

**EECS 120. Midterm No. 1, February 17, 2000.**

Please use these sheets for your answer. Add extra pages if necessary and staple them to these sheets. **Write clearly and put a box around your answer, and show your work.**

Print your name below

Last Name \_\_\_\_\_ First \_\_\_\_\_

Problem 1:

Problem 2:

Problem 3:

Problem 4:

Total:

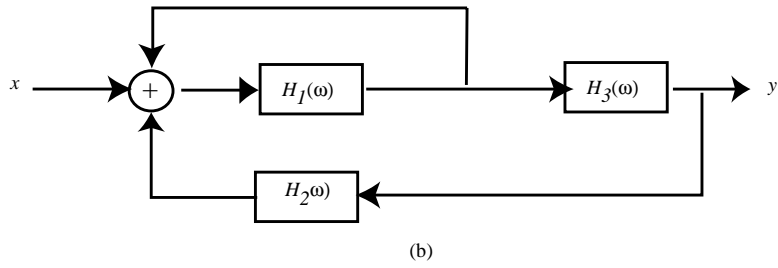
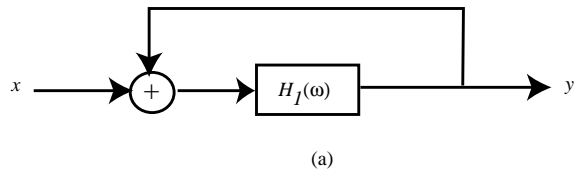


Figure 1: System for Problem 1

1. **20 points** Find the expression for the frequency response from  $x$  to  $y$  in terms of  $H_1, H_2, H_3$  for the system depicted in:
  - (a) Part (a) of Figure 1;
  - (b) Part (b) of Figure 1.

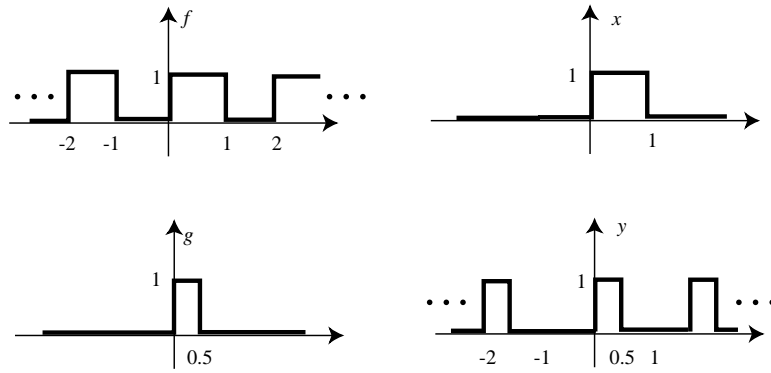


Figure 2: Signals for Problem 2

2. **20 points** Let  $f, g, x, y$  be as in Figure 2.

- (a) Determine  $f * g$ ;
- (b) Determine  $x * y$ .

You may give your answer in the form of a graph or an algebraic expression.

3. **20 points** Give an example of a discrete-time system  $H$  that is:

- (a) Not linear;
- (b) Linear and time-varying;
- (c) LTI but not causal;
- (d) LTI, causal, but not memoryless.

4. **20 points** Suppose a periodic signal  $x : \mathit{Reals} \rightarrow \mathit{Comps}$  with fundamental frequency  $\omega_x$  has the Fourier series representation:

$$\forall t, \quad x(t) = \sum_{k=-\infty}^{\infty} X_k e^{jk\omega_x t}.$$

- (a) Let  $y$  be the signal  $\forall t, y(t) = x(t - \tau)$ , where  $\tau$  is a fixed number. What is the Fourier series representation of  $y$ ?
- (b) Let  $z$  be the signal  $\forall t, z(t) = x(2t)$ . What is the fundamental frequency  $\omega_z$  of  $z$  in terms of  $\omega_x$ ? What is the Fourier series representation of  $z$ ?
- (c) Let  $w$  be the signal  $\forall t, w(t) = z(-t)$ . What is the Fourier series representation of  $w$ ?