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

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

SAMPLE SPACE

ZEROTH MOMENT

$$E[X^0] = \sum p_X(i) = 1$$

FIRST MOMENT

$$E[X] = \sum i \, p_X(i)$$

MEAN

μ_X

SECOND MOMENT

$$E[X^2] = \sum i^2 p_X(i)$$

$$E[(X-\mu_X)^2] =$$ VARIANCE σ_X^2

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

FAMOUS DISCRETE RANDOM VARIABLES

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

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

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

A STOCHASTIC PROCESS OF INDEPENDENT, IDENTICAL BERNOULLI VARIABLES

n - HOW MANY HITS?

$$X_t = [\underbrace{0\,0\,0\,1}_{\text{FIRST HIT}}\,1\,\overbrace{0\,1\,1\,1\,0\,0}^{n}\,1\ \dots\,]$$

- GEOMETRIC $\quad Z$

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

OF EVENTS BEFORE FIRST HIT IN X_t

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

- BINOMIAL $\quad Y$

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

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

OF HITS IN n BERNOULLI TRIALS