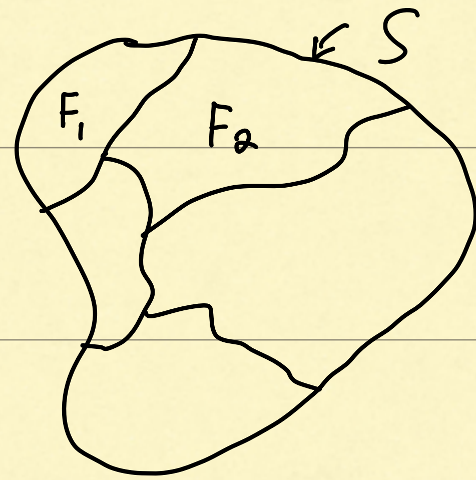
SUPPOSE THE STATE SPACE S CAN BE SPLIT INTO SUBSETS $F_1 \dots F_N$

SUCH THAT



$$\bigcup F_i = S$$

AND

NOTHING

$$F_i \cap F_j = \phi$$

IF $i \neq j$

THEN $\{F_1 \dots F_N\}$ IS CALLED A PARTITION.

THEN SUPPOSE $\underline{e}$ IS AN EVENT

$$\mathbb{P}(e) = \mathbb{P}(e \mid F_1)\mathbb{P}(F_1) + \mathbb{P}(e \mid F_2)\mathbb{P}(F_2) + \dots + \mathbb{P}(e \mid F_N)\mathbb{P}(F_N)$$

LAW OF TOTAL PROBABILITY

X_t - RANDOM VARIABLE

COLLECTION OF RANDOM VARIABLES

$t \in [0, 1, 2 \dots)$ OR $t \in \mathbb{R}$

DISCRETE CONTINUOUS

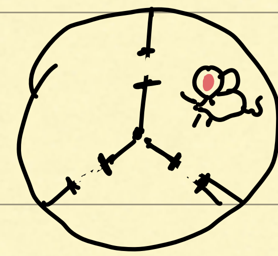
INDEX SET

THEN X_t IS A STOCHASTIC PROCESS.

MARKOV CHAINS

A MOUSE CAN MOVE BETWEEN 3 ROOMS

A, B, C



EVERY MINUTE, THE POSITION OF THE MOUSE IS X_t

$$\mathbb{P}(X_t = i \mid X_{t-1} = j, X_{t-2} = k, X_{t-3} = l \ldots)$$

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

MARKOVIAN ASSUMPTION

$$\mathbb{P}(X_t = i) = \sum_j \underbrace{\mathbb{P}(X_t = i \mid X_{t-1} = j)}_{\text{CALL THIS } p_{j \to i}} \mathbb{P}(X_{t-1} = j)$$

THEN

$$\begin{bmatrix} p_A(t+1) \\ p_B(t+1) \end{bmatrix} = M \cdot \begin{bmatrix} p_A(t) \\ p_B(t) \end{bmatrix}$$

$$\begin{bmatrix} \vdots \\ p_C(t+1) \end{bmatrix} = \begin{bmatrix} \vdots \\ p_C(t) \end{bmatrix}$$

WHERE

$$\underline{\underline{M}} = \begin{bmatrix} P_{A\to A} & P_{B\to A} & \\ P_{A\to B} & P_{B\to B} & \\ & & P_{C\to C} \end{bmatrix}$$

TRANSITION MATRIX

$$P_A(t) = \mathbb{P}(X_t = A)$$

NOTES

SOMETIMES THE MARKOVIAN ASSUMPTION IS REFERED TO AS BEING <u>MEMORYLESS</u>

- IF X_t AND X_{t-1} WERE INDEPENDENT, THIS WOULD BE <u>MORE</u> MEMORYLESS

- SUPPOSE THE MOUSE REMEMBERED THE LAST <u>2</u> ROOMS. THEN DEFINE THE STATE A {CURRENT ROOM, PREVIOUS ROOM}

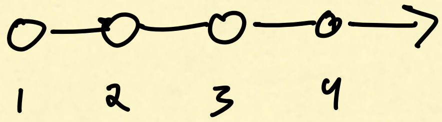
$3 \times 3 = 9$ STATES

TRANSITION MATRIX $M_{9\times 9}$

- HOW DOES THE MARKOVIAN ASSUMPTION GENERALIZE TO CONTINUOUS TIME?

PS2

BASEPAIR = "TIME"

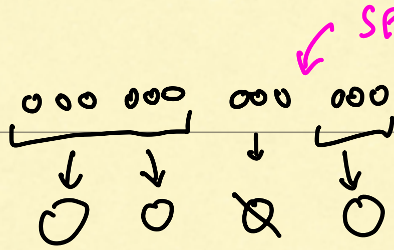


WHAT STATE IS THIS BASEPAIR IN?

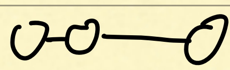
INTRON vs EXON

SPLICE

BASEPAIRS



AMINO ACIDS



PROTEIN