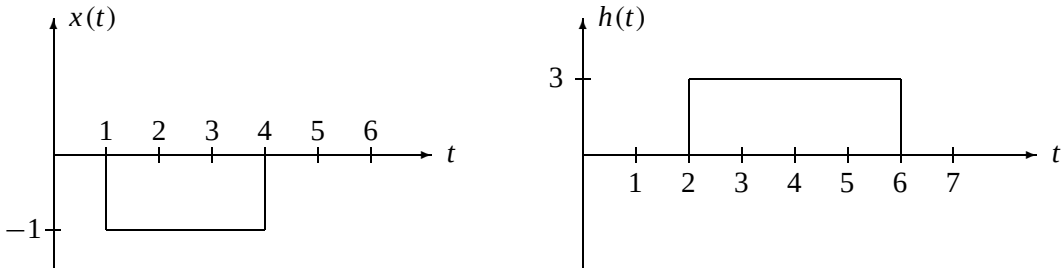
PROBLEM:

The following figure shows the signal $x(t) = -u(t-1)+u(t-4)$, which is the input to a continuous-time LTI system whose impulse response (shown on the right) is $h(t) = 3u(t-2)-3u(t-6)$.



(a) Sketch $h(5-\tau)$ as a function of τ in the space below.

(b) Determine the value of the output of the LTI system, $y(t)$, at $t = 5$; that is, determine $y(5)$. It is not necessary to evaluate $y(t)$ for all t, only for $t = 5$. Note: This problem may be answered without performing any integration.

(c) $y(t)$ reaches its minimum value for $T_1 \leq t \leq T_2$. Find the minimum value, y_{min} and also the values for T_1 and T_2.

$y_{min} =$ _____

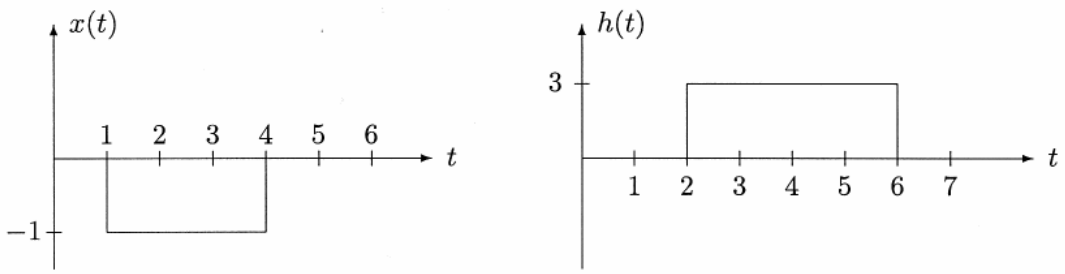
$T_1 =$ _____ sec

$T_2 =$ _____ sec

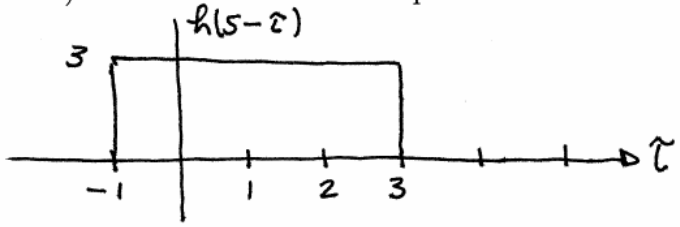
McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

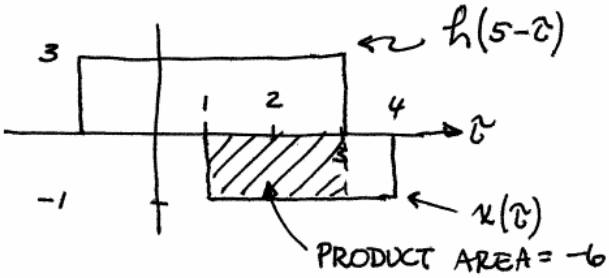
The following figure shows the signal $x(t) = -u(t-1) + u(t-4)$, which is the input to a continuous-time LTI system whose impulse response (shown on the right) is $h(t) = 3u(t-2) - 3u(t-6)$.



(a) Sketch $h(5-\tau)$ as a function of τ in the space below.

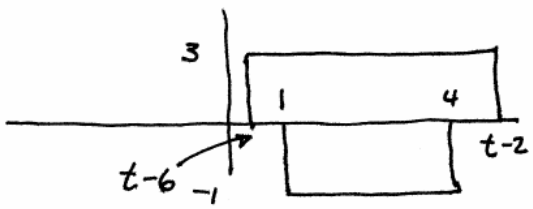


(b) Determine the value of the output of the LTI system, $y(t)$, at $t = 5$; that is, determine $y(5)$. It is not necessary to evaluate $y(t)$ for all t, only for $t = 5$. Note: This problem may be answered without performing any integration.



$\therefore y(5) = -6$

(c) $y(t)$ reaches its minimum value for $T_1 \le t \le T_2$. Find the minimum value, y_{min} and also the values for T_1 and T_2.



$y_{min} =$ −9

$T_1 =$ 6 sec

$T_2 =$ 7 sec

MIN. VALUE ACHIEVED WITH COMPLETE OVERLAP

$\Rightarrow t-6 < 1$ AND $t-2 > 4$

$\Rightarrow t < 7$ AND $t > 6$