ECE 2050 Autumn 2023 Homework 4
Due 5:00 pm, Friday September 29, 2023
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BC:4.1 Use Matlab and the `conv()` command to calculate and plot $\gamma[n]$ vs n, where

$$\gamma[n] = \alpha[n] * \beta[n] = \beta[n] * \alpha[n]$$

for each of the $\alpha[n]$ and $\beta[n]$ pairs below. For full credit, include your *commented* Matlab source code and plots of all nonzero values of $\gamma[n]$ vs n.

a.)
$\alpha[n] = (-0.9)^{1-n} (\delta[n+2] + \delta[n] + \delta[n-1])$

$\beta[n] = \cos(0.25\pi n) (u[n-1] - u[n-5]])$

b.)
$$\alpha[n] = 36^{(n/2-1)} (u[n] - u[n-4])$$
$$\beta[n] = \left(\frac{1}{n+1}\right) (u[n-2] - u[n-6])$$

BC:4.2 For the LTI discrete time system with difference equation

$$y[n] - 0.9y[n-1] + 0.81y[n-2] = 10x[n] - 15x[n-2]$$

that has input signal

$$x[n] = 1.5u[n-1]$$

and initial conditions $y[-2] = 7$ and $y[-1] = -2.5$, write a recursion loop in Matlab to

a.) find the *zero-input* part of $y[n]$ for $-2 \leq n \leq 15$. For full credit, include your *commented* Matlab source code and a plot of $y_{zi}[n]$ for this range of n. Use the curser tool to label $y_{zi}[n]$ at $n = 0$, $n = 5$, $n = 10$ and $n = 15$.

b.) find the *zero-state* part of $y[n]$ for $-2 \leq n \leq 15$. For full credit, include your *commented* Matlab source code and a plot of $y_{zs}[n]$ for this range of n. Use the curser tool to label $y_{zs}[n]$ at $n = 0$, $n = 5$, $n = 10$ and $n = 15$.

c.) find the *impulse response* part of the system for $-2 \leq n \leq 15$. . For full credit, include your *commented* Matlab source code and a plot of $h[n]$ for this range of n. Use the curser tool to label $h[n]$ at $n = 0$, $n = 5$, $n = 10$ and $n = 15$.

BC:4.3 For the LTI discrete time system with difference equation

$$y[n] + 0.12y[n-1] - 0.24y[n-2] = -6x[n-1] + 2x[n-2]$$

that has input signal

$$x[n] = \cos(0.15\pi n - 15^o) (\delta[n] + \delta[n-1] + \delta[n-3])$$

and initial conditions $y[-2] = -3$ and $y[-1] = 1.5$, write a recursion loop in Matlab to

a.) find the *zero-input* part of $y[n]$ for $-2 \leq n \leq 15$. For full credit, include your *commented* Matlab source code and a plot of $y_{zi}[n]$ for this range of n. Use the curser tool to label $y_{zi}[n]$ at $n = 0$, $n = 5$, $n = 10$ and $n = 15$.

b.) find the *zero-state* part of $y[n]$ for $-2 \leq n \leq 15$. For full credit, include your *commented* Matlab source code and a plot of $y_{zs}[n]$ for this range of n. Use the curser tool to label $y_{zs}[n]$ at $n = 0$, $n = 5$, $n = 10$ and $n = 15$.

c.) find the *impulse response* part of the system for $-2 \leq n \leq 15$. . For full credit, include your *commented* Matlab source code and a plot of $h[n]$ for this range of n. Use the curser tool to label $h[n]$ at $n = 0$, $n = 5$, $n = 10$ and $n = 15$.