

## Channel Capacity

In a discrete communication system, the channel capacity  $C$  is defined as the maximum of mutual information

$$C_s = \text{Max. } I(x, y) \quad \text{bits/symbol.}$$

$$C = R \times C_s \quad \text{bits/sec}$$

## Capacities of Special Channels.

### 1. Lossless channel

$$\therefore H(x|y) = 0$$

$$I(x; y) = H(x).$$

$$C_s = \text{Max. } I(x; y)$$

$$= \text{Max } H(x)$$

$$= \log_2 m$$

### 2. Deterministic Channel

$$\therefore H(y|x) = 0$$

$$I(x; y) = H(y)$$

$$C_s = \text{Max. } I(x; y)$$

$$= \text{Max } H(y)$$

$$= \log_2 n$$

### 3. Noiseless channel

$$I(x; y) = H(x) = H(y)$$

$$C_s = \log_2 m = \log_2 n.$$

### 4. Binary Symmetric Channel

$$I(x; y) = H(y) + P \log_2 P + (1-P) \log_2 (1-P)$$

$$C_s = 1 + P \log_2 P + (1-P) \log_2 (1-P)$$