February 13, 1998 **Name:**_____

EE 438 **Exam No. 1** **Spring 1998**

- You have 50 minutes to work the following four problems.
- Be sure to show all your work to obtain full credit.
- The exam is closed book and closed notes.
- Calculators are permitted.

1. (25 pts.) Consider the system defined by the equation

$$y[n] = x[n] - x[n-1] - y[n-1].$$

   a. Find a simple expression for the impulse response $h[n]$ for the system (Do not use Z transforms).

   b. Find the frequency response $H(\omega)$ for the system, and determine simple expressions for the magnitude and phase of the frequency response.

   c. Is this system BIBO stable? Justify your answer.

1. (continued)

2. (15 pts.) Consider the continuous-time signal

$$x(t) = \begin{cases} \cos[2\pi(8)t], & |t| < 1/2 \\ 0, & \text{else} \end{cases}$$

a. Use standard functions and CTFT relations to find the CTFT $X(f)$. (Do *not* directly evaluate any integrals!)

b. Sketch $X(f)$.

2. (continued)

3. (30 pts.) Consider the discrete-time signal

$$x[n] = \begin{cases} 1, & |n| < 16 \\ 0, & \text{else} \end{cases}$$

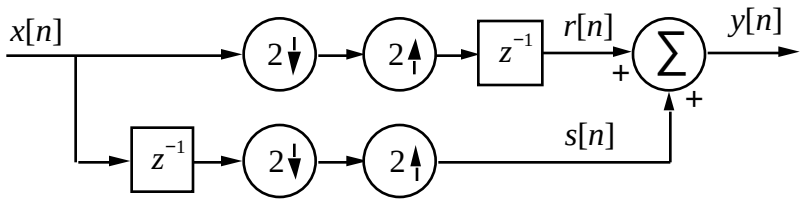
a. Find the DTFT $X(\omega)$ for this signal. Simplify your answer as much as possible.
b. Sketch the DTFT $X(\omega)$.

Now let $y[n] = x[n]\cos(\pi n / 2)$.
c. Use standard transform relations to find the DTFT $Y(\omega)$ for this signal. (Do not evaluate the DTFT sum directly.)
d. Sketch the DTFT $Y(\omega)$.

e. Comment on the relation between $Y(\omega)$ and the CTFT $X(f)$ that you found in Problem 3.

3. (continued)

4. (30 pts.) Consider the system shown below,



where z^{-1} denotes a one-sample delay.

a. Find expressions for $r[n]$ and $s[n]$ in terms of $x[n]$.

b. Based on your answer to part a, find an expression for $y[n]$ in terms of $x[n]$.

c. Find expressions for the DTFTs $R(\omega)$ and $S(\omega)$ in terms of the DTFT $X(\omega)$.

d. Based on your answer to part c, find an expression for the DTFT $Y(\omega)$ in terms of the DTFT $X(\omega)$.

4. (continued)

1.	_____
2.	_____
3.	_____
4.	_____
Total	_____