Homework #8

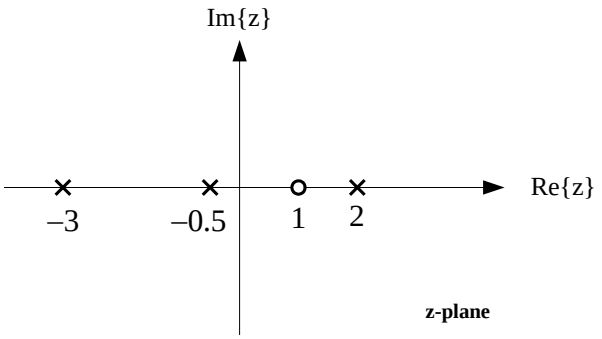
(For practice only; not to turn in)

1. Determine the z-transform for each of the following sequences.

   (1) $2^n u[-n]+(\frac{1}{4})^n u[n-1]$. (10%)

   (2) $n(\frac{1}{2})^{|n|}$. (10%)

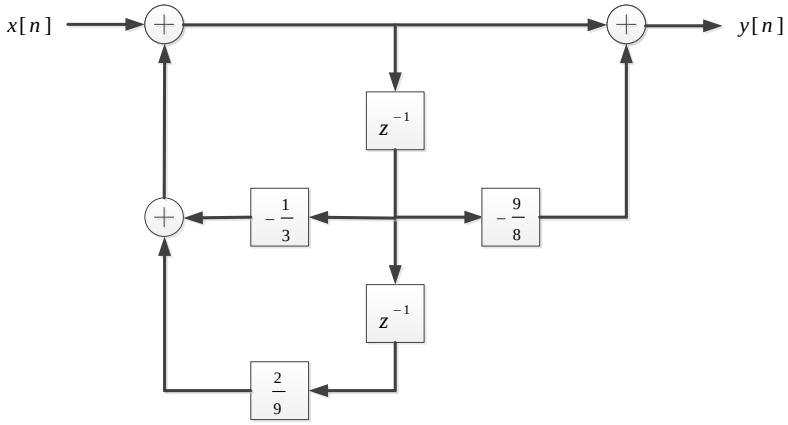
2. Consider a discrete-time LTI system $H_1(z)$ whose pole-zero plot is shown in the following figure:



   (1) How many two-sided impulse responses can be associated with this pole-zero plot? Determine the corresponding ROCs. (10%)

   (2) Consider a cascade interconnection of two systems $H_1(z)$ and $H_2(z)$. Determine a possible solution of $H_2(z)$ such that the overall system is causal and stable. (10%)

3. The input $x[n]$ and output $y[n]$ of a causal LTI system are related through the following block-diagram representation:



   (1) Determine a difference equation relating $y[n]$ and $x[n]$. (10%)

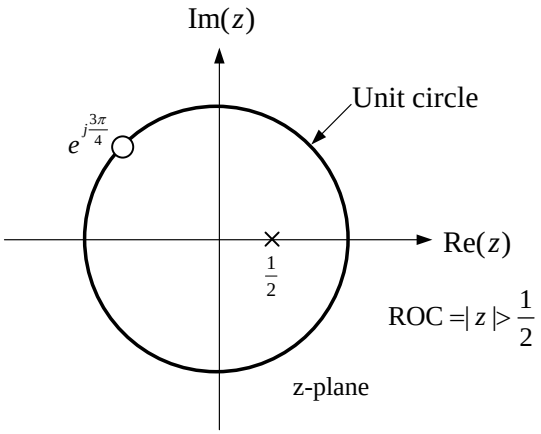
   (2) Is this system stable? (10%)

4. Consider a causal and stable discrete-time LTI system with the following system function:

$$H(z)=\frac{1-z^{-1}}{1-\frac{1}{4}z^{-2}}.$$

(1) Find the impulse response $h[n]$ of the system. (5%)
(2) Find the output $y[n]$ of the system when the input is $x[n]=e^{-j(\pi/2)n}$. (10%)
(3) Is there a causal and stable inverse system of $H(z)$? Justify your answer. (5%)

5. Consider a sequence $x[n]$ with z-transform $X(z)$ whose pole-zero plot is shown as follows:



Determine the z-transform of each of the following signals in terms of $X(z)$. Sketch the pole-zero plot and indicate the ROC for each case.

(1) $x_1[n]=x[-n+4]$. (10%)
(2) $x_2[n]=x[n]\cdot(2e^{-j\frac{\pi}{4}})^n$. (10%)