University of Kentucky
Department of Electrical and Computer Engineering

EE421G: Signals and Systems I – Fall 2007

Problem Set 4

Issued: September 17, 2007 Due: September 24, 2008 (In class)

Reading Assignments:

Read Chapter 3 of Chen.

Computer Assignments:

1) Explore the "*Joy of Convolution*" and "*Joy of Convolution (Discrete Time)*" sections at http://www.jhu.edu/~signals.

If the Java applets in the above webpages are not running properly, install the latest Java Runtime Environment (JRE) from http://java.sun.com/javase/downloads/index.jsp

Paper and Pencil Assignments:

1) Problem 2.16: Consider a DT LTI system with the input-output pair shown below. What is its step response (the output excited by the step sequence q[n])? What is its impulse response (the output excited by the impulse sequence δ[n])?

2) Problem 3.2: Consider the sequence h=[1 2 3 -2] which is located at n=0:3 and u[1 0 -2 4 4 5] which is located at n=0:5. Compute their convolution for n=-2:12.

3) Problem 3.3: Consider the polynomials

$$h(s) = s^3 + 2s^2 + 3s - 2$$

And

$$h(s) = s^5 - 2s^3 + 4s^2 + 4s + 5$$

Compute h(s)u(s). Verify that its coefficients are the same as those in Problem 2. Thus the multiplication of two polynomials can be computed as the convolution of their coefficients.

4) Problem 3.6: Consider a DT LTI system with impulse response h[0]=0 and h[n]=1 for all n≥1. Find a difference equation to describe the system.

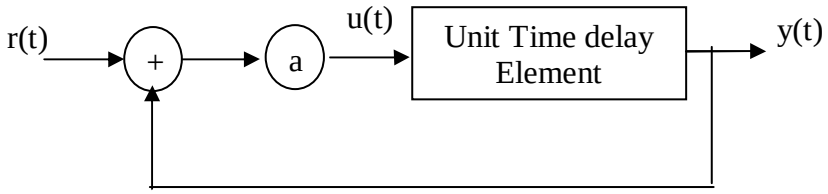
5) Problem 3.9: Consider the difference equation

$$y[n]+2y[n-1]=u[n-1]+3u[n-2]+2u[n-3]$$

Does it describe a causal system? What is its order?

6) Problem 3.10: Compute the impulse response of the DT system in Problem 5. Is it FIR or IIR? If it is FIR, what is its length? Can you find a non-recursive difference equation to describe the system?

~~7) Problem 3.14: Consider the positive feedback system show below. Find its impulse response.~~



~~8) Problem 3.15: Compute the integral convolution of $h_i(t)$ and $u_i(t)$, shown below.~~