1. (a) Use Mason's gain rule to find the transfer function \( H(z) \) of this lattice filter.

\[ x(n) \quad \xrightarrow{\text{filter}} \quad y(n) \]

\( z^{-1} \quad 0.1 \quad -0.1 \quad 0.6 \quad -0.6 \quad 0.3 \quad -0.2 \quad 0.2 \quad z^{-1} \)

Note: The branches that cross in this fashion (\( \times \)) are not connected.

(b) Draw the same system using Direct Form II architecture.

2. Design a highpass filter with the following specifications:

- Passband cutoff: 3 kHz
- Stopband: 0-2.5 kHz
- Stopband attenuation: 72dB
- Sampling rate: 10 kHz

Design a FIR filter using the tapered window method. Find the expression for \( h_{HP}(n) \), then program this in Matlab and plot the frequency response using FREQZ. List the values of \( 20\log_{10}|H_{HP}| \) at the passband and stopband edge frequencies to demonstrate that the specs are satisfied.

3. Design an FIR bandstop filter to satisfy the following specifications:

- Passbands: 0-300Hz, 700-1000Hz
- Stopband: 400-600Hz
- Stopband attenuation: 40dB
- Sampling rate: 2kHz

Find \( h_{BS}(n) \), then validate your design using Matlab as in Question 2.