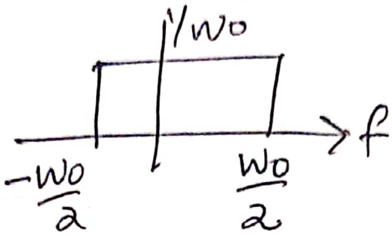
# OBSERVATIONS

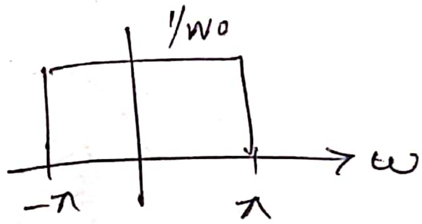
a) $h(t) = \frac{\sin(\pi t w_0)}{\pi t w_0} = \text{sinc}(t w_0)$

$\text{sinc}(t w_0) \longleftrightarrow \frac{1}{w_0}\,\text{rect}\left(\frac{f}{w_0}\right)$

$H(f)$ :




$\Rightarrow H(\omega) =$




$\boxed{\text{for } W = F_s}$

d) As we take W values from $\{\frac{F_s}{2}, \frac{F_s}{4}, \cdots \frac{F_s}{16}\}$

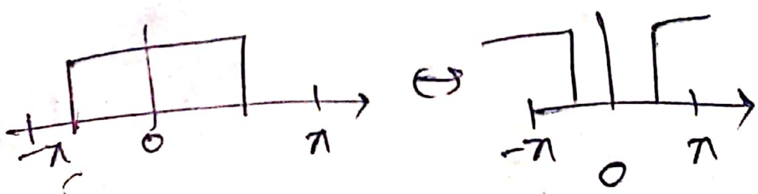
→ high frequency are attenuated and does not pass. while low frequencies are passed.

e) For HPF from LPF

$\left.\begin{array}{ll} \text{HPF:} & H(\omega - \pi) \\ \text{LPF:} & H(\omega) \end{array}\right\} \Rightarrow$ If LPF: $h(n)$

HPF: $h(n)(-1)^n$

$= h(n)\, e^{j\pi n}$.




Low pass $\qquad$ High pass

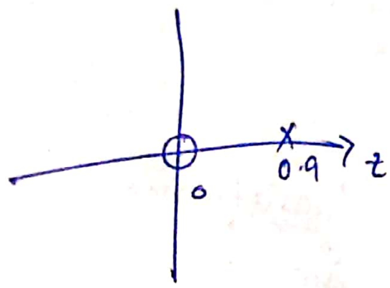
(f)
Sol.

$$H(z) = \frac{1-a}{1-az^{-1}} = \frac{0.1}{1-0.9z^{-1}} = \frac{0.1z}{z-0.9}$$

$\therefore$ Zero at $z=0$

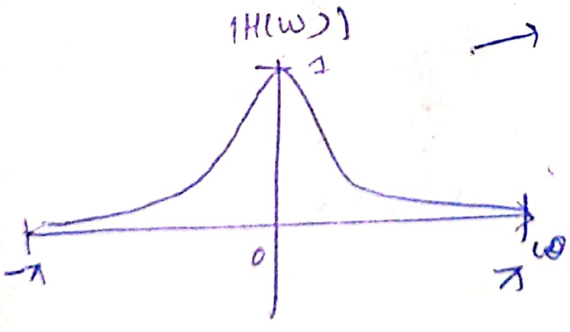
Pole at $z=0.9$

Pole-zero plot is given in the folder




$$h(n) = 0.1 \cdot \left(\frac{9}{10}\right)^n \quad ; \quad \forall\, n \geq 0$$

$$H(\omega) = \frac{0.1\, e^{j\omega}}{e^{j\omega} - 0.9} \quad ; \quad \text{put } z = e^{j\omega}$$




→ considering $H(\omega)$ lies between $\omega \in [-\pi, \pi]$ or else aliasing occurs

The length we choose is

$L = 5 \times F_s$

## Effect of h(n):

→ The high freq components gets lowered and only the low freq. components exist.

⇒ Q. HPF →

If LPF → $H(\omega)$

HPF → $H(\omega-\pi)$

$z = e^{j\omega}$

for $H(\omega-\pi)$ : z-transforms to $e^{j(\omega-\pi)}$

$$= -e^{j\omega} = -z$$

$$\text{LPF}: H(z) = \frac{1-a}{1-\frac{a}{z}} \Rightarrow H(\omega) = \frac{0.1}{1-0.9e^{-j\omega}}$$

$$\text{HPF}: H_{hp}(z) = \frac{1-a}{1+\frac{a}{z}} \Rightarrow$$

$$\boxed{H(\omega) \Rightarrow \frac{0.1}{1+0.9e^{-j\omega}}}$$

⇒ ∴ The low frequency components of input gets ~~lowered~~ attenuated while high frequency pass freely.