CMDA-2006: (CRN 12710/19711) Integrated Quantitative Science II
Spring 2020

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Announcements are made repeatedly in class and/or posted on Canvas. Some announcements made in class may not be repeated on canvas. Students are responsible for checking Canvas regularly, and it is advised that students turn on Canvas email notifications.

Course description:
Integrated topics from quantitative sciences that prepare students for advanced computational modeling and data analytics courses. Intermediate linear algebra, regression, differential equations, and model validation.
Prerequisites: CMDA 2005, MATH 2114

Course Objectives: (Mathematics)
We will cover fundamental topics in linear algebra and differential equations. We shall concentrate on essential techniques for understanding and manipulating matrices and build understanding of system modeling through differential equations. These topics are the foundation of modern research and industrial practice in computational and data science. Specific topics include:
1. Orthogonality, and orthogonal decompositions
2. Matrix factorizations, and Computational Solution of Linear Systems
3. Eigenvalues, diagonalization, singular value decomposition, Computation of Eigenvalues
4. Ordinary differential equations, first and second order
5. Systems of differential equations, nonlinear systems
6. Numerical methods of solving systems of ODEs (with Python)

Course Objectives: (Statistics)
Students should leave CMDA-2006 with an understanding of the common types of traditional statistical methodology and procedures that are prevalent in modern research. This includes an expansion of many of the topics from CMDA-2005, and includes, but is not limited to:
1. Probability Distribution Models
2. Multivariate Distributions
3. Regression Methods
4. Model Validation & Selection Methods
5. One-Way & Two-Way ANOVA with Contrast Analysis
6. Random and Mixed-Effects Models
7. Categorical Data Analysis
8. Generalized Linear Models
9. Nonparametric Methods

10. Simulation

Required Course Materials:
- **Textbooks:**
1. **"Applied Statistics and Probability for Engineers", 5th ed. By Montgomery & Runger.**
   http://proquest.safaribooksonline.com.ezproxy.lib.vt.edu/9780470053041
2. *"Statistics for Engineers and Scientists", by William Navidi, 4th edition. McGraw-Hill ISBN 978-0-07-340133-1*
   https://www.amazon.com/Statistics-Engineers-Scientists-William-Navidi/dp/0073401331/ref=sr_1_1?ie=UTF8&qid=1503665850&sr=8-1&keywords=navidi

- Calculator: A scientific calculator with statistical functions will be needed. TI-83, TI-83 Plus, TI-84, or TI-84 Plus calculators are preferred. These calculators may be used on statistics exams (not math exams) but the memory must be cleared before each exam. Be sure to check the batteries **BEFORE** the exam. Phones/tablets MAY NOT be used for exams.
- Canvas: Announcements, assignments, lecture notes, etc. will be posted.

Required Software:

Download and install both R & RStudio (free)
- **https://cran.r-project.org/**
- **https://www.rstudio.com/products/rstudio/download/**

Download and install the Anaconda3 distribution of Python (free)
- **https://conda.io/docs/user-guide/install/download.html#**

Recommended Course Materials:
1. *"Linear Algebra: A Modern Introduction"*, 4th ed, by D. Poole, ISBN-13: 978-1285463247 (Strongly Recommended)
2. *"Elementary Differential Equations",* 2nd ed., by W. Kohler, L. Johnson, ISBN-13: 978-0321290441 (Strongly Recommended)
3. "Linear Models with R", 2nd ed., by Faraway, ISBN-13: 978-1439887332 - Very optional, only if you want a much deeper discussion on various topics.

Course Expectations:
1. Attendance is key to success. If you miss a lecture, you are responsible for getting all notes/materials and announcements from a fellow classmate and/or Canvas.
2. Be an active, nondisruptive participant in the class. Take notes, ask/answer questions, and be respectful of others. Please do not talk, text, etc. during class. Silence or turn off your phone.
3. Recording (voice, video, pictures) of the lecture is NOT allowed without permission granted for special circumstances.
4. Be prepared for class. Read the assigned textbook sections before class. The lectures are designed to be best understood if you have read the textbook.

Assessments and Grade Weighting:

Your grade will be determined based upon the following:

Homework, Projects, & In-class Quizzes: 20% = 10% Math + 10% Stat

In-class Midterm Exams (5-6): 60% = 30% Math + 30% Stat

Final Exam: 20% = 10% Math + 10% Stat

Scores and grades are posted on Canvas.

