

## Homework 2

Due: Thursday, March 5

**Section 3.5:** 3.8, 3.12, G3.14

**Section 6.5:** 6.4(a), G6.2

**E3.1:** Verify the identity

$$\sum_{n \in \mathbb{Z}} |f[n]|^2 = \|f\|_2^2 = \frac{1}{2\pi} \int_{-\pi}^{\pi} |\hat{f}(\omega)|^2 d\omega.$$

**E3.4:** From the formulation of the FFT, we group the odd frequencies of a finite discrete signal  $f$  of length  $N$ . Show that for the odd frequencies,  $2k + 1$  for  $k = 0, 1, \dots, \frac{N}{2}$ ,

$$\hat{f}[2k + 1] = \sum_{n=0}^{\frac{N}{2}-1} \exp\left(\frac{-2\pi i n}{N}\right) (f[n] - f[n + N/2]) \exp\left(\frac{-2\pi i k n}{N/2}\right).$$

**E4.2:** Prove that the (continuous) Wavelet Dictionary is translation and dilation invariant.