MATH 140 HYBRID *INTRODUCTORY STATISTICS* COURSE SYLLABUS

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(*Note:* If your CSUN email address is not one you use regularly, be sure to set up automatic forwarding of your CSUN email to your primary account.)

Web Page: www.csun.edu/~hcmth031

I plan to post homework solutions and any announcements or other items on the class Moodle site.

Office: Santa Susana Hall, Room 415 (across the lawn from the bookstore)
Office Phone : (818) 677-2126 (Do not leave messages; send me an email instead.)
Office Hours: MW 10:50-11:30, 3:00-3:50 or by appointment.

Why this is an important class: Statistics can be defined as the science of reasoning from data. Data and statistical thinking abound in everyday life and in almost all academic disciplines, so the ability to reason with data is essential to educated citizenship. This course will focus on understanding statistical concepts and reasoning; learning how to organize data and how to extract key information from it; how to obtain useful, high quality data for a study; and how to analyze statistical arguments and communicate findings clearly, as well as appreciating the relevance of statistics to contemporary society. A major goal of this class is to teach you to become *critical* and *informed* consumers of data and statistical information that you will encounter in the real world.

Specific course learning outcomes are listed at the end of this syllabus.

What is a hybrid course? A hybrid class is a class where instruction is delivered partially in the classroom and partially on the Web. Therefore, Internet access is required. The specifics for this class are as follows:

- **Online component:** The presentation of the course material will be delivered primarily through the Carnegie Mellon Open Learning Initiative (OLI) online statistics course, rather than from a textbook and class lectures. You are **required** to read this on-line material and do many of the associated activities, including on-line quizzes. It is crucial that you keep up with these activities in order to be successful in this class.

- **In class:** I will not be lecturing on the course material except on a very limited basis. Instead, I will spend the first part of class answering questions and helping to clarify any difficult or confusing material. During the remainder of class you will be working on exercises and occasionally taking quizzes. **You must bring your Workbook to class every day**. Attendance at class sessions is REQUIRED and constitutes part of your course grade. (See below for attendance policy.) We will have three in-class tests that will last the entire period, in addition to the two-hour final exam.

- **Workbook:** This workbook includes along with this syllabus, a detailed plan for each class day, your homework assignments, study lists for the exams, and several supplements to the OLI material to help organize and clarify the material you need to learn in the course.

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 make a serious and honest effort to do so. The major challenge in this class is **NOT** mathematics! Many Math 140 students who are not confident mathematically surprise themselves by doing quite well in this course. Your success in this class will depend primarily on the extent to which you **read the course material carefully and reflectively**. See *Learning Strategies* at the beginning of the OLI course. If this were a traditional Math 140 class (not a hybrid), you would be expected to devote approximately two hours per unit outside of class time on homework and studying for this class, meaning eight hours per week. Since it is a hybrid course you will therefore probably need to spend about **10 hours per week outside of class**. Plan your schedule accordingly!

My advice:

"Do your stat homework. It's good for you. Think about the millions of poor kids who go to bed without any statistics at all!"

- DO NOT MISS CLASS.
- Do all of the required work.
- Be persistent, and do not procrastinate.
- Ask questions in class and come to office hours if necessary.
- Find a tutor if you need additional help.

Required Materials:

- **Math 140 Hybrid Course Workbook**, available in the Bookstore. Pick it up right away!
- **Calculator:** A calculator is essential. A TI-83 or TI-84 is particularly useful. If you don't have one and don't want to buy one, you can rent one from www.myti83.com for about $9 per month.
- **Open Learning Initiative (OLI):** You will need to log in at https://oli.web.cmu.edu. The Course Admit Code is:
  - For the 1pm class: M140F10-1
  - For the 2pm class: M140F10-2

  There is a $25 registration fee you must pay to access the course. (There *is* a free version of the course, but you must pay and register for the appropriate code above in order for your name and grades to appear on my class roster and to take and get credit for the on-line quizzes.)
- **Minitab Statistical Software:** You will need Minitab to be able to complete some of the OLI assignments. You can rent it (download it) from www.minitab.com/education/semesterrental for $29.99 for the semester, or you can use the computers in our Math Lab in CR 5329 during the hours that it is open. We have Minitab installed on all the computers there, and it's free!

