MATH 140 Introductory Statistics Hybrid Course SYLLABUS

Spring 2010

Instructor: Andrea Nemeth

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The official way of communication is via CSUN email, so please, check your email often or forward your CSUN email to your other account you use.

Webpage: www.csun.edu/~an73773
Announcements, homework and review sheets will be posted, so check my website often.

Office: Santa Susana Hall, Room 434
Office Phone : (818) 677-2826 (Do not leave messages; send me an email instead)
Office Hours: Monday: 11:30am-11:50am, Wednesday: 11:30am-11:50am and 2:00pm-4:00pm, or by appointment.

About the class in general:
This class is an introduction to statistics. A major goal of this class is to teach you to become critical and informed consumers of real data and statistical information. This course will focus on understanding statistical concepts, methods, and reasoning; organizing, interpreting and producing data; analyzing statistical arguments and communicating findings clearly; and appreciating the relevance of statistics to contemporary society. Specific course learning outcomes are listed at the end of the syllabus.

This is a hybrid course. This is a hybrid class delivered partially in the classroom and partially on the web. Therefore, Internet access is required.

• **Online component:** There is no required textbook for the course. Instead, the presentation of the course material will be delivered through the Carnegie Mellon Open Learning Initiative (OLI) online statistics course that I have set up for this class. You will be required to read this on-line material and do the associated activities, including quizzes. It is expected and crucial that you keep up with these activities.

• **In class:** I will not be lecturing on the course material, except on rare occasions. Instead, I will answer questions and help clarify any difficult material. In addition, you will be working on exercise, projects, and taking quizzes and exams. Attendance at class sessions is REQUIRED and will be a part of your course grade.

How to do WELL in this class: This course will cover a great deal of material at a rapid pace, but you can do well if you honestly make the effort to do so. Many Math 140 students who are not confident mathematically surprise themselves by doing quite well in this course. You have to take this class seriously and study in a serious fashion. The expectation is that students spend 2 hours outside of class studying for each unit in order to keep up with and get the most out of the
course. That means you will probably need to spend about **10 hours per week outside of class**, so you should plan accordingly.

My advice:

- **DO NOT MISS CLASS.**
- Do all the required work, including homework.
- Be determined and do not procrastinate.
- Ask questions in class and come to office hours.
- Find a tutor if you need more help.

**Required Material:**

- **Math 140 Hybrid Course Workbook**, available in the bookstore
- **Calculators**: A graphing calculator is essential, preferably a TI-83 or TI-84. If you don’t have one and don’t want to buy one, you can rent one from
  - www.myti83.com
  - www.ti83calculator.com
- **Open Learning Initiative (OLI)**: You will need to log in at [https://oli.web.cmu.edu](https://oli.web.cmu.edu)
The Course Admit Code is:
  - For the 12pm class: M140H-S10-12
  - For the 1pm class: M140H-S10-1

You will need to pay a $25 registration fee to be able to access the OLI course.

**Recommended Software:**

- **Minitab Statistical Software**: you will need Minitab to be able to complete some of the OLI assignments. You can rent it (download it) for $29.99 for the semester from
  - www.minitab.com/education/semesterrental

  Or you can use the computers in our math lab during the hours that it is open. We have Minitab installed on all computers. It’s free there!

**Suggested Books:**
• Any Introductory Statistics textbook, for example:
  o *Elementary Statistics* by Larson and Farber
  o *The Basic Practice of Statistics* by Moore
• *How to Lie with Statistics* by Darrell Huff
Grade Components:

- **Homework:** Homework will be assigned regularly. I will collect the homework assignments randomly and grade them. To receive full credit, homework solutions must be written out neatly and in full. The pages must be STAPLED. You are graded on your explanation and justification, not solely on having the correct numerical solutions. You may work with a partner or in a small group, but all work you turn in should be your own. Copying others’ solutions is not acceptable and will result in disciplinary action. I will post the solution to the homeworks, therefore I won’t accept late homework. If you miss class (NOT recommended) you can turn in the homework to the Math department (SN 114) until 5pm on the due date. No homework will be accepted after that. Your lowest homework score will be dropped.

- **In-class quizzes:** You will have quizzes regularly during class. **No make-up quizzes.** Your lowest quiz score will be dropped.

