

# ISAT 251: TOPICS IN APPLIED STATISTICS (SEC 3) - Fall 2015

## COURSE AND INSTRUCTOR INFORMATION

**Meeting Times:** Wednesday & Friday 8:40am-9:55am in ISAT/CS 343  
**Instructor:** Nicole Radziwill, Ph.D., MBA  
<http://nicoleradziwill.com>  
**Office:** ISAT/CS 325  
**Phone/SMS:** 703.835.6336 (SMS or Email 24/7)  
**Email:** [radziwnm@jmu.edu](mailto:radziwnm@jmu.edu) (OR [nicole.radziwill@gmail.com](mailto:nicole.radziwill@gmail.com) if urgent)  
**Office hours:** Monday night hacking sessions from 8pm-12am in ISAT/CS 337  
WF 11:15am-12:05am & R 8:30-9:30am BY APPOINTMENT!  
In person, Skype or gChat by appointment anytime! (24/7)

## NATURE OF COURSE CONTENT

### COURSE DESCRIPTION

Welcome to ISAT 251. This course is part of the core foundational curriculum for ISAT majors and is also applicable for GenEd credit in Cluster 3, Track I, Group 1. This is a **BLENDED COURSE** that combines face-to-face time in class with online, self-directed activities that allow you to take more control over your learning. This course covers some of the most important and practical quantitative reasoning skills that you will ever need, regardless of your major or chosen area of ISAT concentration. You will learn to COLLECT, ANALYZE, and INTERPRET REAL DATA to better understand many real-world situations that you encounter every day.

### COURSE STYLE & DELIVERY

This course implements the 10 Principles of the Burning Mind Project as its core value system. (See <http://www.burningmindproject.org/2015/05/14/how-the-10-principles-help-me-teach-statistics/> and <http://www.burningmindproject.org/the-ten-principles/> ) As a result, the course is somewhat self-directed, blended (integrating online and in-class components), and gift-oriented. In many classes, you may ask "what can I get out of taking this class?" However, in this course, we want you to ask the question "what can I give to others as a result of my participation in this class?" Individual gifts are an important component. As you explore the topics, we request that you identify things you are good at and can contribute to a larger, team project. Help your classmates find you if they need your skills to build out a particular solution.

The course consists of two open lab sessions per week. Short lectures will be interspersed with interactive activities. Most of your work will be done in pairs or teams, including exams, but oral quizzes will be done individually. The way to succeed in this class is to show up to each scheduled session, and actively participate!

## **COURSE SCHEDULE**

*Subject to Adjustments - [Points Opportunities in Brackets]*

|                            |   |
|----------------------------|---|
| Week 1 (8/31):             | Data, Variables, Characterizing and Graphing Data, 5W's [IDAA: M&Ms]<br><b>Chapters 1.1 through 1.5</b>   |
|                            | Assignments to be completed before next week:<br>[Complete CAOS Pre-Test]<br>[IDAA: Auto Safety]<br>Find a data set with at least 100 observations, 2 cat. vars, & 2 quant vars   |
| Week 2 & 3 (9/7 and 9/14): | Linear Regression [IDAA: Regression]<br><b>Chapter 6.1 and 6.2</b><br>Randomness & Sampling Strategies [IDAA: Sample Surveys]<br><b>Chapter 3.1</b><br>Intro to Experimental Design [IDAA: Experiments]<br><b>Chapter 3.2</b> |
| Week 4 (9/21):             | The Normal Distribution [IDAA: Pulse]<br><b>Chapter 1.7 and 1.8</b>   |
| Week 5 (9/28):             | 6 Steps of Hypothesis Testing (12 for Reports) [Reverse Engineering Presentations]<br><b>Chapter 3.3 and 3.4, Chapter 5.1</b>   |
| Week 6 (10/5):             | Power Analysis [Calculate Sample Size for Your Project]<br><b>Chapter 3.5</b>   |
| Week 7 (10/12):            | Sampling Distribution Models & Central Limit Theorem [In-class Exercise]<br><b>Chapter 3.6 and 3.7</b>  |
| Week 8 (10/19):            | Tests on Means [Exercises with Simulated Data]<br><b>Chapters 5.2 through 5.5</b>   |
| Week 9 (10/26):            | Tests on Categorical Variables & Proportions [Exercises with Simulated Data]<br><b>Chapters 5.6 through 5.8</b>   |
| Week 10 (11/2):            | Tests of Variances [Exercises with Simulated Data]<br><b>Chapters 5.9 through 5.11</b>  |
| Week 11 (11/9):            | [Final Exam]  |
| Week 12 (11/16):           | <i>Statistics Done Wrong: Pitfalls in Experimental Design and Interpretation</i>  |

**\*\* THANKSGIVING BREAK \*\***

|                  |              |
|------------------|--------------|
| Week 13 (11/30): | Project Work |
| Week 14 (12/7):  | Project Work |

## **GOALS OF THE COURSE**

**Course Objectives:** You will learn how to...

- Use several kinds of visual displays (including graphs and tables) to explore data
- Design studies to collect and analyze data so you can answer questions of interest
- Apply statistical reasoning (including formal hypothesis testing) to evaluate how well a given claim is supported by a set of data.

