Math 53.141: Introduction to Statistics

Spring 2008

Section 01: TTh, 8:00 - 9:15, BCH 201
Section 02: TTh, 11:00 - 12:15, BCH 201

Instructor: Dr. Kokoska
Office Hours: MW 8:00 - 10:00
Office: BFH 207, Ext 4629
Email: skokoska@bloomu.edu
IM: calc8128
Web site: http://facsta.bloomu.edu/skokoska/
(Syllabus, Homework Problems, Solutions, FAQs, Daily log)

Texts:
2. Lecture Notes, (University Bookstore).
3. A graphing calculator, TI-84 Plus or equivalent.

Secondary Texts:
1. TI-83 Graphing Calculator Manual (used), by Kokoska (for Mason, Lind, and Marchal), or web page manual.

Prerequisites:
High School algebra. Review summation notation: \( \sum_{i=1}^{n} x_i \)

Written Assignments:
There will be a homework assignment following each section covered in class. These problems from the text should be considered in detail. I also suggest that you try other remaining problems. Little class time will be used to clarify difficulties with the homework. The primary time to assist you with the text problems will be during my office hours. Homework solutions are due the class meeting following the assignment but, in general, will not be collected. However, 5-7 (or more) random problem sets will be collected and graded during the semester. Solutions will eventually be posted on my web site. There are no extra credit assignments. Late homework: same day late: -2, one day late: -5, two days late: -10, three days late: -15. Homework is not accepted four days after the due date. Note: these are calendar days, not class days.

Class Attendance:
There is no formal penalty for absence from a lecture. You are responsible for all classwork missed.

Class Participation:
Please ask questions in class whenever you believe this will help you to understand a particular concept. Learning is not a passive activity and I consider sustained interaction an essential component of the learning process.

Course Grade:
There will be two or three one-hour approximately 50 point exams. Graded homework will be worth approximately 100-150 points. There will also be a final comprehensive exam worth approximately 100 points. The final exam will be held during finals week as determined by the University Registrar and the Department of Mathematics, Computer Science, and Statistics.

Generally, there are no extra credit problems. Mathematical form (or content) is important, only partial credit will be given for a correct answer. I expect you to use a calculator during exams and to complete homework problems.

Your course grade will be determined from these three exams, graded homework assignments, and a subjective assessment of class participation (approximately 350 points). No additional work will be given during the semester so that you may improve a test grade, final exam grade, or course grade.

Extra Help:
BF 207, evening problem sessions, Learning Community hours, solutions manual, secondary texts, extra help session, calculator sessions.
## Homework Problems

