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

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

MOMENTS OF X

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

S ↑ STATE SPACE

ZEROTH MOMENT

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

FIRST MOMENT

$$E[X] = \sum_{i \in S} i \, p_X(i)$$ MEAN μ_X

SECOND MOMENT

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

$E[(X-\mu_X)^2]$ - VARIANCE σ_X^2

$\sqrt{E[(X-\mu_X)^2]}$ - STANDARD DEVIATION σ_X

FAMOUS DISCRETE RANDOM VARIABLES

- BERNOULLI $\quad X = 0 \quad \mathbb{P}(X=0) = 1-p$
  $\quad X = 1 \quad \mathbb{P}(X=1) = p$

$E[X] = p \qquad 0 \le p \le 1$

- A STOCHASTIC PROCESS OF INDEPENDENT, IDENTICALLY DISTRIBUTED BERNOULLI

$$X_t = [\,0\ 0\,0\,0\,1\,1\,0\,0\ \overbrace{1\,1\,1\ 0\,0\,0\,0\,0\,1\,0}^{n}\ \ldots\,]$$

- GEOMETRIC $\quad Z$

$p_Z(k) = (1-p)^{k-1} \cdot p \qquad$ STATE SPACE $k = 0, 1, 2, \ldots$

OF EVENTS BEFORE FIRST SUCCESS IN X_t

$E[Z] = \frac{1}{p} \leftarrow$ PS2?

- BINOMIAL $\quad Y$

$$p_Y(k) = \underbrace{\binom{n}{k}}\, p^k (1-p)^{n-k}$$

$$\binom{n}{k} = \frac{n!}{k!\,(n-k)!}$$

IN A RUN OF n ELEMENTS OF X_t,
Y IS THE NUMBER OF 1's.

PS2

$$
\begin{array}{cc}
 & \begin{array}{cccccc} S & E_1 & E_2 & E_3 & I & \text{DONE} \end{array} \\
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