ENGR 4333/5333: Digital Signal Processing

HW 6: Ch 5

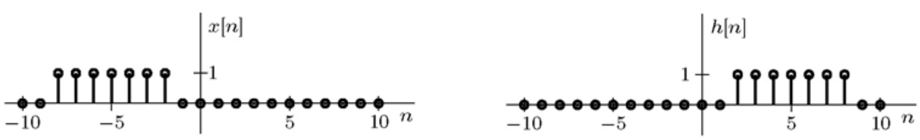
1) Find the zero-state response $y[n]$ of an LTID system if the input $x[n]$ and the unit impulse response $h[n]$ are

a) $x[n] = e^{-n}u[n]$ and $h[n] = (-2)^n u[n]$.
b) $x[n] = e^{-n}u[n]$ and $h[n] = 0.5\ (\delta[n] - (-2)^n)\ u[n]$.
c) $x[n] = (3)^{-n}u[n]$ and $h[n] = 3n(2)^n u[n]$
d) $x[n] = (2)^n u[n]$ and $h[n] = (3)^n \cos(\pi n/3 - 0.5)u[n]$.

2) Two subsystems H_1 and H_2 have impulse responses $h_1[n] = (1+2^{-n})u[n]$ and $h_2[n] = u[n] - u[n-5]$, respectively.

a) Determine the overall impulse response $h_p[n]$ of the parallel connection of these subsystems.
b) Determine the overall impulse response $h_c[n]$ of the cascade connection of these subsystems.

3) Using the sliding-tape algorithm, find $x[n]*h[n]$ for the signals shown below



4) Find the transfer function $H(z)$ for the systems described by the following input output relationships:

a) $y[n] = 2y[n-1] - y[n-2] + 2x[n] - x[n-1] + 3x[n-2]$
b) $y[n+2] + 0.5y[n+1] - 0.8y[n] = x[n+1] - 3x[n]$

5) Find the transfer function $H(z)$ for the systems described by the following impulse response functions:

a) $h[n] = \delta[n] + 4\delta[n-2] - 2\delta[n-4]$
b) $h[n] = \gamma^n u[n]$, where $|\gamma| < 1$

6) Each of the following equations specifies an LTID system. Determine whether these systems are asymptotically stable, unstable, or marginally stable. Determine also whether they are BIBO stable or unstable.

a) $y[n+2] + 0.6y[n+1] - 0.16y[n] = x[n+1] - 2x[n]$
b) $(E^2 + 1)(E^2 + E + 1)\ \{y[n]\} = E\ \{x[n]\}$
c) $(E-1)^2(E + 1/2)\ \{y[n]\} = (E + 2)\{x[n]\}$
d) $y[n] + 2y[n-1] + 0.96y[n-2] = 2x[n-1] + 3x[n-3]$
e) $(E^2 - 1)(E^2 + 1)\ \{y[n]\} = x[n]$

7) A Consider a system with impulse response $h[n] = -n(0.5)^n u[n]$. Determine this system's time constant, rise time, and pulse dispersion. Identify, if possible, an input $x[n]$ that will cause this system to resonate.