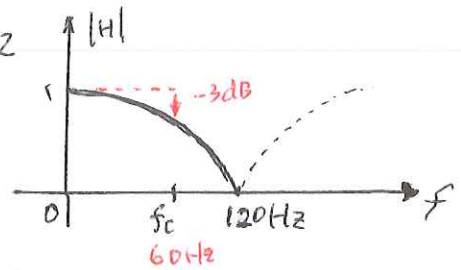


# Comparison of Digital Low-Pass Filters (Sampling rate = 240 Hz)

- First-order FIR  $y[n] = (x[n] + x[n-1]) / 2$

$$|H(e^{j\omega})| = \left| \cos \frac{\omega}{2} \right|$$

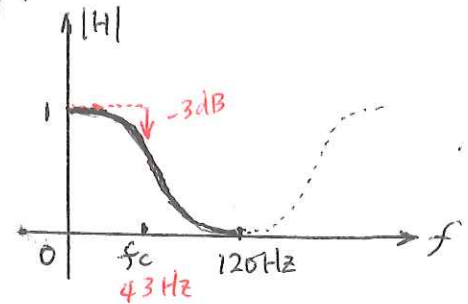
$$f_c = 60 \text{ Hz}$$



- Second-order FIR  $y[n] = (x[n] + 2x[n-1] + x[n-2]) / 4$

$$|H(e^{j\omega})| = \frac{1 + \cos \omega}{2}$$

$$f_c = 43 \text{ Hz}$$

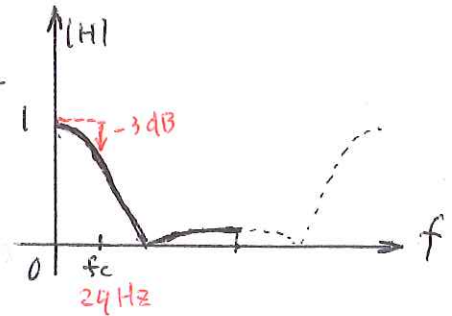


- Fourth-order FIR

$$y[n] = (x[n] + 4x[n-1] + 6x[n-2] + 4x[n-3] + x[n-4]) / 16$$

$$|H(e^{j\omega})| = \left| \frac{\cos 2\omega}{7} + \frac{2}{7} + \frac{4 \cos \omega}{7} \right|$$

$$f_c = 29 \text{ Hz}$$



- First-order IIR

$$y[n] = (x[n] + y[n-1]) / 2$$

$$|H(e^{j\omega})| = \frac{1}{\sqrt{(2 - \cos \omega)^2 + \sin^2 \omega}}$$

$$f_c = 18 \text{ Hz}$$

