EE3221 Homework 4
Dr. Prust
Assigned: 13 April 2020
Due: 17 April 2020 (1:00PM CDT)

Note: Problems from the course textbook (Ulaby and Yagle, 2018) are specified with the prefix "UY".

Submit for Credit:

1. UY 7.15 parts (a), (b), and (c)

   ANSWERS:
   (a) $\frac{2z^2-3z}{z^2-3z+2}$ and ROC: $|z| > 2$
   (c) $\frac{2z^2-4z+4}{z^2-2z}$ and ROC: $|z| > 2$

2. UY 7.17 parts (a), (b), (c), and (d)

   ANSWERS:
   (a) $0.5\delta[n] + 0.5\delta[n-1]$
   (c) $2(-1)^{n-2}u[n-2] + 3(-1)^{n-3}u[n-3]$. Equivalent answer: $3\delta[n-2] - \delta[n-1] + (-1)^{n-1}u[n-1]$

3. Consider a discrete-time LTI system with input $x[n]$, impulse response $h[n]$, and output $y[n]$. The input signal is

   $$x[n] \quad = \quad \{\underline{2}, -3, 4\}$$

   and the impulse response is

   $$h[n] \quad = \quad \{\underline{1}, 2, 1\}$$

   Use Z-transform techniques to find the system output $y[n]$.

   HINT: This problem illustrates that polynomial multiplication in the Z-domain is equivalent to convolution in the time-domain.

4. Consider a discrete-time LTI system with input $x[n]$, impulse response $h[n]$, and output $y[n]$. It is known that input $x[n] = \{\underline{1}, 1\}$ produces the output $y[n] = \{\underline{1}, 2, 2, 1\}$. Use Z-transform techniques to show that the impulse response of the system is $h[n] = \{\underline{1}, 1, 1\}$.

   HINT: First compute $X(z)$ and $Y(z)$. Then, because $y[n] = x[n] * h[n]$, we know that $Y(z) = X(z)H(z)$ and therefore $H(z) = Y(z)/X(z)$. Finally, take the inverse Z-transform to get $h[n]$.