

$$\begin{aligned}
\text{Tr}_{\mathbf{P}, \mathbf{Q}}^{\mathbf{R}}(\mathbf{d})(p^*, q) &= \bigvee_{r \in \mathbf{R}} \mathbf{d}(\langle r, p \rangle^*, \langle r, q \rangle) \\
&\leq_{\mathbf{DP}} \bigvee_{r \in \mathbf{R}} \mathbf{e}(\langle r, p \rangle^*, \langle r, q \rangle) \\
&= \text{Tr}_{\mathbf{P}, \mathbf{Q}}^{\mathbf{R}}(\mathbf{e})(p^*, q).
\end{aligned}$$