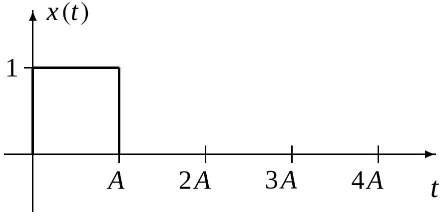
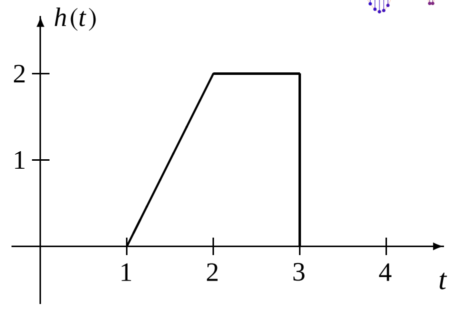
PROBLEM:





Consider the input signal $x(t)$ and the impulse response $h(t)$ shown above. The output of an LTI system is $y(t) = x(t) * h(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$.

(a) Sketch $h(2-\tau)$ as a function of τ in the space below.

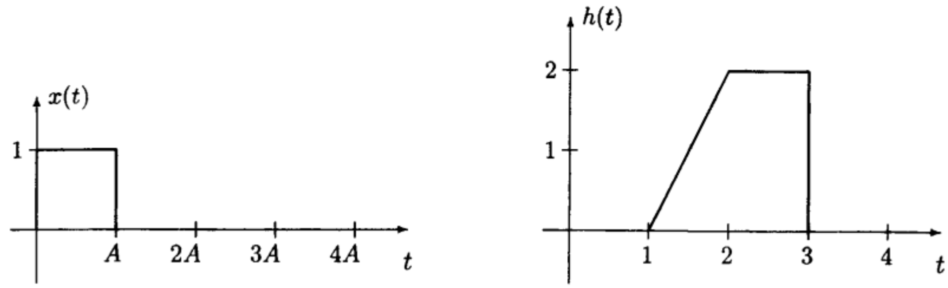
(b) If $A = 1$, for which value(s) of t does $y(t) = 1$?

(c) If $A = \frac{1}{2}$, what is the maximum value for $y(t)$? For which value(s) of t does $y(t)$ reach this maximum value?

(d) What positive value(s) of A will result in the largest maximum value of $y(t)$? Given these value(s) for A, which value(s) of t does $y(t)$ reach this maximum value?

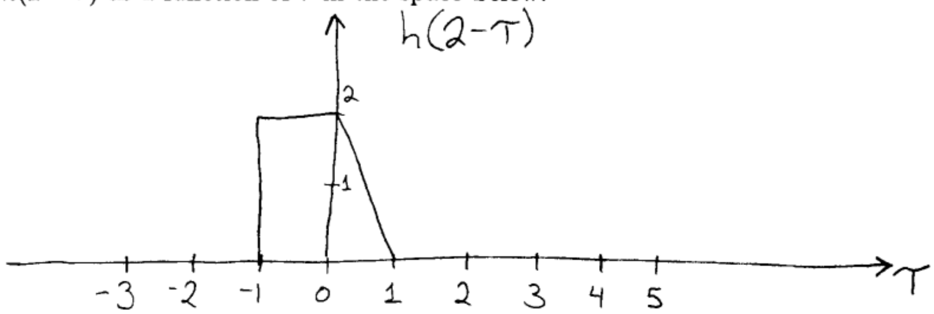
McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

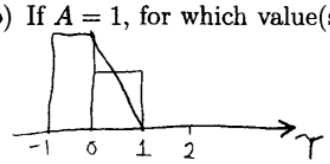


Consider the input signal $x(t)$ and the impulse response $h(t)$ shown above. The output of an LTI system is $y(t) = x(t) * h(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$.

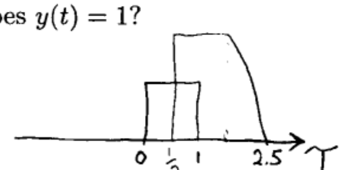
(a) Sketch $h(2-\tau)$ as a function of τ in the space below.



(b) If $A = 1$, for which value(s) of t does $y(t) = 1$?



$y(2) = \frac{1}{2}(2)(1) = 1$

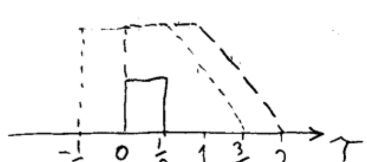


$y(3.5) = \left(\frac{1}{2}\right)(2) = 1$

$y(t) = 1$ when $t = \{2, 3.5\}$

(c) If $A = \frac{1}{2}$, what is the maximum value for $y(t)$? For which value(s) of t does $y(t)$ reach this maximum value?

Maximum value of $y(t) = 2\left(\frac{1}{2}\right) = 1$ over the range of $2.5 \leq t \leq 3$.



(d) What positive value(s) of A will result in the largest maximum value of $y(t)$? Given these value(s) for A, which value(s) of t does $y(t)$ reach this maximum value?

Require full overlap with $h(t)$ so $A \geq 2$

$y(t)$ then is maximum for $t \geq 3$