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
<th>Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1-1.2</td>
<td>8</td>
<td>1, 2, 4, 5, 7, 10, 11, 14</td>
</tr>
<tr>
<td>1.3</td>
<td>14</td>
<td>16, 17, 19, 20, 21, 23, 26</td>
</tr>
<tr>
<td>2.1</td>
<td>24</td>
<td>1, 2, 5, 6, 7, 9</td>
</tr>
<tr>
<td>2.2</td>
<td>33</td>
<td>11, 12, 14, 16, 22, 24, 25, Consider 33</td>
</tr>
<tr>
<td>2.3</td>
<td>46</td>
<td>35, 37, 39, 43, 44, 50</td>
</tr>
<tr>
<td>2.4</td>
<td>63</td>
<td>53, 55, 58, 61, 64, 66, 67, 68</td>
</tr>
<tr>
<td>3.1</td>
<td>88</td>
<td>Know 1-10. Do 11, 13, 16, 19, 22, 24, 27</td>
</tr>
<tr>
<td>3.2</td>
<td>102</td>
<td>Know 31-36. Do 37, 39, 41, 44, 50, 54, Consider 51 and 52</td>
</tr>
<tr>
<td>3.3</td>
<td>116</td>
<td>Know 58-62. Do 64, 66, 69, 70, 76</td>
</tr>
<tr>
<td>3.4</td>
<td>127</td>
<td>82, 84, 85, 87, 90, 91</td>
</tr>
<tr>
<td>4.1</td>
<td>151</td>
<td>2, 4, 7, 8, 9, 14, 15, 18, 20, 23, 25, Consider 31, Know 10 and 11</td>
</tr>
<tr>
<td>4.2</td>
<td>166</td>
<td>33, 37, 40, 42, 43, 45, 50, 51, 53</td>
</tr>
<tr>
<td>4.3</td>
<td>178</td>
<td>59, 60, 63, 64, 65, 68, 69, 71, 74, 80, Consider 66</td>
</tr>
<tr>
<td>4.4</td>
<td>188</td>
<td>85, 90, 91, 92, 95, 97, 100</td>
</tr>
<tr>
<td>4.5</td>
<td>201</td>
<td>107, 113, 115, 119 (not d), 122, 123, 130, Consider 133</td>
</tr>
<tr>
<td>5.1</td>
<td>220</td>
<td>2, 3, 5, 6, 7</td>
</tr>
<tr>
<td>5.2</td>
<td>228</td>
<td>10, 11, 13, 16, 17, 18, 23, 24, Consider 19</td>
</tr>
<tr>
<td>5.3</td>
<td>238</td>
<td>31, 32, 33, 36, 39, 40, Consider 30</td>
</tr>
<tr>
<td>5.4</td>
<td>255</td>
<td>43, 45, 49, 50, 51, 54, 55, 58</td>
</tr>
<tr>
<td>5.5</td>
<td>269</td>
<td>70, 71, 74, 76, 77, 81, 82</td>
</tr>
<tr>
<td>6.1</td>
<td>293</td>
<td>3, 6, 7, 10, 11, 12, 16</td>
</tr>
<tr>
<td>6.2</td>
<td>314</td>
<td>Know 18-28. Do 29, 30, 33, 35, 37, 40, 44</td>
</tr>
<tr>
<td>6.3</td>
<td>327</td>
<td>54, 55, 57, 59</td>
</tr>
<tr>
<td>6.4</td>
<td>336</td>
<td>67, 68, 70, 72, 74</td>
</tr>
<tr>
<td>7.1</td>
<td>356</td>
<td>2, 3, 7, 11</td>
</tr>
<tr>
<td>7.2</td>
<td>371</td>
<td>Know 15-21. Do 22, 24, 25, 26, 29, 34, 35</td>
</tr>
<tr>
<td>7.3</td>
<td>381</td>
<td>44, 46, 47, 50, 52</td>
</tr>
<tr>
<td>8.1</td>
<td>400</td>
<td>6, 7, 8, 11</td>
</tr>
<tr>
<td>8.2</td>
<td>413</td>
<td>17, 19, 20, 22, 24, 27, 32</td>
</tr>
<tr>
<td>8.3</td>
<td>425</td>
<td>42, 43, 45, 47, 49, 52, 57, 59</td>
</tr>
<tr>
<td>8.4</td>
<td>436</td>
<td>69, 71, 73, 74, 76, 82</td>
</tr>
<tr>
<td>8.5</td>
<td>447</td>
<td>92, 93, 95, 98, 100, 105</td>
</tr>
</tbody>
</table>
Math 53.141: Introduction to Statistics

Frequently Asked Questions

1. What do I have to do in order to get an A in this class?
   If you come to class, participate by asking and answering questions, stay current (read the text and do the homework on time), and, of course, do well on the exams, you will excel in this class.

2. What do I have to do in order to fail this class?
   If you have no interest in learning the material and/or show little enthusiasm, then you are not likely to succeed. Bluntly, don’t do the homework and never ask or answer a question.

3. Is the professor out to flunk everyone?
   I do not view the faculty-student relationship as adversarial. I want you to learn the material, share my enthusiasm for the subject, and to succeed. I will do anything (within reason) to help you succeed. That includes extra help sessions, extra problems, and extra office hours. However, you must show some initiative.

4. Is there a curve in this class?
   Absolutely not! It is possible for everyone in the class to get an A. It is also possible for everyone in the class to fail.

5. What sorts of questions should I ask in class and during office hours?
   There is no bad question or answer in this class. We all learn more by making mistakes. You simply cannot remain passive about learning. I have no alternative but to interpret silence as understanding. Even if you do not know what question to ask, stop me, indicate in some diplomatic (or blunt) way that I am going to fast, and we will retrace our steps.

6. What else can I do to help me succeed in this class?
   Make use of the resources available, especially my office hours. I enjoy this material. I realize you may never share my enthusiasm for the subject, but if you do not make an effort to succeed, then there is no doubt you will fail.

7. How do I know if I should I withdraw from this class?
   The first test in my Introductory Statistics class is usually the easiest of the three exams (2 one-hour exams, 1 final exam). If you fail miserably on the first exam, then you should think seriously about withdrawing from the class.

8. Well, how hard are these exams anyway?
   Despite anything you may have heard, my exams are very straightforward. I do not put trick questions on tests and I do not test the most minute detail. The questions on my exams are very similar in style and difficulty to the problems assigned for homework and the examples we discuss in class.

9. So what makes this class so difficult?
   One reason you may have difficulty with this class is because almost every question is a word problem. Statistics really involves a different way of thinking. You must learn to translate the words into a mathematical question, and then solve the problem.

