STA 570
Spring 2011

Lecture 1

Thursday, January 13

WELCOME to STA 570!

- Syllabus: on Blackboard (Bb)
- Class Instructor: Dr. Ruriko Yoshida
- ruriko.yoshida@uky.edu
- Office Hours: 14:00-14:50 on Tue/Thurs
  (No OH on January 18th, Tue)
- 805A Patterson Office Tower
- Lab Instructors:

  Mr. Grady Weyenberg (001/2)
- Note: Course material on Bb– usually not handouts in class
- *The first homework set is posted on Bb. It is due next week in the lab.*

Course Information

- Lecture in *CB 316*
  Tuesday & Thursday, 12:30 – 13:45

- Lab
  001: Tuesday *15:30 to 16:45 CB 309*
  002: Thursday *8:00 to 9:15 CB 309*

Textbook

- Alan Agresti, Barbara Finley, *Statistical Methods for the Social Sciences, Fourth Edition,* Prentice Hall
- We will not follow this book verbatim!

Topics (Book Ch.1-5)

- Methods of analyzing data
- The role of statistics in research
- Statistical concepts and models
- Probability and distribution functions
- Estimation (confidence intervals)

Topics (Book Ch. 7-12 [-14])

- Hypothesis testing
- Analysis of categorical data
- Regression and correlation
- Analysis of variance
- Nonparametric methods

Three Important Concepts

- Sampling Distribution (Ch. 4)
- Confidence Interval (Ch. 5)
- P-value of a Statistical Test (Ch. 6)

Lab Sessions

- Learn and apply the statistical software package SAS
- Clarify contents of the lecture
- Work out quiz and additional problems
- Discuss homework problems
- Get prepared for the exams

- The lab sessions will start next week

Grade Calculation

- Midterm Exam (March 3)……. **20%**
- Final Exam (May 5)…….... **30%**
- Weekly Homework Assignments.... **30%**
- In-Class Quizzes (Tuesdays)…..... **20%**

  (the lowest quiz score will be dropped)

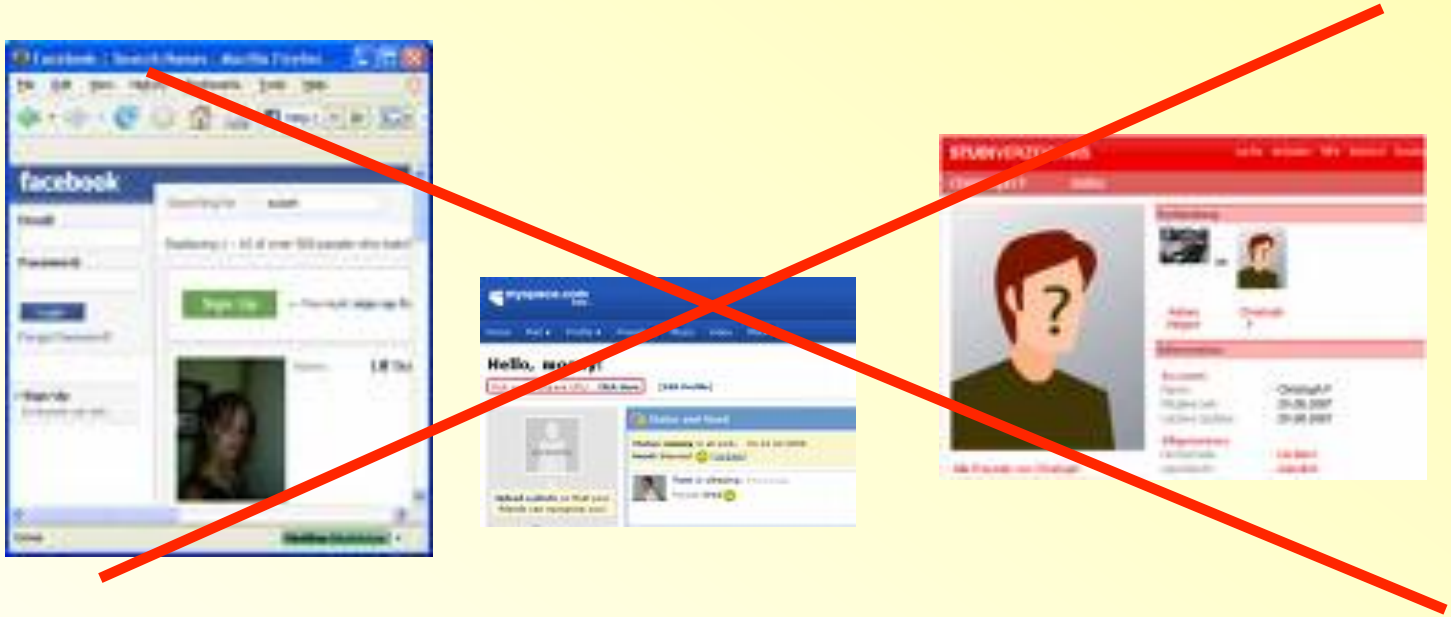
Letter Grades

A: 90-100%, **B:** 80-89%, **C:** 70-79%,

D: 60-69%, **E:** 0-59%

Please...

