

ELEC240 - Tutorial # 7

1. Find the \mathcal{Z} Transforms of the following signals

(a)

$$y_k = \begin{cases} 0.2^k & ; k \geq 0 \\ 0 & ; k < 0 \end{cases}$$

(b)

$$y_k = \begin{cases} 0.4e^{-0.1*k} & ; k \geq 0 \\ 0 & ; k < 0 \end{cases}$$

(c)

$$y_k = \begin{cases} 0.4ke^{-0.1*k} & ; k \geq 0 \\ 0 & ; k < 0 \end{cases}$$

(d)

$$y_k = \begin{cases} 3\Delta \cos(0.1 * k * \Delta) & ; k \geq 0 \\ 0 & ; k < 0 \end{cases}$$

(e)

$$y_k = \begin{cases} 3k\Delta \cos(0.1 * k * \Delta) & ; k \geq 0 \\ 0 & ; k < 0 \end{cases}$$

2. Find the sequence $\{y_k\}$ whose \mathcal{Z} transform $Y(z)$ is

(a)

$$Y(z) = \frac{z^{-3}}{1 - 0.3z^{-1} + 0.02z^{-2}}$$

(b)

$$Y(z) = \frac{1 + z^{-1}}{0.5 - z^{-1}}$$

(c)

$$Y(z) = \frac{z^{-3}}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

(d)

$$Y(z) = \frac{z}{z^2 + 0.1z + 0.01}$$

(e)

$$Y(z) = \frac{4z^{-3}}{(2 + z^{-1})(1 - 0.1z^{-1} - 0.06z^{-2})}$$

3. Use \mathcal{Z} transforms to solve the following difference equations when $\{u_k\}$ is a step input:

$$u_k = \begin{cases} 1 & ; k \geq 0 \\ 0 & ; k < 0 \end{cases}$$

Take into account the specified initial conditions.

(a)

$$y_{k+1} + 0.4y_k = 2u_{k+1} \quad y_{-1} = 2.$$

(b)

$$y_{k+2} - 0.2y_{k+1} - 0.08y_k = 2u_{k+2} - 2u_k \quad y_{-1} = -2., y_{-2} = 3.$$

4. Are the systems corresponding to the following transfer functions stable, unstable, or marginally stable?

(a)

$$H(z) = \frac{z + 2}{8z^2 - 2z + 3}$$

(b)

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

(c)

$$H(z) = \frac{z^2 - 3}{z^2 + 2.5z + 1}$$

(d)

$$H(z) = \frac{1 - 0.5z^{-3}}{1 - 0.5z^{-1} - z^{-2} + 0.5z^{-3}}$$