Lecture 6:

2/19/21

Discrete RV: PMF = probability mass func : $P(X = x_i)$

Expectation : $E[X] = \sum_i g(x_i) \cdot P(X = x_i)$, Variance : $VAR[X]$

$E[X+Y] = E[X] + E[Y]$; when $X \perp\!\!\!\perp Y$ (independent), $VAR[X+Y] = VAR[X] + VAR[Y]$.

Discrete RVs: uniform, bernoulli, binomial, geometric, Poisson RV*

- uniform → expected outcomes have equal probability
- bernoulli → takes on val of 1 w/ probability p and 0 w/ probability 1-p.
- binomial → 2 possible outcomes
- geometric → probability of succeeding after n^{th} try if each try P, 1-P

Continuous variables.

CDF : cummulative distribution function ↗ any RV

PDF : probability density function

{ PMF only for discrete *
{ PDF - continuous random vars.

CDF : $F_X(x) = P(X \leq x)$ where $-\infty \leq x \leq \infty$

$= P(X \in (-\infty, x])$

$= P[\{\theta : X(\theta) \leq x\}]$

$P(X = a) = F_X(a) - F_X(a^-)$

Continuous RV : RV whose CDF has no jumps. also, $P(X = a) = 0$ ← always 0 b/c continuous F_X

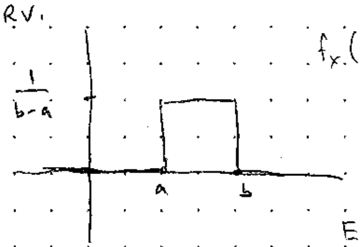
Since CDF continuous, $P(X=a) = 0$, so useless for continuous RV: use PDF

PDF $f_X(x) = \frac{d}{dx} F_X(x)$. if deriv. exists.

$F_X(x) = \int_{-\infty}^{\infty} f_X(t)\, dt$

$P(a \leq x \leq b) = \int_a^b f_X(t)\, dt$

Uniform RV.



$$f_X(x) = \begin{cases} \frac{1}{b-a} & a \leq x \leq b \\ 0 & \text{otherwise} \end{cases}$$

$E[g(x)] = \int_{-\infty}^{+\infty} g(x) \cdot f_X(x)\, dx$

$VAR[g(x)] = E[x^2] - E[x]^2$

$E[x^2] = \int_{-\infty}^{\infty} g(x)^2 \cdot f_X(x) dx$