ECE250: Signals and Systems
Self practice questions

1. The input $x(t)$ and the impulse response $h(t)$ of a continuous time LTI system are given by;

   $x(t) = u(t)$
   $h(t) = e^{-at}u(t), \qquad a > 0$

   (a) Compute the output $y(t) = x(t) \circledast h(t)$ mathematically and graphically.
   (b) Compute the output $y(t) = h(t) \circledast x(t)$ mathematically and graphically.

   where, $\circledast$ denotes convolution operator.

2. The system shown in Figure 1 is formed by connecting two systems in cascade. The impulse responses of the systems are given by $h_1(t)$ and $h_2(t)$ respectively, and

   $h_1(t) = e^{-2t}u(t)$
   $h_2(t) = e^{-t}u(t)$

   (a) Find the impulse response $h(t)$ of the overall system shown in Figure 1 (b)
   (b) Determine if the overall system is BIBO stable.

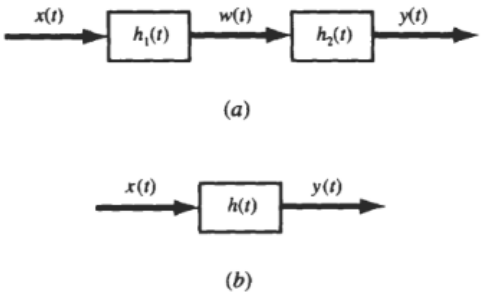

Figure 1: Signal for problem 2

3. Evaluate $y(t) = x(t) \circledast h(t)$, where $x(t)$ and $h(t)$ are shown in Figure 2

   $$x(t) = \begin{cases} u(t), & 0 \le t \le 3 \\ 0, & elsewhere \end{cases}$$

   $$h(t) = \begin{cases} u(t), & 0 \le t \le 2 \\ 0, & elsewhere \end{cases}$$

   (a) using analytical technique.
   (b) using graphical method

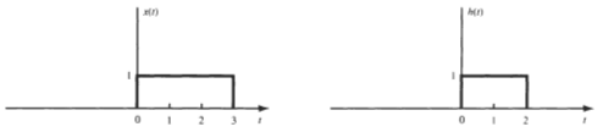

Figure 2: Signal for problem 3

4. Determine and sketch the convolution of the following two signals:

$$x(t) = \begin{cases} t+1, & 0 \le t \le 1 \\ 2-t, & 1 \le t \le 2 \\ 0, & elsewhere \end{cases}$$

$$h(t) = \delta(t+2) + 2\delta(t+1)$$

5. Which of the following impulse responses correspond(s) to stable LTI systems?

(a) $h_1(t) = e^{-(1-2j)t}u(t)$
(b) $h_2(t) = e^{-t}cos(2t)u(t)$