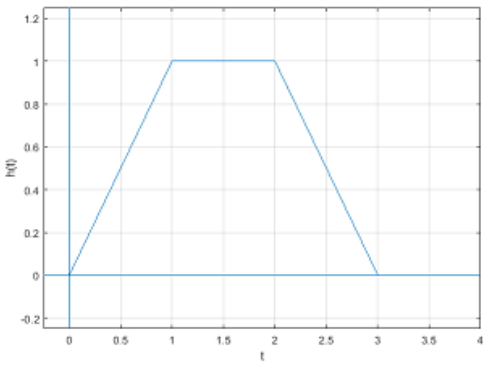
University of Illinois **Fall 2018**

ECE 210 Homework 11 - Updated

Due: Wednesday, November 14, 2018

1. Let $f(t)=rect\left(t-\frac{1}{2}\right)$, and h(t) given as:

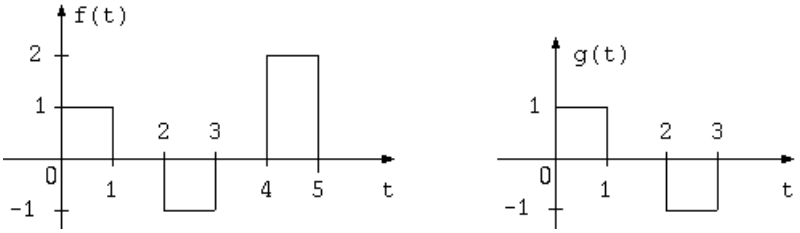


And let $y(t)=f(t) * h(t)$

(a) Determine $x(t)=f(t) * h(t)$ by direct integration and sketch the result.
(b) Determine the value of t_I, the first instant in time when $y(t)$ is non-zero.
(c) Determine the value of t_F, the last instant in time when $y(t)$ is non-zero.
(d) Determine the values of $y(0), y(1), y(2), y(3)$.

2. Let $f(t)=3u(1+t)$, and $h(t)=e^{-t}u(t)$, and let $y(t)=f(t) * h(t)$. Determine $y(t)$ for all t.

3. For the functions sketched as shown below:



(a) Determine $x(t)=g(t) * g(t)$ by direct integration and sketch the result.
(b) Determine $y(t)=f(t) * g(t)$ using appropriate properties of convolution.
(c) Determine $z(t)=f(t) * f(t-1)$ using appropriate properties of convolution. Sketch the result.

4. Given $h(t)=u(t+2)$ and $f(t)=2\Delta(t+4)$
   (a) Determine $y(t)=h(t) * f(t)$ and sketch the result.
   (b) Determine $z(t)=h(t) * \frac{df}{dt}$ using appropriate properties of convolution and sketch the result.

5. Given $(t)=u(t+1), g(t)=\Delta\frac{(t-2)}{2}$, and $q(t)=f(t-2) * g(t)$,determine $q(4)$.

6. Given $f(t)=u(t+1), h(t)=t^2u(2-t)$, and $y(t)=f(t) * h(t)$, determine $y(-4)$

7. Simplify the following expressions involving the impulse and/ or shifted impulse and sketch the results:

   (a) $g(t)=\sin(2\pi t)\left(\frac{du}{dt}+\delta(t+0.5)\right)$.
   (b) $a(t)=\int_{-\infty}^{t}\delta(\tau-1)d\tau+\Delta\left(\frac{t}{4}\right)\delta(t-2)$.
   (c) $b(t)=\delta(t-2) * rect(t-3)$
   (d) $y(t)=\int_{-\infty}^{2}(\tau^2-3)\delta(\tau-3)d\tau$