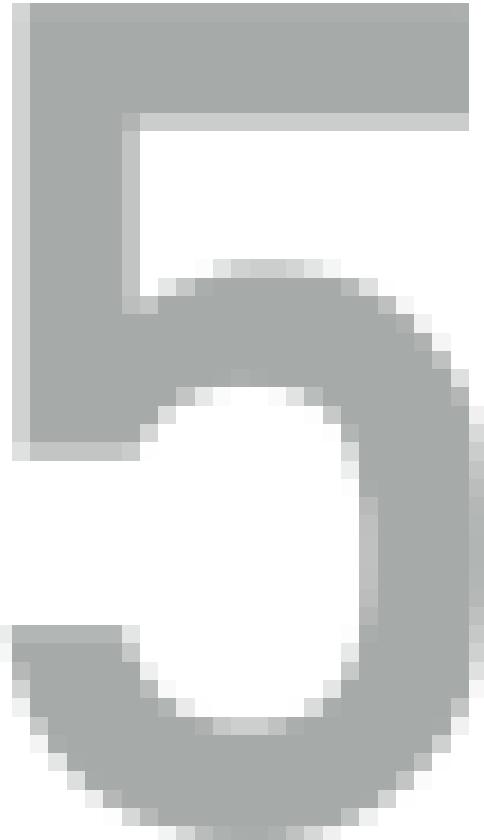
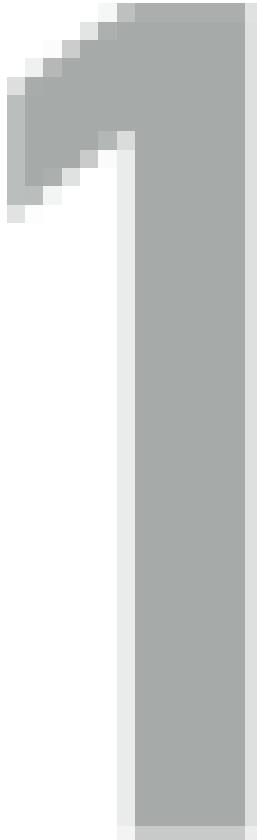




MARSHALL MARKETING CHANNELS



► A Markov Chain  $X_0, X_1, \dots \in \mathbb{X}$  is a stochastic process in  $\mathbb{X}$  such that

$$P[X_t \in A | X_0, \dots, X_{t-1}] = P[X_t \in A | X_{t-1}]$$

- ▶ Given a Markov kernel  $K$  can construct a chain  $X_t$  by iterating over  $X_0 \sim \mu$

$$X_t \sim K(X_{t-1}, dx_t)$$

► The marginal law  $\mu_t$  of  $X_t$  after  $t$  steps satisfies

$$\mu_t = \text{Law}(X_t) = \mu_{t-1} K = \mu K^t$$

- The joint law of  $X_{0:t} = (X_0, \dots, X_t)$

$$\mu \otimes K \cdots \otimes K(dx_{0:t}) = \mu(dx_0) \prod_{s=1}^t K(x_{s-1}, dx_s)$$

► Given a Markov chain defines a Markov kernel as the one step transition

$$K(x, A) = P[X_1 \in A | X_0 = x] = P_x[X_1 \in A]$$

# MARKOV KERNELS V4: MARKOV CHAINS

- ▶ A Markov Chain  $X_0, X_1, \dots \in \mathbb{X}$  is a stochastic process in  $\mathbb{X}$  such that

$$\mathbb{P}[X_t \in A | X_0, \dots, X_{t-1}] = \mathbb{P}[X_t \in A | X_{t-1}]$$

- ▶ Given a Markov chain defines a Markov kernel as the one step transition

$$K(x, A) = \mathbb{P}[X_1 \in A | X_0 = x] = \mathbb{P}_x[X_1 \in A]$$

- ▶ Given a Markov kernel  $K$  can construct a chain  $X_t$  by iterating over  $X_0 \sim \mu$

$$X_t \sim K(X_{t-1}, dx_t)$$

- ▶ The marginal law  $\mu_t$  of  $X_t$  after  $t$  steps satisfies

$$\mu_t = \text{Law}(X_t) = \mu_{t-1} K = \mu K^t$$

- ▶ The joint law of  $X_{0:t} = (X_0, \dots, X_t)$

$$\mu \otimes K \cdots \otimes K(dx_{0:t}) = \mu(dx_0) \prod_{s=1}^t K(x_{s-1}, dx_s)$$

# $f$ -DIVERGENCES