Appeals for points, partial credit, incorrect score, missing scores on Canvas, etc. should be brought to our attention in a timely manner. For homework that has been submitted to Canvas, use the comments box to contest grades first, then follow up with the TA. If the appeal is not resolved with the TA, then proceed to contact the professor.

The grading scale will be as follows:

- [92.5, ∞)   A
- [89.5, 92.5)   A-
- [86.5, 89.5)   B+
- [82.5, 86.5)   B
- [79.5, 82.5)   B-
- [76.5, 79.5)   C+

- [72.5, 76.5)   C
- [69.5, 72.5)   C-
- [66.5, 69.5)   D+
- [62.5, 66.5)   D
- [59.5, 62.5)   D-
- [0, 59.5)   F

The instructors reserve the right to use their discretion in assigning grades in borderline cases. Note that this grading scale already incorporates rounding so you should not assume, for example, that a final percentage grade of 92.47 will be rounded to an A.

Homework, Projects, and In-class Quizzes:

Homework will be assigned and collected on a regular basis. Due dates will be posted on the assignment and on Canvas. We will also remind you about due dates during class. You are permitted, and encouraged, to discuss the assignments with other students, but the final work (including computer code) must be entirely your own. Copying the work of other students is a violation of the Honor Code (see section below).

Homework will consist of pencil-and-paper type problems and/or problems that require you to use software (R/RStudio or Python).

For the pencil-and-paper portion of the assignment, you must show a ***reasonable*** amount of algebraic work (showing your steps) in addition to using complete sentences to provide sufficient explanations. **Showing no work will result in no credit.**

For problems that use Python and/or R, you will need to upload your small write-up (.pdf preferably) and computer code (.py or .R files) to canvas. Specific instructions will be given in the assignments.

In-class Quizzes will be given and occasionally collected for a grade.

Graded In-class Quizzes can be made up only with PRIOR consent of the instructor. An exceptional arrangement might be made only in the case of a legitimate documented excuse. All university policies regarding religious observances and health related absences will be followed.

Projects are like homework assignments but require more effort and may feature open ended questions with less direction. Due dates will typically be longer than a regular homework assignment. The use of R and/or Python will be essential to completing projects.

Submitting Assignments:

Assignments will be submitted to Canvas only. Do not email the instructors or teaching assistants your assignment materials to be graded. If the assignment is not on Canvas, it will not be graded.

Do not wait until the last minute to turn in assignments. Canvas will flag late assignments. Late assignments will not be accepted and will not be graded. *For example, if an assignment has a 1pm deadline, submit the assignment BEFORE 1pm.* We will not accept excuses that you "finished the assignment, but forgot to turn in the assignment, here is my screenshot to prove it" and similar statements. Students have doctored such images in the past and were reported for honor code violations.

Exams:

There will be 5-6 midterm exams (2-3 for statistics, 3 for mathematics; dates to be determined) and one cumulative final exam (covering all aspects of the course). Exams will be closed book and closed notes, unless exceptions are specifically announced.

Some exams (especially Statistics) may allow the use of calculators for the exam. See the calculator requirement section at the top. Tablets, phones, and other connected devices are strictly forbidden. Make sure to check your calculator batteries before coming to the exam. You will not be allowed to share calculators.

Exams can be made up only with PRIOR consent of the instructor. An exceptional arrangement might be made only in the case of a legitimate documented excuse. All university policies regarding religious observances and health related absences will be followed.

The final exam for CRN 12710 is scheduled for Wednesday, May 13th from 10:05am-12:05pm in Room NCB 230 which is our normal MW classroom.

The final exam for CRN 19711 is scheduled for Monday, May 11th from 7:45am-9:45am in Room NCB 230 which is our normal MW classroom.

The final exam is a required class meeting that will not be rescheduled for discretionary reasons, *including conflicts with work schedules, classes and exams at other colleges, or attempting to leave for vacation early because of cheaper flights, etc.*

Work Presentation:

Do your best to present your work in a well-organized and professional manner. Work should be done in pencil (mistakes happen, easy to erase!) and/or typed, if appropriate. Please write legibly! The easier it is to read, the easier it is to grade! When homework is submitted, list the problems in the assigned order.

