Setup: Have a pmf or pdf that is difficult to sample from.

Example: $p(\theta \mid x)$, posterior dist^{n}

Ex: $p(x, y)$

Assume: Easily sample from the conditional distributions

$p(x \mid y)$ and $p(y \mid x)$.

Gibbs sampler

(x_0, y_0)

1. set x, y to starting values $x = x_0$, $y = y_0$ (init.)

2. $x \mid y = y_0 \rightarrow (x_1, y_0)$

updating the value of x conditioned on the current value of $y = y_0$.

$y \mid x = x_1$

updating the value of y cond. on the current value of $x = x_1$

(x_1, y_1)

Suppose (x_0, y_0)

1. $y \mid x = x_0 \longrightarrow (x_0, y_1)$
2. $x \mid y = y_1 \longrightarrow (x_1, y_1)$

quest. Does it matter if we start w/ y ~~int~~ instead of x? No.

Goal: Build samples

	$\underline{x}$	$\underline{y}$
init →	x_0	y_0
1st iter. of G.S. →	x_1	y_1
2nd iter of G.S. →	⋮	⋮
M^{th} iter of G.S. →	x_M	y_M

current state

2nd iteration: (x_1, y_1)

1. $x \mid y = y_1 \longrightarrow (x_2, y_1)$
2. $y \mid x = x_2 \longrightarrow (x_2, y_2)$

⋮

M^{th} iteration (x_{M-1}, y_{M-1})

1. $x \mid y = y_{M-1} \longrightarrow (x_M, y_{M-1})$

2. $y \mid x = x_M \longrightarrow (x_M, y_M)$.