GPGN 404
2nd Midterm Exam
November 15, 2013 **Name:** _____

Question:	1	2	3	4	Total
Points:	8	12	15	15	50
Score:					

Question 1 ..... (8 points)

Specify system responses $H(z)$ (including regions of convergence) for linear time-invariant systems having the following impulse responses. (The symbol $*$ denotes convolution.)

(a) $h_1[n] = u[n] - u[n-16]$

(b) $h_2[n] = h_1[n] * h_1[n]$

Question 2 ..... (12 points)

Specify the system response $H(z)$ (including the ROC) of any system that

(a) has a finite impulse response

(b) is unstable

(c) is stable, with a left-sided (infinitely long) impulse response

(d) is stable, not causal, and has a right-sided impulse response

Question 3 ..... (15 points)

Consider the LTI system with system response $H(z) = 1 - z^{-4}$.

(a) Sketch locations of all poles and zeros in the complex z-plane.

(b) Sketch the impulse response $h[n]$ for this system. (Label axes.)

(c) What is the frequency response $H(\omega)$ for this system?

(d) Sketch the amplitude response $A(\omega)$ for $-\pi \leq \omega \leq \pi$. (Label axes.)

(e) Sketch the phase response $\phi(\omega)$ for $-\pi \leq \omega \leq \pi$. (Label axes.)

Question 4 ..... (15 points)

Suppose you are given a sequence $x[n]$ that was obtained by sampling *without aliasing* an analog signal $s(t)$, with sampling interval $T = 0.1$ s. Specifically, $x[n] = s(nT) = s(\frac{n}{10})$.

(a) Specify an upper bound on the maximum frequency contained in the analog signal $s(t)$.

(b) Use sinc interpolation to express a new sequence $y[n] = s(\frac{n}{20})$ in terms of the given sequence $x[n]$.

(c) Might the new sequence $y[n]$ be aliased? Why or why not?

(d) *Without* using sinc interpolation, express a new sequence $z[n] = s(\frac{n}{5})$ in terms of the given sequence $x[n]$.

(e) Give an example of a signal $s(t)$ for which the original sequence $x[n]$ *is not* aliased, but for which the new sequence $z[n]$ *is* aliased.