

## Homework 8

1. Sample the odd signal  $k(t) = \sin(2\omega t) + 2\sin(3\omega t) + 5\sin(4\omega t)$ , with  $\omega = 2\pi f$ . What are the ratios of the corresponding  $H_n$  for relevant values of  $n$ ? (Write the ratios in a sensible way.) Are the relevant  $H_n$  real or imaginary? Include your answers in the answer file along with a plot of the  $H_n$ .

2. Sample the function  $g(t) = \sin(2\pi ft)$  with  $f = 10.5$  Hz at two different sampling frequencies,  $f_1$  and  $f_2$ . Use any number of total measurements you want but sample in two ways:  $f_1$  should be *below* the Nyquist critical frequency  $f_c$  and  $f_2$  should be *above*.

Compute the DFT of  $g(t)$  (using the clunky DFT routine) for both  $f_1$  and  $f_2$ . Recreate  $g(t)$  from the two DFTs corresponding to  $f_1$  and  $f_2$ . How well did you do? Now you see why paying attention to the Nyquist critical frequency is important. Include in your answer file: your values of  $f_1$  and  $f_2$ ; the plots of the two DFTs corresponding to  $f_1$  and  $f_2$  (indicate which plot goes with which sampling frequency); the plots for  $g(t)$  recreated from the DFTs.