

### 332:346 – Final Exam Review Topics – Spring 2010

- Chapter 4: Convolution and FIR filtering.
- All review Topics for Exam-2.
- Digital audio effects. Delays, echoes, comb filters, reverberators, multi-tap delay algorithms. Circular buffer implementations.
- Frequency resolution and windowing. Mainlobe widths, sidelobe levels, and their tradeoffs. Hamming window. Kaiser window for spectral analysis.
- Determining the minimum signal length required to achieve a desired frequency resolution, with rectangular, Hamming, or Kaiser windows.
- What is an  $N$ -point DFT? What is the meaning of the  $N$  computed DFT values? What are the DFT frequencies in Hertz? Computational versus physical resolution.
- How do you map negative frequencies onto positive DFT frequencies, or onto positive DFT indices?
- Effect on the DFT of padding zeros at the end or the beginning of a signal.
- Given a linear combination of sinusoids, predict at what DFT indices you are going to get peaks in the DFT spectrum and estimate the frequencies of the sinusoids from the DFT.
- Computing inverse  $N$ -point DFTs, using  $[\text{DFT}(\mathbf{X}^*)]^* / N$  or  $[\text{FFT}(\mathbf{X}^*)]^* / N$ .
- Given a linear combination of sinusoids, determine the DFT without performing any DFT/FFT calculations. Method: compare terms with the inverse DFT formula. Conversely, given the DFT, express the signal as a sum of sinusoids.
- Filtering a periodic signal  $x(n)$  of period  $N$  through a stable filter and determining the periodic steady-state output  $y_{\text{steady}}(n)$ . Using DFT/FFT and IDFT/IFFT methods.
- How can you compute very large FFTs from smaller ones?
- Computational cost of the FFT. Derivation of computational cost.
- Computing up to 8-point FFTs and IFFTs by hand.
- Second-order digital parametric equalizer design, including notch filters, using the bilinear transformation.

#### Reading Materials:

chapters 4-7, sections 8.2.1-8.2.4, 9.1-9.8, 10.2.2, and 11.1-11.4.

#### Preparing for the final:

The final is comprehensive and the questions may blend material from different chapters. To prepare properly for the final, you need to review all: (a) examples in class, (b) examples in text, (c) assigned and non-assigned homework problems, and (d) old exam problems. Good luck.