PROBLEM:

The diagram in Fig. 1 depicts a *cascade connection* of two linear time-invariant systems; i.e., the output of the first system is the input to the second system, and the overall output is the output of the second system.
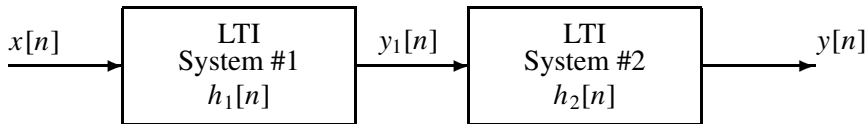

Figure 1: Cascade connection of two LTI systems.

(a) Suppose that System #1 is a "first-difference" filter described by the difference equation

$$y_1[n] = x[n] - x[n - 1],$$

and System #2 is described by the impulse response

$$h_2[n] = u[n] - u[n - 10]$$

Determine the impulse response sequence, $h[n] = h_1[n] * h_2[n]$, of the overall cascade system.

(b) Obtain a single difference equation that relates $y[n]$ to $x[n]$ in Fig. 1.