Rmk We write

$P(X \leq a, Y \leq b)$

for

$P((X \leq a) \cap (Y \leq b))$

Notation for marginals

F_X = cdf for r.v. X

F_Y = cdf for r.v Y

$F_X(a) = \lim_{b \to \infty} F_X(a,b)$

$p_X(a)$ = pmf for X (discrete case)

$p_Y(b)$ = pmf for Y (" ")

Coin tossing example

$X_1 = \mathbb{1}(\text{At most 1H})$

$X_2 = \mathbb{1}(\text{At least 1H \& 1T})$

$X = (X_1, X_2)$

Pmf for X: Given by 4 quant.

$p(0,0) = P(X = (0,0)) = P(\{(h,h,h)\}) = 1/8$

$p(0,1) = P(X = (0,1)) = P(\{(t,h,h),(h,t,h),(h,h,t)\}) = 3/8$

$p(1,0) = P(X = (1,0)) = 1/8$

$p(1,1) = P(X = (1,1)) = 3/8$

Marginal for X_1:

$$P(X_1 = 0) = \sum_{i_2=0}^{1} p(0, i_2) = \underbrace{p(0,0)}_{1/8} + \underbrace{p(0,1)}_{3/8} = \frac{1}{2}$$

$$P(X_1 = 1) = \sum_{i_2=0}^{1} p(1, i_2) = 1/2$$

Rmk: $X_1 \sim \mathcal{B}(1/2)$

Rmk: As in the 1-d case

$\sum$ in the discrete case

$\Leftrightarrow$

$\int$ in the continuous case.