

# In Class Problem

## Typical Error

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- A variable has a standard deviation of  $\sigma = .15$ 
  - How many samples  $N$ , do I need to use in the estimate of the mean, to have a typical error of the estimate equal to .01?

# In Class Problem

## Typical Error

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- A variable has a standard deviation of  $\sigma = .15$ 
  - How many samples do I need to average to estimate the mean to within a typical error of .01?

$$\text{Typical Error} = \sigma_{\text{estimate}} = \frac{\sigma}{\sqrt{N}}$$

Solving for N:

$$N = \left( \frac{\sigma}{.01} \right)^2 = \left( \frac{.15}{.01} \right)^2 = 225 \text{ samples}$$

# In Class Problem

## Adding Two Signals with Noise

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- Given two signals with the following statistics:

Signal 1       $\mu_1 = 2, \sigma_1 = .5$

Signal 2       $\mu_2 = 1, \sigma_2 = .125$

- Compute their individual SNR's
- Compute the SNR of the sum of the 2 signals

# In Class Problem

## Adding Two Signals with Noise

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- Assume two signals with the following probabilities:

$$\text{Signal 1} \quad \mu_1 = 2, \sigma_1 = .5$$

$$\text{Signal 2} \quad \mu_2 = 1, \sigma_2 = .125$$

- Compute their individual SNR's

$$SNR_1 = \frac{\mu_1^2}{\sigma_1^2} = 4 / .25 = 16$$

$$SNR_2 = \frac{\mu_2^2}{\sigma_2^2} = 1 / .0156 = 64$$

# In Class Problem

## Adding Two Signals with Noise

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- Compute the SNR of the sum of the 2 signals

$$\text{Signal 1} \quad \mu_1 = 2, \sigma_1 = .5 \quad SNR_1 = 16$$

$$\text{Signal 2} \quad \mu_2 = 1, \sigma_2 = .125 \quad SNR_2 = 64$$

- Then:

$$\mu_{total} = \mu_1 + \mu_2 = 3 \quad \sigma_{total} = \sqrt{\sigma_1^2 + \sigma_2^2} = .5154$$

$$SNR_{total} = \frac{3^2}{.5154^2} = 33.88$$

# In Class Problem

## Adding Two Signals with Noise

$$\mu_1 = 2, \sigma_1 = .5$$

$$\mu_2 = 1, \sigma_2 = .125$$

$$\mu_{total} = \mu_1 + \mu_2 = 3$$

$$\sigma_{total} = \sqrt{\sigma_1^2 + \sigma_2^2} = .5154$$

