Cross-Entropy

\[ H(P, Q) = -\sum_x P(x) \log Q(x) \]

KL Divergence

\[ D_{\text{KL}}(P \| Q) = -\sum_x P(x) \log \left( \frac{Q(x)}{P(x)} \right) \]

Entropy

\[ H(P) = -\sum_x P(x) \log (P(x)) \]

Ex: Write the cross-entropy as function of entropy & KL divergence.

Sol'n:

\[ H(P, Q) = -\sum_x P(x) \log \left( \frac{Q(x) \cdot P(x)}{P(x)} \right) \]

\[ = \sum_x P(x) \log \left( \frac{Q(x)}{P(x)} \right) - \sum_x P(x) \log (P(x)) \]

\[ = D_{\text{KL}}(P \| Q) + H(P) \]