KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

EE406- SIGNAL PROCESING
FALL SEMESTER 2003-2004

PROJECT #2

Due Date: January 3rd, 2004

Problem 1

Consider the rectangular pulse $x(n) = u(n) - u(n - 10)$ acting as an input to an LTI system with the impulse response $h(n) = (0.9)^n u(n)$.

Determine the output $y(n) = x(n) * h(n)$.

Problem 2

As in discrete-time Fourier transform, the Z-transform also had its properties and one of the more important is the convolution property which is going to be demonstrated below:

Let $X_1(z) = 1 + 2z^{-1} + 3z^{-2}$ and $X_2(z) = 4 + 5z^{-1} + 6z^{-2} + 7z^{-3}$

Thus, determine $X_3(z) = X_1(z)\, X_2(z)$

Problem 3

To show the relationship between convolution and deconvolution, we use the same equation as in prvious problem but this time we take the resultant $X_3(z)$ to divide by the $X_2(z)$.

Hence,

$$X_3(z) = 4 + 13z^{-1} + 28z^{-2} + 34z^{-3} + 32z^{-4} + 21z^{-5}$$

$$X_2(z) = 4 + 5z^{-1} + 6z^{-2} + 7z^{-3}$$

Problem 4

Compute the inverse Z-transform of

$$X(z) = 1 / (1 - 0.9\, z^{-1})^2 (1 + 0.9\, z^{-1})$$

where $|Z| > 0.9$

Problem 5

Determine the inverse Z-transform of

$$X = 1 + 0.4\,z^{-1} / 1 - 0.8\,z^{-1} + 0.64\,z^{-2}$$

so that the resulting sequence is causal and contain no complex numbers.

Problem 6

Given a causal system

$$y(n) = 0.9y(n-1) + x(n)$$

a. *Find H(z) and sketch its pole-zero plot.*

b. *Plot* $|H(e^{j\omega})|$ *and* $\angle H(e^{j\omega})$