

Definition 7.2 (Discrete Channel II) Let \mathcal{X} , \mathcal{Y} , and \mathcal{Z} be discrete alphabets. Let $\alpha : \mathcal{X} \times \mathcal{Z} \rightarrow \mathcal{Y}$, and Z be a random variable taking values in \mathcal{Z} , called the **noise variable**. A discrete channel (α, Z) is a single-input single-output system with input alphabet \mathcal{X} and output alphabet \mathcal{Y} . For any input random variable X , the noise variable Z is independent of X , and the output random variable Y is given by

$$Y = \alpha(X, Z).$$