1. In Octave/Matlab we implement FIR systems with the conv () function. For example, the following statements

```
xx = sin (0.07*pi*(0:50));
hh = ones (11,1)/11;
yy = conv (h,xx);
```

evaluates the convolution of the 11-point sequence hh with the 51-point sinusoidal sequence xx. The particular choice of the Octave/Matlab vector hh is actually the impulse response of an 11-point running average system:

\[
h[n] = \begin{cases} 
1/11 & n = 0,1,\ldots,10 \\
0 & \text{otherwise}
\end{cases}
\]

In Octave/Matlab one can only compute the convolution of finite-length signals. Plot the input and output sequences and determine the length of the output signal computed by the Octave/Matlab convolution above.

2. Determine the difference equation for the following block diagram:

![Block Diagram]

3. An FIR filter is described by the difference equation:

\[
y[n] = 3x[n-1] - 2x[n-3]
\]

(a) Find its impulse response \( h[n] \) and plot versus \( n \).

(b) Find the output when the input signal is \( x[n] = \begin{cases} 
1 & n = 0,2,4 \\
0 & \text{otherwise}
\end{cases} \)

4. Suppose that two systems are cascaded. The first system is defined by the set of coefficients \( \{1,2,3,4\} \) and the second system is defined by the coefficients \( \{-1,1,-1\} \). Determine the frequency response and the impulse response of the overall cascade system.

5. Find the impulse response \( h[n] \) of a FIR filter whose system function is

\[
H(z) = 4(1 - z^{-1})(1 + z^{-1})(1 + 0.8z^{-1})
\]
6. Find the system function (i.e., z-transform) of the following feedback filter:
\[ y[n] = 0.5y[n - 1] - 3x[n] + 2x[n - 1]. \]

7. Determine the system function of the system implemented by the following Octave/Matlab statement: \( yy = filter(5, [1, 0.8], xx). \)

8. Find the poles and zeros of the following z-transform system function
\[ H(z) = \frac{2 + 4z^{-1}}{1 + 0.5z^{-1}}. \]

9. Find the system function \( H(z) \) of the following feedback filter:
\[ y[n] = 0.5y[n - 1] + 0.3y[n - 2] - x[n] + 3x[n - 1] - 2x[n - 2]. \]