Today, we will:

- Do a review example problem – digital data acquisition & aliasing
- Review the pdf module: Fourier Transforms, DFTs, and FFTs and do some examples

**Example: Digital data acquisition**

**Given:** Andy collects data with a digital data acquisition system that is 14-bit and has a range of -5 to 5 V. He samples at a sampling frequency of 200 Hz.

**(a) To do:** Calculate the quantization error in millivolts.

**Solution:**

**(b) To do:** For each case, will Andy’s signal be clipped? Is there any aliasing? If so, what frequencies will he see (perceive)?

(i) Signal has a frequency of 40 Hz with a range of –3 to 3 V.
(ii) Signal has a frequency of 120 Hz with DC offset = –4.5 V and amplitude = 1.0 V.
(iii) Signal is \( f(t) = 3.5\sin(700\pi t) + 1.0 \) V.

**Solution:**
**Example: DFTs and FFTs**

**Given:** Voltage data are acquired with a digital data acquisition system. A DFT (or FFT) is performed, and a frequency spectrum plot is generated.

**To do:** Which of the following has the better frequency resolution?
- **Case a:** Data are sampled at $f_s = 100$ Hz, and 512 data points are taken.
- **Case b:** Data are sampled at $f_s = 200$ Hz, and 256 data points are taken.

**Solution:**

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**Example: DFTs and FFTs**

**Given:** A signal contains frequencies up to 500 Hz. Voltage data are acquired with a digital data acquisition system at $f_s = 1000$ Hz to avoid aliasing. 2048 data points are taken, a DFT or FFT is performed, and a frequency spectrum plot is generated.

**To do:** Calculate the following:
- The total sampling time
- The folding frequency of the resulting frequency spectrum
- The frequency resolution of the resulting frequency spectrum

**Solution:**