ELEC 309
Signals and Systems
Homework 2 Assignment

Time-Domain Analysis of Signals

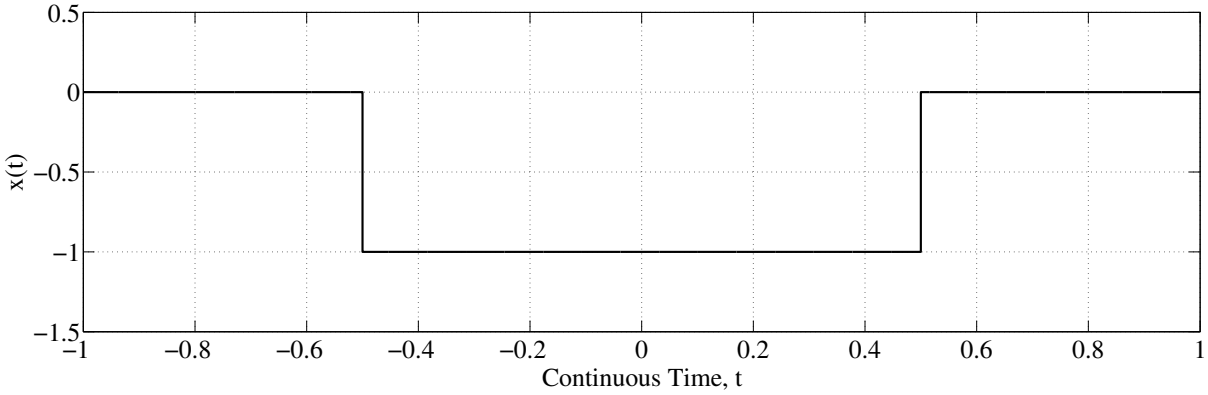

Figure 1: Rectangular Pulse Signal

1. A rectangular pulse signal $x(t)$ is depicted in Figure 1. Express $x(t)$ as a weighted sum of unit step functions.

2. A discrete-time signal $x[n]$ is given by

$$x[n] = \begin{cases} 1 & 0 \leq n \leq 9 \\ 0 & \text{otherwise.} \end{cases}$$

   (a) Express $x[n]$ as a weighted sum of unit step functions.
   (b) Express $x[n]$ as a weighted sum of unit impulse functions.

3. Simplify
   (a) $\int_{-\pi}^{\pi} e^{-(t-\pi)^2}\delta(t)dt$
   (b) $\int_{-\pi}^{\pi} e^{-(t-\pi)^2}\delta(t-2\pi)dt$
   (c) $\cos(2\pi t)\,\delta(-2t)$

4. The systems that follow have input $x(t)$ or $x[n]$ and output $y(t)$ or $y[n]$. For each system determine whether it is (i) memoryless, (ii) causal, (iii) linear, (iv) time-invariant, (v) invertible, and (vi) stable.
   (a) $y(t) = \cos(x(t))$
   (b) $y[n] = 2x[n]u[n]$
   (c) $y(t) = \int_{-\infty}^{t/2} x(\tau)d\tau$
   (d) $y[n] = \cos(2[n+1]) + x[n]$