STT 464
Statistics for Biologists
Interdepartmental with Animal Science/Plant, Soil and Microbial Sciences
Fall 2019

COURSE:

Statistics 464 - Statistics for Biologists

INSTRUCTOR:

Dr. Rob Tempelman
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1205J Anthony Hall
Tel: 517-355-8445
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GRADER:

TBA

OFFICE HOURS FOR TEMPELMAN:

Afternoons after class (3:50 – 4:30 p.m. Mon, Wed, Fri)
Other times by appointment (through phone/email) please
If you send an inquiry by email, I will almost always answer within 12 hours

OFFICE HOURS FOR GRADER:

TBA

TEXTS:

1. Course Notes: available online through MSU D2L (www.d2l.msu.edu)

2. *Statistical Methods 3rd Edition* (2010) by R.J. Freund, W.J. Wilson, and Donna L. Mohr. Academic Press, ISBN 0-12-267651-3. This resource is FREELY available to anybody downloading materials from a campus computer through the MSU library link www.lib.msu.edu (or specifically: http://www.sciencedirect.com.proxy2.cl.msu.edu/science/book/9780123749703)

3. *Introductory Statistics with R. 2nd Edition* (2008) by Peter Dalgaard, Springer, ISBN 978-0-12-374970-3
This resource is also FREELY available to anybody downloading materials from a campus computer through the MSU library link www.lib.msu.edu (or specifically: http://www.springerlink.com.proxy1.cl.msu.edu/content/m17578/?MUD=MP)

4. *OpenIntro Statistics Textbook*
https://www.openintro.org/stat/textbook.php

Please note that the following electronic textbooks pertaining to the use of R in statistical analyses are freely available to the MSU community and may be useful for the course.

General Introduction to R references

http://www.springerlink.com.proxy1.cl.msu.edu/content/ht5453/#section=1024950&page=1 (*R by example: Concepts to Code* by Jim Albert and Maria Rizzo)
http://www.springerlink.com.proxy1.cl.msu.edu/content/m00470/#section=872625&page=1 (*Tiny Handbook of R,* by Mike Allerhand)
http://www.springerlink.com.proxy1.cl.msu.edu/content/w26370/#section=79195&page=1 (*A Beginner's Guide to R* by Alain F. Zuur, Elena N. Ieno and Erik Meesters)

General statistics and R references

http://www.crcnetbase.com/isbn/978-1-4398-2755-0 (*Using R for Data Management, Statistical Analysis, and Graphics* by Nicholas J. Horton and Ken Kleinman)
http://www.crcnetbase.com/isbn/978-1-4200-7933-3 (*Handbook of Statistical Analyses Using R, Second Edition* by Torsten Hothorn and Brian S. Everitt)
http://www.crcnetbase.com.proxy1.cl.msu.edu/ISBN/9781584885740 (*Multiple comparisons using R* by Frank Bretz, Torston Hothorn, and Peter Westfall).
http://onlinelibrary.wiley.com.proxy1.cl.msu.edu/book/10.1002/9781444319620 (*Biostatistical Design and Analysis Using R* by Murray Logan)
http://www.springerlink.com.proxy1.cl.msu.edu/content/j50262/#section=1003214&page=1 (*Biostatistics with R: An Introduction to Statistics through Biological Data* by Babak Shahbaba)
http://onlinelibrary.wiley.com.proxy1.cl.msu.edu/book/10.1002/9780470721896 (*Statistics and Data with R: An applied approach through examples* by Yosef Cohen and Jeremiah Y. Cohen)
http://site.ebrary.com.proxy1.cl.msu.edu/lib/michstate/docDetail.action?docID=10435404 (*Statistical Analysis with R* by John M. Quick)

