STAT 301 Probability and Statistics

Instructor

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Fall Semester 2013

Class time: Mon, Wed, Fri 2:30 pm – 3:20 pm
Class location: TLC 040
Instructor's office hours: M, T, W 11:00 –12:00.
Or you can email me and I will set aside time.

Course Description

Intended for engineers, mathematicians, and physical scientists. Introduction to sample spaces, random variables, statistical distributions, hypothesis testing, basic experimental design, regression, and correlation. 3 credits, prerequisite: Math 175. Credit awarded for only one of Stat 251, Stat 301, and Stat 416.

Learning Outcomes

Students who successfully complete this course will be able to:

1. Describe central tendency and variability for a dataset,
2. Present statistical information graphically using histograms, box-plots, Pivot charts, and other techniques,
3. Conduct statistical analysis using Microsoft Excel and R,
4. Calculate probabilities and evaluate risk using Monte Carlo Simulation,
5. Formulate testable hypotheses and determine statistical significance for various statistical tests, including two sample t-test, paired test, ANOVA, chi-squared contingency tables, correlation, and multiple regression,
6. Calibrate, validate, and use statistical models for estimation.

This course will prepare students for the statistics material in the Fundamentals of Engineering (FE) exam.

Class materials and website

The syllabus and all class materials are subject to change until the instructor indicates otherwise.
http://www.uidaho.edu/~mlowry/Teaching/syllabus.stat301.pdf

Required Text

A: *Probability and Statistics for Engineering and the Sciences*, 8th Edition by J. Devore, 2012.
http://www.cengagebrain.com/shop/ISBN/9780538733526?cid=APL1

B: *Statistics Essentials For Dummies* by Deborah Rumsey, 2010.
http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470618396.html

C: *simpleR – Using R for Introductory Statistics* by John Verzani, 2001. Available here:
http://www.webpages.uidaho.edu/~mlowry/Teaching/STAT_301/Supplemental/Verzani-SimpleR.pdf

D: *FE Review Chapter 6. Probability and Statistics* by Michael Lindeburg, 2010. Available here:
http://www.webpages.uidaho.edu/~mlowry/Teaching/STAT_301/Supplemental/FE_Review_Ch6.pdf

Software

We will use Microsoft Excel and a free statistical software package called "R". R can be installed on Linux, Windows, and MacOS. To download R, choose a CRAN mirror at http://www.r-project.org/ . Install 32-bit and 64 bit.

Statistics Assistance Center

Your $30 lab fee pays for a drop-in assistance center located on the first floor of the library. Check the webpage for the tutoring schedule at http://www.uidaho.edu/sci/stat/about/sac .

Grading Criteria

Participation in class	5	points	2%
8 Homeworks	40	points	17%
4 Projects	40	points	17%
4 Topic-focused Exams	100	points	43%
1 Final Comprehensive Exam	50	points	21%
Total possible	235	points	

***I will not accept late homework or projects. Homework and projects are due at the beginning of class.**

****Using homework, projects, or exams from previous semesters to study for exams, to help complete your assignments, or for any other purpose whatsoever is strictly prohibited. Violators will be failed. ****

STAT 301 Probability and Statistics

Schedule

Topic	Week	Discussion	Reading	Due*
Part 1: Descriptive Statistics	1: Aug, 26 - Aug, 30	Central tendency and variability	Ch. 1	
	2: Sep, 2 - Sep, 6	Graphical presentation and Pivot tables	Presentation reading	HW1
	3: Sep, 9 - Sep, 13	Using R	R reading	
	4: Sep, 16 - Sep, 20	Catch up, review, and **Exam 1**	FE reading	P1, HW2
Part 2: Probability Analysis	5: Sep, 23 - Sep, 27	Probability rules	Ch. 2	
	6: Sep, 30 - Oct, 4	Discrete and continuous distributions	Ch. 3 & 4	HW3
	7: Oct, 7 - Oct, 11	Joint distributions	Ch. 5	
	8: Oct, 14 - Oct, 18	Catch up, review, and **Exam 2**		P2, HW4
Part 3: Hypothesis Testing	9: Oct, 21 - Oct, 25	One and two sample tests	Ch. 7, 8, & 9	
	10: Oct, 28 - Nov, 1	ANOVA	Ch. 10	HW5
	11: Nov, 4 - Nov, 8	Categorical tests	Ch. 14	
	12: Nov, 11 - Nov, 15	Catch up, review, and **Exam 3**		P3, HW6
Part 4: Statistical Models	13: Nov, 18 - Nov, 22	Simple OLS	Ch. 12	
	14: Nov, 25 - Nov, 29	Turkey		
	15: Dec, 2 - Dec, 6	Multiple regression	Ch. 13	HW7
	16: Dec, 9 - Dec, 13	Catch up, review, and **Exam 4**		P4, HW8
	17: Wednesday Dec, 18	**Final Comprehensive Exam**	3:00pm - 5:00pm	

* Projects (P) are due on Mondays before class begins. Homeworks (HW) are due on Wednesdays before class begins. Exams are on Fridays. *I will <u>not</u> accept homework or projects that are late.*

Homework

Some problems are easy, some are difficult, and all are worth a half a point with no partial credit. Your work must be uncluttered, clearly written, and well organized. Use a box, underline, or arrow to indicate the final solution. "Hand" means using only your calculator without any special functions (like you will do for the exams). You can hand-write or type Hand problems. For Excel problems, only provide the relevant output. You may want to include additional information for your own reference when studying later, such as Excel formulas and explanatory notes. For R problems, you must include a snippet of your R code. I recommend doing the homework in numerical order, but you may submit in numerical order or organized as Hand, Excel, and R. Only submit a "hardcopy." Staple the pages.

