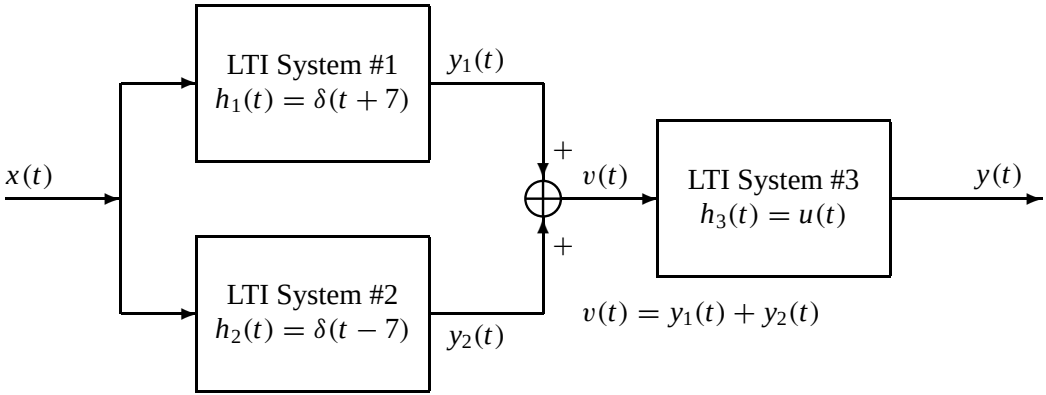
PROBLEM:



(a) What is the impulse response of the overall LTI system (i.e., from $x(t)$ to $y(t)$)? Give your answer both as an equation and as a carefully labeled sketch.

(b) Is the overall system a causal system? Explain to receive credit.

(c) Is the overall system a stable system? Explain to receive credit.

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

SOLUTION

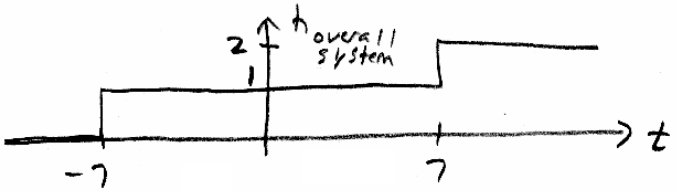
A) $h_1(t) = \delta(t+7)$, $h_2(t) = \delta(t-7)$, $h_3(t) = u(t)$

$$h_{\text{overall system}}(t) = \big(h_1(t) + h_2(t)\big) * h_3(t)$$

$$= \big(\delta(t+7) + \delta(t-7)\big) * u(t)$$

$$= \delta(t+7) * u(t) + \delta(t-7) * u(t)$$

$$= u(t+7) + u(t-7)$$



B) Causal if $h(t) = 0$ for $t < 0$. From graph above, $h(t) \neq 0$ for $t < 0$. Therefore, the system is <u>not causal</u>.

C) Stable if $\int_{-\infty}^{\infty} |h(t)|\,dt < \infty$

For this system $\int_{-\infty}^{\infty} |h(t)|\,dt = \int_{-7}^{7} dt + \int_{7}^{\infty} 2\,dt = \infty$

Therefore the system is <u>not stable</u>.