These are notes from Katherine's office hours on how to approach the homework. They are not complete or definitive, and probably have typos! So use at your own risk X)

Homework 1:

1. Find the signature frequency of the submarine
    a. Data has dimensions 64^3 x 49
    b. Loop through the columns:
        i. Reshape the data to be 3D cube
        ii. FFT using fftn()
        iii. fftshift() for sake of visualization
        Note: Do not take the absolute value before averaging
    c. Take average of the frequency signals
    d. Find location of the peak in frequency space
        i. Find Index using argmax and unravel_index, or amax and where
        ii. Pull corresponding tuple from the 3D frequency domain:
            Kx,Ky,Kz = meshgrid(K_grid,K_grid, K_grid)

2. Build Filter centered at the center frequency
    a. filter will be 3D
    b. Try visualizing it and make sure that it makes sense with your center frequency (or center frequency pair). This might be a nice plot to include in your report.
3. Apply the filter to each time step to denoise the signal + find sub location from that denoised signal

    Here's one possible way to do this, assuming that filter is your filter that is centered at the signature frequency in the frequency domain.
    a. shifted_filter = fftshift(filter)
    b. Loop through the columns:
        c. Reshape the data to be 3D cube
        d. Take the FFT using fftn()
        e. filtered_freq = Multiply fft-ed signal by shifted_filter
        f. ifftn(filtered_freq)
        g. Take the absolute value
        h. Find index of max entry using argmax and unravel_index, or amax and where
        i. Pull corresponding entry from the spatial domain:
            X,Y,Z = meshgrid(N_grid, N_grid, N_grid)

- Be sure to also address the final task of the homework by either including a 2D plot of the X,Y coordinates with an indication of which is the first/last point. Alternatively you could include a table.