



Introduction: Statistics in Science Fair Projects A tutorial

Introduction

- Our Sponsor: the American Society for Quality Ann Arbor (MI) Section
 - ASQ is an International society of professionals who use the quality sciences in their daily work
 - The Ann Arbor Section is comprised of quality practitioners located in the Ann Arbor, MI, area
 - Composed of 300+ members
 - Meets monthly to discuss topics in product and process quality in industry and business
 - We are at: www.asq1010.org

Introduction

- Design of the Modules
 - The modules cover the most commonly found statistics used in Science Fair Projects
 - Are grouped by topics that parallel the development of your Science Fair Project
- How to Use the Modules
 - The modules are starting points that demonstrate how a statistic is used not how it is derived
 - In-depth information is found in statistics references

Introduction

- Modules are only guides
 - This tutorial is NOT intended to be a course in statistical inference
 - It is just a guide to using the most commonly found statistics in Science Fair Projects

Introduction

- The Modules

- 1. Starting Your Science Fair Project
- 2. Analyze Your Data: Mean, Median, Mode, etc.
- 3. What Does My Data “Look” Like?
- 4. How Do I Know if my Data is Significant?
- 5. Some Advanced Techniques: Linear Regression
- 6. Ideas on Non-parametric Statistics: Data Ordering
- 7. Using Computer Programs like Excel
- 8. Presenting Your Data to the World
- 9. When Things Go Wrong.....
- 10. Appendix 1: Definition of Terms
- 11. Appendix 2: Bibliography

What is Statistics?

- What is “Statistics”?
 - “...a field of endeavor in which data are collected and analyzed for the purpose of drawing conclusions.” (W. C. Guenther, *Concepts of Statistical Inference*, McGraw-Hill, 1965)
 - “...the entire science of decision making in the face of uncertainty.” (J. Freund, *Mathematical Statistics*, Prentice-Hall, 1962)
 - “...scientific study of the analysis of numerical data.” (N. Johnson & F. Leone, *Statistics and Experimental Design*, Wiley, 1964)

What is Data?

- What is Data?
 - Information collected about an event or series of events
 - Numerical data resulting from measurements of events
 - For example, temperatures, distances, weights
 - Attribute data are non-numerical data describing the outcome of an event or events
 - For example, pass or fail, yes or no
 - In these modules we will consider only numerical data

Variability

- Our Variable World
 - Data are usually samples taken from a much larger population of results
 - Population refers to all possible outcomes from an experiment or event
 - Sample refers to the few measurements we actually take to represent the population

Variability

- Our Variable World

- Variability

- When we do our projects we notice that we do NOT get the same number all the time
 - This is Variability
 - Statistical inference is about:
 - Making sense of our varying data
 - Predicting the outcome of an experiment for the whole population based on our sample in our Science Fair Project

Our Team

- We thank the American Society for Quality Ann Arbor Section for supporting this project and for hosting the tutorial on their website.
- We thank members of the Section Science Fair Committee:
 - Kevin Gilson, CQM, Chair
 - Lori Busha, CQE, CRE
 - Kelvin Elvidge, CQA, CQE
 - Michael Hagan, DO, CQA, CQM