EE 3054: Signals, Systems, and Transforms **Fall 2003**

Quiz 1

- *No calculators, no notes, closed book.*
- *Show your work.*
- *Simplify your answers.*

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1. Make an accurate sketch of the following signal

$$x(n) = 2\,\delta(n+4) - \delta(n-2) + u(n-3)$$

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2. Make an accurate sketch of the following signal

$$x(n) = \sum_{k=0}^{\infty} 4\,\delta(n - 3\,k - 1)$$

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3. A discrete-time system is described by the following rule

$$y(n) = \max\{x(n),\ x(n+1)\}$$

Classify the system as:

(a) memoryless/with memory
(b) causal/noncausal
(c) linear/nonlinear
(d) time-invariant/time-varying
(e) BIBO stable/unstable

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4. The signals $f(n)$ and $g(n)$ are given by

$$f(n) = -\delta(n+2) - \delta(n+1) - \delta(n)$$

$$g(n) = \delta(n) + \delta(n+1) + \delta(n+2)$$

Sketch the two signals; and derive and sketch the convolution $x(n) = f(n) * g(n)$.

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5. The impulse response $h(n)$ of an LTI system is given by

$$h(n) = \left(\frac{1}{2}\right)^n u(n).$$

Find and sketch the output $y(n)$ when the input is given by

$$x(n) = u(n) - u(n-2).$$

Simplify your mathematical formula for $y(n)$ as far as you can. Show your work.

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6. The impulse response $h(n)$ of an LTI system is given by

$$h(n) = \delta(n) + \delta(n-2).$$

Find and sketch the output $y(n)$ when the input is given by

$$x(n) = \sum_{k=-\infty}^{\infty} (-1)^k \, \delta(n - 2\,k).$$

Simplify your mathematical formula for $y(n)$ as far as you can. Show your work.

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7. The Z-transform of the signal $x(n)$ is

$$X(z) = -3\,z^2 + 2\,z^{-3}$$

Find and sketch the signal $x(n)$.

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8. The impulse response $h(n)$ of an LTI system is given by

$$h(n) = u(n) - u(n-5).$$

(a) What is the transfer function $H(z)$ of this system?

(b) What difference equation implements this system?

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9. A causal LTI system is implemented using the difference equation

$$y(n) = x(n) + \frac{9}{14}\,y(n-1) - \frac{1}{14}\,y(n-2)$$

(a) What is the transfer function $H(z)$ of this system?

(b) What is the impulse response $h(n)$ of this system?
