Assignment 3 — ECEN 449/749 (Fall 2017)
Due: Nov 15, 2017

1. (25pt)

A system uses PAM-4 to transmit messages, and sends a pulse every 100 ns. What is the data rate of this system? Explain your answer.

2. (25pt)

A system uses PAM to transmit messages, and sends a pulse every 100 ns. The magnitude of the pulse can be any number between $[0, 1]$. The magnitude of the noise is known to be within the range of $(-2^{-4}, 2^{-4})$. For example, if the transmitter sends a pulse with magnitude 0.3, then the magnitude received by the receives is within the range of $(0.3 - 2^{-4}, 0.3 + 2^{-4})$. To achieve error-free transmissions, what is the maximum data rate of the system? Explain your answer.

3. (25pt)

Consider the system in P2. Suppose you wish to double the data rate of the system by increasing the transmission power, so that the magnitude of the pulse is in the range $[0, M]$. Find the value M.

4. (25pt)

Write a decoder for PWM in C. Your program should read the input from the file "input4.txt", and output the result to the file "output4.txt". The input file begins with a single number, which indicates the number of time slots in T seconds. (Recall that one value is transmitted every T seconds.) Following the number is a sequence of binary numbers (either 0 or 1), separated by space. Your program should output the sequence of transmitted values. Please remember to provide sufficient comments to explain your decoder.

Sample Input 1

5
1 1 1 0 0 1 0 0 0 0 1 1 1 1 0

Sample Output 1

3
1
4

Sample Input 2

5
0 1 1 1 0 0 0 1 0 0 0 0 1 1 0

Sample Output 2

3
1
2

5. (749 only, 25pt)

Write a decoder for PPM in C. Your program should read the input from the file "input5.txt", and output the result to the file "output5.txt". The input file begins with a single number, which indicates the number of time slots in T seconds. (Recall that one value is transmitted every T seconds.) Following the number is a sequence of binary numbers (either 0 or 1), separated by space. Your program should output the sequence of transmitted values. Please remember to provide sufficient comments to explain your decoder.

Sample Input 1

5
0 0 0 0 1 0 0 1 0 0 0 1 0 0 0

Sample Output 1

5
3
2