

**Homework 2**

(Total 100 pts)

**Due 5:00 pm on June 19, 2020 (Friday)****Note:** Your work must be electronically submitted to Canvas as a single **PDF** file.

1. (10 pts) Determine the  $z$ -transform, including the ROC for the following sequence:

$$x[n] = -\left(\frac{1}{2}\right)^n u[-n - 1].$$

2. (20 pts) Determine the  $z$ -transform of the following sequence. Include with your answer the region of convergence in the  $z$ -plane and a sketch of the pole-zero plot. Express all sums in closed form;  $\alpha$  can be complex.

$$x_\alpha[n] = \alpha^{|n|}, \text{ where } 0 < |\alpha| < 1.$$

3. (60 pts) A causal LTI system has the following system function:

$$H(z) = \frac{4 + 0.25z^{-1} - 0.5z^{-2}}{(1 - 0.25z^{-1})(1 + 0.5z^{-1})}$$

(A) What is the ROC for  $H(z)$ ?

(B) Is the system stable or not?

(C) Determine the difference equation that is satisfied by the input  $x[n]$  and the output  $y[n]$ .

(D) Determine the impulse response of the system  $h[n]$ .

(E) Find  $Y(z)$ , the  $z$ -transform of the output, when the input  $x[n] = u[-n - 1]$ . Specify the ROC for  $Y(z)$ .

(F) Find the output sequence  $y[n]$  when the input is  $x[n] = u[-n - 1]$ .

4. (10 pts) A causal LTI system with input  $x[n]$  and output  $y[n]$  is described by  $y[n] = 2y[n - 1] + x[n]$ . Find the impulse response of the system  $h[n]$ . Is the system stable?