Overview: Statistics concerns drawing conclusions and making decisions based on data. The practice of statistics involves collecting data, analyzing data, and making inferences from data. The mathematical foundations of statistical inference lie in probability, the study of randomness and uncertainty. This course introduces you to fundamental ideas and methods of probability and statistics.

I like to believe, and I’ll try to demonstrate to you, that statistics is both an extremely important discipline in today’s world and also a very exciting one. I’m glad to report that I’m not alone in these beliefs. Consider the following quote from Hal Varian, chief economist for Google, taken from an October 2008 interview (available here; I added the emphasis in the last sentence):

“I keep saying the sexy job in the next ten years will be statisticians…. The ability to take data – to be able to understand it, to process it, to extract value from it, to visualize it, to communicate it – that’s going to be a hugely important skill in the next decades, not only at the professional level but even at the educational level for elementary school kids, for high school kids, for college kids. Because now we really do have essentially free and ubiquitous data. So the complementary scarce factor is the ability to understand that data and extract value from it.”

“I think statisticians are part of it, but it’s just a part. You also want to be able to visualize the data, communicate the data, and utilize it effectively. But I do think those skills – of being able to access, understand, and communicate the insights you get from data analysis – are going to be extremely important. Managers need to be able to access and understand the data themselves.”

Goals: By the conclusion of the course, I hope that you have improved your ability to:
- apply and interpret the results of a variety of statistical techniques, including both descriptive and inferential methods;
- understand many of the fundamental ideas of statistics, such as variability, distribution, association, causation, sampling, experimentation, confidence, and significance;
• **understand and apply** basic ideas and methods of **probability**;
• **analyze and assess statistical arguments**, such as those found in the popular press as well as in scholarly publications;
• **use statistical software** to **analyze data**;
• **communicate** your knowledge of statistical ideas effectively.

You can see the expanded course outline (available [here](#)) for more specific learning objectives and a more detailed outline of topics.

**Grading Policies:** Your course grade will be determined by the following components, with relative weights as indicated:

- quizzes (10%)
- investigation assignments (15%)
- two midterm exams (40%: 20% each)
- cumulative final exam (30%)

You may notice that these weights only add up to 95%. An additional 5% weight will be added to whichever component produces your highest score.

**Quizzes:** We will have _lots_ of quizzes. I will encourage and reward you for class preparation and participation by collecting and grading some aspect of your work, formulated as a quiz, in most class periods. In fact, because our class meets for two hours at a time, we may have two quizzes during some class sessions. Specific rules for each quiz (individual or group, open- or closed-notes, in-class or take-home, based on what we’ve done that day or from previous days) will vary and will be announced as we go. Missed quizzes cannot be made up or excused, but you may drop your lowest three quiz scores before calculating your overall score. (So, for example, if you miss three quizzes due to illness or any other reason, those will be the three that you drop.) These quizzes, and their solutions, will be posted [here](#) so that you can check your work afterward.

**Investigation Assignments:** Investigation assignments ask you to investigate a concept or application in some depth. These will be assigned occasionally, roughly an average of one per week. These assignments are often fairly open-ended, requiring both writing and computer work. You may work with one partner on these investigations, submitting one report with both names, provided that both of you genuinely contribute to the work. Word-processed reports of investigations are preferred to hand-written ones, and computer output should be integrated into the report as appropriate. Investigations are due at the beginning of class on the indicated day, which will be announced in class. Late investigations will not be graded, and missed investigations cannot be made up. You may drop your lowest investigation score. The investigation assignments will be posted [here](#), and no hard copies of these assignments will be distributed.

I will also specify optional exercises from the text for you to work on. You are encouraged to solve these to benefit your learning, but these will not be turned in for grading. A listing of these optional homework assignments will be maintained [here](#).
The purposes of these assignments are to:

- further your discovery and exploration of course material,
- give you the problem-solving practice necessary to learn, understand, and apply the concepts and techniques presented,
- provide you with feedback regarding your understanding of the material, and
- prepare you for the kinds of questions that will be on the exams.

**Exams:** There will be two mid-term exams and a final exam. Dates will be announced at least one week in advance; a rough indication can be found in the schedule below. You may make up a missed exam only with a written medical excuse. The final exam will focus on more recent material but will also have a cumulative component. These exams will be open-book and open-notes. You will be provided with preparation advice before each exam ([here](#)). One thing to keep in mind is that interpretations and explanations will be as important as calculations.

**Advice:** I offer the following suggestions for learning the course material well and succeeding in this course:

1. **Organize handouts and notes.** I suggest obtaining a three-ring binder for storing and organizing your handouts/notes. I think you’ll find your handouts/notes to be your most valuable study materials, so please keep them well organized and refer to them often. Some topics will be covered in the handouts that are not covered in the (optional) text.

2. **Print handouts in advance.** For every class period I will post 1-2 handouts on our course website. I will make these handouts available by 4pm on the previous day, usually much earlier than that. These handouts consist of activities and questions that I design to help you learn and understand the course material. I think you’ll find it very helpful to bring these handouts to class each day and take notes directly on these handouts.

3. **Come to class.** Come to class every day. Especially with our class only meeting twice per week, missing one class means missing a lot of material. I’ll do my best to make every class period interesting and worthwhile. You are responsible for heeding all announcements made in class, whether you are in attendance that day or not.