Also Please...



Why Statistics?

- Research in the sciences is getting more quantitative (look at research journals)
- Computers make even complex statistical methods easier to use
  - danger of using inappropriate methods
  - vital to understand a method before using it
- Job market: Most graduates need to be familiar with basic statistical methodology
- *"Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write."*

  Herbert George Wells (1866–1946)

Why Statistics? (contd)

- Everyday Newspaper, advertising, surveys, internet and other media:

  Many statements contain statistical arguments or techniques

- Recent examples…

http://www.cdc.gov/flu/weekly/

http://money.cnn.com/2011/01/07/news/economy/december_jobs_report/index.htm

What does it take to understand the STA 570 material?

- Logical thinking
- Perseverance
- …+ see Syllabus

  (attend lectures and labs, obtain material when absent, do homework yourself, etc.)
- Don't procrastinate ☺

What is Statistics?

Methods for Collecting, Describing, Analyzing, and Drawing Conclusions from Data

These methods are used for…

Design
- Planning research studies
- How best to obtain the required data

Description
- Summarizing data
- Exploring patterns in the data
- Extract/condense information
- Graphical pictures of the data

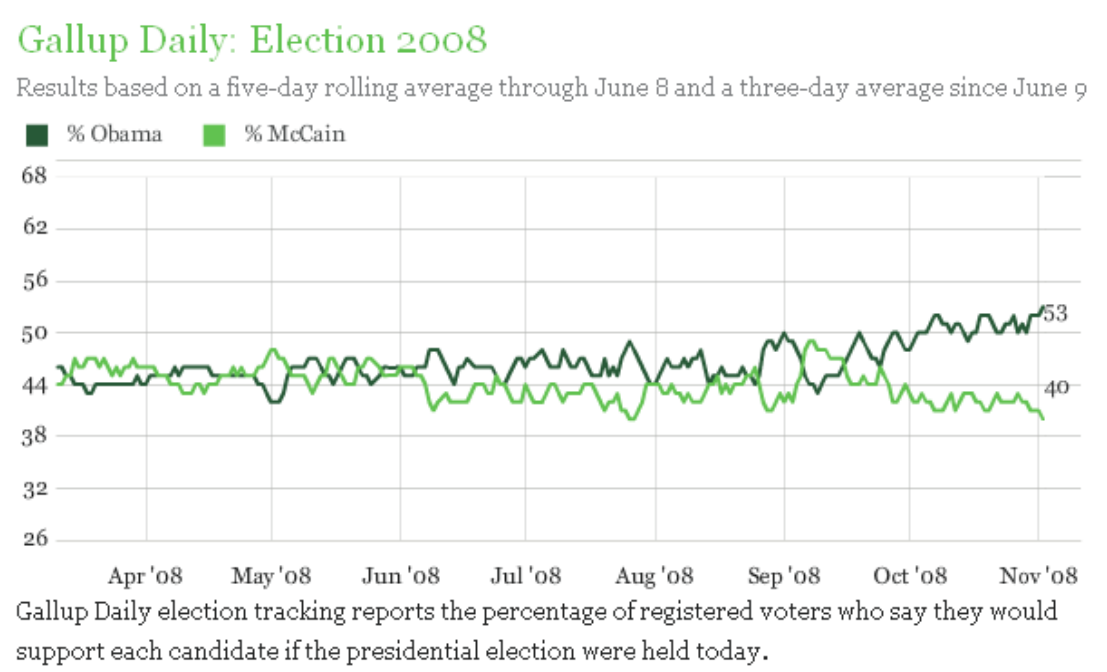
Inference
- Make predictions based on the data
- "Infer" from sample to population
- Generalize

Descriptive Statistics, e.g.

