Full Name: _____

EEE 5502 (Fall 2022) – Practice **Designing FIR Filters, 2022**

Question #1: Answer the following questions.

(a) Prove that the frequency response $|H(\omega)|e^{-j\omega\tau}$ always represents a linear phase filter.

(b) (True or False) An IIR filter cannot be a stable and linear phase filter. Justify.

(c) (True or False) An IIR filter cannot be causal and linear phase simultaneously. Justify.

Question #2: Consider a desired magnitude response defined by

$$H_d(\omega) = \sum_{k=-\infty}^{\infty} u(\omega + \pi/2 - 2\pi k) - u(\omega - \pi/2 - 2\pi k)$$

(a) Design discrete-time FIR filter coefficients $h[n]$ that approximate a filter with magnitude response $|H_d(\omega)|$ with the windowing method of length $N = 4$. Force the impulse response to be causal and linear-phase (thru shifting if necessary). Sketch $h[n]$.

(b) Design discrete-time FIR filter coefficients $g[n]$ that approximate a filter with frequency response $|H_d(\omega)|$ with a 5-point frequency sampling method.