Signals and Systems
Fall 2013

Issued: 4 September 2013
Due: 11 September 2013

Homework Assignment #3

1. Iterate by hand to find the first few values of $y(k)$ for the following difference equations:

   (a) $y(k+1) + y(k) = x(k),\ y(0) = 0,\ x(k) = \begin{cases} 1, & k \geq 0 \\ 0, & k < 0 \end{cases}$.

   (b) $y(k+1) + y(k) = 0,\ y(0) = 1.$

   (c) $y(k+2) - y(k+1) - 2y(k) = x(k+1) + x(k),\ y(0) = y(1) = 0,\ x(k) = \begin{cases} 1, & k = 0 \\ 0, & k \neq 0 \end{cases}$.

   (d) $y(k+2) - y(k+1) - 2y(k) = 0,\ y(0) = 1,\ y(1) = 0.$

2. For each difference equation or operational relation, draw a corresponding simulation diagram having the minimum possible number of delay blocks:

   (a) $y(k+1) + y(k) = x(k)$

   (b) $y(k+2) - y(k+1) = 1.5x(k+1) - 0.5x(k)$

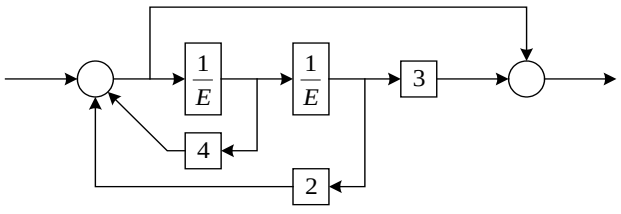
   (c) $(\mathrm{E}^2 - 1)\{y(k)\} = (\mathrm{E}+2)\{x(k)\}$

   (d) $\{y(k)\} = \dfrac{6E^2 + 2E}{E^2 + 5E + 4}\{x(k)\}$

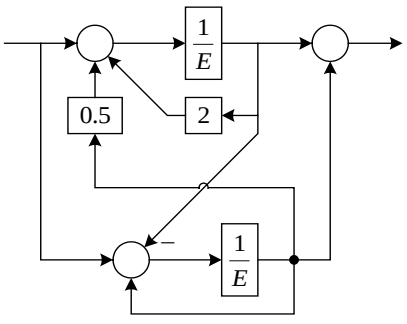
   (e) $\{y(k)\} = \dfrac{6E^3 + 2}{E^3}\{x(k)\}$

3. Find the operational transfer function for each of the following simulation diagrams:

   (a)



   (b)



(See Problem 4 on reverse.)

4. (a) Write a computer program to simulate the discrete-time system shown below 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.

   (b) Run your program to obtain the sequence $y(k)$, assuming $x(k)$ is the unit step sequence and given zero initial conditions in all delay blocks.