# Statistics

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# 1 Introduction

The probability theory mainly research random variables such as $x$. $x$ could be some of the values with a measure call probability:

$$P(x = k), \quad P(x \in A), \quad \text{where} \quad A \quad \text{is a Boreal set}$$

The general study of statistics is to find out the distribution of $x$, hopefully, the probability distribution function or cumulative distribution function. Moreover, for multivariate variables, the task could be to find out the joint distribution($P(x_1, x_2, \vdots)$) or conditional distribution($P(x|y)$). Typically, the following steps:

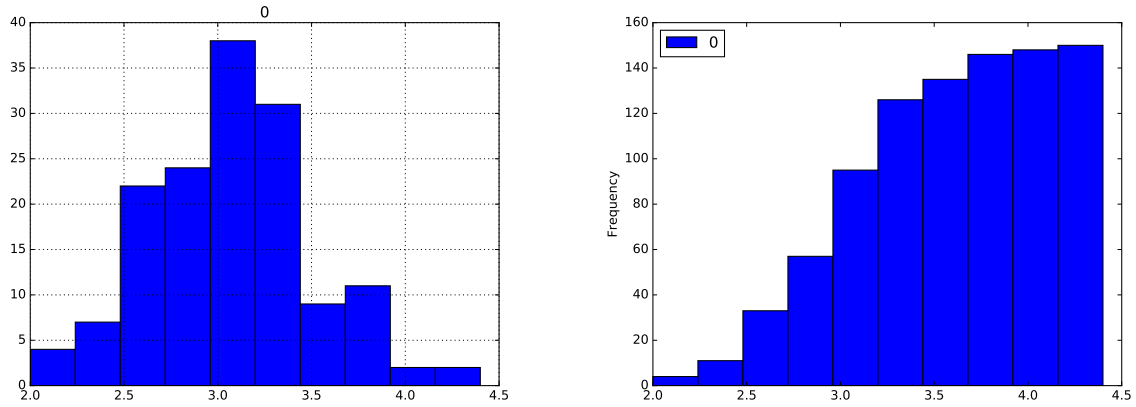
- Guess what should be the right distribution
- Estimate the parameters
- Prove your suppose(prove the distribution assumption or the parameters estimation is right)

So, this document is going to review the basic points of statistics follow the step: guess→estimate→prove.

# 2 Guess

## 2.1 Data perspective

Normally, the frequency bar chart can help us for a general perspective of the data probability distribution (data.hist(grid=...)) or cumulative distribution (idate.plot.hist(cumulative=True)).




(a) probability distribution

(b) cumulative distribution

Figure 1: Histogram

And the estimation of probability distribution

$$P(s_k < x \leq s_{k+1}) \approx \sum I(s_k < x_i \leq s_{k+1})/N$$

or cumulative distribution

$$P(x \leq s_{k+1}) \approx \sum I(x_i \leq s_{k+1})/N$$

# 3 Estimate

# 4 Prove