- **Exams:** There will be three in-class exams, and a comprehensive final exam. All exams are closed book and notes; however you can use your calculator. **No phone-calculators will be allowed. NO MAKE-UP EXAMS.**

- **OLI reading and quizzes:** You will be required to read the material online, and complete some online quizzes. You can take each online quiz only once.

Grade Components:

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<th>Component</th>
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<td>Homework</td>
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<td>OLI reading, StatTutors and quizzes, in-class quizzes</td>
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<td>Project</td>
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Grading Scheme:

- 90-100%: A
- 80-89%: B
- 68-79%: C
- 55-67%: D
- <55%: F

**Final Exam:**

- For the 12pm class: May 10, 2010 12:45 PM - 02:45 PM
- For the 1pm class: May 12, 2010 12:45 PM - 02:45 PM

Remarks:

- In case of an emergency make sure to contact me as soon as possible.
- Newspapers or materials from other classes need to put away once the class is underway.
- I expect you to be on time to class, and to not leave early.
• Electronic devices: Please have consideration for others and remember to turn off your cell phone, pager, etc. during every class period!

University Policy for Adds and Drops
Please make sure to read the university policy for adds and drops.

Student Conduct and Cheating: You are expected to act according to the “Student Conduct Code” (see current College Catalog or Schedule of Classes). Cheating will not be tolerated. During tests all extraneous objects are to be removed from your workspace. Violators are subject to instructor and college disciplinary action. Keep your work original.

General Course Goals

• Learn how to construct and interpret graphical and numerical summaries of data
• Understand many of the fundamental ideas of statistics, such as variability, distribution, association, sampling
• Understand how the nature of data collection methods affects the scope of the conclusions that can be drawn from statistical studies (especially cause and effect); the role of probability in sampling and experiments
• Learn the normal distribution and the Central Limit Theorem
• Learn the basics of statistical inference: estimation, assessing statistical significance, statistical reasoning; apply and interpret the results of a variety of statistical techniques
• Analyze and assess statistical arguments, such as those found in the popular press and scholarly publications;
• Learn about correlation and regression
• Communicate knowledge of statistical ideas effectively

G.E. Student Learning Outcomes
As a course that fulfills the above mentioned General Education requirement, this class will address the following Student Learning Outcomes (SLO’s) that have been established by the Mathematics Department:

• SLO 1 Represent, understand and explain mathematical information symbolically, graphically, numerically and verbally.
• SLO 2 Develop mathematical models of real-world situations and explain the assumptions and limitations of those models.
• SLO 3 Use models to make predictions, draw conclusions, check whether the results are reasonable, and find optimal results using technology where necessary and appropriate.
• SLO 4 Demonstrate an understanding of the nature of mathematical reasoning including the ability to prove simple results and/or make statistical inferences.

Examples of activities that will involve the SLO’s are given below:
SLO 1: Summarizing distributions with numerical measures such as mean, median, standard deviation, interquartile range; making and interpreting dotplots, histograms, stem plots, bar charts, scatterplots; describing relationships with least squares regression equations; standard scores (Z-scores). A majority of homework and examination questions will involve verbal statements that involve statistical interpretations.

SLO2: The normal and other distributions; random number tables to represent populations; simulation; least squares regression equations; tests of significance.

SLO3: Probability models; confidence intervals and tests of significance; statistical pitfalls; choosing the sample size; using experimental design to reduce variability. The Minitab statistical software will be used frequently in class and for homework to generate statistical graphs, perform simulations, and make statistical computations.

SLO4: Understanding the logic and structure of methods of statistical inference is a critical aspect of the course. This includes making correct interpretations and conclusions for confidence intervals and tests of significance.
Essential Course Learning Outcomes

The following outline lists the key learning objectives that are contained in this course. In order for you to achieve a successful outcome from this class (i.e., learning well and earning a good grade) you must learn all or nearly all of the items listed below. This list consists of the essential main ideas, terminologies and techniques in the course; however, there are many subtopics not listed that are also important to learn. The study guides that will be made available before each exam will indicate these more completely. You should refer to this list throughout the semester to check on your learning progress. You can also consider this outline to be your top level study guide for the final exam.

I. The Big Picture (OLI Introduction & 1st page of Unit 2)
   A. Know the “Big Picture of Statistics”.
   B. Know what exploratory data analysis is.
   C. Know what statistical inference is.

