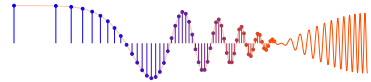


PROBLEM:

Pick the correct output signal and enter the number in the answer box:

Difference Equation, $H(z)$, $\mathcal{H}(\hat{\omega})$, or $h[n]$.

(a) `firfilt( [1,1], [0,1,-1] )`

ANS =

(b) $y[n] = y[n-1] + x[n]$ (at rest)

with $x[n] = \delta[n] - \delta[n-1]$

ANS =

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

with $x[n] = \delta[n]$

ANS =

(d) $y[n] = x[n-1] - x[n-2]$

with $x[n] = 3 + \cos(2\pi n/3)$ for all n.

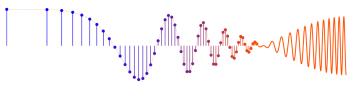
ANS =

Output Signal

1. $y[n] = \delta[n-1] - \delta[n-2]$
2. $y[n] = \delta[n]$
3. $y[n] = \delta[n-1] - \delta[n-3]$
4. $y[n] = u[n]$
5. $y[n] = (\frac{1}{2})^n u[n]$
6. $y[n] = (-\frac{1}{2})^n u[n]$
7. $y[n] = 0$ for all n
8. $y[n] = \cos(2\pi n/3 - \pi)$ for all n
9. $y[n] = \sqrt{3}\cos(2\pi n/3 + 3\pi/2)$ for all n

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION



Pick the correct output signal and enter the number in the answer box:

Difference Equation, $H(z)$, $\mathcal{H}(\hat{\omega})$, or $h[n]$.

(a) `firfilt( [1,1], [0,1,-1] )`

ANS = 3

(b) $y[n] = y[n-1] + x[n]$ (at rest)
with $x[n] = \delta[n] - \delta[n-1]$

ANS = 2

(c) $H(z) = \dfrac{1}{1 + \frac{1}{2}z^{-1}}$
with $x[n] = \delta[n]$

ANS = 6

(d) $y[n] = x[n-1] - x[n-2]$
with $x[n] = 3 + \cos(2\pi n/3)$ for all n.

ANS = 9

Output Signal

1. $y[n] = \delta[n-1] - \delta[n-2]$
2. $y[n] = \delta[n]$
3. $y[n] = \delta[n-1] - \delta[n-3]$
4. $y[n] = u[n]$
5. $y[n] = (\frac{1}{2})^n u[n]$
6. $y[n] = (-\frac{1}{2})^n u[n]$
7. $y[n] = 0$ for all n
8. $y[n] = \cos(2\pi n/3 - \pi)$ for all n
9. $y[n] = \sqrt{3}\cos(2\pi n/3 + 3\pi/2)$ for all n

(a) convolve:

$$\begin{array}{r} 0\ \ 1\ \ -1 \\ 1\ \ 1 \\ \hline 0\ \ 1\ \ -1 \\ \quad 0\ \ 1\ \ -1 \\ \hline 0\ \ 1\ \ 0\ \ -1 \end{array}$$

$y[n] = \delta[n-1] - \delta[n-3]$

(b) $\delta[n] - \delta[n-1] \xrightarrow{X(z) = 1 - z^{-1}} \boxed{\dfrac{1}{1 - z^{-1}}} \longrightarrow Y(z) = H(z)X(z) = (1 - z^{-1})\left(\dfrac{1}{1 - z^{-1}}\right) = 1$

If $Y(z) = 1$, then $y[n] = \delta[n]$.

(c) $\dfrac{1}{1 + \frac{1}{2}z^{-1}} \longrightarrow a^n u[n]$ with $a = -\frac{1}{2}$ $\qquad (-\frac{1}{2})^n u[n]$

(d) $H(e^{j\hat{\omega}}) = e^{-j\hat{\omega}} - e^{-j2\hat{\omega}}$

Need to evaluate at $\hat{\omega} = 0$ and $\hat{\omega} = 2\pi/3$.

$H(e^{j0}) = 1 - 1 = 0$

$H(e^{j2\pi/3}) = e^{-j2\pi/3} - e^{-j4\pi/3}$