University of Massachusetts Lowell
Department of Electrical and Computer Engineering
EECE 5090 Linear Systems

1. Evaluate the z-transform of the listed functions. Be sure to note the region of convergence.

a. $x(n) = (3n-1)u(-n-1) + 3^{n-1}u(n-1)$

b. $x(n) = 0.5^n u(-n) + \cos(n\pi/10)u(n)$

c. $x(t) = \sum_{k=0}^{\infty} a^{2k}\delta(n+2k)$

2. Determine the inverse transform of the result obtained in problem one using residue calculus. Please denote the contour used.

3. Invert the z-transform of

$$H(z) = \frac{3z^3 + 2z^2 + z}{(z+3)^2(z-2)}$$

given the ROC

a. $|z| > 3$

b. $|z| < 2$

4. Evaluate the expressions

a. $3^n u(-n) * 2^n u(-n)$

b. $(0.6)^{|n|} \oplus (0.6)^{|n|}$

5. Consider the causal Laplace transform

$$H(s) = \frac{2}{(s+3)(s+1)}$$

We wish to determine an impulse response invariant transformation of $H(s)$ to its discrete analog $\hat{H}(z)$. If successful $h(t)$ evaluated at $t = nT_s$ is equal to $\hat{h}(n)$.

a. Find $h(nT_s)$

b. Find the z-transform of $h(nT_s)$ which equal to $\hat{H}(z)$.

c. Given that $z = e^{sT_s}$ compare the frequency response of $H(s)$ and $\hat{H}(z)$ for sampling frequencies 6, 12 and 24 Hz.