

ECE 480
Spring/Summer 2007
First Midterm Test
“Write out and sign the Honor Pledge”

Time: 2 hours

- 1) Consider the discrete-time signal $x(n) = (4 - n)\{u(-n + 4) u(n)\}$
- Sketch $x(n)$. Hence find its energy.
 - Sketch the following signals that are derived from $x(n)$
 - $y(n) = |x(n) - 2|$
 - $z(n) = x(2n)$
 - $g(n) = (-1)^n x(-n)$.

- 2) Consider a discrete-time signal $x(n]$, which has a Fourier transform given by
- $$X(e^{j\omega}) = e^{-2j\omega} (1 - e^{-j\omega})^2.$$

- Determine and sketch $x(n)$.
 - Write expressions for the magnitude and phase of $X(e^{j\omega})$. Hence, find the magnitude and phase values at $\omega = 0$ and $\omega = \pi$.
 - Determine the signal $y(n) = nx(n+1)$ and its Fourier transform $Y(e^{j\omega})$.
- 3) Suppose that a LTI system is described by the difference equation:

$$y(n) = 0.5 \{x(n) + x(n - 4)\}$$

- Determine and sketch the impulse response of the system.
- Find and sketch the step response of the system
- Is the system an IIR or FIR system? Check for stability.
- Derive an expression for the frequency response of the filter. Hence, plot the magnitude and phase responses.
- Determine the steady-state output of the filter, $y_{ss}(n)$ for an input given by

$$x(n) = -5 + 4 \cos\left(\frac{\pi}{8} n\right) \cos\left(\frac{3\pi}{8} n - \pi/4\right).$$