

1. Consider the following sequences and their intervals:

a) $x[n] = 2\delta[n + 2] - \delta[n - 4], \quad -5 \leq n \leq 5$

b) $x[n] = n(2u[n] - u[n - 10]) + 10e^{-0.3(n-10)}(u[n - 10] - u[n - 20]), \quad 0 \leq n \leq 20$

Write Matlab routines to illustrate these sequence in time (n) .

2. Determine whether the following systems are i) stable, ii) causal, iii) linear, iv) time-invariant and v) memoryless.

a) $T(x[n]) = e^{x[n]}$

b) $T(x[n]) = ax[n] + b$

c) $T(x[n]) = x[n] + 3u[n + 1]$

3. Determine the unit step response to the linear time-invariant system described by the impulse response given by

$$h[n] = a^{-n}u[-n], \quad 0 < a < 1$$

4. A linear time-invariant system is described by the difference equation given by

$$y[n] - 5y[n - 1] + 6y[n - 2] = 2x[n - 1]$$

a) Determine the homogeneous response of the system. (Hint: the output when $x[n]=0$ for all n).

b) Determine the impulse response of the system.

c) Determine the unit step response of the system.

d) Write Matlab routines to generate the results of items b) and c) in $-20 \leq n \leq 120$.

5. Consider the linear time-invariant system described by the difference equation given by

$$y[n] = -2x[n] + 4x[n - 1] - 2x[n - 2]$$

a) Determine the impulse response of the system.

b) Determine the frequency response of the system. Express your answer in the form

$$H(e^{j\omega}) = A(e^{j\omega})e^{-j\omega n_d}$$

c) Sketch figures with the magnitude $|H(e^{j\omega})|$ and the phase $\angle H(e^{j\omega})$ responses.