

CSE 4214 :: Problem Set 4

1. Let

$$\mathbf{a} = [1, 1, 1, 1] \tag{1}$$

and

$$\mathbf{b} = [1, 1, 0, 0]. \tag{2}$$

Find an orthonormal basis for the vector space formed by \mathbf{a} and \mathbf{b} , and express \mathbf{a} and \mathbf{b} in terms of that basis.

2. In a one-dimensional M -ary scheme, suppose the distance between adjacent noise-free filter outputs is $D = 2$. Assuming $\sigma^2 = 1$, find E_b and probability of error (in terms of erfc) for $M = 4$ and $M = 8$.
3. Consider the 27 symbols formed by the letters of the English alphabet, plus the space. How many binary, 3-ary, and 4-ary symbols are required to represent each of these symbols, and what is the bit rate in (bits per symbol) of each? Which scheme is the most efficient, and why?