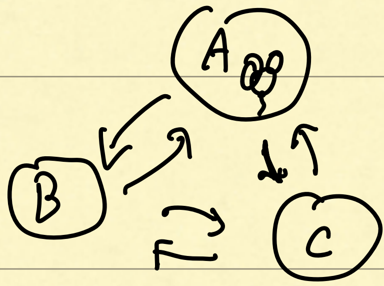


$$\begin{bmatrix} p_A(t+1) \\ p_B(t+1) \\ p_C(t+1) \end{bmatrix} = \begin{bmatrix} p_{A \to A} & & p_{C \to A} \\ & p_{B \to C} & \\ & & p_{C \to C} \end{bmatrix} \begin{bmatrix} p_A(t) \\ p_B(t) \\ p_C(t) \end{bmatrix}$$

IF STATE SPACE OF X IS A DISCRETE SET OF NUMBERS, THEN X IS A DISCRETE RANDOM VARIABLE

$$\mathbb{P}(X = x) = p_X(x)$$

PROBABILITY MASS FUNCTION

MOMENTS

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

$n = 0 \qquad E[X^0] = \sum_{i \in S} p_X(i) = 1$

$n = 1 \qquad E[X] = \sum_{i \in S} i\, p_X(i) = \mu$

AVERAGE,
MEAN
EXPECTATION

$n = 2 \qquad E[X^2] = \sum_{i \in S} i^2 p_X(i)$

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

σ^2

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

STANDARD DEVIATION

FAMOUS DISCRETE RANDOM VARIABLES

BERNOULLI $\quad X=0$

$X=1 \quad P(X=1) = p$

$E[X] = p$

STOCHASTIC PROCESS OF INDEPENDENT, IDENTICALLY DISTRIBUTED BERNOULLI TRIALS

n TRIALS, HOW MANY SUCCESS?

$$X_t = [\underbrace{0\,0\,0\,1}_{\#\text{ TRIALS TO FIRST SUCCESS}}\,1\;0\,1\,1\;1\,0\,0\,1\,0\;\ldots$$

GEOMETRIC

$$p_X(k) = (1-p)^{k-1} \cdot p$$

$$k = 0, 1, 2 \ldots$$

OF TRIALS BEFORE FIRST SUCCESS

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

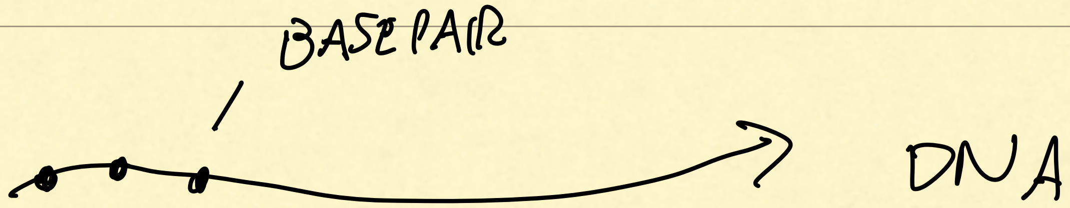
PS 2

BINOMIAL

$$p_X(k) = \binom{n}{k} p^k (1-p)^{n-k}$$

OF SUCCESSES IN A SERIES OF n TRIALS

PS 2



$t=0$ $\quad t=1$

$$
\begin{array}{cccccc c}
\text{START} & E1 & E2 & E3 & I & \text{END} & \\
\left[\begin{array}{cccccc}
0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & & & 0 \\
0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & & & 0 \\
0 & 0 & 0 & & 0 & 1
\end{array}\right] & & & & & &
\begin{array}{c} \text{START} \\ E1 \\ E2 \\ E3 \\ I \\ \text{END} \end{array}
\end{array}
$$