

Homework No. 3
Due 10:10 am, March 28, 2006

1. A linear system S has the relationship

$$y[n] = \sum_{k=-\infty}^{\infty} x[k]g[n-2k]$$

between its input $x[n]$ and its output $y[n]$, where $g[n] = u[n] - u[n-4]$.

- (1) Determine $y[n]$ when $x[n] = \delta[n-1]$.
 - (2) Determine $y[n]$ when $x[n] = \delta[n-2]$.
 - (3) Is the system S LTI?
 - (4) Determine $y[n]$ when $x[n] = u[n]$.
2. Evaluate the following discrete-time convolution sums:

$$(1) \quad y[n] = (-1)^n * 2^n u[-n+2].$$

$$(2) \quad y[n] = (u[n+10] - 2u[n] + u[n-4]) * \beta^n u[n], \quad |\beta| < 1.$$

3. Evaluate the following continuous-time convolution integrals:

$$(1) \quad y(t) = 2t^2 [u(t+1) - u(t-1)] * 2u(t+2).$$

$$(2) \quad y(t) = e^{-\gamma t} u(t) * e^{\beta t} u(-t).$$

4. For each of the following impulse responses, determine whether the corresponding system is (i) memoryless, (ii) causal, and (iii) stable. Justify your answer.

$$(1) \quad h(t) = \cos(\pi t); \quad (2) \quad h(t) = e^{-2t} u(t-1); \quad (3) \quad h[n] = (1/2)^{|n|};$$

$$(4) \quad h[n] = \sum_{p=-1}^{\infty} \delta[n-2p]$$

5. Evaluate the step response for the LTI systems represented by the following impulse responses:

$$(1) \quad h[n] = (-1)^n \{u[n+2] - u[n-3]\}.$$

$$(2) \quad h(t) = e^{-|t|}.$$