**General Education, Cluster Three learning objectives pertinent to the course are:**

Objective 1: Describe methods of inquiry that lead to mathematical truth and scientific knowledge; be able to distinguish science from pseudoscience. Objective 2: Use theories and models as unifying principles to understand natural phenomena and make predictions. Objective 5: Use graphical, symbolic, numerical methods to analyze, organize, and interpret natural phenomena. Objective 6: Discriminate between association and causation, and identify the types of evidence used to establish causation. Objective 7: Formulate hypotheses, identify relevant variables, design experiments to test hypotheses. Objective 8: Evaluate the credibility, use, and misuse of scientific and mathematical information in scientific developments and public-policy issues.

**METHODS OF EVALUATION**

**GRADING**

The goal of this course is to *produce artifacts* that demonstrate your understanding of the topics that we cover, and that *provide value* to real clients and/or real people (including your instructors, the students within your learning community, and students who will participate in future learning communities by enrolling in this course). **Your grade** in this course is ultimately based on **my opinion of your professionalism** as you participate in this class, learn key concepts and how to apply them to problem solving, and demonstrate your ability to explain some of the key concepts and solve problems by the end of the course. **My opinion will be predominantly based on the artifacts you produce, and how you produce them, reflected by accrued points** for completing various labs, exams, and projects, to the satisfaction of the instructor and/or instructor-designated proxy (e.g. TA). You get as many chances as you like within a 3-week window to continually improve the quality of your work, but points can only be accrued for successful *completion* of an activity or artifact!

| 1 Point Each   | 2 Points Each   | 3 Points Each  | 6 Points Each   |
|--|---|--|---|
| 1. CAOS Pre-Test (*)<br>2. CAOS Post-Test (*)<br>3. Download R onto your machine | 4. Complete one section of IRB training (3 sections total)<br>5. Develop a New Project Proposal | 6. Complete an IDAA as an individual or with a group, and pass oral exam<br><b>7. Present the results of your project to the class during final exam session (*)</b> | 8. Complete final exam with at least 85% correct, or, remove deficiencies with oral exam<br><b>9. Complete Grp Project with written "12 Steps" report and presentation (*)</b><br>10. Write and submit research paper for JMURJ ( <a href="http://jmu.edu/jmurj">http://jmu.edu/jmurj</a> ) |

(\*) = REQUIRED

Grading rubrics for assessment of the team projects will be issued later in the semester.

**Your work plan should take into consideration:**

- That all exercises, labs, and new labs **must be checked off (and points received) by the end the week after they are introduced**. This will help everyone stay on schedule.
- That there will be scheduled sittings for each of the exams. If you plan to take an exam, you should complete the preparatory exercises in advance of those exam dates.
- **That the exercises provided to you are just "starting places"**. I would love to see you develop new IDAAs this semester, or conduct real research projects that you can submit to arXiv.org and/or the new JMU Research Journal!
- You are responsible for keeping track of the points you will accrue. At the end of the semester, you will check your records against mine, so if there are any discrepancies we can resolve them before grades are turned in. **Your accrued points are not "vested" until you complete and present a project.**

**Grading Guidelines:** 40+ accrued points is an A, 30-39 is a B, 20-29 is a C, 10-29 is a D, 9 or below is F. To receive a passing grade in this course, you must successfully conduct and complete CAOS Pre-Test and Post-Test and at least one project. **Your accrued points are not "vested" until you complete and present a project during our regularly scheduled session during finals week.** That means yes, you are REQUIRED to attend the final exam session and present your project with your team!

## REQUIREMENTS & POLICIES

### **Textbook and Other Resources:**

Nicole Radziwill, **Statistics (The Easier Way) With R.** (\$37)

[http://www.amazon.com/gp/product/0692339426/ref=as\\_li\\_tl?ie=UTF8&camp=1789&creative=390957&creativeASIN=0692339426&linkCode=as2&tag=qualandinnowe-20&linkId=MWGWRHUB4IK7LUAT](http://www.amazon.com/gp/product/0692339426/ref=as_li_tl?ie=UTF8&camp=1789&creative=390957&creativeASIN=0692339426&linkCode=as2&tag=qualandinnowe-20&linkId=MWGWRHUB4IK7LUAT)

I will provide it to you as a PDF file as well.

