

ME 351 – SIGNALS AND SYSTEMS

ASSIGNMENT 1

1. For the given $x(t)$ in Figure 1, plot the following:

- $x(t + 1)$
- $x(-t + 1)$
- $x\left(\frac{3}{2}t + 1\right)$

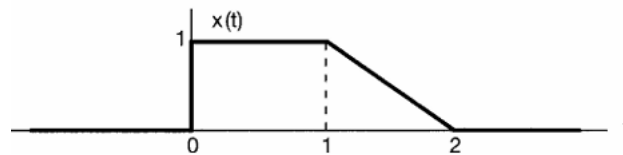


Figure 1: $x(t)$ for Problem 1

2. Is the following (see Figure 2) an energy signal, a power signal, or neither? Please justify. Also calculate the energy/power of the signal (whichever is applicable).

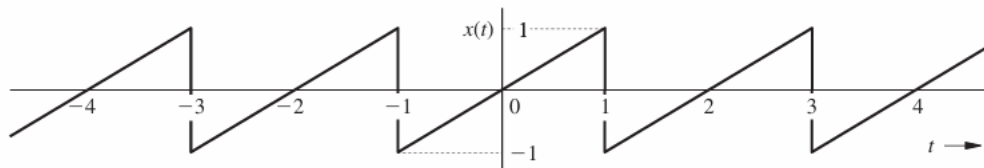


Figure 2: $x(t)$ for Problem 2

3. Describe the following signal (see Figure 3) mathematically in terms of unit step and ramp functions.

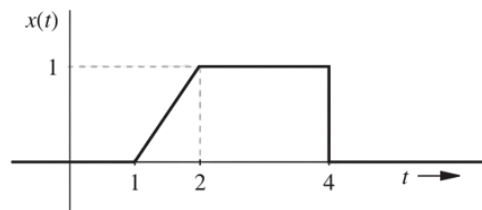


Figure 3: $x(t)$ for Problem 3

4. Is the system represented by $y(t) = \frac{d}{dt}x(t)$:
- Causal or non-causal?
 - Time-varying or invariant?

c. Memoryless or with memory?

5. Find $y_0(t)$, the zero-input response of an LTIC system described by the repeated root system $(D^2 + 2D + 1)y(t) = (D + 2)x(t)$ with initial conditions $y_0(0) = 1$ and $\dot{y}_0(0) = 2$.
6. Using **convolution tables**, determine the output of the system represented by $h(t) = (3e^{-3t} + 2e^{-t})u(t)$ for an input $x(t) = 5e^{-2t}$.
7. During semester n , $x[n]$ students enroll in a course requiring a certain textbook while the publisher sells $y[n]$ new copies of the same book. On average, one-third of students with books in salable condition resell the texts at the end of the semester, and the book life is three semesters. Write the equation relating $y[n]$, the new books sold by the publisher, to $x[n]$, the number of students enrolled in the n -th semester, assuming that every student buys a book.
8. Solve the following iteratively (3 iterations)

$$y[n + 2] - y[n + 1] + 0.24[n] = x[n + 2] - 2x[n + 1]$$
 when $y[-1] = 2, y[-2] = 1$ and $x[n] = nu[n]$.
9. For the given $h[n]$ and $x[n]$ (see Figure 4), determine the output signal $y[n]$.

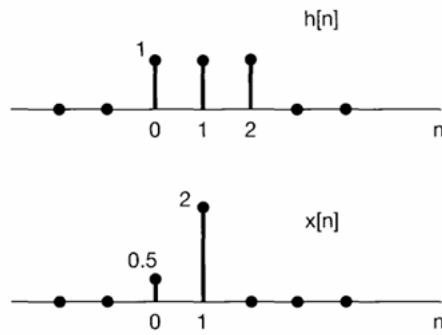


Figure 4: $h[n]$ and $x[n]$ for Problem 9

10. Find the unilateral Laplace transform of

$$\frac{8s + 10}{(s + 1)(s + 2)^3}$$