

Sample Assignment 3
Decoding of Linear Block Codes / Performance

Question 1

A binary linear block code is described by the generator matrix given below:

$$G = \begin{bmatrix} 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 \end{bmatrix}$$

- (a) Find n and k as well as the code rate of this code.
- (b) List all of the code words of the code and find the code's minimum distance.
- (c) How many errors can this code correct?
- (d) Find the parity check matrix for this code.
- (e) Create the standard array for this code.
- (f) Find the most likely transmitted codeword if the received word is $r=101111$ using your standard array.
- (g) Find the parity check matrix for this code.
- (h) Find the syndrome S if $r = 111100$. From this syndrome, find the most likely bit(s) to be in error. Confirm your answer with your standard array.
- (i) If there is a 5% chance that a bit is in error, what is the exact probability of an undetectable error in a received word? What is the probability that the decoder incorrectly decodes the codeword based on your standard array?

Question 2

Repeat Question 1 for the following code based on GF(4) symbols

$$G = \begin{bmatrix} 1 & 0 & 1 & \alpha \\ 0 & 1 & \alpha^2 & 1 \end{bmatrix}$$