(6) real-time biomedical signal processing with minimal distortion.

6.2 The following transfer functions represent two different filters meeting identical amplitude frequency response specifications:

(1) $H(z) = \dfrac{b_0 + b_1 z^{-1} + b_2 z^{-2}}{1 + a_1 z^{-1} + a_2 z^{-2}} \times \dfrac{b_3 + b_4 z^{-1} + b_5 z^{-2}}{1 + a_3 z^{-1} + a_4 z^{-2}}$

where

$b_0 = 3.136\,362 \times 10^{-1}$

$b_1 = -5.456\,657 \times 10^{-2}$

$b_2 = 4.635\,728 \times 10^{-1}$

$b_3 = -5.456\,657 \times 10^{-2}$

$b_4 = 3.136\,362 \times 10^{-1}$

$b_5 = 4.635\,728 \times 10^{-1}$

$a_1 = -8.118\,702 \times 10^{-1}$

$a_2 = 3.339\,288 \times 10^{-1}$

$a_3 = -2.794\,577 \times 10^{-1}$

$a_4 = 3.030\,631 \times 10^{-1}$

(2) $H(z) = \sum_{k=0}^{22} h_k z^{-k}$

where

$h_0 = 0.398\,264\,80 \times 10^{-1} = h_{22}$

$h_1 = -0.168\,743\,80 \times 10^{-1} = h_{21}$

$h_2 = 0.347\,811\,30 \times 10^{-1} = h_{20}$

$h_3 = 0.120\,528\,90 \times 10^{-1} = h_{19}$

$h_4 = -0.447\,318\,60 \times 10^{-1} = h_{18}$

$h_5 = 0.278\,946\,10 \times 10^{-1} = h_{17}$

$h_6 = -0.875\,733\,60 \times 10^{-1} = h_{16}$

$h_7 = -0.909\,720\,60 \times 10^{-1} = h_{15}$

$h_8 = -0.156\,675\,50 \times 10^{-1} = h_{14}$

$h_9 = -0.284\,995\,60 \times 10^{0} = h_{13}$

$h_{10} = 0.740\,350\,30 \times 10^{-1} = h_{12}$

$h_{11} = 0.623\,495\,60 \times 10^{0}$

For each filter,

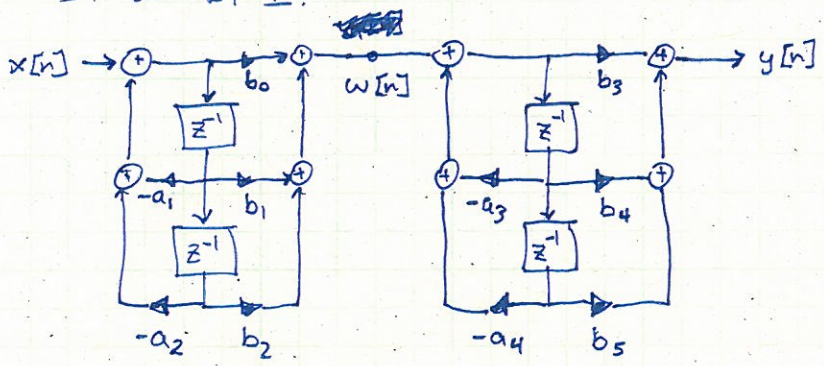
(a) state whether it is an FIR or IIR filte

(b) represent the filtering operation in a block diagram form and write down the difference equation;

(c) determine and comment on the comp tational and storage requirements.

(1)(a) IIR → has poles

(b) written as 2 cascaded, 2nd order sections
I'll use DF II.



in this form, write difference equation for each section

$w[n] = b_0 x[n] + b_1 x[n-1] + b_2 x[n-2] - a_1 w[n-1] - a_2 w[n-2]$

$y[n] = b_3 w[n] + b_4 w[n-1] + b_5 w[n-2] - a_3 y[n-1] - a_4 y[n-2]$

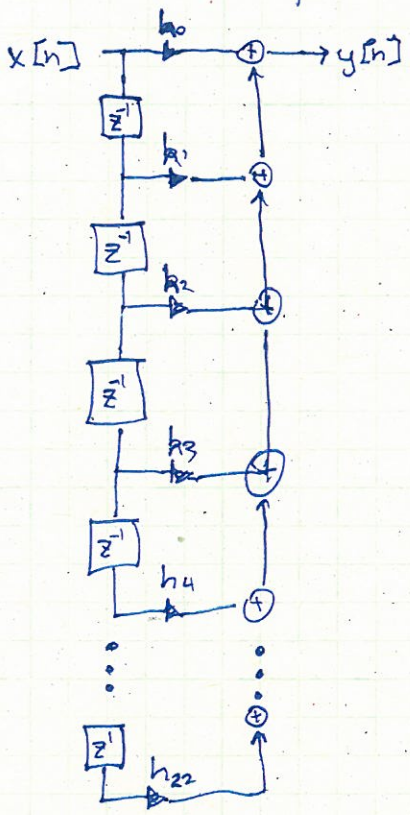
(c) Mutiplies 10

Adds 8

Storage 15

(2) (a) FIR → no poles

(b)



(c)

Multipliers	23
Adds	22
Storage	46