Use 0.7 mm mechanical pencil. Keep 0.25 inch from edge of box. Erase mistakes thoroughly.

ZT 1
Problem Type Acronym

Name

ID #

Question

Find the z transform for

$$x[n] = [9 + 3 \cdot 2^n]\, u[n]$$

what are the poles and zeros?

Answer

since $a^n u[n] \overset{z}{\longleftrightarrow} \frac{z}{z-a}$

$$9u[n] \overset{z}{\longleftrightarrow} \frac{9z}{z-1}$$

$$3 \cdot 2^n u[n] \overset{z}{\longleftrightarrow} \frac{3z}{z-2}$$

$$x[n] \overset{z}{\longleftrightarrow} \frac{9z}{z-1} + \frac{3z}{z-2} =$$

$$\frac{9z^2 - 18z + 3z^2 - 3z}{(z-1)(z-2)} =$$

$$\frac{(12z-21)z}{(z-1)(z-2)}$$

poles at 1, 2

zeros at 0, $\frac{21}{12}$

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ZT2 (Problem Type Acronym) | Name | ID #

Question

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

Find the z-transform.

Plot the poles + zeros (if any) on the z-plane.

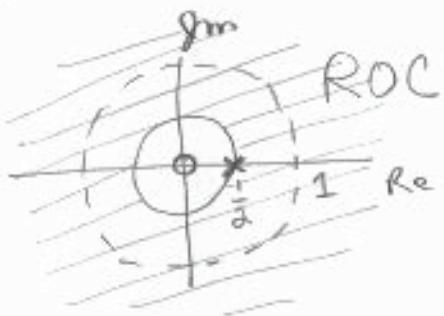
Can the signal have a Fourier Transform performed on it (is it stable?)

Answer

$$X(z) = \sum_{n=-\infty}^{+\infty} x[n] z^{-n} = \sum_{n=0}^{+\infty} \left(\frac{1}{2}\right)^n z^{-n}$$

$$= \sum_{n=0}^{+\infty} \left(\frac{1}{2z}\right)^n = \frac{1}{1 - \frac{1}{2z}} = \frac{z}{z - \frac{1}{2}}$$

$$\sum_{n=0}^{+\infty} \alpha^n = \frac{1}{1-\alpha} \qquad |\alpha| < 1$$



ROC contains unit circle ⇒ stable

Use 0.7 mm mechanical pencil. Keep 0.25 inch from edge of box. Erase mistakes thoroughly.

ZT3 — Problem Type Acronym

Name

ID #

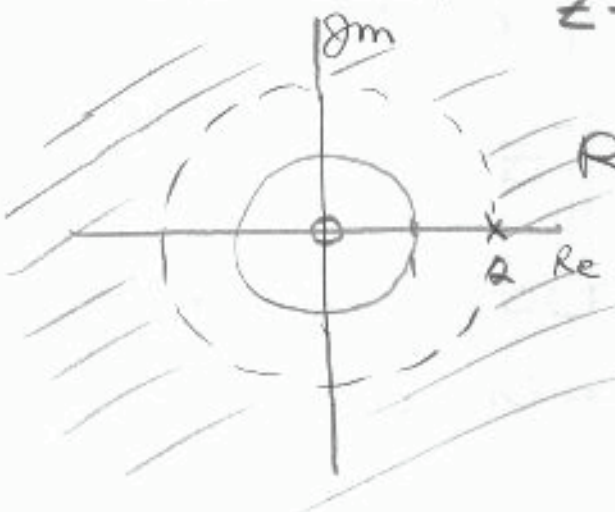
Question

Clearly a system with impulse response $h[n]=2^n u[n]$ is not stable. What is its Z transform? Plot its poles and zeros on the Z plane. Does the ROC contain the unit circle?

Answer

$$a^n u[n] \overset{Z}{\longleftrightarrow} \frac{z}{z-a}$$

$a = 2 \quad H(z) = \frac{z}{z-2}$



ROC does not contain unit circle.

Use 0.7 mm mechanical pencil. Keep 0.25 inch from edge of box. Erase mistakes thoroughly.

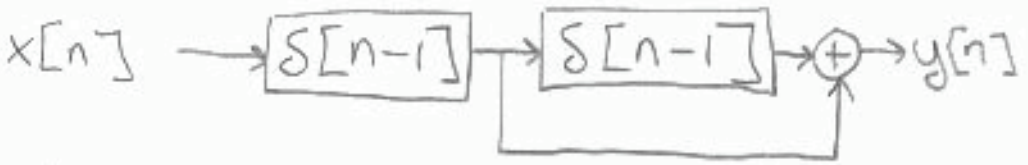
ZT4 — Problem Type Acronym

Name

ID #

Question

What is the impulse response $h[n]$ of the following system?



Is it IIR or FIR?

What is its Z transform $H(z)$?

Are there any poles (where $H(z)=\infty$)?

Is the system stable?

Answer

$$h[n] = \delta[n-1] + \delta[n-2]$$

FIR

$$H(z) = z^{-1} + z^{-2}$$

QUESTION OF POLE AT $z=0$

DISCUSS IN CLASS

Use 0.7 mm mechanical pencil. Keep 0.25 inch from edge of box. Erase mistakes thoroughly.

ZTS
Problem Type Acronym

Name

ID #

Question

A system has an impulse response

$$h[n] = \delta[n] + \delta[n-1] + \delta[n-2]$$

(A) given that input $x[n]$ is the daily price of Apple stock, describe what the system does.

(B) what is the z transform $H(z)$?

(C) are there any poles?

(D) is the system stable?

(E) is it FIR or IIR?

Answer

(A) Three day moving sum

(B) $H(z) = 1 + z^{-1} + z^{-2}$

(C) pole at $z = 0$

(D) yes it is stable

(E) FIR