

## Introduction to Decision Making with Statistical Analysis

Lecture XIII  
[Chapter 10 in textbook]

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Why do “statistics” scare people?



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## Industrial Statistics

How is  
*Industrial Statistics*  
different from any other statistics?

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## Industrial Statistics

*Different Goals:*

**Advance Basic Knowledge**

*versus*

**Solve Problems or Model Systems**

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## Industrial Statistics

Generally Involve Different  
*Costs and Payoffs*  
Basic Research

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## Approaches to Problem Solution

Common Sense  
Experience  
Consult an “Expert”  
Collect and Analyze Data  
Ignore the Problem

[ *Based on Cost / Benefits* ]

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### Sequence of Events

Design the Study  
Collect the Data  
Analyze the Data  
Draw Conclusions  
Make Decisions

***Take Action***

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### Types of Studies

**Confirmation Studies**

*versus*

**Exploratory Studies**

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### Example of a Confirmation Study

**Compare the moisture content with and without an additive in the chiller**

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### Example of an Exploratory Study

**Develop a model to predict the moisture content from the amount of additive, chiller temperature, time and bird size.**

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### Why Design and Experiment

**To arrive at reliable and valid conclusions**

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### Methods of Handling Experimental "Error"

**Control  
Study  
Randomize  
Ignore**

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## Methods of Handling Experimental “Error”

Control	[Choose only one temperature]
Study	[Use two or more temperatures]
Randomize	[Randomly assign conditions]
Ignore	[Assume temperature has no effect]

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## Types of “Significance”

### Statistical Significance

*[Reliable]*

### Practical Significance

*[Meaningful]*

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## The “Real” Problem

The Problem is **not** that we are ignorant;  
rather,  
it is that so much of what we *know*  
is **not** true.

*F. Bacon*

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## Types of Statistics

Descriptive Statistics

Inferential Statistics

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## The Type of Analysis Depends Upon the Type of Data You are Analyzing

Quantitative - Qualitative

Objective - Subjective

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## Types of Data

Nominal [Gender]

Ordinal [Ranking]

Interval [Temperature]

Ratio [Weight]

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## Types of Error



Random (Variable) Errors



Constant (Bias) Errors

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## Point Estimators

*Average:*

Mean  
Median  
Mode

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## Point Estimators

*Variability:*

Range  
Inter-quartile Range  
Standard Deviation

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## Measure of Variation About the Mean

$$\text{Standard Deviation} = \sqrt{\frac{\sum (X_i - \bar{X})^2}{n - 1}}$$

Root Mean Squared Deviation

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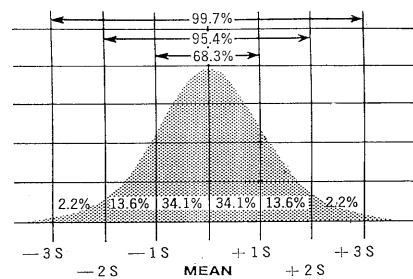
## Standardized Normal Distribution

*Used to Convert:*

Differences to Probabilities  
or  
Probabilities to Differences

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## Standardized Normal Distribution



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## Standardized Normal Distribution

Distance  $\longrightarrow$  Probability

$1\sigma$   $0.16$

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Probability  $\longrightarrow$  Distance

$0.022$   $2\sigma's$