CDF and PMF

val.	1	3	5	7
pmf $p(x)$:	1/2	0,25	0,15	0,1
cdf $F(x)$:	0	0,5	0,75	0,9

Week 2 Tutorial

values of x:	1	3	5	7
cdf $F(a)$:	0,5	0,75	0,9	1

Q1: What is $P(x \le 3)$?

a) 0,15 b) 0,25 c) 0,5 d) 0,75

$$F(3) = P(x \le 3) = \underbrace{P(x=1)}_{\text{points until 3}} + P(x=3)$$

$$= p(1) + p(3)$$

$$0{,}5 + 0{,}25 = F(3) = 0{,}75$$

Definition of cdf $F(a) = P(x \le a)$

Definition of pmf $p(a) = P(x = a)$

$$\boxed{p(a) = F(b) - F(a)}$$

$$\boxed{P(x \le 3) = F(3) = 0{,}75}$$

$$1 - P(x \le 3) = P(x > 3) + P(x \ge 3)$$

$p(a) = \text{binom}(n, p)$

$p(a) = \text{bern}(p)$

X = # of successes before the second failure of a sequence of independent Bernoulli(p) trials.

Describe the pmf of X.

$X = 0, 1, 2, 3$

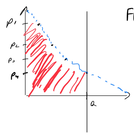
Week 2 Tutorial (2nd group)

pmf. $p(a) \triangleq P(x = a)$

cdf. $F(a) \triangleq P(x \le a)$

$X : \Omega \to \mathbb{R}$

Ω → all possible outcomes



$$F(a) = p_1 + p_2 + p_3 + p_4 = \int_{-\infty}^{a} p(x)\,dx$$

Example of Dice

$$\Omega = \{ \underset{\omega_1}{\boxed{\cdot}}, \underset{\omega_2}{\boxed{\cdot\cdot}}, \underset{\omega_3}{\boxed{\cdot\cdot\cdot}}, \dots, \underset{\omega_6}{\boxed{\cdot\cdot\cdot\cdot\cdot\cdot}} \}$$

discrete outcomes

discrete R.V.

not a number

$X(\omega_1) = 1 \quad X(\omega_2) = 2 \dots$

$p(x = 1) = 1/6$

Bernoulli (p) = 1 (success) with probability p of failure with probability $1-p$

Binomial (n, p) = # successes in n independent Bernoulli(p) trails.

pmf

cdf

$P(x=0) = 1 - p = p(0)$

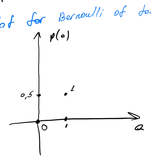
$P(x=1) = p = p(1)$

$p = 0{,}5 \to$ success

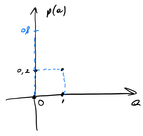
X values	0	1
pmf	1-p	p

plot for Bernoulli of tossing a coin

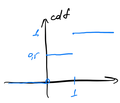
$p = 0{,}5$



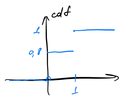
$p = 0{,}2$ success



$p = 0{,}5$



$p = 0{,}2$ success



Binomial distribution

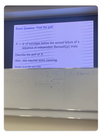
$$\underbrace{0, 0, 1, 0, 1, 1}_{6}$$

$$\text{Binomial}(6, 0{,}5) = \left(\frac{1}{2}\right)^6$$

$$\text{Binomial}(6, 0{,}3) = (0{,}3)^3 \cdot (0{,}7)^3$$

$p(a) = p^a \cdot q^{n-a}$ | pmf for Binomial distribution

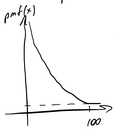
a → # success



X = # successes, BEFORE the 2nd failure

SSSFSSF $\quad x = 5$

#1 failure, #2 failure

$$FF \left(\frac{1}{2}\right)^2 \underbrace{(1-p)^2}_{F}$$

$$\boxed{p(a) = p^a (1-p)^2 \cdot (a-1)}$$