October 13, 1998

Midterm Exam I

EE 3302: Signals and Systems

NOTE: **Please, complete the following table and keep record of your assignment number.**

First Name	
Last Name	
Student ID	
Assignment #	0

Exercise 1. Consider the signal

$$x(t) = -\mathrm{e}^{-at}u(t) \qquad 0 < a < 1$$

where $u(t)$ is the causal step function.

A) Derive the energy and the time-averaged power of the signal over $-\infty < t < \infty$.

Exercise 2. Consider the following discrete-time signal

$$x[n] = \cos\left(\frac{3\pi}{5}n\right)$$

A) Determine whether or not $x[n]$ is periodic. If it is, determine its fundamental period.

Exercise 3. Consider the continuous-time signal

$$x(t) = \begin{cases} 3 - |t| & -3 \le t \le 3 \\ 0 & \text{otherwise} \end{cases}$$

A) Sketch and label carefully $\quad 2\ x(3 - 2t)$.

Exercise 4. Consider the discrete-time LTI system with impulse response

$$h[n] = \begin{cases} 1 & n = 0, 1, 2, 3 \\ 0 & \text{otherwise} \end{cases}$$

The signal at the system input is

$$x[n] = a^n\ u[n] \qquad 0 < a < 1$$

where $u[n]$ is the causal step function.

A) Derive the expression of the signal at the output of the system. Sketch the output signal.

Exercise 5. A continuous-time LTI system has impulse response

$$h(t) = \mathrm{e}^{-a(t+1)}\ u(t+1) \qquad 0 < a < 1$$

where $u(t)$ is the causal step function.

A) Determine whether or not the system is:

- memoryless

- causal
- stable

Exercise 6. Consider the LTI system with the following input (x) output (y) relation

$$y(t) = \int_{-\infty}^{t} 2\, x(t)\, dt \;+\; x(t+1)$$

A) Calculate the impulse response of the system and determine whether or not the system is causal.

Exercise 7. Consider the continuous-time LTI system shown in Fig. 1, where the impulse responses of the

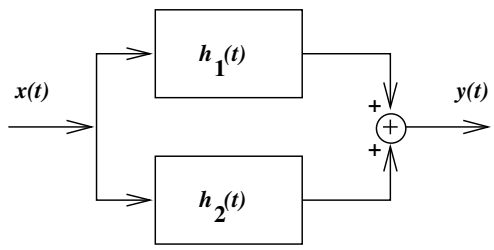

Figure 1: Parallel of two LTI subsystems.

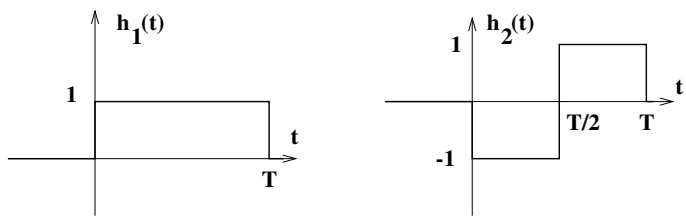

Figure 2: Impulse responses.

two subsystems are shown in Fig. 2.

A) Sketch and label carefully the response of the system $y(t)$ to the input

$$x(t) = \sum_{k=-\infty}^{+\infty} \delta(t - kT)$$