad | \qquad \qquad | \qquad \qquad |$$

$$\varphi, \psi \circ \psi \qquad \varphi, \psi \circ \varphi \qquad \varphi \circ \varphi, \psi \qquad \psi \circ \varphi, \psi$$

$$| \qquad \qquad | \qquad \qquad | \qquad \qquad |$$

$$* \qquad * \qquad * \qquad *$$

(3)
$$\varphi \to \psi; \neg \psi \to \neg \varphi$$

$$\varphi \rightarrow \psi \circ \neg \psi \rightarrow \neg \varphi$$

$$| \neg \psi, \varphi \rightarrow \psi \circ \neg \varphi$$

$$| \varphi \rightarrow \psi \circ \neg \varphi, \psi$$

$$| \varphi, \varphi \rightarrow \psi \circ \psi$$

$$\varphi \circ \varphi, \psi \circ \varphi, \psi \circ \psi$$

$$| | | | |$$

$$*$$

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Opgave 5.38

$$(3) \ ((p \rightarrow q) \land (q \rightarrow r)) \rightarrow (p \rightarrow r)$$

$$\circ \ ((p \rightarrow q) \land (q \rightarrow r)) \rightarrow (p \rightarrow r)$$

$$| \qquad \qquad | \qquad \qquad |$$

$$(p \rightarrow q) \land (q \rightarrow r) \circ p \rightarrow r$$

$$| \qquad \qquad | \qquad \qquad |$$

$$p, p \rightarrow q, q \rightarrow r \circ r$$

$$p, q \rightarrow r \circ p, r$$

$$| \qquad \qquad | \qquad \qquad |$$

$$p, q \circ r, q \quad p, q, r \circ r \quad p \circ p, q, r \quad p, r \circ p, r$$

$$| \qquad \qquad | \qquad \qquad |$$

$$| \qquad |$$

$$| \qquad |$$

$$| \qquad |$$

$$| \qquad \qquad |$$

$$| \qquad$$

Opgave 5.53

Geef de semantische tableauregels voor de Quine dolk †.

 \bullet † - links

• † - rechts

$$\phi \circ \phi \dagger \psi$$
 $\phi \circ \psi \circ$

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