Treat the missing data as parameters to be estimated.

Goal: Find $\pi(\alpha, \beta, \sigma, \{\mathbf{x}\}_{unobs}, \{\mathbf{y}\}_{unobs} | \{\mathbf{x}\}_{obs}, \{\mathbf{y}\}_{obs})$

$$y_{1} \sim U\left(\min\{\mathbf{y}\}_{obs}, \max\{\mathbf{y}\}_{obs}\right)$$

$$x_{2} \sim U\left(\min\{\mathbf{x}\}_{obs}, \max\{\mathbf{x}\}_{obs}\right)$$

$$y_{2} \sim U\left(\min\{\mathbf{y}\}_{obs}, \max\{\mathbf{y}\}_{obs}\right)$$

 $x_1 \sim U\left(min\{\mathbf{x}\}_{obs}, max\{\mathbf{x}\}_{obs}\right)$

 $\alpha = \beta k \sim N(0, 10^2)$

$$\begin{bmatrix} \mathbf{x}_t \\ \mathbf{y}_t \end{bmatrix} \sim N \left((2 - \beta) \begin{bmatrix} x_{t-1} \\ y_{t-1} \end{bmatrix} + (\beta - 1 - 2k\beta) \begin{bmatrix} x_{t-2} \\ y_{t-2} \end{bmatrix}, \sigma^2 I \right), \qquad t \in \{3:500\}$$

$$\begin{bmatrix} \mathbf{y}_t \end{bmatrix} \sim IV \left((2-p) \begin{bmatrix} y_{t-1} \end{bmatrix} + (p-1-2kp) \begin{bmatrix} y_{t-2} \end{bmatrix}, \quad t \in \{3...5\}, \\ \sigma \sim IG(1,1) \end{bmatrix}$$

$$\sigma \sim IG(1,1)$$

$$\beta \sim N(0,10^2)$$

Treat the missing data as parameters to be estimated.

Goal: Find $\pi(\alpha, \beta, \sigma, \{\mathbf{x}\}_{unobs}, \{\mathbf{y}\}_{unobs} | \{\mathbf{x}\}_{obs}, \{\mathbf{y}\}_{obs})$

$$x_{1} \sim U\left(\min\{\mathbf{x}\}_{obs}, \max\{\mathbf{x}\}_{obs}\right)$$

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$$y_{2} \sim U\left(\min\{\mathbf{y}\}_{obs}, \max\{\mathbf{y}\}_{obs}\right)$$

$$\begin{bmatrix} \mathbf{x}_{t} \\ \mathbf{y}_{t} \end{bmatrix} \sim N\left((2-\beta)\begin{bmatrix} x_{t-1} \\ y_{t-1} \end{bmatrix} + (\beta-1-2k\beta)\begin{bmatrix} x_{t-2} \\ y_{t-2} \end{bmatrix}, \sigma^{2}I\right), \qquad t \in \{3:500\}$$

$$\sigma \sim IG(1,1)$$

$$\beta \sim N\left(0,10^{2}\right)$$

$$\alpha = \beta k \sim N\left(0,10^{2}\right)$$

To estimate the parameters, we use Adaptive Metropolis-Within-Gibbs