Homework 3

March 12, 2016

Problem 1:
In this chapter,we introduced a number of general properties of systems.In particular,a system may or may not be
(1)Memoryless;(2)Time invariant;(3)Linear;(4)Causal;(5)Stable.Determine which of these properties hold and which do not hold for each of the following continuous-time systems.Justify your answers.In each example.y(t) denotes the system output and $x(t)$ is the system input.

$(a)\quad y(t) = \int_{-\infty}^{2t} x(\tau)d\tau$ $\qquad$ $(b)\quad y(t) = \begin{cases} 0 & t < 0 \\ x(t) + x(t-2), & t \geq 0 \end{cases}$

$(c)\quad y(t) = x(t/3)$ $\qquad$ $(d)\quad y(t) = \dfrac{dx(t)}{dt}$

Problem 2:
Let

$$x(t) = u(t-3) - u(t-5) \tag{1}$$
$$h(t) = e^{3t}u(t) \tag{2}$$

(a) Compute $y(t) = x(t) * h(t)$.
(b) Compute $g(t) = (dx(t)/dt) * h(t)$.
(c) How is $g(t)$ related to $y(t)$?

Problem 3:
(a) Consider an LTI system with input and output related through the equation

$$y(t) = \int_{-\infty}^{t} e^{-(t-\tau)}x(\tau - 2)d\tau \tag{3}$$

What is the impulse response $h(t)$ for this system?
(b) Determine the response of the system when the input $x(t)$ is as shown in Figure 1,

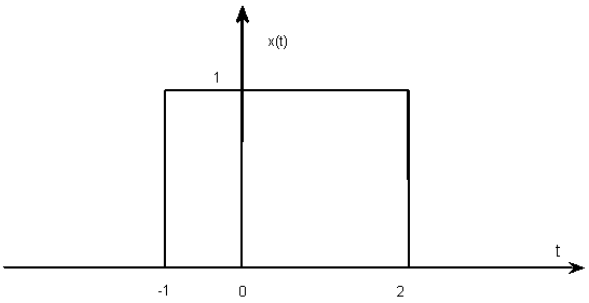

Figure 1: Input $x(t)$

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Problem 4:Consider an LTI system S and a signal $x(t) = 2e^{-3t}u(t-1)$.If

$$x(t) \to y(t) \tag{4}$$

and

$$\frac{dx(t)}{dt} \to -3y(t) + e^{-2t}u(t) \tag{5}$$

determine the impulse response $h(t)$ of S.