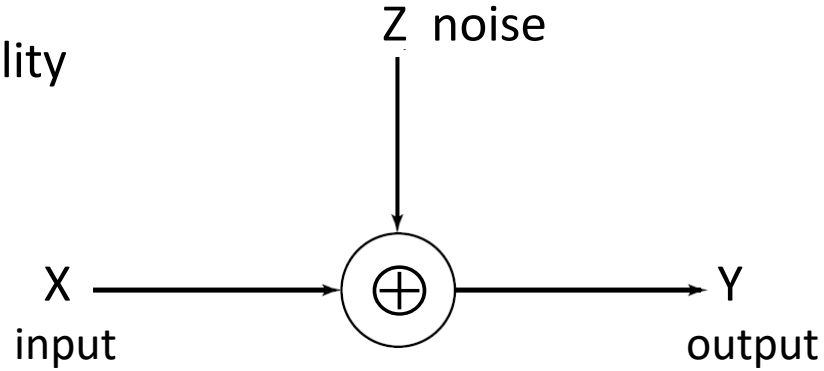
ELEC 515
Information Theory

Continuous Channel Capacity

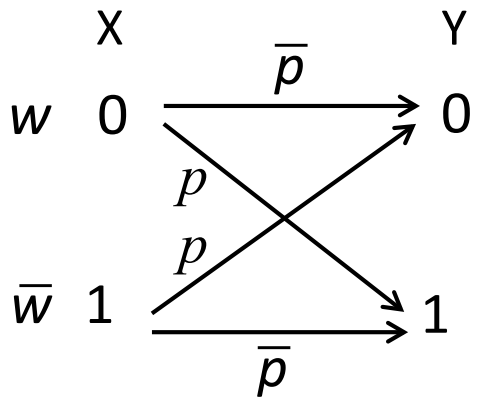
BSC Channel Capacity

crossover probability
$p = \Pr(z = 1)$



$\Pr(x = 0) = w$

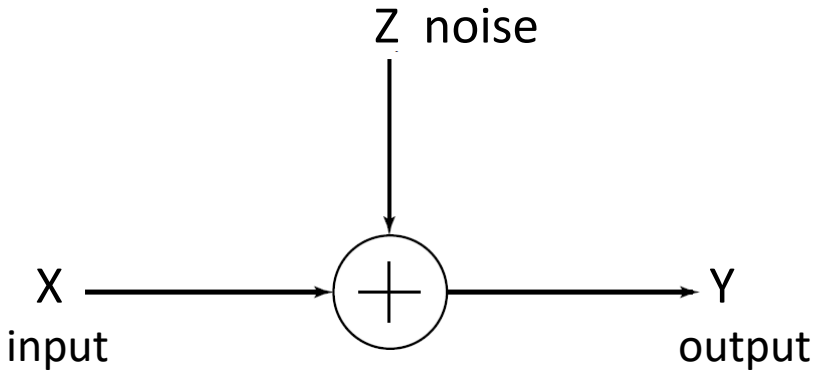
$\Pr(x = 1) = 1 - w = \bar{w}$



$w = \bar{w} = \frac{1}{2}$

$C = 1 - h(p)$

AWGN Channel Capacity



$$f_Z(z) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left[-\frac{(z-\mu)^2}{2\sigma^2} \right]$$

Differential Entropy

- Continuous random variable X with pdf $f(x)$
- The differential entropy of X is defined as

$$\mathrm{H(X)} = -\int_S f(x)\log f(x)dx$$

where S is the support set of X (values of x for which $f(x) > 0$

AWGN Channel Capacity

$$C = W \log_2 \left(1 + \frac{P}{N_0 W} \right)$$

$$E = PT \rightarrow P = E_b R_b$$

$$C = W \log_2 \left(1 + \frac{E_b R_b}{N_0 W} \right)$$

Let $R_b = C$

$$\frac{C}{W} = \log_2 \left(1 + \frac{E_b}{N_0} \frac{C}{W} \right)$$

$$\frac{E_b}{N_0} = \frac{2^{C/W} - 1}{C/W}$$

Bandwidth Efficiency versus SNR