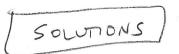# Quiz #5

ECEn 380: Signals & Systems

Fall 2015

SOLUTIONS

Closed book, closed note, closed neighbor, no calculators allowed. Time limit is 15 minutes.
20 points total possible.

1. Find the inverse z-Transform of the following signal: $\frac{z^2+3z+2}{2z^3}$ (2 pts) ✓   OR $\left\{0, \frac{1}{2}, \frac{3}{2}, 1\right\}$

$$= \frac{1}{2}z^{-1} + \frac{3}{2}z^{-2} + z^{-3} \implies \boxed{\frac{1}{2}\delta[n-1] + \frac{3}{2}\delta[n-2] + \delta[n-3]}$$

2. Consider an LTI system with the following transfer function: $H(z) = \frac{(z-1)(z-4)}{(z-2)(z-5)} = \frac{z^2-5z+4}{z^2-7z+10}$

   a. Is this system BIBO stable? **Explain your answer for full credit.** (2 pts)

   $\boxed{\text{NO. POLES OUTSIDE UNIT CIRCLE!}}$

   b. Find the input/output relationship that describes this system. In other words, find the linear constant coefficient difference equation that describes the system. (2 pts)

   $$= \frac{1-5z^{-1}+4z^{-2}}{1-7z^{-1}+10z^{-2}} \quad \boxed{y[n] - 7y[n-1] + 10y[n-2] = x[n] - 5x[n-1] + 4x[n-2]}$$

   c. Find the output of the system when the input is { 1, -7, 10 }. (2 pts)

   $Y(z) = X(z)H(z) = \frac{(z^2-7z+10)(z-1)(z-4)}{z^2(z-2)(z-5)} = \frac{z^2-5z+4}{z^2}$

   $= 1 - 5z^{-1} + 4z^{-2}$

   $X(z) = 1 - 7z^{-1} + 10z^{-2}$

   $= \frac{z^2 - 7z + 10}{z^2}$

   $= \frac{(z-2)(z-5)}{z^2}$

3. Consider the following discrete-time signal:

   $$h[n] = \left(3n^5 - n^2 + e^{\frac{2\pi n}{7}}\right)u[n-2] + \cos\left(\frac{7}{3}\pi n\right)u[n-5]$$

   $z^{-1} \rightarrow \boxed{\{1, -5, 4\}}$

   a. What is the period of the DTFT of $h[n]$? (2 pts) $\boxed{2\pi}$

   b. Is the DTFT of $h[n]$ a continuous or discrete signal? (2 pts)

   $\boxed{\text{CONTINUOUS}}$

4. Consider the time domain (or the n-domain for discrete signals) and the Fourier domain for both continuous-time and discrete-time signals.

   a. If a signal is either discrete or a series of uniformly-spaced unit impulses in one domain, what does that imply about the signal in the other domain? (2 pt)

   $\boxed{\text{IT IS PERIODIC IN OTHER DOMAIN}}$

   b. If a signal is periodic in one domain, what does that imply about the signal in the other domain? (2 pt)

   $\boxed{\text{"DISCRETE-ISH"}}$:- $\boxed{\text{IT IS DISCRETE OR A SERIES OF UNIFORMLY-SPACED UNIT IMPULSES IN OTHER DOMAIN}}$

5. Is the DFT the same thing as the DTFT? (2 pt)

   $\boxed{\text{NO}}$ $\left\langle\text{"PSEUDO DISCRETE"}\right\rangle$:⁒

6. What is the most common algorithm for computing the DFT? (2 pt)

   $\boxed{\text{FFT}}$