Two Discrete Random Variables

For discrete rvs X and Y:

Joint Mass Function: $p(x,y) = P(X=x,\ Y=y)$ ← gives the probability that $X=x$ and $Y=y$ simultaneously

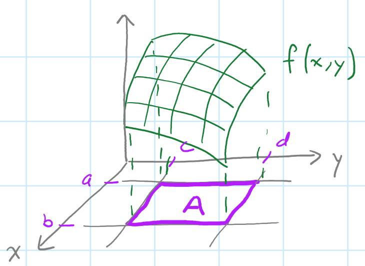
Marginal Mass Functions:
$$p_X(x) = \sum_y p(x,y)$$
$$p_Y(y) = \sum_x p(x,y)$$
give probabilities of X and Y individually

X and Y are **INDEPENDENT** if $p(x,y) = p_X(x)\,p_Y(y)$.

Two Continuous Random Variables

For continuous rvs X and Y:

Joint Density Function: $f(x,y)$ such that for any set A in $\mathbb{R}^2$, $P((X,Y)\in A) = \iint_A f(x,y)\,dA$



$$P(a \le X \le b,\ c \le Y \le d) = P((X,Y)\in A)$$
$$= \int_a^b \int_c^d f(x,y)\,dy\,dx = \iint_A f(x,y)\,dA$$

Marginal Density Functions:
$$f_X(x) = \int_{-\infty}^{\infty} f(x,y)\,dy$$
$$f_Y(y) = \int_{-\infty}^{\infty} f(x,y)\,dx$$

X and Y are **INDEPENDENT** if $f(x,y) = f_X(x)\,f_Y(y)$.