BIRZEIT UNIVERSITY

Faculty of Engineering and Technology

Electrical and Computer Engineering

DSP (Fall 2016) - Quiz (2)

Name: Key ID:

The signal y[n] is the output of an LTI system with impulse response h[n] for a given input x[n]. Assume that y[n] is stable and has a z-transform Y(z) with the pole-zero diagram shown in **figure 1**. The signal x[n] is stable and has the pole-zero diagram shown in **figure 2**.

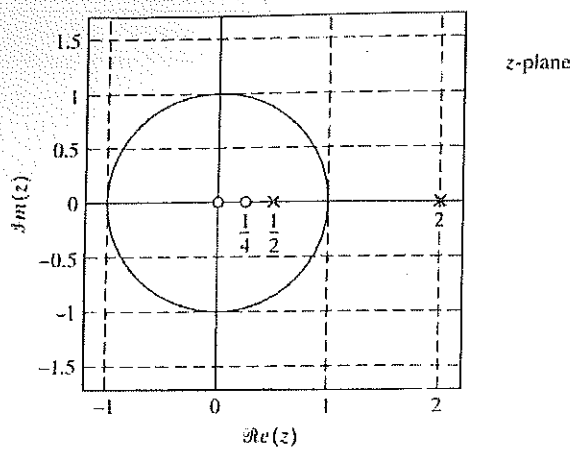


Figure 1: pole-zero diagram of Y(z)

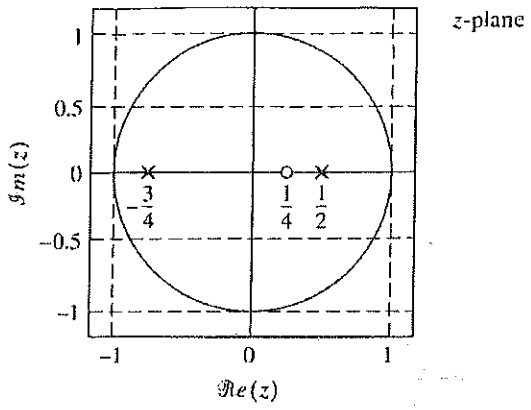


Figure 2: pole-zero diagram of X(z)

[2] 1- What is the region of convergence, ROC, of Y(z)?

$\frac{1}{2} < |z| < 2$

[2] 2- Is y[n] left sided, right sided, or two sided?

Two-sided

[2] 3- What is ROC of X(z)?

$|z| > \frac{3}{4}$

[2] 4 –is x[n] a causal sequence? Justify?

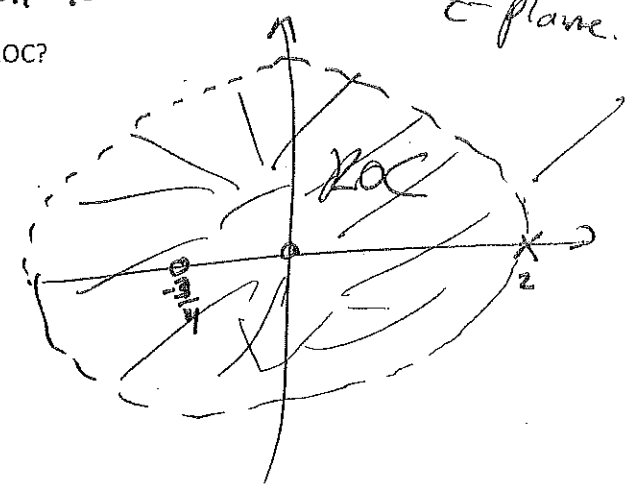
Yes, ROC extends from outermost pole to ∞

[2] 5 –draw the pole-zero diagram of H(z), and specify its ROC?

System zeros: $z = -\frac{3}{4}, z = 0$,

poles: $z = 2$

ROC: $|z| < 2$



Quiz (2) – Section 2

Part (5)

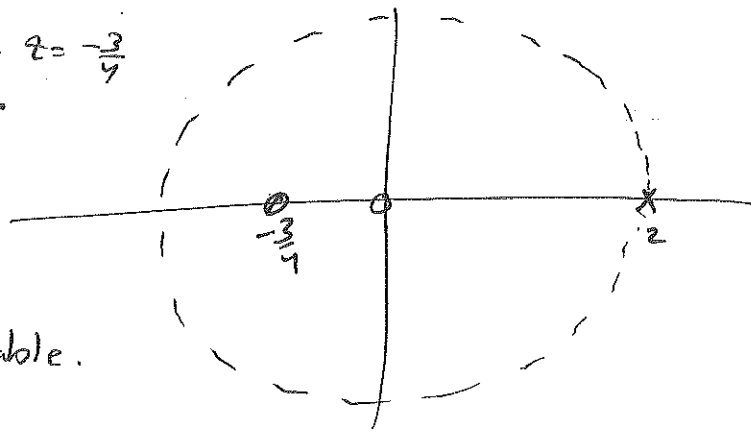
$$Y(z) = k_1 \frac{z(z-\frac{1}{4})}{(z-\frac{1}{2})(z-2)}$$

$$X(z) = k_2 \frac{(z-\frac{1}{4})}{(z-\frac{1}{2})(z+\frac{3}{4})}$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{k_1 z(z-\frac{1}{4})}{(z-\frac{1}{2})(z-2)} \cdot \frac{(z-\frac{1}{2})(z+\frac{3}{4})}{k_2(z-\frac{1}{4})}$$

$$= \frac{k_1}{k_2} \frac{z(z+\frac{3}{4})}{z-2}$$

System: Zeros: $z=0, z=-\frac{3}{4}$
Poles: $z=2$



ROC: Two options

✗ ① $|z| > 2$

⇒ sys. in not stable.

✓ ② $|z| < 2$

⇒ sys. is stable.

we choose option ② because sys. must be stable. stable input ⇒ stable output ⇒ sys. is stable.