Signals and Systems
Fall 2013

Issued: 11 September 2013
Due: 18 September 2013

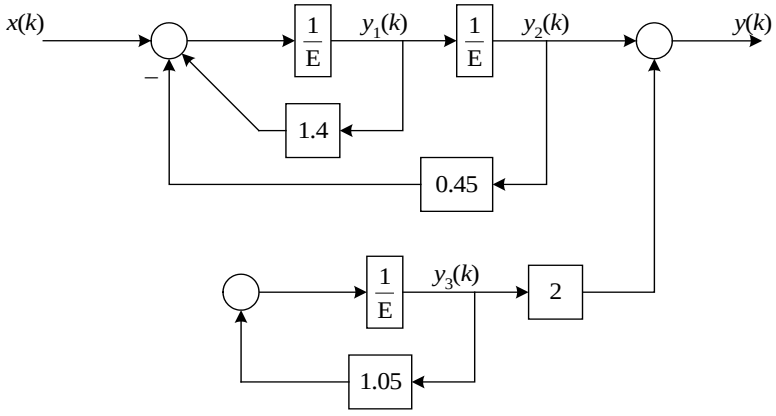
Homework Assignment #4

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. Are the following systems BIBO stable? Justify your answer.

   (a) $(E^2+3E+2)y(k) = x(k)$

   (b) $(10E^2+3E+2)y(k) = (E-2)\{x(k)\}$

   (c) $(E^2+1.2E+0.2)y(k) = x(k)$

   (d) $(E^3+3E^2+3E+1)y(k) = (E^2-0.1E)\{x(k)\}$