Frequency Distribution

STA 570 Grade	Frequency
A	31
B	37
C	10
E	2

Time Plot

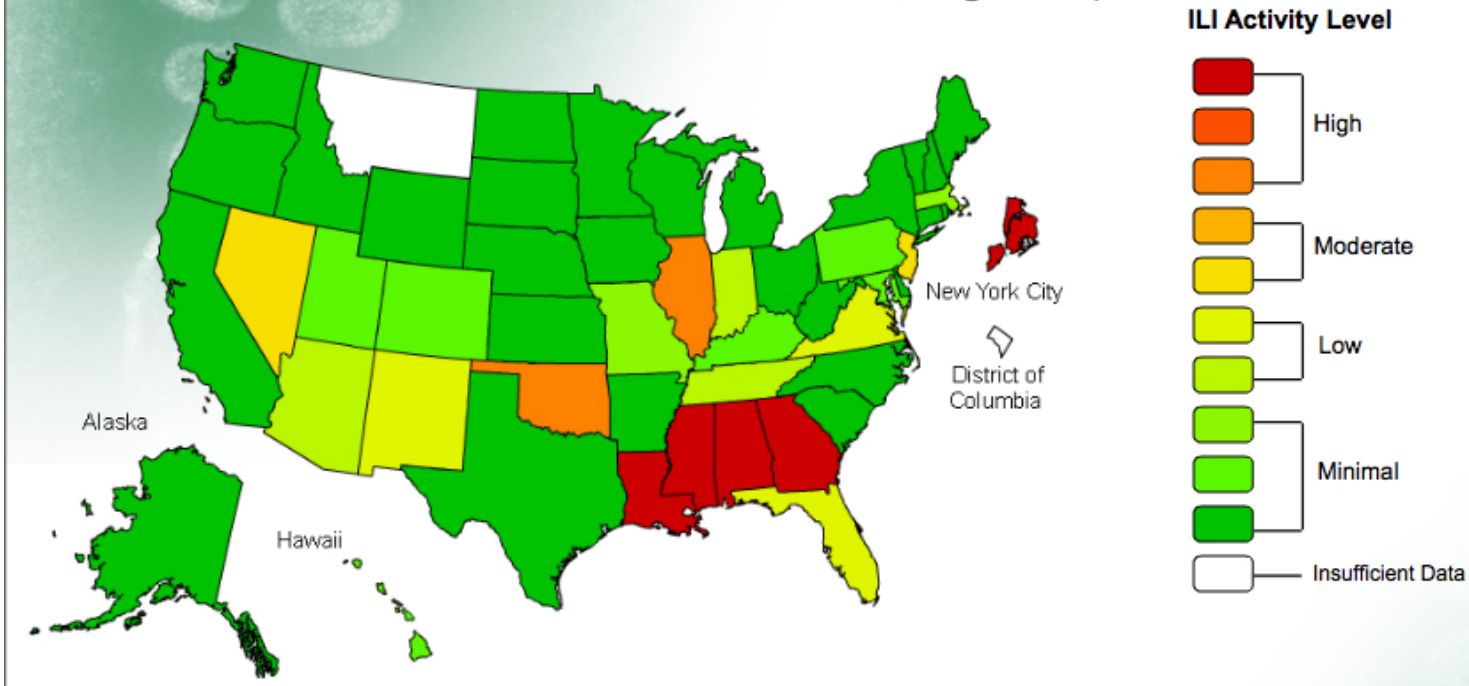


FLUVIEW

A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Influenza-Like Illness (ILI) Activity Level Indicator Determined by Data Reported to ILINet

2010-11 Influenza Season Week 52 ending Jan 01, 2011



*This map uses the proportion of outpatient visits to healthcare providers for influenza-like illness to measure the ILI activity level within a state. It does not, however, measure the extent of geographic spread of flu within a state. Therefore, outbreaks occurring in a single city could cause the state to display high activity levels.

*Data collected in ILINet may disproportionately represent certain populations within a state, and therefore may not accurately depict the full picture of influenza activity for the whole state.

*Data displayed in this map are based on data collected in ILINet, whereas the State and Territorial flu activity map are based on reports from state and territorial epidemiologists. The data presented in this map is preliminary and may change as more data is received.

*Differences in the data presented by CDC and state health departments likely represent differing levels of data completeness with data presented by the state likely being the more complete.