  If you ever feel that you need to have a standard statistics textbook to refer to, a good choice is *The Basic Practice of Statistics* by David S. Moore. Oviatt Library has a few copies.

Grade Components:

- **Homework:** Homework will be assigned regularly (whenever new material is covered) and due at the beginning of the following class period. I will collect some of the homework assignments at random and often grade some of the problems. To receive full credit, homework solutions must be written out neatly and in full and STAPLED. You will lose points for turning in homework on multiple pages that is not stapled. Using both sides of the paper and using space efficiently is encouraged. For many problems you may be graded on your explanation, not solely on your calculations. Be sure to show work when necessary (which is usually). You *may* discuss the homework problems with a partner or in a small group, but **all work you turn in must be your own**. When two or more papers have identical written solutions, the total points for the assignment will be divided between the parties involved. For example, if you let a classmate copy your homework, you will each receive at most half of the possible points for the problems involved. I will post the solutions to the homeworks promptly, therefore **late homework will not be accepted**.

- **In-class quizzes:** You will have short quizzes in class from time to time. These will not be announced in advance, and if you miss class when there is a quiz you will earn a zero for the quiz.

- **Exams:** There will be three in-class exams and a comprehensive final. All exams are closed book and notes; however you can use your calculator. No phone-calculators will be allowed. Examinations will include problem solving, short answer questions on concepts, construction and interpretation of graphical displays, definitions, true/false and multiple choice. There will be **NO MAKE-UP EXAMS**.

- **Attendance:** Attendance is mandatory. Two absences are allowed without penalty, although not recommended. Each additional absence results in a deduction of 1% of the total number of points achievable for the course, up to a maximum penalty of 10%. **Tardiness is not acceptable and may result in a loss of attendance credit, as will leaving early.** You will receive a bonus of 2% for perfect attendance, or 1% if you have just one absence. My classes invariably have excellent attendance, and quite likely most students will receive a bonus. Plan on being one of them.

- **OLI readings and quizzes:** You will be required to read the online course material and complete certain exercises called *Learn By Doing* and *StatTutor*, as well as taking several online quizzes (called "Checkpoints"). You can take each quiz only once. The system keeps a record of whether and when you do the online reading and the exercises, and records your quiz scores. All of these form part of your course grade.

Breakdown of Course Points

OLI readings, exercises and Checkpoints; in-class quizzes	20%
Homework	15%
Exam 1	15%
Exam 2	15%
Exam 3	15%
Final exam	20%

Final Exam: For the 1pm class: December 15th 12:45 PM - 2:45 PM (in our usual classroom)
For the 2pm class: December 13th 3:00 PM - 5:00 PM (in our usual classroom)

Cell phones: Cell phones, pagers, etc. must be turned to "Silent" during every class period. **An electronic device that goes off audibly during class may result in a pop quiz for everyone.**

Drops and Incompletes: Students can drop through SOLAR during the first four weeks of instruction. Drops after the fourth week are rarely approved. Incompletes have several stringent conditions, the most important of which is that a student who requests an incomplete must be doing passing work at the time the incomplete is granted.

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

Below are two lists indicating what you will learn in this class. The first (Course Goals) is brief, while the second (Essential Course Learning Outcomes) is an expanded and more detailed itemization of the course material:

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

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 use this outline as your top level study guide for the final exam.

I. The Big Picture (OLI Introduction & 1st page of Unit 1)

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 1)

- **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 6, Normal Random Variables part)

- **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* Workbook supplement, OLI Modules 7-10 (parts))

- **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 9 through 11 (parts))

- **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.