ASQ CRE Prep course

Lesson II. A. 3. a.

Probability Distributions

The Four Functions

A way to answer questions based on your data

THE FOUR FUNCTIONS

Probability Density Function

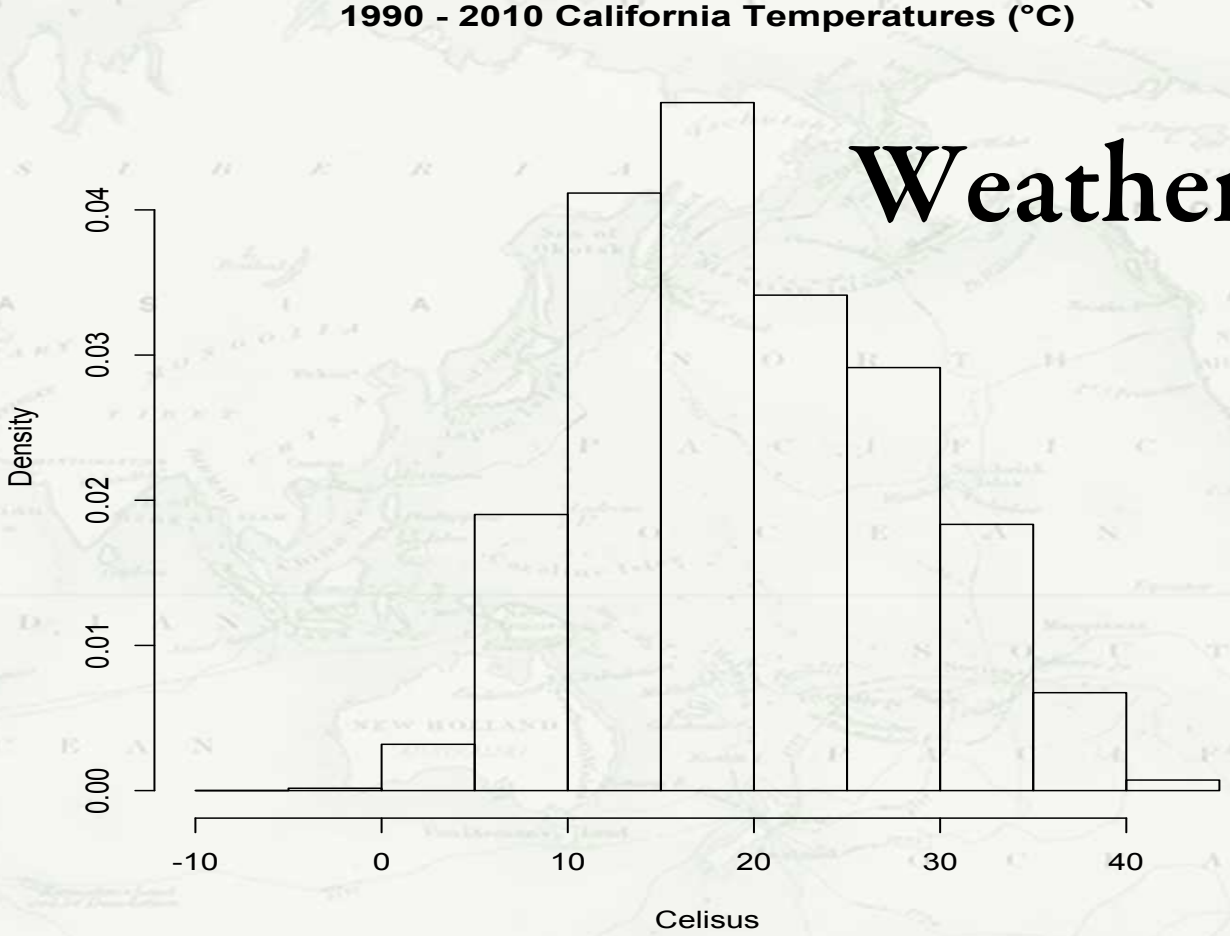
- **Think Histogram**

- **Mathematically**

$$\int_{-\infty}^{\infty} f(t)dt = 1 \qquad \sum_{k} f(k) = 1$$

For all values of t or k, and f(x) ≥ 0

Weather Data



Cumulative Density Function

$$F(x) = \int_{-\infty}^{x} f(\tau)\, d\tau$$

$$F(k) = \sum_{k_i \le k} f(k_i)$$

CDF Example

Time to fail for motor has following PDF

$$f(t) = 0.02e^{-0.02t}$$

What probability of failure before t = 100

Reliability Function

$$R(x) = \int_{x}^{\infty} f(\tau)\,d\tau = 1 - \int_{-\infty}^{x} f(\tau)\,d\tau$$

Hazard Function

- **A measure of tendency to fail**
- **Instantaneous failure rate**

$$h(x) = \frac{f(x)}{R(x)}$$

Given one function derive the others

$$h(x) = \frac{f(x)}{R(x)}$$

$$F(x) = 1 - R(x)$$

$$R(x) = e^{-\int_{-\infty}^{x} h(\tau)\,d\tau}$$

$$f(x) = h(x)e^{-\int_{-\infty}^{x} h(\tau)\,d\tau}$$

Just getting started with formulas

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Lesson II. A. 3. b.

Probability Distributions

Continuous Distributions