Basic Terminology I

- **Population**
  - total set of all subjects of interest
  - the entire group of people, animal or things about which we want information
- **Elementary Unit**
  - any individual member of the population
- **Sample**
  - subset of the population from which the study actually collects information
  - used to draw conclusions about the whole population

Basic Terminology II

- **Variable**
  - a characteristic of a unit that can vary among subjects in the population/sample
  - Examples: gender, nationality, age, income, hair color, height, disease status, company rating, grade in STA 570, state of residence
- **Sampling Frame**
  - listing of all the units in the population
- **Parameter**
  - numerical characteristic of the **p**opulation
  - calculated using the whole population
- **Statistic**
  - numerical characteristic of the **s**ample
  - calculated using the sample

Statistic vs. Parameter

- **Statistics are based on a sample**

  (even if they are used to describe a population)
- **Parameters are calculated using the whole population**

Data Collection and Sampling Theory

Why not measure all of the the units in the population? Why not take a census?

Problems:

- *Accuracy:* May not be able to list them all—may not be able to come up with a ***frame***.
- *Time:* Speed of Response
- *Expense:* Cost
- *Infinite Population*
- *Destructive Sampling or Testing*

Flavors of Statistics

- **Descriptive Statistics**
  - Summarizing the information in a collection of data
- **Inferential Statistics**
  - Using information from a sample to make conclusions/predictions about the population

Example 1

- University Health Services at UK conducts a survey about alcohol abuse among students.
- 200 of the 30,000 students are sampled and asked to complete a questionnaire.
- One question is “have you regretted something you did while drinking”?
- What is the population? Sample?
- For the 30,000 students, of interest is the percentage who would respond “yes”.

  This value is computed for the students sampled.

  Is this a parameter or a statistic?

Example 2

- Polls in the United Kingdom, France, and Germany indicated that (Gallup, July 23, 2008) majorities of citizens in these countries preferred Obama over McCain.
- In the U.K., 60% of those surveyed favored Obama, 15% favored McCain, and 25% did not know or refused to answer this question.
- France: 64%, 4%, 32%
- Germany: 62%, 10%, 27%
- Are these numbers statistics or parameters?
- The report says that the percentage of all adults in the U.K. who favored Obama was at least 57%, but no greater than 63%.
- Is this an example of descriptive or inferential statistics?

Univariate vs Multivariate

- Univariate data set
  - Consists of observations on a single attribute
- Multivariate data
  - Consists of observations on several attributes
- Special case: Bivariate data
  - Two attributes collected per observation

Scales of Measurement

- Qualitative and Quantitative
- Nominal and Ordinal
- Discrete and Continuous

- **Recall:**
  - A **Variable** is a characteristic of a unit that can vary among subjects in the population/sample

Qualitative Variables (=Categorical Variables) **Nominal** or Ordinal

- **Nominal**: gender, nationality, hair color, state of residence
- Nominal variables have a **scale of unordered categories**
- It does not make sense to say, for example, that green hair is greater/higher/better than orange hair

Qualitative (Categorical) Variables Nominal or **Ordinal**

- **Ordinal:** Disease status, company rating, grade in STA 570
- Ordinal variables have a scale of ordered categories. They are often treated in a quantitative manner (A=4.0, B=3.0,…)
- One unit can have more of a certain property than does another unit

Quantitative Variables

- **Quantitative:** age, income, height
- Quantitative variables are measured numerically, that is, for each subject, a number is observed
- The scale for quantitative variables is called **interval scale**

Example 1

- Vigild “Oral hygiene and periodontal conditions among 201 institutionalized elderly”, Gerodontics, 4:140-145
- Variables measured
  - Nominal: Requires Assistance from Staff?

    Yes / No
  - Ordinal: Plaque Score

    No Visible Plaque - Small Amounts of Plaque - Moderate Amounts of Plaque - Abundant Plaque
  - Interval: Number of Teeth

Example 2

- The following data are collected on newborns as part of a birth registry database
- Ethnic background: African-American, Hispanic, Native American, Caucasian, Other
- Infant's Condition: Excellent, Good, Fair, Poor
- Birthweight: in grams
- Number of prenatal visits

- What are the appropriate scales?

Why is it important to distinguish between different types of data?

- Some statistical methods only work for quantitative variables, others are designed for qualitative variables.

Nominal - Ordinal - Interval

Qualitative (Categorical) — Quantitative

Lowest level — Highest Level

- most information
- best statistical methods

You **can not** use statistical methods for quantitative data to analyze qualitative data.
You **can** treat variables in a less quantitative manner.

- Example.
  - Height: Quantitative variable, interval scale, *measured in cm (or ft/in)*
  - Can be treated as ordinal

    short, average, tall
  - Can even be treated as nominal

    180cm-200cm, all others

- Try to measure variables at the highest possible level
- Higher-level variables can be analyzed with a greater variety of methods

Caution: Sometimes, ordinal variables are treated as quantitative

- Reminder: First homework set is posted on Bb – due next week in the lab.