14 February 2003 **Name:**_____

EE 438 **Exam No. 1** **Spring 2003**

- 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 a linear, time-invariant system defined by the equation

$$y[n] = x[n] - x[n-2] - y[n-1]$$

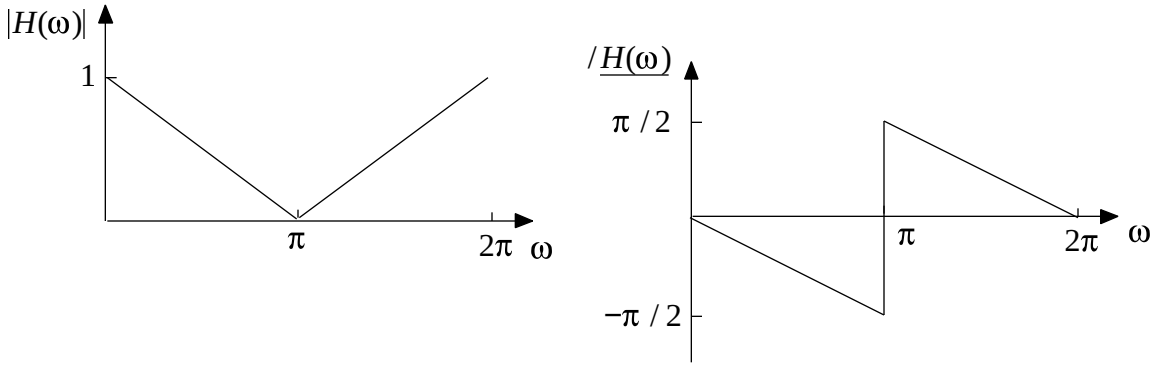
a. (12) Find a simple expression for the frequency response $H(\omega)$.

b. (7) Find and sketch the magnitude $|H(\omega)|$. Be sure to label your axes.

c. (6) Find and sketch the phase $/\underline{H(\omega)}$. Be sure to label your axes.

1. (continued)

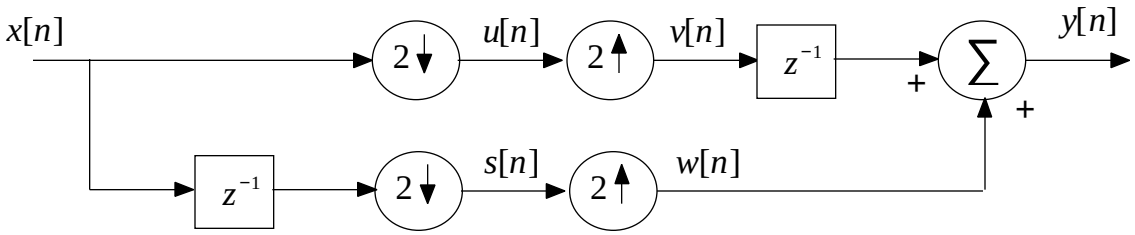
2. (25 pts.) The signal $x[n] = \cos(2\pi n / 3)$ is input to a digital filter with frequency response magnitude and phase as shown:



Find the output $y[n]$ from this system.

2. (continued)

3. (25) Consider the system below where z^{-1} denotes a unit sample delay.



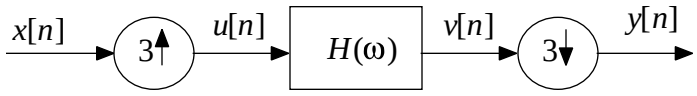
with input signal

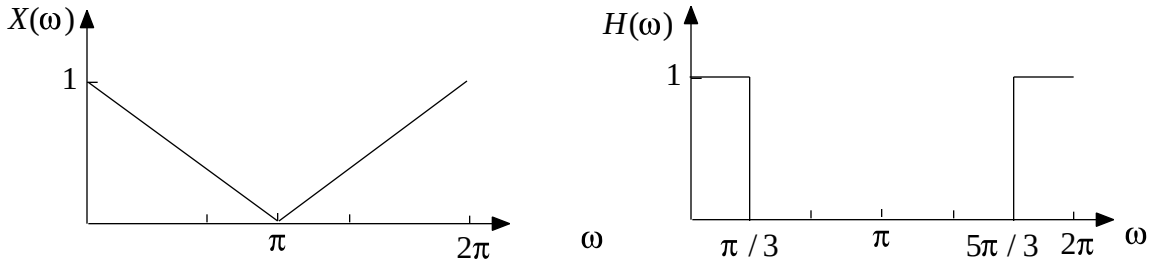
n	...,	−2,	−1,	0,	1,	2,	3,	4,	5,	6,	...,
$x[n]$	...,	0,	0,	5,	4,	3,	2,	1,	0,	0,	...,

Tabulate the signals $u[n], v[n], s[n], w[n], y[n]$.

3. (continued)

4. (25 pts) Consider the DT system and input signal $x[n]$ with DTFT $X(\omega)$ and filter frequency response $H(\omega)$ shown below:





a) (8) Sketch the DTFT $U(\omega)$. Be sure to label all axes

b) (8) Sketch the DTFT $V(\omega)$. Be sure to label all axes

c) (9) Sketch the DTFT $Y(\omega)$. Be sure to label all axes

4. (continued)

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