

$$\begin{aligned}
(((\mathbf{d} \circledast \mathbf{e})) \circledast \mathbf{g})(p^*, s) &= \bigvee_{r \in \mathbf{R}} \left( \bigvee_{q \in \mathbf{Q}} \mathbf{d}(p^*, q) \wedge \mathbf{e}(q^*, r) \right) \wedge \mathbf{g}(r^*, s) \\
&= \bigvee_{r \in \mathbf{R}} \left( \bigvee_{q \in \mathbf{Q}} \mathbf{d}(p^*, q) \wedge \mathbf{e}(q^*, r) \wedge \mathbf{g}(r^*, s) \right) \\
&= \bigvee_{q \in \mathbf{Q}} \mathbf{d}(p^*, q) \wedge \left( \bigvee_{r \in \mathbf{R}} \mathbf{e}(q^*, r) \wedge \mathbf{g}(r^*, s) \right) \\
&= (\mathbf{d} \circledast (\mathbf{e} \circledast \mathbf{g}))(p^*, s).
\end{aligned}$$