**Assignment #11**

ECSE-2410 Signals & Systems - Spring 2011 Due Tue 03/11/11

1(5). Find the $z$-transform of the repeating sequence, $x[n]=\{\underline{0},1,0,1,0,\ldots\}$

2(15). Find the closed form analytic expressions for the inverse $z$-transforms of the following. Use tables and properties. Assume $x[n]=0$ for $n<0$.

(a)(5) $X(z)=\dfrac{z^{-2}}{1-\frac{1}{3}z^{-1}}$ (b)(10) $X(z)=\dfrac{z^{-2}}{\left(1-\frac{1}{3}z^{-1}\right)^2}$ $\left(\text{use property, } nx[n]\leftrightarrow -z\dfrac{dX(z)}{dz}\right)$

(c)(10) $X(z)=\dfrac{z^2}{z^2+\frac{1}{2}z-\frac{1}{2}}$ (use partial fraction expansion)

3.(15) The z-transform of sequences $x_1[n]$ and $x_2[n]$ are $X_1(z)=1+z^{-1}+2z^{-3}$ and $X_2(z)=2z^{-1}+z^{-2}+3z^{-3}$, respectively.

(a) What are $x_1[n]$ and $x_2[n]$? Express each as a sequence starting at $n=0$.

(b) Convolve $x_1[n]$ with $x_2[n]$, i.e., find $y[n]=x_1[n]*x_2[n]$.

(c) Form the polynomial product $X_1(z)X_2(z)$. What is the inverse z-transform of $X_1(z)X_2(z)$?

4(15). The output of a discrete-time linear, time-invariant system is $y[n]=\left(1-\left(\dfrac{1}{2}\right)^n\right)u[n]$ when the input is a unit step, $x[n]=u[n]$. Using $z$-transforms, find the impulse response, $h[n]$.

5(10). The signal $x(t)=\cos(5\pi t)$ is sampled every 0.1 seconds, starting at $t=0$. Find $X(z)$, the $z$-transform of the resulting sampled signal $x[n]$. Note that $x[n]=0$ for $n<0$

6(10). Find the $z$-transform of $x[n]=\left(\frac{1}{3}\right)^n\cos\left(\frac{\pi}{4}n\right)u[n]$ and sketch its pole-zero diagram.

7(15). Find the inverse transform of $X(z)=\left(\dfrac{1}{4}\right)\left(\dfrac{8-\left(1+2\sqrt{3}\right)z^{-1}}{1-\dfrac{1}{4}z^{-1}+\dfrac{1}{16}z^{-2}}\right)$.

8(15). Find Find the inverse transform of $X(z)=\left(\dfrac{5\left(1-z^{-1}\right)}{1-1.6z^{-1}+0.8z^{-2}}\right)$. Express in the form,

$x[n]=K(a)^n\cos(bn+c)u[n]$.