4. **Participate in class.** Coming to class is of little value if you do not participate. Please think about and respond to the questions asked in class. Try to stay focused on course material, and by all means do not distract others from remaining on task.

5. **Don’t get behind.** The material in this class builds on itself progressively throughout the entire quarter. As a consequence, it can be very hard to get caught up if you allow yourself to fall behind. This is especially important because our class only meets twice per week. Please feel free to ask questions as they occur to you, and make use of office hours.

6. **Pay attention to context.** Statistics is about data. Data are numbers with a context. I spend a good bit of time and effort on finding genuine studies and real data to present in
class and on assignments, in part to show you some of the broad applicability of statistics. When working on assignments and quizzes and exams, be sure to express your conclusions in context. In other words, say “most students in our class got at least seven hours of sleep last night” instead of “most of the dots on the graph are at the values seven and above.”

7. **Expect more than number-crunching.** Statistics is about much more than performing calculations. I also expect you to understand statistical concepts and interpret results from applying statistical methods. Try not to concentrate so much on a specific task that you lose sight of the big picture. You really will be expected to think in this course.

8. **Make use of online resources.** I will post lots of information and resources on our course website. There you’ll find daily handouts, quizzes and solutions, investigation assignments and solutions, exam information and preparation advice, and more. Please make frequent use of these resources. You can also monitor your grade information using PolyLearn. I may also occasionally distribute announcements via email. You are welcome to ask questions of me via email as well.

9. **Use technology.** We’ll use computer software both for exploring statistical concepts and also for analyzing data. We’ll use two kinds of software: applets that can be run from any computer that can access the internet, and Minitab statistical software. The good news is that through a site license with the university, you can download Minitab for free from the my.calpoly.edu portal; instructions are provided on our course website. The bad news (for some of you) is that Minitab does not run on Macintosh computers. One consolation is that PC labs on campus, including in the library, have Minitab on their computers.

10. **Study together.** Please feel free to study together and help each other to learn the course material. The policy on investigation assignments is that you can work with a group of as many as 3 students and hand in one report with all names, provided that all of you contribute substantially to the work. On some quizzes you will be invited to work with one or more partners. You can always work together on optional problems from the text and to study for exams.

11. **Invest time.** There’s no reason that you can’t do very well in this course, but you will need to spend time outside of class working on it. Your out-of-class activities should consist of reading the textbook, reviewing your notes, working on assignments, solving optional problems, and preparing for exams.

12. **Take pride in your work.** Please do your best with all aspects of the course. Do not turn in sloppy, half-hearted work. Take pride in what you produce, make your work look nice as well as convey substance. Express yourself clearly.
13. **Have fun with the material.** We’ll be examining many interesting studies, some of which are meant to be entertaining and perhaps even silly. Please enjoy the fun aspects of the course.

14. **Think!** I believe you’ll find that you really are expected to think in this course. You’ll need to figure some things out for yourself and wrestle with some challenging ideas. Please be prepared to think hard as well as work hard. Of course, developing the ability to think well is what a Cal Poly education is all about.

A common theme emerges from this list of advice, important enough that I’ll put it in both bold and italics: **You are responsible for your own learning.** As your instructor, I view my role as providing you with contexts and opportunities that facilitate the learning process. Please call on me to help you with this learning in whatever ways I can.

**Courtesy:** I ask you to please observe some common courtesies, specifically to:
- arrive to class on time;
- do not talk to others when I am talking;
- do not allow your cell phone to ring or send text messages during class;
- staple pages together when you hand in a multi-page assignment;
- include your name when you send me an e-mail message.

**Tentative Schedule:** The following is always subject to change but should give you an approximate sense for what topics we will cover and when:

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topics</th>
<th>Sections of text</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Jan 5, 7</td>
<td>Data, Drawing Conclusions, Sampling</td>
<td>1.1-1.3, 8.1-8.5</td>
</tr>
<tr>
<td>2</td>
<td>Jan 12, 14</td>
<td>Experiments, Categorical Data Analysis</td>
<td>20.1-20.5, 2.1-2.5</td>
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<tr>
<td>3</td>
<td>Jan 20, 21</td>
<td>Exploring Quantitative Data</td>
<td>3.1-3.9</td>
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<tr>
<td>4</td>
<td>Jan 26, 28</td>
<td>Exam, Probability and Simulation</td>
<td>5.1-5.3</td>
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<td>5</td>
<td>Feb 2, 4</td>
<td>Probability Rules, Conditional Probability</td>
<td>5.4-5.9</td>
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<tr>
<td>6</td>
<td>Feb 9, 11</td>
<td>Random Variables, Binomial Distributions</td>
<td>6.1-6.5</td>
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<td>7</td>
<td>Feb 18</td>
<td>Normal Distributions</td>
<td>7.1-7.2</td>
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<tr>
<td>8</td>
<td>Feb 23, 25</td>
<td>Exam, Sampling Distribution for Proportion</td>
<td>9.1-9.2</td>
</tr>
<tr>
<td>9</td>
<td>Mar 2, 4</td>
<td>Confidence Intervals, Hypothesis Tests for Proportion</td>
<td>9.3-9.4,10.1-10.6</td>
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<td>10</td>
<td>Mar 9, 11</td>
<td>Sampling Distribution, Confidence Intervals,</td>
<td>11.1-11.7, 12.1-12.6</td>
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<td>Hypothesis Tests for Mean</td>
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<td>Mar 20 (F)</td>
<td>Final Exam (7:10-10am)</td>
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