Signals and Systems | 12 September 2012
Fall 2012 | Quiz: Wednesday 19 September 2012

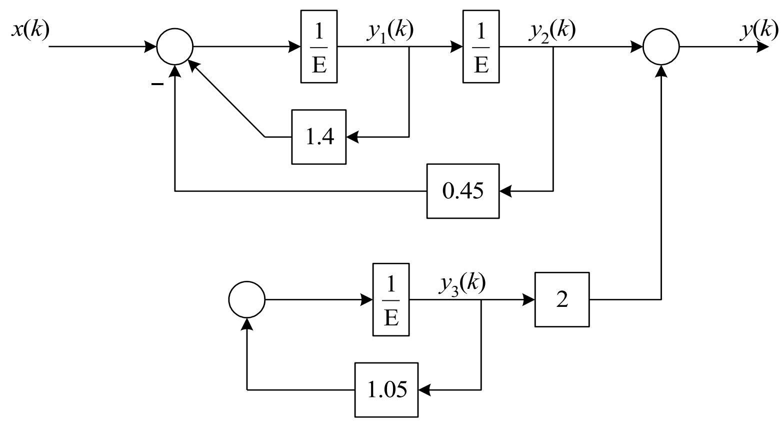
Homework Assignment #4

1. (a) For the given simulation diagram, find the operational transfer function relating $y(k)$ and $x(k)$;

   (b) Write a computer program to simulate the system and plot its output. Make your program correspond to the given simulation diagram; that is, program coupled difference equations in variables that correspond to the outputs of the delay blocks.

   (c) Run the program to determine the zero-input response of $y_1(k)$, $y_2(k)$, $y_3(k)$, and $y(k)$ if the initial conditions are $y_1(0) = y_2(0) = 1$, $y_3(0) = 1$.

   (d) Run the program to determine the zero-state response of $y_1(k)$, $y_2(k)$, $y_3(k)$, and $y(k)$ if the input $x(k)$ is the unit step sequence.



2. Find the complete closed-form solution of the following difference equations:

   (a) $(E-0.5)\{y(k)\} = 0$, $y(0) = 7$.

   (b) $(E-1)\{y(k)\} = 3\cdot(0.5)^k$, $y(0) = 0$.

   (c) $(E^2+3E+2)\{y(k)\} = 0$, $y(0) = 1$, $y(1) = 0$.

   (d) $(E^2+1)\{y(k)\} = 3\cdot 2^k$, $y(0) = y(1) = 0$.

   (e) $(E^2-1)\{y(k)\} = 0.5$, $y(0) = 1$, $y(1) = 2$.

3. For each of the following systems, find an expression for the impulse response $h(k)$ by iterating until you see a pattern.

   (a) $y(k) = \dfrac{1}{E-0.25}\{x(k)\}$ [Ans: $h(0) = 0$; $h(k) = (0.25)^{k-1}$, $k = 1,2,3,\cdots$.]

   (b) $y(k) = \dfrac{1}{E(E-0.25)}\{x(k)\}$

   (c) $y(k) = \dfrac{1}{E^2+2E+1}\{x(k)\}$