

Let $P = (P_1, P_2, \dots, P_n)$ and $Q = (Q_1, Q_2, \dots, Q_m)$ be two paths where P_1, P_2, \dots, P_n and Q_1, Q_2, \dots, Q_m are the edges of them. Then, P is shorter than Q if and only if

$$\begin{aligned}
 & \sum_{i=1}^n P_i.weight < \sum_{j=1}^m Q_j.weight \\
 \Leftrightarrow & \sum_{i=1}^n -\ln(P_i.relevance) < \sum_{j=1}^m -\ln(Q_j.relevance) \\
 \Leftrightarrow & \sum_{i=1}^n \ln(P_i.relevance) > \sum_{j=1}^m \ln(Q_j.relevance) \\
 \Leftrightarrow & \ln\left(\prod_{i=1}^n P_i.relevance\right) > \ln\left(\prod_{j=1}^m Q_j.relevance\right) \\
 \Leftrightarrow & \prod_{i=1}^n P_i.relevance > \prod_{j=1}^m Q_j.relevance
 \end{aligned}$$