**ENGR 4333/5333: Digital Signal Processing**

**HW 5: Ch 5**

**1)** Using $x[n] = (3)^n\, u[n]$, $y[-1] = 3$, and $y[-2] = 2$, iteratively determine (first three terms only) the total response, ZIR, and ZSR for

$$y[n+2] + 3y[n+1] + 2y[n] = x[n+2] + 3x[n+1] + 3x[n].$$

**2)** A person deposits a \$10,000 lottery prize at $n = -1$ in a bank savings account and makes no further deposits. The bank offers an annual percent yield (interest rate) of 12% per year (or $[(1.12)^{1/12} - 1]$ per month). Find the savings account balance $y[n]$, where $n$ indicates the $n$th month.

**3)** Using $y[-1] = 0$ and $y[-2] = 1$, solve $y[n+2] + 3y[n+1] + 2y[n] = 0$.

**4)** Using $y[-1] = 1$ and $y[-2] = 1$, solve $y[n+2] + 2y[n+1] + y[n] = 0$.

**5)** Using $y[-1] = 1$ and $y[-2] = 0$, solve $y[n+2] - 2y[n+1] + 2y[n] = 0$.

**6)** Find the unit impulse response $h[n]$ for each of the following systems:

**a)** $y[n+1] + 2y[n] = x[n+1]$

**b)** $y[n] - 6y[n-1] + 25y[n-2] = 2x[n] - 4x[n-1]$

**7)** A digital integrator that uses a trapezoidal approximation is characterized by the difference equation

$$y[n] - y[n-1] = T/2\,(x[n] + x[n-1]),$$

where $T$ is the sampling interval and the zero initial condition $y[-1] = 0$.

**a)** Realize the system using gain, delay, and summing blocks. Apply $\delta[n]$ at the input of the realization, and find the resulting impulse response $h[n]$ by inspection.

**b)** Determine the unit impulse response $h[n]$ by using the methods of Sec. 5.4.