10. What if I absolutely need a C in order to play on the golf team next semester?
    Please do not tell me that you need a certain grade in order to maintain your eligibility for financial aid, or a sports team, or whatever. I do have compassion for extreme situations, but nobody likes a whiner. A grade is not a negotiable entity. It is inappropriate for a student to contact a professor and ask for a any grade to be changed. I will not respond to emails, telephone calls, or notes that indicate a need for a certain grade.
11. So what’s really on the tests?
   Do not ask me “Is blah blah blah going to be on the test?” That’s an indication that you are not interested
   in learning and only concerned with getting a grade, and besides it’s aggravating.

12. Does the collected, graded homework really count for approximately 1/3 of my grade?
   You bet! For emphasis: homework is due the class meeting following the assignment. The purpose of this
   is to help keep you current and to give you the opportunity for some easy points toward your final grade.
   If you choose not to do the homework, then you must accept the consequences.

13. Can I do any extra work in order to raise my grade?
   Absolutely not! There is never any extra work given to an individual during the semester so that a course
   grade may be raised.

14. What is the real purpose of this class?
   The purpose of this class is to learn a little about statistics, mathematics, how to reason, and to have
   some fun along the way.

15. If I study for a long time, will I get an A?
   Although difficult to accept, effort is not always rewarded with good grades. In other words: long hours
   studying do not guarantee an A.

16. Does the professor really play pre-dawn basketball at 5:45 am two days a week and at 6:30 am on a third?
   Yes, and he can be very cranky if he did not win any of the pick-up games.

17. Do I really need to buy the TI-84 Plus calculator?
   You must have a calculator in this class. Hand calculations are unnecessarily tedious and calculators are
   much more accurate and quicker. Wherever possible I will use the TI-84 Plus to solve problems. There
   are several calculator programs that you will have to get from me that will only work on the TI-84 Plus
   (and the TI-83 family). If you already have a graphing calculator and feel you know how to use it for
   statistics, then you may certainly use it. However, if you do buy a TI-84 Plus just for this class I will try
   to sell your used calculator for you to the students in the next Introductory Statistics class.

18. Can I get a tutor for this class?
   It is unlikely, though possible, that you will be able to find a tutor through academic services. The Dep-
   artment of Mathematics, Computer Science, and Statistics maintains a list of majors who are interested
   in tutoring. Contact the Department Secretary (BFH, second floor) if you are interested. Remember that
   these tutors expect and deserve to be paid. If you feel you need a tutor, you should probably be camped
   outside my office door - and that’s fine. I enjoy the material, and I am happy to help as long as you show
   some effort.

19. What if I miss a class?
   You are responsible for all classwork missed. I advise you to get the notes from someone in the class, and
   find out if you missed any important announcements concerning tests or collected homework.

20. Where did the professor get that odd accent?
   That is called a Boston accent. He puts r’s where they do not belong, and takes them away where they do
   belong. You will quickly learn the slang, and if you do not understand something, simply ask for another
   explanation.
21. Why is the professor so demanding? I only need this course to fulfill some silly requirement, and I will never use statistics again anyway.

To paraphrase Polya: A teacher of mathematics has a great opportunity. Drilling students in routine operations kills their interest, hampers their intellectual development, and misuses this opportunity. However, if he challenges the curiosity of his students by setting demands proportionate to their knowledge and expects excellence, students will develop a means for logical, independent thinking, and a desire to excel in any endeavor.

22. What is classroom etiquette?

Classroom etiquette is a set of natural courtesies and standards of conduct extended to the professor and fellow students. Here are some reasonable guidelines.

(a) Don’t sleep in class. If you absolutely cannot keep your eyes open, have no desire to participate, then don’t come to class. Nodding off in class is unbelievably annoying.

(b) Pay attention! Don’t stare off into the distance, or at the bulletin board, or at the floor, or out the window.

(c) Don’t fiddle with your pencil, hair, drawings, or bits of paper. Concentrate, even at 8:00 in the morning!

(d) Turn your cell phone off in the classroom.

(e) Don’t mumble questions to a neighbor. Ask me!

(f) Come prepared to participate and learn. Ask and answer questions. Be an active learner.

(g) Do not use inappropriate or offensive language.

(h) Don’t eat an entire meal in class. Small snacks are OK, but a Denny’s Grand Slam breakfast is inappropriate.

(i) Don’t be habitually late to class. If you are always 10 or 15 minutes late, that action reflects your commitment to statistics and learning.

A student who violates these standards and becomes disruptive may be asked to leave the classroom. If the request is ignored, University Police will be called for assistance.

23. What is homework protocol?

Homework protocol is a collection of reasonable expectations for the presentation of solutions.

