

EE 341 - Homework 4
Due September 21, 2005

For problems which require MATLAB, please include a MATLAB m-file which shows how you made your plots.

1. Find the convolution $y[n] = x[n] * h[n]$ for each of the following signal pairs. Use an arrow to indicate $n = 0$. Do the convolution by hand, and verify with the `conv` function of MATLAB.
 - (a) $x[n] = \{\overset{\downarrow}{1}, 2, 0, 1\}$ $h[n] = \{\overset{\downarrow}{2}, 2, 3\}$
 - (b) $x[n] = \{3, 2, \overset{\downarrow}{1}, 1, 2\}$ $h[n] = \{4, \overset{\downarrow}{2}, 3, 2\}$
 - (c) $x[n] = \{\overset{\downarrow}{0}, 0, 0, 3, 1, 2\}$ $h[n] = \{4, \overset{\downarrow}{2}, 3, 2\}$
2. Let $x[n] = h[n] = \{\overset{\downarrow}{3}, 4, 2, 1\}$.
 - (a) Find $x[n] * h[n]$
 - (b) Find $x[n] * h[-n]$
 - (c) Use the properties of convolution to find $x[n-1] * h[n+4]$
3. Consider a system which computes the average value of the current and past two inputs.
 - (a) Write a difference equation for the system.
 - (b) Use the difference equation to find the response of the system to the input $x[n] = \{\overset{\downarrow}{1}, 2, 3, 4, 5\}$
 - (c) Find the impulse response of the system.
 - (d) Find $x[n] * h[n]$, and show the answer is the same as for part (b).
4. A linear time-invariant discrete-time system has an impulse response $h[n] = \left(\frac{1}{2}\right)^n u[n]$. Find the output to the system when the input is $x[n] = \left(\frac{1}{3}\right)^n u[n]$.
5. Problem 3.16 (d) (e).
6. The impulse response of an LTI CT system is $h(t) = 2e^{-t}u(t) - \delta(t)$.
 - (a) Find the output $y(t)$ of the system when the input is $x(t) = u(t)$.
 - (b) Find the output $y(t)$ of the system when the input is $x(t) = e^{-t}u(t)$.
7. Problem 3.26