Some exam exercises:

1. *Given the transfer function*

$$H(z) = \frac{-3 + 6z^{-1} + 4z^{-2} - 8z^{-3}}{1 - \frac{3}{8}z^{-2} + \frac{1}{2}z^{-3}},$$

draw its direct form II realization and its lattice ladder realization. Determine if the filter is BIBO stable or unstable.

2. *Given the transfer function*

$$H(z) = \frac{8 + \frac{17}{2}z^{-1} + \frac{17}{4}z^{-2} + \frac{1}{2}z^{-3}}{\left(1 + z^{-1} + \frac{1}{2}z^{-2}\right) \cdot \left(1 + \frac{1}{4}z^{-1}\right)},$$

draw its parallel realization using two second order direct form II filters. From the knowledge of the poles, states if the filter is BIBO stable.

3. *Given the transfer function*

$$H(z) = 1 + \frac{7}{4}z^{-1} + \frac{3}{4}z^{-2} + \frac{1}{2}z^{-3} + \frac{1}{2}z^{-4},$$

draw its direct form realization and its lattice realization. Determine if the transfer function zeros fall inside the unit circle.

4. *Given the transfer function*

$$H(z) = \frac{26 + 3z^{-1} - 14z^{-2} + 4z^{-3}}{4 - 6z^{-1} - 9z^{-2} + 2z^{-3}},$$

draw its direct form II transposed realization and its lattice ladder realization. Determine if the filter is BIBO stable or unstable.

5. *Given the transfer function*

$$H(z) = \frac{4 + 4z^{-1} + \frac{5}{2}z^{-2} + \frac{3}{4}z^{-3} + \frac{1}{4}z^{-4}}{\left(1 + \frac{1}{4}z^{-2}\right) \cdot \left(1 + \frac{1}{2}z^{-1}\right)},$$

draw its direct form II realization and its parallel realization using 2 second order sections having direct form transposed II realization.

6. *Given the transfer function*

$$H(z) = \frac{-3 + 6z^{-1} + 4z^{-2} - 8z^{-3}}{1 - \frac{3}{8}z^{-2} + \frac{1}{2}z^{-3}},$$

draw its direct form II realization and its lattice ladder realization. Determine if the filter is BIBO stable or unstable.