CS 4390: HW 3

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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.

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