

CpE 319 Assignment 2

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Feb. 19, 2014

1 Problem 2.3

For a channel 6MHz wide with 4 levels and no noise, Nyquist's theorem gives us a maximum data rate of

$$C = 2 * 6Mhz * \log_2 4 = 24Mbps \quad (1)$$

2 Problem 2.4

The Shannon capacity of a 3kHz channel with a 20 dB SNR is

$$M = \sqrt{1 + S/N} = \sqrt{1 + 10^{SNR/10}} = 10 \quad (2)$$

This means we can have an alphabet of up to 10 symbols without an excessive error rate.

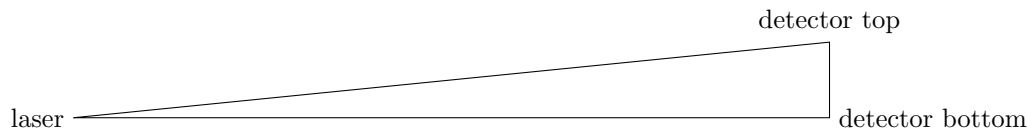
The Nyquist theorem thus gives us a maximum data rate of

$$C = 2 * 3kHz * \log_2 10 = 19.93kbps \quad (3)$$

3 Problem 2.8

4 Problem 2.11

This is a simple geometry problem:



While this diagram simplifies the issue somewhat, it is a correct representation of the issue.

Since we have a right triangle with two known edges, we can solve for our angle:

$$\theta = \tan^{-1} \frac{0.001}{100} = 5.73 \times 10^{-4} \quad (4)$$