$$\operatorname{Tr}_{\mathbf{P},\mathbf{Q}}^{\mathbf{R}}(\mathbf{d}): \mathbf{P}^{\mathrm{op}} \times \mathbf{Q} \to_{\mathbf{Pos}} \mathbf{Bool},$$

$$\langle p^*, q \rangle \mapsto \sqrt{\mathbf{d}(\langle p, r \rangle^*, \langle q, r \rangle)}.$$