Probability

using python.

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Expected

is defined as the mean of a random variable

Variance

$$\sigma^2 = E(x^2) - \mu^2 \tag{1}$$

remember that $\sum_x f(x)x = \mu$ and $\sum_x f(x) = 1$

$$\begin{aligned} \sigma^2 &= \sum_x (x-\mu)^2 f(x) \\ &= \sum (x^2 f(x) - 2x\mu f(x) + \mu^2 f(x)) \end{aligned} \tag{2}$$

Applying the algebra we find $\sum x^2 f(x) - \mu^2$.

Theorem 1

X is a random variable with a pdf $f(x)$ then μ of $g(x)$ is

$$\mu_{g(x)} = E(g(x)) = \sum g(x)f(x) \tag{3}$$

Example of income and the probability of sell a product.

Theorem

X is a random variable with pdf $f(x)$ then then variance of $g(x)$ will be:

$$\sigma^2_{g(x)} = E((g(x) - \mu_{g(x)})^2 \tag{4}$$

this is equation is derived of the definition of variance of a random variable, remember that $g(x)$ is a random variable with mean $\mu_{g(x)}$.

Join distribution

until now we try Ω in $\mathbf{R}^1$ and we can be interested in find the probability of occurrence of two simultaneous random variables.

$$f(x, y) = P(X = x, Y = y) \tag{5}$$

Some intuitive properties are:

- $f(x, y) \geq 0$
- $\sum_x \sum_y f(x, y) = 1$

Excercise

Suppose the bag model with n balls and there there are r balls and w balls where $r + w = n$ find the probability of get x, y balls respectively.

Marginal distribution

$$g(x) = \sum_{y} f(x, y) \tag{6}$$

$$h(y) = \sum_{x} = f(x, y) \tag{7}$$

Expected value of two random variables

let be X, Y two random variables with joint probability function distribution $f(x, y)$ the mean of $g(X, Y)$ is:

$$\mu_{g(X,Y)} = E[g(X, Y)] = \sum_x \sum_y g(x, y) f(x, y) \tag{8}$$

Covariance

Insights

$$\begin{aligned}\sigma_{X,Y} &= E[(X-\mu_x)(Y-\mu_y)] \\ &= \sum_x \sum_y (x-\mu_x)(y-\mu_y) f(x,y)\end{aligned} \tag{9}$$

is a measure of association between two variables

Shapiro wilk

P -values

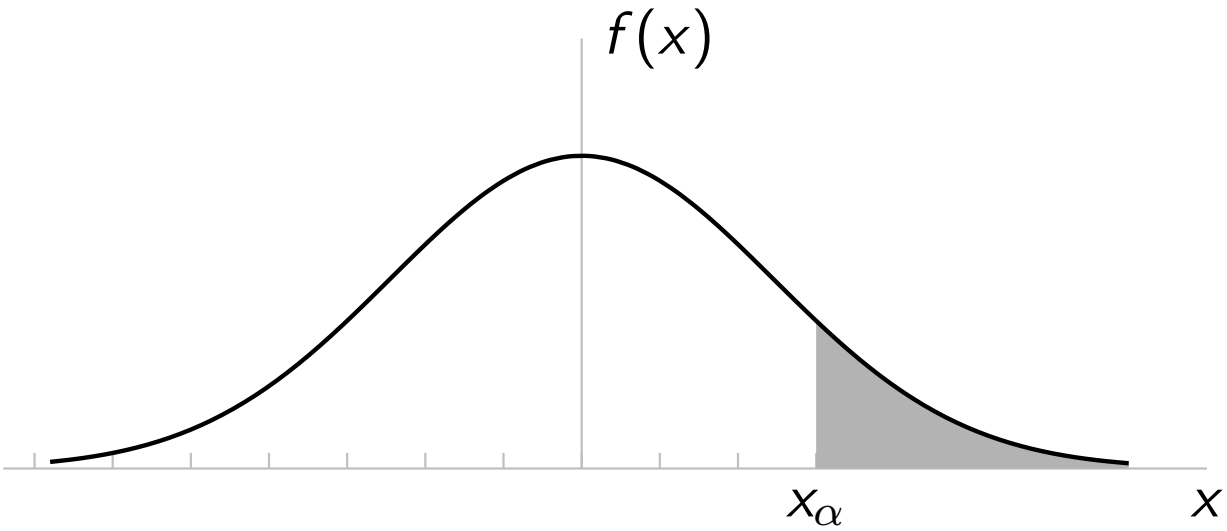
Hypothesis testing

Hypothesis as idea or believe about a issue.

Null hypothesis

H_0 describe the current believe, and H_1 is a option if there is enough evidence to reject H_0.

One tailed test



Two tailed test

$H_1 \neq value$

Test statistic

test statistics is a value that allow us reject the null hypothesis, this uses the sampling statistics (proportion, mean, or standard deviation) in a value of z, t or χ^2.3

ANOVA test

t-test

χ^2 test

Person

Spearman

Table one

It is a useful algorithm to present working papers or give us insights about the problem.