CS 4390: HW 3

Written by Zach Leach, NetID: zcl190002

Draft February 20, 2024

1   Data Rate Problem

It is desired to send a sequence of computer screen images over optical fiber. The screen is 3840 × 2160 pixels, each pixel being 24 bits. There are 60 screen images per second. What data rate is needed?

$$\text{Data Rate} = \frac{\text{Number of bits}}{\text{Bits per second}}$$

There are $24 \text{ bits} \cdot (3840 \times 2160) = 199{,}065{,}600$ bits per image. Transmitting 60 images per second gives a data rate of data rate is $60 \cdot 199{,}065{,}600 = \underline{1.194 \cdot 10^{10} \text{ bits per second}}$.

2   FDM Multiplexing Problem

Ten signals, each requiring 4000 Hz, are multiplexed onto a single channel using FDM. What is the minimum bandwidth required for the multiplexed channel? Assume that the guard bands are 400 Hz wide.

$$\text{Bandwidth} =$$
$$[\text{\# of channels} \cdot \text{channel bandwidth}]$$
$$+[(\text{\# of channels} - 1) \cdot \text{guard band width}]$$