Statistics and R references with specific biological application areas:
http://www.crcnetbase.com/isbn/978-1-4200-8826-7 (*Introduction to Data Analysis with R for Forensic Scientists* by James Michael Curran)
http://www.springerlink.com.proxy1.cl.msu.edu/content/p415n2/#section=641583&page=1 (*Advances in Social Science Research Using R* by H.D. Vinod)
http://www.springerlink.com.proxy1.cl.msu.edu/content/x36228/#section=808528&page=1 (*Forest Analytics with R* by Andrew P. Robinson and Jeff D. Harnann)
http://onlinelibrary.wiley.com.proxy1.cl.msu.edu/book/10.1002/9780470987605 (*Statistical Data Analysis Explained: Applied Environmental Statistics with R* by Clemens Reimann, Peter Filzmoser, Robert G. Garrett, and Rudolf Dutter)
http://www.springerlink.com.proxy1.cl.msu.edu/content/p70228/#section=982568&page=1 (*Analysis of Phylogenetics and Evolution* by R Emmanuel Paradis)

http://www.springerlink.com.proxy1.cl.msu.edu/content/l48073/#section=64710&page=1 (*A Primer of Ecology with R* by M. Henry H. Stevens)

http://www.springerlink.com.proxy1.cl.msu.edu/content/uw07v1/#section=147788&page=1 (*Applied Spatial Analysis with R* by Roger S. Bivand, Edzer J. Pebesma and Virgilio Gómez-Rubio)

GRADING PROCEDURE:

MATERIAL	**Contribution to GradePoint**
First Hourly Test (around September 27, 2019)	15%
Second Hourly Test (around October 25, 2019)	15%
Third Test (Monday November 25, 2019) TWO HOURS	15%
Pop Quizzes (**At least** 5 throughout the year, each worth 1% or less)	5%
Homework (likely 10-11 homeworks; I'll drop the lowest two homework scores)	25%
Final Examination (**MONDAY** December 9, 2019 @ 3:00 p.m.)	25%

- The first and second test will be held in class, the third test will be scheduled for two hours so plan to stay for an extra hour after class pending availability of classroom. These dates are tentative; however, final test-dates will be announced at least 9 days in advance. And yes, we will still have class scheduled for the Wednesday before Thanksgiving.

- **If you have a 4.0 GradePoint within 7 days of the final examination, you are not required to write the final. Your GradePoint will then be based on all other materials and reweighted accordingly (i.e., divide the above percentages by 75), including homework due during the last week of classes.**

However, please note that if you did qualify and your last homework is not graded 7 days prior to the final examination, you do run the risk of having a GradePoint < 4.0 if your last homework was done poorly.

- **Pop Quizzes will be administered in between lectures. Typically, they should not take longer than 15-20 minutes to do and most often you would not be allowed more than 1 hour to complete them. Most likely, they would occur once every 1-2 weeks. They're intended to keep you on top of the material.**

Gradepoints on homeworks and tests/final are assigned as follows:

>90% ->	GradePoint = 4.0
80-89%	-> GradePoint = 3.5
70-79%	-> GradePoint = 3.0
60-69%	-> GradePoint = 2.5
50-59%	-> GradePoint = 2.0
35-49%	-> GradePoint = 1.5
20-34%	-> GradePoint = 1.0
10-19%	-> GradePoint = 0.5
<10% ->	GradePoint = 0.0

Student Learning Outcomes:

Students how successfully complete this course should

1. Attain fundamental statistical knowledge and skills to be able to perform exploratory and statistical analyses on experimental and observational research data in simple balanced and unbalanced designs.
2. Be able to read the scientific literature critically on fundamental experimental design, statistical analysis and proper interpretation of statistical inference.
3. Develop some proficiency in the use of a statistical software package, specifically R, to provide meaningful diagnostic plots and statistical analyses for simple designs and single-covariate regression.

