Aufgabe 1.

a.) Beschreibung des Filters

$$y[k] = c_1 \cdot x[k-1] + c_2 \cdot x[k-2] + c_3 \cdot y[k-1] + c_4 \cdot y[k-2]$$

$$c_1 = -\frac{1}{4} \qquad c_3 = 1$$

$$c_2 = \frac{1}{4} \qquad c_4 = -\frac{1}{2}$$

$$y[k] = -\frac{1}{4} \cdot x[k-1] + \frac{1}{4} \cdot x[k-2] + 1 \cdot y[k-1] - \frac{1}{2} y[k-2]$$

b.) $H(z) = \frac{Y(z)}{X(z)}$

$$\underline{Y(z)} = -\frac{1}{4} z^{-1} X(z) + \frac{1}{4} z^{-2} X(z) + \underline{z^{-1} Y(z)} - \underline{\frac{1}{2} z^{-2} Y(z)}$$

$$Y(z) - z^{-1} Y(z) + \frac{1}{2} z^{-2} Y(z) = -\frac{1}{4} z^{-1} X(z) + \frac{1}{4} z^{-2} X(z)$$

$$Y(z) \cdot \left(1 - z^{-1} + \frac{1}{2} z^{-2}\right) = X(z) \cdot \left(-\frac{1}{4} z^{-1} + \frac{1}{4} z^{-2}\right)$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{-\frac{1}{4} z^{-1} + \frac{1}{4} z^{-2}}{1 - z^{-1} + \frac{1}{2} z^{-2}} = \frac{1-z}{4z^2 - 4z + 2}$$

$\rightarrow 1 - z = 0$

$z_{n} = 1$

$\rightarrow 4z^2 - 4z + 2 = 0$

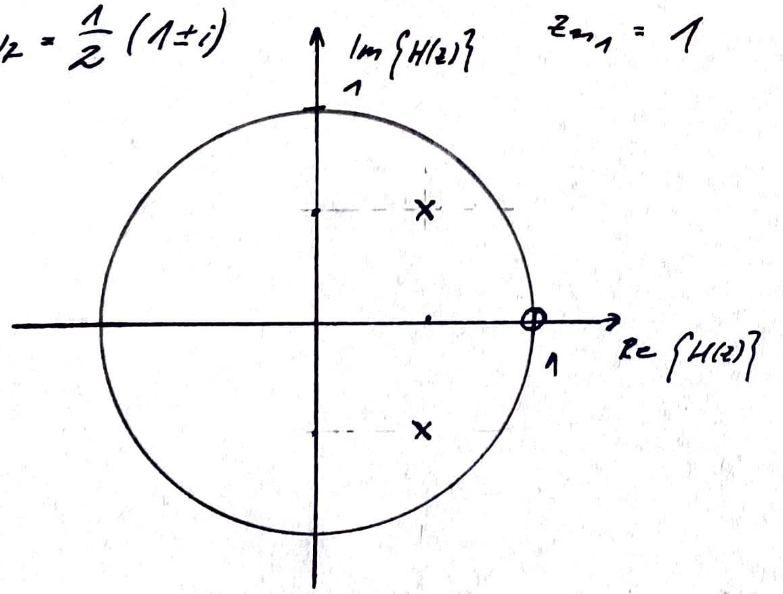
$2z^2 - 2z + 1 = 0$

$z^2 - z + \frac{1}{2} = 0$

$z_{p1/2} = \frac{1}{2}(1 \pm i)$

c.) Pol (z_p) Nullstellen (z_n)

$z_{p1/2} = \frac{1}{2}(1 \pm i)$ $z_{n1} = 1$



d.) IIR Hochpass

e.) System ist <u>stabil</u>, da Pole von $H(z)$ innerhalb des Einheitskreises liegen.

$|z_{p1/2}| < 1$