(a) Put your name on your homework. Staple pages together. Don’t fold corners using an ancient Etruscan rip technique in order to hold pages together.

(b) Homework should not have any rough or frayed edges. Don’t rip pages out of a spiral notebook.

(c) Write legibly, logically, and neatly. Use a ruler to carefully sketch graphs.

(d) The late homework policy is firm, period. Class day late: −2, One day late: −5, Two days late: −10, Three days late: −15. If you forget your homework and bring it to me after class, it’s class day late: −2. If I collect homework at the beginning of class, and you hand in your homework at the end of class, it’s class day late: −2.

24. How does the University Academic Integrity Policy apply to this course?

All students are expected to be honest in all of their academic work. Any act of misrepresentation, including plagiarism, cheating on a test, and falsification of an excuse, constitutes academic misconduct. A student who commits an act of academic dishonesty is subject to a full range of penalties, from an oral reprimand to expulsion from the university.

25. What is the professor’s ultimate objective?

I really want you to succeed! However, excellence takes hard work, dedication, and sacrifice. Just as an athlete is willing to practice until actions are committed to muscle memory, a student must practice solving problems with the same passion and desire to succeed.
Graphing Calculators

<table>
<thead>
<tr>
<th>Calculator</th>
<th>Suitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI-83</td>
<td>Just barely.</td>
</tr>
<tr>
<td>TI-83 Plus</td>
<td>Okay.</td>
</tr>
<tr>
<td>TI-83 Plus Silver Edition</td>
<td>Okay also, slightly more expensive.</td>
</tr>
<tr>
<td>TI-84 Plus (Silver Edition)</td>
<td>Perfect</td>
</tr>
<tr>
<td>TI-85</td>
<td>No!</td>
</tr>
<tr>
<td>TI-86</td>
<td>No!</td>
</tr>
<tr>
<td>TI-89</td>
<td>Okay, extra (free) stats application, no programs.</td>
</tr>
<tr>
<td>TI-89 Titanium</td>
<td>Okay, overkill.</td>
</tr>
<tr>
<td>TI-82</td>
<td>Definitely not.</td>
</tr>
<tr>
<td>Scientific Calculator</td>
<td>Definitely not.</td>
</tr>
<tr>
<td>Casio, Sharp, HP</td>
<td>Use at your own risk.</td>
</tr>
</tbody>
</table>

The calculator programs that I have only work on a TI-83/84. I do not have programs for the TI-89, nor for any other calculator.

The Socratic Method

*I cannot teach anybody anything. I can only make them think.*  – Socrates

Consider the following links:


An excerpt from Plato’s dialog *Meno*, in which Socrates leads a slave boy to discover the area of a certain square.

http://www.cut-the-knot.org/proofs/half_sq.shtml

http://darkwing.uoregon.edu/~mwilson/AncSciMeno.html
The Statistical Inference Procedure

The ultimate, constant theme for this course is statistical inference and decision making through problem solving. Computation is important, but calculators (and computers) remove the drudgery of hand calculations and allow us to concentrate more on drawing conclusions. Almost every problem contains a part asking the reader to interpret the statistical result or draw a conclusion.

The process of checking a claim can be divided into four parts.

Claim:
This is a statement of what we assume to be true.

Experiment:
In order to check the claim, we conduct a relevant experiment.

Likelihood:
Consider the likelihood of occurrence of the observed experimental outcome assuming the claim is true. We will use many techniques to determine whether the experimental outcome is a reasonable observation (subject to reasonable variability), or whether it is a rare occurrence.

Conclusion:
There are only two possible conclusions.

1. If the outcome is reasonable, then we cannot doubt the claim. We usually write, “There is no evidence to suggest the claim is false.”

2. If the outcome is rare, we disregard the lucky alternative, and question the claim. A rare outcome is a contradiction. It shouldn’t happen (often) if the claim is true. In this case we write, “There is evidence to suggest the claim is false.”

Problem Solving

I believe the most difficult concept to teach is problem solving. A reason students view statistics as difficult is because almost every problem is a word problem. Students in an introductory statistics course must translate these word problems into mathematics. The Solution Trail is a prescriptive technique and visual aid for problem solving. A student starts this hike by identifying keywords and phrases. The four steps to solving each problem are:

1. Find the keywords.
2. Correctly translate these words into statistics.
3. Determine the applicable concepts.
4. Develop a vision, or strategy, for the solution.

| Keywords | Translation | Concepts | Vision |

The keywords lead to a translation into statistics. The statistics question is solved using specific concepts. The keywords, translation, and concepts are used to develop a vision for the solution. This technique is not applicable in every problem. However, it is most appropriate for probability through hypothesis testing, the foundation of most introductory statistics courses.