#	Hand	Excel	R
HW 1.	1-10, 1-15, 1-19, 1-33, 1-47, 1-69	1-24, 1-27, 1-34, 1-51	
HW 2.	1-38, 1-41, 1-61, 1-81	1-39, 1-63	1-14, 1-20, 1-50, 1-60
HW 3.	2-2, 2-9, 2-12, 2-13, 2-26, 2-37, 2-38, 2-47, 2-60, 2-78		
HW 4.	3-11, 3-23, 3-46, 3-50, 3-51, 3-81, 4-1, 4-28, 4-65	4-34	3-75, 4-60, 4-72, 4-95
HW 5.		8-24, 8-39, 9-28, 9-36, 9-61	8-58, 8-59, 9-23, 9-38, 9-90
HW 6.	canceled		
HW 7.	12-7, 13-39	12-14, 12-16, 12-17, 12-18, 12-19, 12-24, 13-44, 13-45	
HW 8.	canceled		

STAT 301 Probability and Statistics

Exam Material

#	Document Name	File
1	FE Reference Formulas Excerpt pgs. 40-48	FE_Reference_Formulas_Excerpt.pdf
2	Discrete & Continuous Distributions Summary pgs. 1-4	Distributions_Summary.pdf
3	Textbook Appendix Tables pgs. A-1 to A-28	Textbook_Appendix_Tables.pdf
4	Hypothesis Tests Summary pgs. 1	Hypothesis_Tests_Summary.pdf

These are the ONLY documents you can use during the Exams. **Do NOT write on them before the exam.** If any writing in pen or pencil is found on these documents before the exam it will be considered cheating and violators will be failed.

Data

Textbook_Data.zip (This zip file has comma separated .txt files Other file formats are available here: http://www.cengage.com/cgi-wadsworth/course_products_wp.pl?fid=M20bI&product_isbn_issn=9780538733526

My_Example_Data.zip

My R Files

To save and open these files in R:
1. Click the link to open the text file in your browser.
2. Right click and select **Save as…** to save my file to your desired location.
3. In R, click **File**. Select **Open script**. Next to Files of type: select **All files (*.*)** to see files with the .txt extension. (Alternatively, a script can have a .R extension, but that extension does not open easily in a browser or in notepad so I don't like using it as much.)

R_Introduction.txt
R_Homework_Example.txt (This shows how to import a data file).
R_Plots.txt
R_Functions.txt
MyFavoriteFunctions.txt
R_Monte_Carlo.txt
R_Calculate_Distribution_Probabilities.txt
R_Probability_Plots.txt
R_z_tests_and_t_tests.txt
R_ANOVA_Tests.txt

R information

R main webpage: http://www.r-project.org/
R reference card: http://cran.r-project.org/doc/contrib/Baggott-refcard-v2.pdf
"Quick-R" webpage: http://www.statmethods.net/
"simpleR" user guide: http://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf
idre webpage: http://www.ats.ucla.edu/stat/r/

Project Information

Note that 4 out of 10 points on each project are for the quality of your report. Please refer to the Professional Report Example below or consult the instructor for information about making professional, high quality reports. You can name and organize the sections of your report how you please, but at least include an "Introduction" and "Conclusion."

P1_Descriptive_Statistics.pdf
P2_Probability_Analysis.pdf
P3_Hypothesis_Testing.pdf
P4_Statistical_Models.pdf

Professional_Report_Example.pdf

STAT 301 Probability and Statistics

Schedule (For Future Classes)

