MA 171 Introduction to Statistics

Cheryl Peterson
NSF 1115
227-1609
cpeterso@nmu.edu

Office hours: 2:00, on class days

By appointment: 12:30, 5:00 (other times possible)

Class days

Class will meet 4 days a week – the day off may vary from week to week, but will be announced in advance and posted on the class website.

Class website

Assignments, data sets, and other information pertaining to the course will often be posted on the class website, *http://mathlab.nmu.edu/~cpeterso/* or *http://mathlab.nmu.edu* (then select Cheryl Peterson's Page).

Prerequisites

Finite Mathematics (MA103); or College Algebra (MA104 or MA105); or equivalent.

Textbook

Fundamentals of Statistics, Michael Sullivan, III, Prentice Hall

Student CD: The textbook comes with a CD containing

- Data sets for many of the problems in the book (also on textbook website)
- Additional chapters / sections, not printed in the book. We will use the Analysis of Variance (ANOVA) section

Textbook website: *http://www.prenhall.com/sullivanstats*

- Review questions to use at beginning and end of each chapter
- "Statlets" -- interactive statistics simulations and demos
- Power Point slides covering the important points for each section of the book
- Case studies
- Statistical tables, formulas, summaries

"See-through" ruler (optional)

An inexpensive "see-through" ruler (6-inch is good) can be useful for fitting a line through a set of data points.

Computer

A computer is necessary for the Minitab software that we will be using. We will frequently be using laptop computers in class. If you don't have a laptop, check with me about what to do.

For many things, a TI-83 calculator could be used instead of a computer. The most basic statistical operations can be done on any graphing calculator. TI-Interactive and Microsoft Excel (which are provided on University-owned laptops) can also be used for some of the things we will be doing.

If you have a calculator , you may sometimes want to use it for basic arithmetic calculations while you are using your computer.

Statistical Software

You will need Minitab (Release 14) software.

For University-owned laptops: Minitab 14 will be supplied by the university. This is a "keyed" version, meaning that you have to be connected to the NMU network – no problem on or near campus, with "wireless" connection; but beyond "wireless" range, you would need a modem, and transfer may be slow.

For Non-university-owned computers or beyond "wireless" range: You can rent Minitab 14 for the semester (5 months, actually) for $29.99 at *http://www.minitab.com/education/semesterrental/default.aspx*

There is also a free 30-day demo that you can download onto your computer, or you can request a CD: *http://www.minitab.com/products/minitab/14/demo/*

Goals

Statistics is the science of using data to make decisions (in the face of uncertainty).

By the end of the course, you will be able to use data to make decisions. In particular, you will be able to

- State hypotheses to test
- Know good ways (& poor ways) to set up observational studies & experiments and to collect data by sampling
- Summarize & display data graphically & numerically
- Test a hypothesis using probability
- Estimate a population parameter with a confidence interval
- Understand the probabilities associated with sampling error

General information

There will be approximately three to five ‘major’ exams, including a final exam. There will also be assignments to be handed in. Some of these assignments will be done individually and some will be done in groups. There will be quizzes to provide feedback on how things are going.

Most of the grade will be based on the exams (probably about 2/3 to 3/4 or possibly more); the rest of the grade will be based on quizzes and assignments. Final exam is – for 3:00 class: Thursday, May 3,, 2:00–3:50); for 4:00 class: Monday, April 30, 4:00–5:50.

Liberal studies requirement

This course satisfies the Formal Communication Studies requirement.
These courses are designed to introduce students to the ways in which information and ideas are expressed using a communication system other than English. Such courses should foster the student’s ability to conceptualize and communicate in an orderly, rational manner. Characteristics of a communication system include: 1) possession of a grammar; 2) operation from an established set of rules; 3) reasoning properties such as deduction, inference drawing and problem solving. This includes courses in languages and those in which the central focus of the course is on statistics, computers or formal logic.

Disability services

If you have a need for disability-related accommodations or services, please inform the Coordinator of Disability Services in the Disability Services Office at 2001 C. B. Hedgcock (227-1700; TTY 227-1543). Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state and University guidelines.

Brief Outline of the Course

A. How can we use statistics to make a decision ? : Preview

Example: A sample of 5 Brand X tires had an average lifespan of 60,000 miles, and a sample of 5 Brand Y tires had an average lifespan of 62,000 miles. Can we conclude that, on average, Brand Y tires last longer? If we took new samples, could the results be different? Perhaps even reversed? What if we had sampled 500 tires of each brand?

B. What is our data telling us? : Summarizing data numerically & graphically

Example: The lifespans for a sample of 500 Brand X tires were:

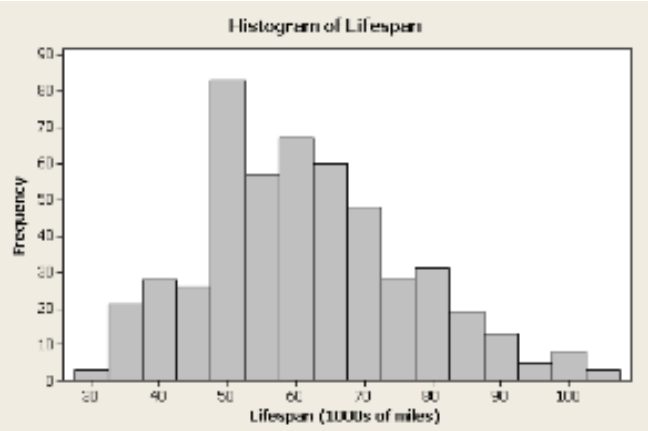
30,000 35,000 . . . 100,000 106,000 miles

We can summarize this data

numerically:

average = 60,000, minimum = 30,000, maximum = 106,000,
range of values = 76,000 miles,

graphically:



C. How do we tell if there a relationship between two things? Can we predict one from the other? : Correlation & regression

Example: The value of a car decreases as the age of the car increases. Does the value decrease in a systematic way, so that we can come up with a formula for predicting the value of a car, given its age?

D. If our "opponent's" theory is true, what are the chances of getting a sample like we got? : Probability distributions

1. Probability distributions
2. Sampling distributions & the Central Limit Theorem

Example: The manufacturers of Brand X tires claim that, on average, their tires last 70,000 miles. If that is true, what is the likelihood that a sample of 5 tires will have an average of only 60,000 miles? What is the likelihood that a sample of 500 tires will have an average of only 60,000 miles?

E. Is our theory really true? How confident can we be that we are right? : Hypothesis tests & Confidence intervals

1. Making decisions about population averages
2. Making decisions about population proportions
3. Comparing two treatments
4. Comparing many treatments --Analysis of variance

Example: If a sample of 5 Brand X tires has an average lifespan of 60,000 miles, can we conclude that the average for all Brand X tires is less than 70,000? Perhaps we can say something like: "we are 95% confident that the average for all Brand X tires is somewhere between 55,000 and 65,000 miles (60,000 miles, give or take 5000 miles"). In this case, might safely conclude that the average is less than 70,000 miles.

F. How can we tell if two factors are related, or independent? : Chi-square analysis

Examples: Are smoking and heart disease related, or independent?
Are gender (male, female) and political preference (Democrat, Republican) related, or independent?