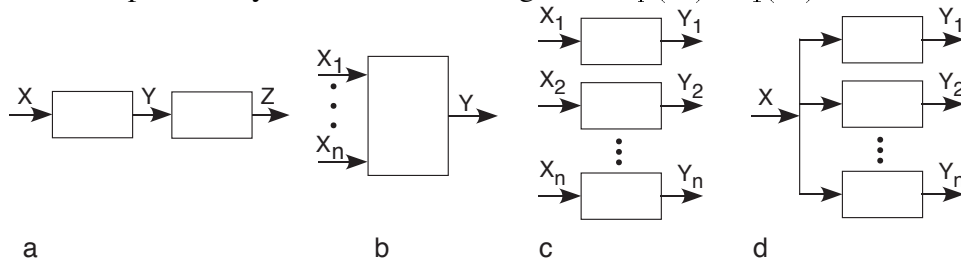


6 A Systems Theory of Information

For each of the following configurations, determine the mutual information and the ratio of output-to-input Kullback-Leibler distances behave. In the case of the Kullback-Leibler distance ratio calculations, the probability function of X changes from $p(X)$ to $q(X)$.



- (a) For the cascade configuration, how is $\gamma_{X,Z}$ related to $\gamma_{X,Y}$ and $\gamma_{Y,Z}$? How is $\mathcal{I}(X; Z)$ related to $\mathcal{I}(X; Y)$?
- (b) Here, and in configuration c, the random variables X_1, \dots, X_n are statistically independent.
- (c) Here, the systems introduce randomness and are characterized by $p(Y_i | X_i)$, which need not be the same.
- (d) Here, each system acts independently, so that the outputs are statistically independent given the input X .