Problem 9.1: A certain discrete-time LTI system has the impulse response $h[n]$ shown in Figure 1. Does the system possess the following properties: Memoryless? Causal? Stable?

Problem 9.2: For the discrete-time LTI system whose impulse response is shown in Figure 1,

(a) Determine the system's input-output relationship.

(b) What is the output of the system $y[n]$ when the input is $x[n] = \cos\left(\frac{\pi}{4}n\right)$? Determine a mathematical expression for $y[n]$ and plot it. Use a straightedge and label both axes and all important features. Show the origin for context.

Problem 9.3: As will be shown later in the course, the RC circuit in Figure 2 has impulse response

$$h(t) = \frac{1}{RC}e^{-t/RC}u(t),$$

where $R,\ C > 0$ are both constants. The system is linear because of the linear relationship between voltage and current in a resistor and capacitor, and time-invariant because the resistance R and capacitance C do not change with time. Does the circuit possess the following properties: Memoryless? Causal? Stable?

Problem 9.4: Shown in Figure 3 is an LTI system that is a composite of three LTI systems with impulse responses $h_1(t) = \delta(t-1)$, $h_2(t) = 2\delta(t)$, and $h_3(t) = \delta(t-2)$.

(a) Determine the impulse response $h(t)$ of the overall system.

(b) Determine the output of the system $y(t)$ when the input is $x(t) = u(t)$.

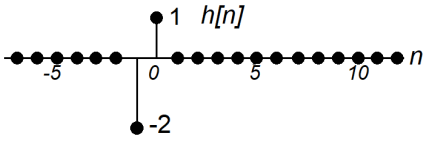

Figure 1

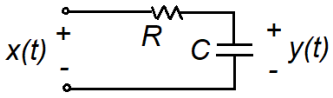

Figure 2

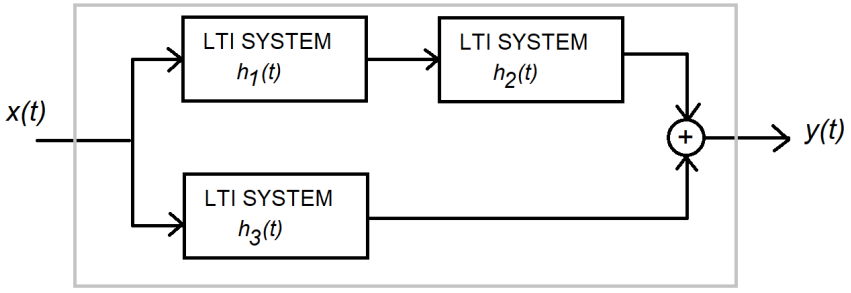

Figure 3

Optional, but testable, problems: From the textbook, Problems 2.26, 2.28, 2.29.