EE 362: Signals and Systems Name: _____

Spring 2019

Homework #3 (Due: Tuesday, February 12, 2019)

- Circle or box your answer (don't forget units).
- **Show** your steps.
- Use 8.5" x 11" paper, and trim off any ragged edges.
- **Staple** your work together and write your name neatly.

1. Consider the N-Point EWMA Filter given by $y[n] = \sum_{i=0}^{N-1} a\left(b^i x[n-i]\right)$ and $a = \frac{1-b}{1-b^N}$, where $0 < b < 1$. When the input $x[n]$ is equal to a constant c for $n \geq 0$, show that the resulting response $y[n] = c$ for all $n \geq N$. [3 points]

2. Compute the unit-pulse response $h[n]$ for $n = 0, 1, 2, 3$ for the following discrete-time systems: [4 points]
(a) $y[n+1] + y[n] = 2x[n]$
(b) $y[n+1] + 0.5y[n] = x[n]$

3. Compute the unit-pulse response $h[n]$ for $n = 0, 1, 2, 3$ for the following discrete-time system: [3 points]

$y[n+1] + 0.5y[n] = x[n+1]$

4. For the discrete-time signals $x[n]$ and $v[n]$ given below, compute the convolution $x[n] * v[n]$. [4 points]
$x[0] = 4$; $x[1] = 1$; $x[3] = -1$; $x[n] = 0$ for all other integers n;
$v[0] = 1$; $v[1] = -2$; $v[2] = 3$; $v[3] = -4$; $v[n] = 0$ for all other integers n.

5. Find a closed-form solution for the unit-pulse response of the following system. [4 points]

$$y[n+1] + 1.5y[n] = x[n]$$

6. For the RLC circuit shown below, find the input/output differential equation when the output is the voltage across the capacitor. [4 points]