COURSE OUTLINE (very approximate timeline)

Week	Topic
1	Introduction, Notation and Definitions, Exploratory Data Analysis, R statistical software
2	Descriptive measures, Probability
3	Distributions, Sampling distributions of statistics
4	Estimation/Confidence Intervals and Hypothesis testing
5	Power, Variance testing
6	Experimental Design, Multi-population (treatment) inference
7	Analysis of Variance (ANOVA), Linear Model, and Distributional Assumptions
8	Preplanned Contrasts, Multiple comparisons
9	Two-way factorials, interaction
10	Correlation and Linear Regression
11	Linear Regression/Residual and Influence Diagnostics
12	Categorical Data Analysis

Other notes:
The public domain software R will be used extensively throughout the course. You can download this software freely on your own laptop/desktop from http://www.r-project.org/. If you wish to get some practice with R, go through the introductory materials available at http://cran.r-project.org/doc/manuals/R-intro.pdf or the recommended text by Dalgaard. This software is also freely available on all MSU computer labs. For locations of these labs, check ***http://computerlabs.msu.edu/general.html***

Datasets required for homeworks will be periodically available on ANGEL.

Special note for the first week:

- Three computer lab orientations for STT 464 students have been scheduled. Your attendance at any one of the following two sessions is highly encouraged. Please sign up for one session via D2L.

    1. Tuesday September 3, 2019 9:00 –10:00 a.m.
    2. Wednesday September 4, 2019 4:30 –5:30 p.m.
    3. Wednesday September 4, 2019 11:15 a.m. – 12:15 p.m.

    All sessions will be held in Room 106 Farrall Hall

Please be aware of the following MSU policies:

1. **Academic Honesty**: Article 2.III.B.2 of the Academic Freedom Report states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, STT 464 adheres to the policies on academic honesty as specified in General Student Regulations 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See Spartan Life: Student Handbook and Resource Guide and/or the MSU Web site:www.msu.edu.)
   Therefore, unless authorized by your instructor, you are expected to complete all course assignments, including homework, lab work, quizzes, tests and exams, without assistance from any source. You are expected to develop original work for this course; therefore, you may not submit course work you completed for another course to satisfy the requirements for this course. Also, you are not authorized to use the www.allmsu.com Web site to complete any course work in this course. Students who violate MSU academic integrity rules may receive a penalty grade, including a failing grade on the assignment or in the course. (See also https://ombud.msu.edu/academic-integrity/How%20to%20an%20Allegation%20of%20Academic%20Dishonesty.html regarding your rights)

2. **Accommodations for Students with Disabilities** (from the Resource Center for Persons with Disabilities (RCPD): Michigan State University is committed to

providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation ("VISA") form. Please present this form to me at the start of the term and/or two weeks prior to the accommodation date (test, project, etc.). Requests received after this date may not be honored.

3. **Commercialized Lecture Notes**: Commercialization of lecture notes and university-provided course materials is **not permitted** in this course.*

4. **Disruptive Behavior**: Article 2.III.B.4 of the Academic Freedom Report (AFR) for students at Michigan State University states: "The student's behavior in the classroom shall be conducive to the teaching and learning process for all concerned." Article 2.III.B.10 of the AFR states that "The student has a right to scholarly relationships with faculty based on mutual trust and civility." General Student Regulation 5.02 states: "No student shall . . . interfere with the functions and services of the University (for example, but not limited to, classes . . .) such that the function or service is obstructed or disrupted. Students whose conduct adversely affects the learning environment in this classroom may be subject to disciplinary action through the Student Judicial Affairs office.

Graduate Student Life and Wellness:

If you're a new graduate student, please avail yourself of opportunities to address all aspects of your wellness at MSU, whether physical (e.g. http://recsports.msu.edu/ , social (e.g. https://cogs.msu.edu/ https://oiss.isp.msu.edu/health-wellness-and-safety/myssp/), spiritual (e.g. https://campusedgemsu.com/ https://msu.edu/~msa/), or otherwise (https://grad.msu.edu/wellness).

Take the pledge! http://splife.studentlife.msu.edu/spartan-code-of-honor-academic-pledge

SPARTAN CODE OF HONOR

As a Spartan, I will strive to uphold values of the **highest ethical standard**. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that **honor is worth more than grades**. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do.