II. Exploratory Data Analysis (OLI Unit 2)
   A. Be able to classify a situation involving data according to the number and type of variables involved. For data on a single variable (OLI Module 1), know whether that variable is quantitative or categorical. For data on two variables (OLI Module 2), know the Role-Type Classification, and make sure to know how to identify the response variable and the explanatory variable.
   B. Know which numerical summaries and graphical procedures are appropriate for each of the situations referred to in A.
   C. Know how to obtain the numerical summaries and construct the graphical procedures referred to in B.
   D. Know how to interpret graphical and numerical summaries of data, including being able to identify the key features of graphical displays such as histograms, dotplots, boxplots, scatterplots, etc.
   E. Know the Standard Deviation Rule and what type of distributions it applies to.
   F. Know how to assess the nature and strength of an association between two variables.
   G. Know how to use linear regression to predict the value of a response variable from a given value of the explanatory variable.

III. Types of Samples and their Properties (OLI Module 3)
A. Know the different types of sampling.
B. Understand the meaning of bias in sampling.
C. Know that random sampling eliminates bias.
D. Know what a simple random sample is.

IV. Types of Studies; Experimental Design (OLI Module 4)

A. Know the difference between observational studies and experiments.
B. Know the key components of an effective experimental design—comparison, randomization, and where applicable, blindness.
C. Know what lurking (confounding) variables are.
D. Know that cause and effect conclusions cannot confidently be made from observational studies because of the possible presence of lurking variables.
E. Know that only randomized controlled experiments allow cause and effect conclusions to be drawn with confidence.

V. Working with Z-Scores and Normal Distributions (OLI Module 8, Normal Random Variables, 1 of 11 through 8 of 11)

A. Know the formula for a Z-score.
B. Know how to interpret Z-scores in context.
C. Know how to determine probabilities from a normal table given the mean, standard deviation and interval for the variable (Example: Find the probability that an adult male is taller than 6' 2" given that the mean and s.d. are 64.1" and 2.8", respectively.)
D. Know how to determine the value of a variable that corresponds to a given percentage (Example: How tall does a man have to be to be within the top 10% of heights?)

VI. Statistical Inference: Terminology and Fundamental Concepts (Learning Statistical Inference Handout, OLI Modules 9, 10 and parts of 11)

A. Know the basic terminology of statistical inference: population, sample, parameter and statistic (point estimate).
B. Be absolutely clear about what a sampling distribution is. Know what is meant by the term sampling variability.
C. Know the Central Limit Theorem (both forms—means and proportions).
D. Be able to explain how sampling distributions are the foundation of inference. Know the role they play in (1) estimation and (2) hypothesis testing.
E. Be able to explain what a confidence interval is.
F. Know what is meant by the margin of error of an interval estimate (confidence interval).
G. Know the meaning of the term confidence level.
H. Appreciate that the validity of statistical inferences depends on using random sampling or a close approximation to it.

I. Know that the accuracy of estimation depend on sample size but not generally on population size.

J. Know how to draw the correct conclusion, in context, from a hypothesis test, depending on the calculated p-value: know that small p-values are evidence against the null hypothesis and in favor of the alternative, know that p-values that are not small show that the data is compatible with the null hypothesis but do not establish that it is true.

K. Know the literal definition of p-value.

L. Be able to judge the strength of the evidence given by the p-value according to how small it is.

M. Know the effect of sample size on hypothesis tests.

VII. Statistical Inference: Techniques (OLI Modules 11, 12)

A. Know the general form of a confidence interval: point estimate ± margin of error, where the margin of error is a multiple of the standard error that depends on the confidence level.

B. Know how to identify and use the correct confidence interval formula according to the situation involved (means, proportions, one sample, two independent samples, paired data).

C. Know the basic terminology and components of a hypothesis test: null hypothesis, alternative hypothesis, test statistic, p-value, statistical significance.

D. Know how to choose the null and alternative hypotheses.

E. Know how to determine the p-value for both one-sided and two-sided alternatives.

F. Know how to identify and use the correct testing procedure according to the situation involved (means, proportions, one sample, two independent samples, paired data).

G. Know the relationship of two-sided hypothesis tests to confidence intervals—i.e., how a confidence interval can indicate the result that a hypothesis test would produce at the corresponding significance level.