March 20, 1997 **Name:**_____

EE 438 **Exam No. 2** **Spring 1997**

- You have 75 minutes to work the following five problems.
- Be sure to show all your work to obtain full credit.
- The exam is closed book and closed notes. However, you may bring with you 2 sheets of formulas handwritten on both sides of one 8.5x11 in. sheet of paper, readable by the unaided eye.
- Calculators are permitted.

1. (20 pts.) A signal $x[n]$ has Z transform $X(z) = \dfrac{2}{(1-0.5z^{-1})(1+z^{-1})}$, $0.5 < |z| < 1$.

   Find $x[n]$.

1. (continued)

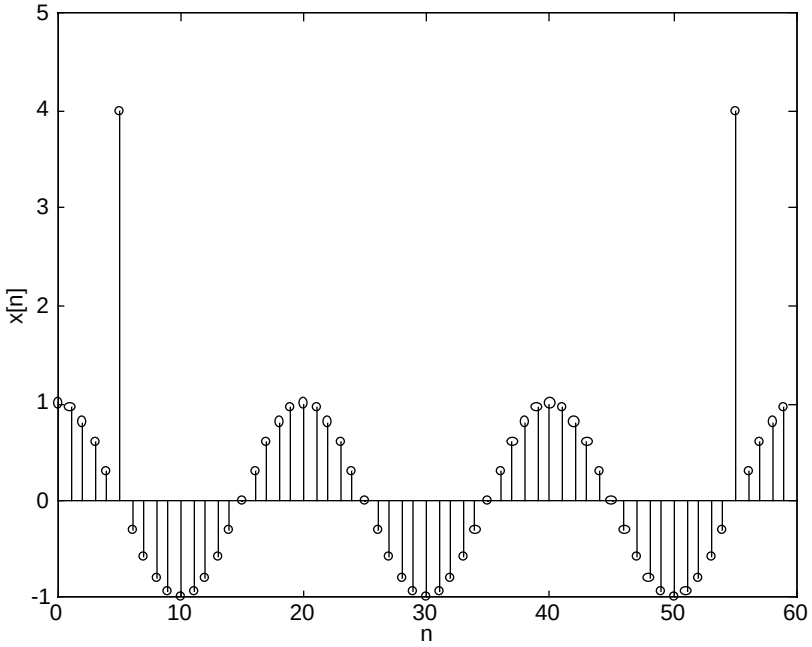
2. (20 pts.) The output $y[n] = \frac{1}{2}\left[\left(\frac{1}{2}\right)^n + \left(-\frac{1}{2}\right)^n\right]\mathrm{u}[n]$ is observed from a LTI DT system described by the difference equation $y[n] = x[n] - \frac{1}{2}y[n-1]$. Find a simple expression for the input $x[n]$ that generated this output.

2. (continued)

3. (20 pts.) Consider the signal $x[n]$ shown below.

   a. Find a simple closed form expression for the 60 point DFT $X[k]$ of this signal.

   b. Sketch $X[k]$.



3. (continued)

4. (20 pts.) Derive the complete flow diagram for a 6 point FFT. Be sure to specify all twiddle factors.

4. (continued)

5. (20 pts.) Compute the circular convolution with period 8 of the following two signals:

n	0	1	2	3	4	5	6	7
$x_1[n]$	1	2	3	4	5	5	5	5
$x_2[n]$	1	1	-1	-1	0	0	0	0

5. (continued)

1. _____

2. _____

3. _____

4. _____

5. _____

Total _____