Marginal Distributions

Discrete

X, Y discrete random variables and $f(x,y)$ is the value of their joint pmf at (x,y), the function

$$f_X(x) = \sum_y f(x,y)$$

is the marginal pmf of X

Example

Box: 3 black marbles, 2 white, 5 red, 10 total

select two

X = # of black marbles

Y = " white "

X \ Y	0	1	2	
0	2/9	2/9	1/45	7/15
1	1/3	2/15		7/15
2	1/15			1/15
	28/45	16/45	1/45	1

$$f_X(1) = \sum_y f(1,y) = 7/15$$

$$f_Y(0) = \sum_x f(x,0) = \frac{28}{45}$$

Continuous

X, Y continuous r.v. and $f(x,y)$ is the value of their joint pdf at (x,y), the function:

$$f_X(x) = \int_{-\infty}^{\infty} f(x,y)\,dy$$

is the marginal pdf of X

Example

$$f(x,y) = \frac{2}{5}(x+4y) \qquad 0 \le x \le 1,\ 0 \le y \le 1$$

$$\int_0^1 \int_0^1 \frac{2}{5}(x+4y)\,dx\,dy = 1$$

$$f_X(x) = \int_0^1 \frac{2}{5}(x+4y)\,dy$$

$$= \frac{2}{5}\left(xy + 4\frac{y^2}{2}\right)_0^1$$

$$= \frac{2}{5}(x+2)$$