HI AGAIN!

$X$ - STATE SPACE OF NUMBERS

- DISCRETE NUMBERS

$\{0, 1, 2, 3, \dots\}$

$X_t$ ← INDEX - TIME

INDEX SET - DISCRETE

CONTINUOUS

↑

STOCHASTIC PROCESS

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$p_x(i) = \mathbb{P}(X = i)$ PROBABILITY MASS

PROBABILITY DISTRIBUTION

$X \sim p_x(i)$

## MOMENTS

$$E[X^n] = \sum_{i \in S} i^n p_x(i)$$

^ STATE SPACE

ZEROTH

0-TH MOMENT $E[x^0] = \sum_{i = S} p_x(i) = 1$

1ST MOMENT $E[X] = \sum_{i \in S} i p_x(i) = \mu$

EXPECTED VALUE

MEAN

AVERAGE

2ND MOMENT $E[X^2]$

$$\sigma^2 = E[(X-\mu)^2]$$

$$= E[X^2] - \mu^2$$ VARIANCE

$\sigma$ - STANDARD DEVIATION

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FAMOUS DISCRETE RANDOM VARIABLES

- UNIFORM
- BERNOULLI

$X = 0$ $1-p$

$X = 1$ $p$ $p \in [0,1]$

$E[X] = p$

STOCHASTASTIC PROCESS

$$X_t = \{0,1,1,0,0,0,1,1,\ldots\}$$

- GEOMETRIC

$$p_X(k) = (1-p)^{k-1} p \qquad p \in [0,1]$$

$$= \mathbb{P}(X=k)$$

# ATTEMPTS IN SERIES OF BERNOULLIS BEFORE $X_t = 1$

$$E[X] = \frac{1}{p}$$

- BINOMIAL

$$p_X(k) = \binom{n}{k} p^k (1-p)^{n-k} \qquad p \in [0,1], \; n$$

# SUCCESSES IN A SERIES OF $n$ BERNOULLIS.

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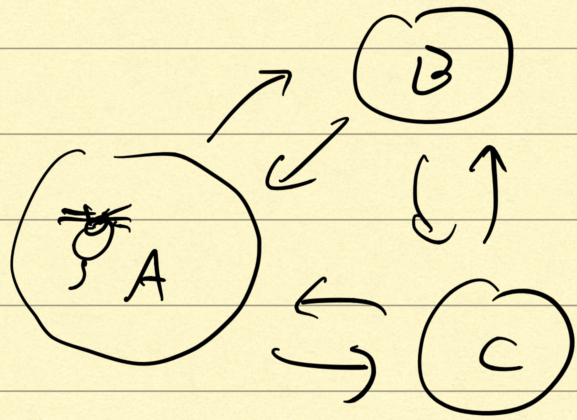
## MARKOV CHAINS




$X_t$ - ROOM MOUSE IS IN AT TIME $t$

ASSUMPTION

$$P(X_t = i \mid X_{t-1} = j, X_{t-2} = k \ldots)$$

$$= P(X_t = i \mid X_{t-1} = j)$$

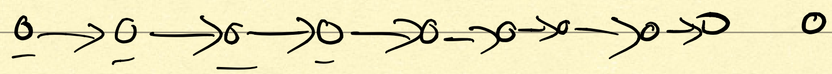
$$M = \begin{bmatrix} p_{11} & & p_{1,3} \\ & & \\ & & p_{33} \end{bmatrix}$$

TRANSITION MATRIX

$$p_{ij} = P(X_{t+1} = i \mid X_t = j)$$

$$\begin{bmatrix} \rho_A(t+1) \\ \rho_B(t+1) \\ \rho_C(t+1) \end{bmatrix} = M \cdot \begin{bmatrix} \rho_A(t) \\ \rho_B(t) \\ \rho_C(t) \end{bmatrix}, \quad \begin{bmatrix} \rho_A(0) \\ \rho_B(0) \\ \rho_C(0) \end{bmatrix}$$

DNA



BASE PAIR $i$