

# Stats Formula

Measure of location:

$$\bar{x} = \frac{\sum x_i}{n} \qquad \bar{x} = \frac{\sum x_i f_i}{\sum f_i}$$

$$\bar{x} = \frac{\sum (x-a)}{n} + a$$

Measure of spread:

$$\text{var} = \frac{1}{n} \sum (x_i - \bar{x})^2 \qquad \text{var} = \frac{1}{n} (\sum x_i^2) - \bar{x}^2$$

$$\text{var} = \frac{\sum (x_i - \bar{x})^2 f_i}{\sum f_i} \qquad \text{var} = \frac{\sum x_i^2 f_i}{\sum f_i} - \bar{x}^2$$

$$SD = \sigma = \sqrt{\text{var}} \qquad \Leftrightarrow \qquad \text{var} = \sigma^2$$

Probability

Mutually Exclusive

$$P(A \text{ or } B) = P(A) + P(B)$$
$$P(A \text{ and } B) = P(A) \times P(B)$$

Non-Mutually Exclusive

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$
$$P(A | B) = \frac{P(A \text{ and } B)}{P(B)}$$
$$\Leftrightarrow$$
$$P(A \text{ and } B) = P(A | B) \times P(B)$$

Binomial distribution:

$$X \sim B(n, p) \qquad P(X = x) = {}^n C_x p^x q^{n-x}$$

Geometric distribution:

$$X \sim G(p) \qquad P(X = x) = pq^{x-1}$$

Expectation & Variance of Binomial & Geometric distribution:

$X \sim B(n, p)$	$X \sim G(p)$
$E(x) = \mu = np$	$E(x) = \frac{1}{p}$
$Var(x) = \sigma^2 = npq$	

Expectation (mean) & Variance of random variable from Probability Distribution:

$$E(x) = \mu = \sum x_i p_i \qquad Var(x) = \sigma^2 = \sum (x_i - \mu)^2 p_i = \sum x_i^2 p_i - \mu^2$$

( $\mu \neq \bar{x}$ .  $\mu$  is 'theoretical mean',  $\bar{x}$  is 'actual mean'.)

Product Moment Correlation Coefficient:

$$r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}}$$

$$S_{xy} = \sum x_i y_i - \frac{1}{n} \sum x_i \sum y_i$$

$$S_{xx} = \sum x_i^2 - \frac{1}{n} (\sum x_i)^2 \qquad S_{yy} = \sum y_i^2 - \frac{1}{n} (\sum y_i)^2$$

Spearman's Rank:

$$r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

Regression:

y on x	x on y
$y = a + bx$	$x = a' + b' y$
$a = \bar{y} - b\bar{x}$	$a' = \bar{x} - b'\bar{y}$
$b = \frac{S_{xy}}{S_{xx}}$	$b' = \frac{S_{xy}}{S_{yy}}$