

## The Joy of Convolution

September, 2006

1. Sketch the signal  $y(t) = x(t) * h(t)$ , where

$$x(t) = u(t) - u(t - T_1)$$

$$h(t) = \delta(t) - \delta(t - T_2)$$

for:

(a)  $0 < T_1 < T_2$

(b)  $0 < T_2 < T_1$

Make sure you carefully label your graph.

Is the LTI system given by  $h(t)$  stable, causal?

2. Consider the signals

$$h[n] = (-1)^n \text{ and}$$

$$x[n] = \delta[n] + \delta[n - 1].$$

(a) Sketch  $x[n]$  and  $h[n]$ .

(b) Determine (analytically)

$$y[n] = x[n] * h[n].$$

(c) Sketch  $y[n] = u[n] * x[n]$ .

3. Let  $h[n] = (-1)^n(u[n] - u[n - 4])$ .

Sketch  $h[n] * h[n]$ .