EE 473 HW 7 (Fall 2019)

1) Homework is due **December 19, Thursday!**
2) Do NOT exceed 4 pages. Additional pages will not be graded, or even looked at.

1: *Reading.* Oppenheim and Schafer/2e, DFT (Chapter 8) is over, and we are doing fast Fourier transform (Chapter 9). The critical part is Section 8.7. We did not cover 8.7.3 in class but consider this a reading assignment so that you get a feel for concepts such as zero-padding, block convolution and overlap-add/overlap-save methods.

2: Download "wavesurfer" tool from the `https://sourceforge.net/projects/wavesurfer/` link. Next, record the utterance "Birazdan bu işareti işleyeceğim için çok mutlu ve huzurluyum." with your voice using Wavesurfer at 16-kHz sampling rate and 16-bit PCM encoding. If you are not a native Turkish speaker, do that with the utterance "I am very happy and content because I will be processing this signal now." Add white Gaussian noise and load the resulting signal to Matlab. The energy of the noise should be 1/20th of that of the signal. Plot the resulting signal waveform.

3: Design a filter to extract your voice from the noisy signal you recorded in **2** using the (i) impulse-invariance, (ii) bilinear transformation, (iii) Parks-McClellan, and (iv) Kaiser window approaches. All decisions are yours. State clearly and justify your choices of cut-off frequencies, design tolerances, continuous-time filter type where it applies, etc. Plot the noisy and filtered waveforms' magnitude and phase responses, and also provide the original signal before noise was added for comparison purposes.

4: Order the filtering methods from best to worst in terms of performance and complexity with respect to your choice of relevant measures. How would you rate the methods based on your own listening to the filter outputs? Do theoretical performances match what you experience?