1. Let $x[n]$ and $y[n]$ be sequences related by the following difference equation

$$y[n] - \frac{1}{4} y[n - 2] = x[n - 2] - \frac{1}{4} x[n]$$

(a) Draw the direct form I implementation for the system.
(b) Draw the direct form II implementation for the system.
(c) Write the system transfer function of the system.

2. Consider the signal flow graph shown in the figure

(a) Using the node variables indicated, write the set of difference equations represented by this flow graph.
(b) Draw the flow graph of an equivalent system that is the cascade of two 1st-order systems.
(c) Is the system stable?

3. A causal LTI system function given by the following expression:

$$H(z) = \frac{1}{1 - z^{-1}} + \frac{1 - z^{-1}}{1 - z^{-1} + 0.8z^{-2}}$$

(a) Is this system stable? Explain briefly.
(b) Draw the signal flow graph of parallel form implementation of this system.
(c) Draw the signal flow graph of cascade form implementation of this system as a cascade of the 1st order and 2nd order system.
(d) Repeat part (c) with a transpose direct form II implementation for the 2nd order system.
(e) Write the difference equation for the system.
4. The flow graph shown in the figure is non-computable i.e. it is not possible to compute the output using the difference equations represented by the flow graph because it contains a closed loop having no delay elements.

(a) Write the difference equation for the system and from them find the system function of the flow graph.

(b) From the system function, obtain a flow graph that is computable.

5. For the LTI system described by the flow graph in the figure determine the difference equation relating the input $x[n]$ to the output $y[n]$. 

(a) Write the difference equation for the system and from them find the system function of the flow graph.

(b) From the system function, obtain a flow graph that is computable.