February 24, 2003

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 following discrete-time signal

$$x[n] = \cos\left(2\pi^2 n\right)$$

A) Determine whether or not $x[n]$ is periodic. If it is, determine its fundamental period [pt. 10].

Exercise 2. Consider the continuous-time signal

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

A) Sketch and label carefully $x(3-2t)$ [pt. 10].

Exercise 3. A continuous-time LTI system has impulse response

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

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

A) Determine whether or not the system is [pt. 10]:

- memoryless
- causal
- stable

Exercise 4. Consider the signal

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

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

A) Derive the energy and the time-averaged power of the signal over $-\infty < t < \infty$ [pt. 10].

Exercise 5. Consider the discrete-time LTI system with impulse response

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

The signal at the system input is

$$x[n] = u[n] + \delta[n+1]$$

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 [pt. 20].

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

$$y(t) = \int_{-\infty}^{t+15} 2\ x(\tau)\ d\tau$$

A) Calculate the impulse response of the system and determine whether or not the system is causal [pt. 18].

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

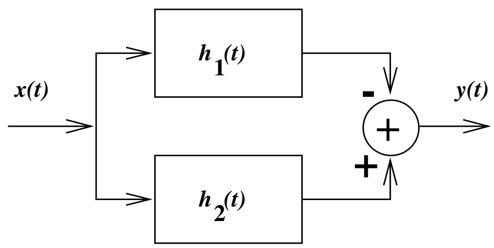

Figure 1: Parallel of two LTI subsystems.

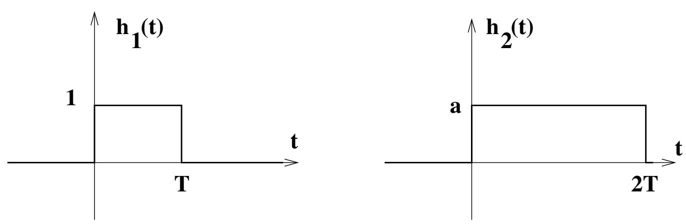

Figure 2: Impulse responses.

two subsystems are shown in Fig. 2.

A) Sketch and label carefully the response of the system $y(t)$ to the input [pt. 22]

$$x(t) = \sum_{k=-\infty}^{+\infty} \delta(t - 2kT)$$