High Pass 1 Pole $\quad H(s) = \frac{1}{s+1}$

$$\hat{P}(s)\Big|_{s=\frac{\omega_A}{s}} = \frac{s}{\omega_A + s}$$

$$H(z) = \hat{P}(s)\Big|_{s=\frac{z-1}{z+1}} = \frac{z-1}{\omega_A(z+1) + z - 1} = \frac{z-1}{(\omega_A+1)z + \omega_A - 1}$$

For the difference equation we need the z^{-n} terms

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

$$Y(z)\left[(\omega_A+1) + (\omega_A-1)z^{-1}\right] = X(z)\left[1 - z^{-1}\right]$$

$$Y(z)(\omega_A+1) = X(z) - X(z)z^{-1} - (\omega_A-1)Y(z)z^{-1}$$

$$y(n) = \frac{1}{\omega_A+1}x(n) - \frac{1}{\omega_A+1}x(n-1) - (\omega_A-1)y(n-1)$$

$$y(n) = \underbrace{\frac{1}{\omega_A+1}}_{=a_0}x(n) - \underbrace{\frac{1}{\omega_A+1}}_{=a_1}x(n-1) + \underbrace{(1-\omega_A)}_{=b_1}y(n-1)$$

$\omega_A = \tan\left(\frac{2\pi f_h T}{2}\right)$

T = Sample Period

f_h = high pass freq

$\omega_A = 0.036836$ Rad/s for $T = 0.0293$ s

$f_c = f_h = 0.4$ Hz

$a_0 = 0.964473$

$a_1 = -0.964473$

$b_1 = 0.963164$