



ASQ CRE Prep course

Lesson II. A. 3. a.

Probability Distributions

The Four Functions

A wide-angle photograph of a sunset over a calm sea. The sky is filled with dramatic, layered clouds in shades of orange, yellow, and purple. The sun is a bright orange orb on the horizon, casting a long, vertical reflection of its light across the dark blue water. In the bottom left corner, the dark silhouette of a rocky shoreline is visible.

A way to answer questions based on your data

THE FOUR FUNCTIONS

Probability Density Function

- **Think Histogram**
- **Mathematically**

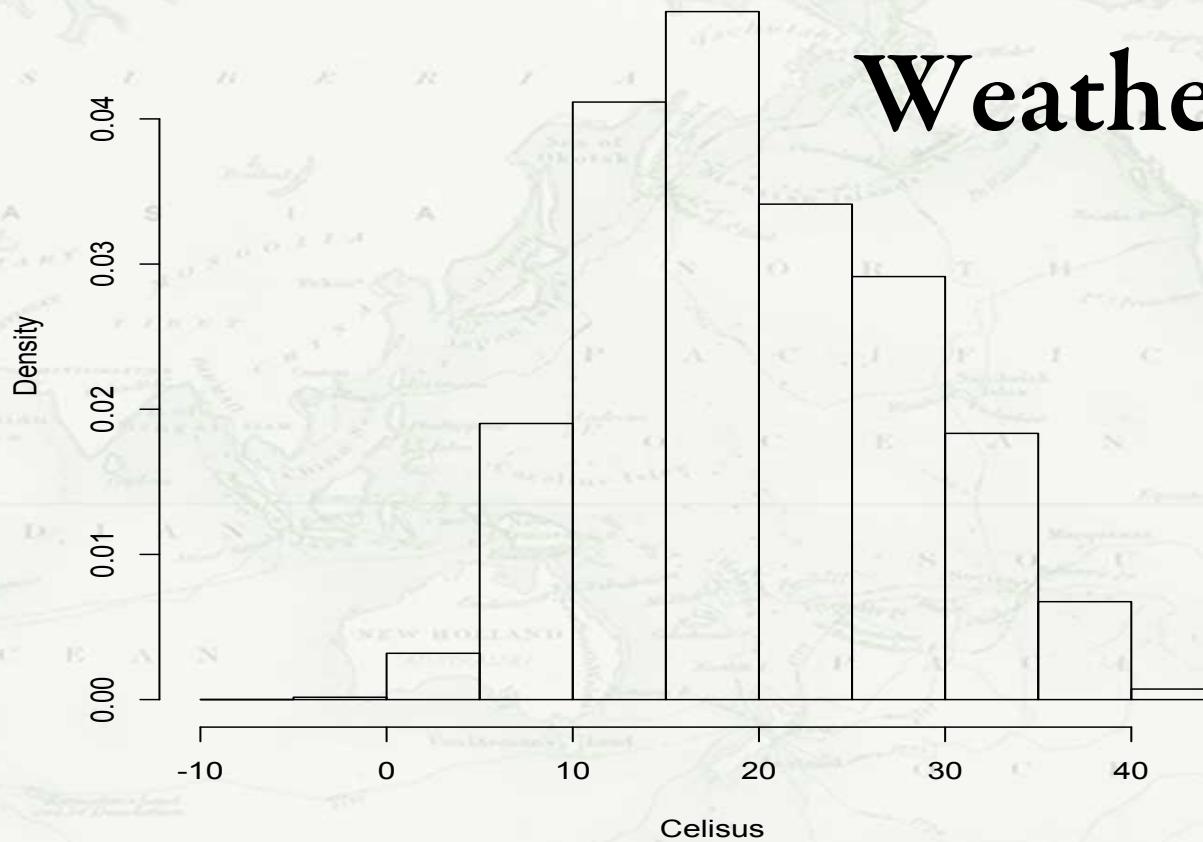
$$\int_{-\infty}^{\infty} f(t)dt = 1$$

$$\sum_k f(k) = 1$$

For all values of t or k, and $f(x) \geq 0$

1990 - 2010 California Temperatures (°C)

Weather Data



Cumulative Density Function

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

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

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