

Discrete Kalman filter - vector case

2D robot model

- system model

$$\begin{aligned}x_{k+1} &= Ax_k + d_k + w_k \\z_k &= Hx_k + v_k\end{aligned}$$

where

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, d_k = \begin{bmatrix} 5 \\ 5 \end{bmatrix}, Q = \begin{bmatrix} 1 & 0.5 \\ 0.5 & 1 \end{bmatrix}, H = [1 \ 0], R = 1$$

- initial estimation: $\hat{x}_0 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ and $P_0 = I$
- measurement: $z_1 = 4, z_2 = 9, z_3 = 16$

Homework

- find \hat{x}_3, P_3
- draw 90% ellipse using (\hat{x}_3, P_3) .

Sample matlab

```
z = [ 4 9 16];  
for i = 1:3  
    x = A * x + d;  
    P = A * P * A' + Q;  
    K = P * H' * inv(H * P * H' + R);  
    x = x + K * (z(i) - H * x);  
    P = (eye(2) - K * H) * P;  
end
```