- KALMAN GAIN (K) : (large P) → prediction is highly uncertain ⇒ trust Measurement MORE
  (larger R (measurement is Noisy), rely more on the prediction)

$$K = P^- \cdot H^T \cdot (H \cdot P^- \cdot H^T + R)^{-1}$$

e.g.,

$$K = \begin{bmatrix} 1000 & 0 & 0 & 0 \\ 0 & 1000 & 0 & 0 \\ 0 & 0 & 1000 & 0 \\ 0 & 0 & 0 & 1000 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \cdot \left(\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} \cdot \begin{bmatrix} 1000 & 0 & 0 & 0 \\ 0 & 1000 & 0 & 0 \\ 0 & 0 & 1000 & 0 \\ 0 & 0 & 0 & 1000 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix} \right)^{-1}$$

$$= \begin{bmatrix} 1000 & 0 & 0 & 0 \\ 0 & 1000 & 0 & 0 \\ 0 & 0 & 1000 & 0 \\ 0 & 0 & 0 & 1000 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \cdot \left(\begin{bmatrix} 1010 & 0 \\ 0 & 1010 \end{bmatrix} \right)^{-1}$$

$$= \begin{bmatrix} 1000 & 0 & 0 & 0 \\ 0 & 1000 & 0 & 0 \\ 0 & 0 & 1000 & 0 \\ 0 & 0 & 0 & 1000 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \cdot \begin{bmatrix} \frac{1}{1010} & 0 \\ 0 & \frac{1}{1010} \end{bmatrix}$$

- UPDATE STATE ESTIMATE ($\hat{x}$)

$$\hat{x} = \hat{x}^- + K \cdot y$$

- UPDATE COVARIANCE (P) : represent the UNCERTAINTY of the UPDATED STATE.

$$P = (I - K \cdot H) \cdot P^-$$

where I is the IDENTITY MATRIX.