This homework can be completed either individually or in pairs. Please clearly and neatly write the name(s) of the people doing the assignment in the top right corner of the top page turned of your submission. (If done in pairs, only one submission is needed.)

When sketching signals for graded assignments, students are expected to clearly label the horizontal and vertical axes, as well as characteristic points on the signals.

1. An LTI system has the following input-output relationship, \( y(t) = x(t-1) \).
   a. What is the impulse response?
   b. Is this system causal?

2. An LTI system has the following input-output relationship, \( y(t) = x(t-1) + x(t+1) \).
   a. What is the impulse response?
   b. Is this system causal?

3. The input to a system is \( x(t) = u(t-2) \). The output is \( (t-1)[u(t-1)-u(t-3)] \). Is this system causal? Explain your answer/reasoning.

4. An LTI system has the impulse response \( h(t) = u(t+1) - u(t-2) \).
   a. Is this system causal? Explain your answer/reasoning.
   b. Find and sketch the output, \( y(t) \), when the input is \( x(t) = u(t) \).
   c. Find and sketch the output, \( y(t) \), when the input is \( x(t) = u(t-3) - u(t-6) \).
   d. Find and sketch the output, \( y(t) \), when the input is \( x(t) = (t-3)[u(t-3) - u(t-6)] \).

5. Convolve the signals \( g(t) = u(t) - u(t-1) \) and \( w(t) = u(t-2) - u(t-4) \).

6. Convolve the signals \( g(t) = t[u(t) - u(t-1)] \) and \( w(t) = t[u(t-2) - u(t-4)] \).

7. Comment on how the solution procedures for Problems 5 and 6 are similar/different when the graphical approach to convolution is used.

8. An LTI system has the impulse response \( h(t) = u(t-1) - u(t-2) \).
   a. Find and sketch the output when the input signal is \( x(t) = \sin(\pi t) \).
   b. Find and sketch the output when the input signal is \( x(t) = \sin(2\pi t) \).
   c. Briefly explain the reason for the significant difference between your answers for 5a and 5b.
   d. Explain how one could develop the transfer function (i.e., frequency response) of this LTI system by choosing different signals, \( x(t) \).