lec 7.

Ex. 1 IIR Filter: $H(z) = 0.0317 \cdot \frac{1 + 3z^{-1} + 3z^{-2} + z^{-3}}{1 - 1.4590z^{-1} + 0.9104z^{-2} - 0.1978z^{-3}}$

1) Restructure $H(z)$ to cascade form into 2nd order and 1st order

$$H1(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - 1.045z^{-1} + 0.4787z^{-2}} \quad \text{Matlab}^{TM}$$

$$H2(z) = \frac{1 + z^{-1}}{1 - 0.413z^{-1}}$$

$$H2(z) = \frac{Y(z)}{X(z)} \iff X(z)H(z) = Y(z)$$

2) Direct form 1 filter structure

$$Y_2[n] = 0.413\,Y[n-1] + X[n] + X[n-1]$$

$$Y_1[n] = 1.045\,Y[n-1] - 0.4787\,Y[n-2] + X[n] + 2X[n-1] + X[n-2]$$