(a) Can system S be time-invariant? Explain.
(b) Can system S be linear? Explain.
(c) Suppose (2) and (3) are input–output pairs of a particular system S_2, and the system is known to be LTI. What is $h[n]$, the impulse response of the system?
(d) Suppose (1) is the input–output pair of an LTI system S_3. What is the output of this system for the input in Figure P2.28-2:

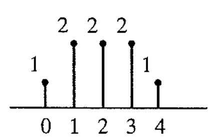

Figure P2.28–2

2.29. An LTI system has impulse response defined by

$$h[n] = \begin{cases} 0 & n < 0 \\ 1 & n = 0, 1, 2, 3 \\ -2 & n = 4, 5 \\ 0 & n > 5 \end{cases}$$

Determine and plot the output $y[n]$ when the input $x[n]$ is:

(a) $u[n]$
(b) $u[n-4]$
(c) $u[n] - u[n-4]$.

2.30. Consider the cascade connection of two LTI systems in Figure P2.30:

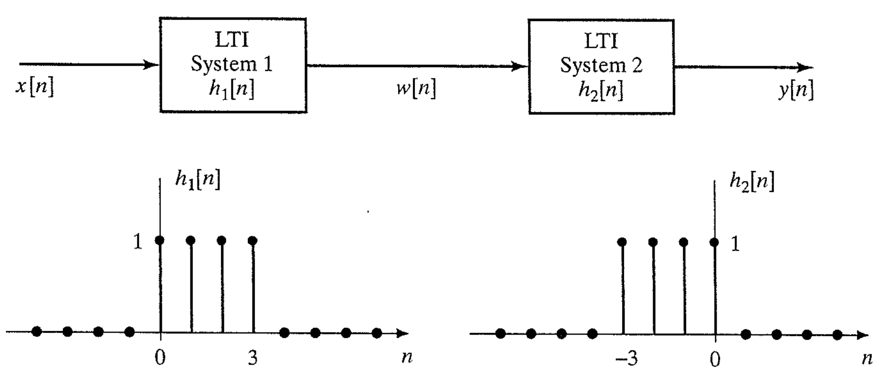

Figure P2.30

(a) Determine and sketch $w[n]$ if $x[n] = (-1)^n u[n]$. Also, determine the overall output $y[n]$.
(b) Determine and sketch the overall impulse response of the cascade system; i.e., plot the output $y[n] = h[n]$ when $x[n] = \delta[n]$.
(c) Now consider the input $x[n] = 2\delta[n] + 4\delta[n-4] - 2\delta[n-12]$. Sketch $w[n]$.
(d) For the input of part (c), write an expression for the output $y[n]$ in terms of the overall impulse response $h[n]$ as defined in part (b). Make a carefully labeled sketch of your answer.