Topic	Class	Discussion	Reading
Part 1: Descriptive Statistics	1	Introduction	**A:** 1.1, **B:** 1
	2	Central Tendency	**A:** 1.3, **B:** 2
	3	Variability	**A:** 1.4
		Labor Day	
	4	Histograms and Other Charts	**A:** 1.2, **B:** 3
	5	Pivot Tables	
	6	Using R for Descriptive Statistics	**C:** 1-31, 103-106
	7	Writing functions in R	**C:** 32-51, 100-103
	8	Review	**B:** 12, **D:** 5, 6
	9	**Exam 1**	
Part 2: Probability Analysis	10	Review	
	11	Rules of Probability	**A:** 2.1-2.5
	12	Probability Trees and Bayes' Theorem	**A:** 2.4
	13	Introduction to Discrete and Continuous Distributions	**A:** 3.1-3.3, 4.1-4.2
	14	Monte Carlo Method	**C:** 41-46
	15	Arbitrary, Bernoulli, and Binomial Distributions	**A:** 3.4, **B:** 4
	16	Negative Binomial and Poisson Distributions	**A:** 3.5-3.6
	17	Normal Distribution and Percentiles	**A:** 4.3, **B:** 5
	18	Exponential & Weibull Distributions and Probability Plots	**A:** 4.4-4.6
	19	Joint Probabilities	**A:** 5.1
	20	Central Limit Theorem	**A:** 5.3-5.4, **B:** 6, **C:** 47-51
	21	Review	**D:** 1-4, 7-8
	22	**Exam 2**	
Part 3: Hypothesis Testing	23	Review	
	24	Scientific Method	**A:** 8.1
	25	Hypothesis Test p-values	**A:** 8.4, **B:** 8, **C:** 66-68
	26	One Sample Tests	**A:** 8.2-8.3
	27	Two Sample Tests	**A:** 9.1-9.4, **C:** 68-71
	28	Single Factor ANOVA Tests	**A:** 10.1, **C:** 89-92
	29	Two Factor ANOVA Tests	**A:** 11.1-11.2
	30	Chi-Squared Tests	**A:** 14.3, **B:** 11, **C:** 72-76
	31	Calcualting p-values by hand from the test statistic	**B:** 9
	32	Confidence Intervals	**A:** 7.1-7.4, **B:** 7, **C:** 59-65
	33	Type I and Type II Errors, Practical Signficance	**A:** 8.5, **B:** 13,14
	34	Review	**D:** 9-12
	35	**Exam 3**	
Part 4: Statistical Models	36	Review	
	37	Regression Introduction	**A:** 12.1-12.2, 13.4, **B:** 10
	38	Model Validation	**A:** 12.3-12.4, **C:** 77-89
		Fall Break	
		Fall Break	
		Fall Break	
	39	Modeling Process	**A:** 13.5
	40	Diagnostics of Assumptions	**A:** 13.2-13.3
	41	Transformations and Polynomial Regression	**A:** 13.2-13.3
	42	Review	**C:** 94-97, **D:** 13
	43	**Exam 4**	
	44	Review	**D:** 1-13
		Final Comprehensive Exam	

***Reading - A:** *Probability and Statistics*, **B:** *Statistics Essentials For Dummies*, **C:** *simpleR*, **D:** *FE Review Chapter 6*.
**Homeworks (HW) and Projects (P) are due before class begins. *I will <u>not</u> accept homework or projects that are late.*

Homework (For Future Classes)

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HW 3.	2-2, 2-9, 2-12, 2-13, 2-26, 2-37, 2-38, 2-47, 2-60, 2-78		
HW 4.	3-11, 3-23, 3-46, 3-50, 3-51, 3-81, 4-1, 4-28, 4-65	4-34	3-75, 4-60, 4-72, 4-95
HW 5.		8-24, 8-39, 9-28, 9-36, 9-61	8-58, 8-59, 9-23, 9-38, 9-90
HW 6.		10-6, 10-8, 11-5, 11-10	10-9, 11-17, 11-20, 14-28, 14-29,14-31
HW 7.	12-7, 13-39	12-14, 12-16, 12-17, 12-18, 12-19, 12-24, 13-44, 13-45	
HW 8.	13-38, 13-40, 13-59	13-4, 13-5, 13-15, 13-26, 13-42, 13-43, 13-62	

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B: *Statistics Essentials For Dummies*, by Deborah Rumsey (2010 Wiley) http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470618396.html

C: *simpleR – Using R for Introductory Statistics*, by John Verzani (2001 John Verzani) Available here: http://www.webpages.uidaho.edu/~mlowry/Teaching/STAT_301/Supplemental/Verzani-SimpleR.pdf

D: *FE Review Chapter 6. Probability and Statistics* Chapter excerpt from FE Review Manual: Rapid Preparation for the Fundamentals of Engineering Examby Michael Lindeburg (2010) Available here: http://www.webpages.uidaho.edu/~mlowry/Teaching/STAT_301/Supplemental/FE_Review_Ch6.pdf

Additional Optional Reading

E: *Probability For Dummies*, http://www.wiley.com/WileyCDA/WileyTitle/productCd-0471751413.html

F: *Statistics For Dummies*, http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470911085.html

G: *Statistics II For Dummies*, http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470466464.html

H: *Statistical Analysis with Excel For Dummies*, http://www.wiley.com/WileyCDA/WileyTitle/productCd-1118464311.html

I: *R For Dummies*, http://www.wiley.com/WileyCDA/WileyTitle/productCd-1119962846.html

J: *Pivot Table Tutorial* http://www.webpages.uidaho.edu/~mlowry/Teaching/STAT_301/Supplemental/PivotTableTutorial.pdf

K: *Making Data Meaningful Part 2: A guide to presenting statistics* http://www.webpages.uidaho.edu/~mlowry/Teaching/STAT_301/Supplemental/MDM_Part2.pdf