Study questions from slides:

- Make method and parameter decisions for time-frequency analysis **(e.g., window and step length, wavelet length and scaling, filter bands, etc)** based on signal properties, e.g., the table we filled out together in L8 for frequencies and timescale of change in example phenomena
    - **Example Q**: (hypothetically) ocean waves wash the shore at a rate of once every 5-20 seconds, which changes on the scale of hours, depending on tide (time of day). Provide a range of parameters for window length and step length in STFT for analyzing ocean surface height data recorded near the pier.

- Understand the advantages and disadvantages for short-time Fourier transform (STFT), wavelet analysis, and Hilbert transform analysis.
    - **Example Q**: knowing that your signal is limited to a confined frequency band (narrowband signal), what analysis would you employ to maximize the temporal resolution of your analysis?

- Understand and interpret the time-frequency tiling diagrams

- Strengths and weaknesses of Fourier analysis in general, and the assumptions we make about the underlying signal.

- How the complex exponential conjugates sum together to form a real-valued cosine signal, and what the Hilbert Transform does with respect to those. WvD Ch13.6. Highly advise reading through: https://ccrma.stanford.edu/~jos/r320/Analytic_Signals_Hilbert_Transform.html
    - **Example Q**: given a cosine wave x(t) = cos(2pi*8.5*t), write out the expressions for the corresponding complex exponentials that sum to x(t)

- Understand symmetry in FT transform (especially in the context of Hilbert transform), and what Nyquist rate and Nyquist frequency is.

- Understand the different types of filters, what their magnitude and phase response look like, the necessary parameters for them, and how to design them using scipy.signal.firwin(). WvD Ch15.1-2
    - **Example Q:** see A3 last question- given requirements, call signal.firwin with appropriate parameters.

- Single-neuron physiology, ions, and phases of the action potential (the slide we filled out together in L12). WvD Ch20.

- Procedures for spike sorting: the different stages, what their functions are, and why they are necessary.

- Correlation coefficient computation and assumptions:
    - **Example Q**: given two short vectors, compute the correlation coefficient by hand and interpret the result.

- Understand the stages of linear-nonlinear-Poisson model of neuron, and the properties of Poisson process we talked about in class after our coin toss experiment.
    - **Example Q**: given an average firing rate of 4Hz, what's the probability of a neuron firing given a time bin of 100ms? What are the average and variance of the number of spikes across 100 trials that's 1 second long?

- Spike timing vs rate coding; sparse vs. distributed coding; examples of each.

- Interpreting tuning curves and spike triggered average plots for stimulus encoding/decoding models, and motivation for population encoding models

- Know the details of Readings 3 and 4: what the context was, where and what kind of data was recorded in the brain, what kinds of tasks did the patients perform, and what the main findings were.