Adler (2012), **R in a Nutshell.** (\$43)

[http://www.amazon.com/gp/product/144931208X/ref=as\\_li\\_tl?ie=UTF8&camp=1789&creative=390957&creativeASIN=144931208X&linkCode=as2&tag=qualandinnowe-20&linkId=M6KSUSPPUFQIWITH](http://www.amazon.com/gp/product/144931208X/ref=as_li_tl?ie=UTF8&camp=1789&creative=390957&creativeASIN=144931208X&linkCode=as2&tag=qualandinnowe-20&linkId=M6KSUSPPUFQIWITH)

This is **RECOMMENDED** if you would like an additional book to help you learn more about R, but **NOT REQUIRED**. If you plan to take more courses with me, we do a lot of R... and this book covers topics from all of my courses.

Readings from P. Norvig, <http://norvig.com/experiment-design.html> and A. Reinhardt, **Statistics Done Wrong**

### **Facebook:**

Join our class Facebook group at <https://www.facebook.com/groups/262216220608559/>!

If you don't use Facebook, please create a fake account to use just for this class for this semester.

### **Statistical Software:**

**R** - Free, Open Source!

1. Download it onto your computer from <http://www.r-project.org> (instructions are in "Intro to R" in Course Materials as well as first chapter of your required textbook)
2. The latest version of R is also installed in all the ISAT computer labs

### **Textbook Policies:**

Question: **DO I HAVE TO GET A BOOK?** Answer: **YES.**

Question: **WHEN DO I HAVE TO GET THE BOOK?** Answer: **NOW.**

Question: **CAN I SHARE A BOOK WITH MY FRIEND/TEAMMATE/DOG?** Answer: **Sure**, just don't complain if your friend is hogging the book and/or you haven't been able to get in touch with them by cell phone. It's **YOUR** responsibility to do the readings. If you do the readings, you'll notice that you get the **SAME** answers that you would have (verbatim, most of the time) if you'd read the book.

Question: **WHERE DO I GET THE BOOK?** Answer: **AMAZON.**

[http://www.amazon.com/gp/product/0596809158/ref=as\\_li\\_tl?ie=UTF8&camp=1789&creative=390957&creativeASIN=0596809158&linkCode=as2&tag=qualandinnowe-20&linkId=GMVX2K666THNK756](http://www.amazon.com/gp/product/0596809158/ref=as_li_tl?ie=UTF8&camp=1789&creative=390957&creativeASIN=0596809158&linkCode=as2&tag=qualandinnowe-20&linkId=GMVX2K666THNK756)

**Attendance Policy and Final Exam:** The way to succeed in this class is to **SHOW UP AND ACTIVELY PARTICIPATE** during **EACH** of our scheduled class sessions. If you need additional help *beyond regular class sessions*, just ask. But you need to show up for the regular class sessions first. I'm usually available on Monday nights during hacking sessions, and I regularly schedule one or two open labs a month on Saturdays or Sundays if you need extra help.

Question: **WHAT DO I DO IF I MISS A CLASS?** Answer: The materials we go through will be on our Google Drive folder and accessible through our Facebook group. Feel free to post messages to your classmates on the Facebook groups to get into discussions about what we did, how to catch up, and/or if anyone is interested in working with you to catch up.

Question: **WHAT IF I MISS A LECTURE WHERE WE DID AN IMPORTANT INTERACTIVE ACTIVITY, LIKE WHEN WE COLLECT DATA ON OUR M&Ms?** Answer: Then you'll have to ask your classmates what we did,

buy your own M&Ms, and do the exercise on your own so that you can catch up. (In short, it's just not a good idea to miss a class session.)

Question: **SHOULD I EMAIL/TEXT/STOP YOU AFTER CLASS TO LET YOU KNOW IF I WILL MISS A LECTURE?**

Answer: No. But it's your responsibility to leverage *online resources like our Facebook group and your classmates* to figure out what went on during the session, if you must miss it. Please don't come to me and say "I missed class on Tuesday. What did we do?" My job is to tell you that stuff *during class*.

**Incompletes:** I do NOT give incompletes in this class (any more). Failure to complete the semester project and present with your team during Final Exam Week makes it very unlikely that you'll pass this class, so please plan ahead and start working on your semester projects early.

**Honor Code:** You are expected to read, understand, and abide by the JMU Honor Code (<http://www.jmu.edu/honor/code.shtml>) at all times.

**Special Needs:** If you are a student who is registered with the Office of Disabilities, I need to be given written documentation to support your situation in order to provide you with any accommodations (this is required by law). **Plans for any accommodations MUST be made within the first week of this course.**

**Contacting the Instructor:** You can contact the instructor any time (24/7) via email or SMS to 703.835.6336. If you text, PLEASE say who you are, and from what class. I really honestly don't mind being contacted at any time of day; there's as good a chance of your question getting answered at 3am as there is at 3pm. If I'm really busy or asleep, I'll turn my ringer off. If you don't hear from me within 24 hours, I may not have seen your message or may have been temporarily overwhelmed -- please contact me again. I AM ALWAYS HAPPY TO HELP YOU OUT.