University of South Australia

Formula Sheet for Source and Channel Coding

Source Entropy: $H(X) = \sum_{i=1}^{K} P(X=i) \log_2(1/P(X=i))$

Mutual Information: $I(X;Y) = \sum_i \sum_j P(X=i;Y=j) \log_2 \frac{P(X=i/Y=j)}{P(X=i)}$

Conditional Entropy: $H(X/Y) = \sum_i \sum_j P(X=i;Y=j) \log_2 \frac{1}{P(X=i/Y=j)}$

Kraft Inequality: $\sum_{i=1}^{K} D^{-n_i} \leq 1$ Average Message Length: $L = \sum_{i=1}^{K} p_n n_i$

PCM μ-Law Characteristic: $\frac{c(x)}{x_{max}} = \frac{\ln(1+\mu|x|/x_{max}}{\ln(1+\mu)} \mathrm{sign}(x)$

Baseband Error Probability: Baseband $p_e = Q(A/\sigma)$, Bandpass $p_e = Q(\sqrt{(}2E_b/N_0))$
Boltzman's constant: $k = 1.3710^{-23}$ J/deg

Capacity: continuous channel $C = B\log_2(1+S/N)$, discrete system: $\frac{E_b}{N_0} > \frac{B}{r_b}(2^{\frac{r_b}{B}} - 1)$

Block Code Generator: $\boldsymbol{c_i = d_i G}$ where $\boldsymbol{G = [I_k|P]}$, where $\boldsymbol{d_i}$ is the i-th row vector of information bits etc; Syndrome Decoding: $\boldsymbol{s_i^T = H r_i^T}$ where $\boldsymbol{H = [P^T|I_{n-k}]}$

Binomial Distribution: Let the discrete random variable I be the number of times an event E occurs in n independent trials. If $P(E) = q$ then

$$P_I(i) = \binom{n}{i} q^i (1-q)^{n-i}$$

where $\binom{n}{i} = \frac{n!}{i!(n-i)!}$