Other class policies:

- If you need course adaptations or accommodations because of disability or medical emergencies, notify the instructor.
- Barring illness or other unforeseen emergencies, missed homework assignments, in-class quizzes, and exams cannot be made up and will receive a grade of zero. The only other exceptions to this policy are if you are involved in an official University activity (e.g., out-of-town competition) or event directly related to your graduate program (e.g., conference) that cannot be scheduled at another time. In those instances, you must notify the instructor at least three weeks prior to the date that the missed homework will be assigned or missed exam is scheduled, so that alternative arrangements can be made.
- Any questions about homework grades should be referred first to the teaching assistant. If you have questions about an exam grade, or cannot resolve an issue with the teaching assistant, see the instructor during office hours.
- Questions on grading are to be submitted in writing, no earlier than 24 hours *after* the assignment has been returned or grades have been posted.
- The grader reserves the right to mark off for untidy or unclear submitted work. All work must be written (or typed) neatly, with each problem clearly labeled and final answers clearly indicated.

Classroom Courtesy:

Note taking computers are only to be used in the flat-on-the-desk position. Other uses of electronic devices are a potential distraction to others and are not permitted.

Please be sure phones are turned off or silenced (vibrations can still distract others).

Use of cell phones or computers during class for entertainment purposes (games, texting, social media, web browsing, etc.) is not acceptable.

Make an effort to be on time to class. If you must leave early, please do so quietly and let one of your professors know before class.

Course Feedback:

Toward the end of the semester the online Student Perceptions of Teaching (SPOT) questionnaire will be used to gather feedback on particular aspects of the course and instruction.

Constructive student feedback is important for enhancing the learning experience in this course. We read and consider all student comments regarding the course and instruction.

Honor Code:

The Undergraduate Honor Code pledge that each member of the university community agrees to abide by states:

"As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do."

Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code. For additional information about the Honor Code, please visit: www.honorsystem.vt.edu.

Assignments submitted shall be considered ``graded work'' and all aspects of your coursework are covered by the Honor Code. All projects and homework assignments are to be completed individually unless otherwise specified.

Commission of any of the following acts shall constitute academic misconduct. This listing is not, however, exclusive of other acts that may reasonably be said to constitute academic misconduct. Clarification is provided for each definition with some examples of prohibited behaviors in the Undergraduate Honor Code Manual located at www.honorsystem.vt.edu.

A. CHEATING: Cheating includes the intentional use of unauthorized materials, information, notes, study aids or other devices or materials in any academic exercise, or attempts thereof.

B. PLAGIARISM: Plagiarism includes the copying of the language, structure, programming, computer code, ideas, and/or thoughts of another and passing off the same as one's own original work, or attempts thereof.

C. FALSIFICATION: Falsification includes the statement of any untruth, either verbally or in writing, with respect to any element of one's academic work, or attempts thereof.

D. FABRICATION: Fabrication includes making up data and results, and recording or reporting them, or submitting fabricated documents, or attempts thereof.

E. MULTIPLE SUBMISSION: Multiple submission involves the submission for credit without authorization of the instructor receiving the work—of substantial portions of any work (including oral reports) previously submitted for credit at any academic institution, or attempts thereof.

F. COMPLICITY: Complicity includes intentionally helping another to engage in an act of academic misconduct, or attempts thereof.

G. VIOLATION OF UNIVERSITY, COLLEGE, DEPARTMENTAL, PROGRAM, COURSE, OR FACULTY RULES: The violation of any University, College, Departmental, Program, Course, or Faculty Rules relating to academic matters that may lead to an unfair academic advantage by the student violating the rule(s).

Honor Code Pledge for Assignments:

The Virginia Tech honor pledge for assignments is as follows: **"I have neither given nor received unauthorized assistance on this assignment."**

The pledge is to be written out on all graded assignments at the university and signed by the student. The honor pledge represents both an expression of the student's support of the honor code and an unambiguous acknowledgment that the student has, on the assignment in question, abided by the obligation that the Honor Code entails. In the absence of a written honor pledge, the Honor Code still applies to an assignment.

Understanding the Code:

The Virginia Tech Office of Academic Integrity hosts ``Understanding the Code'' seminars to ``students to become more familiar with the Undergraduate Honor Code, and better understand classroom expectations related to academic integrity.'' There is also an online Module offered through Canvas.

You are required to take the online module (link below) this semester.

https://canvas.vt.edu/enroll/NCWG7M

For further clarification:

- You will receive a certificate indicating that you have completed the online module. Take a screenshot of this certificate and submit it to Canvas to complete this requirement.
- The university policy for the penalty for honor code violations is an F* as final grade. Instructors are permitted to recommend reduced penalty.

    If you do not complete this requirement, instructors in this class will not consider recommending reduced penalties in the event of violations.

- Ask the instructor if you have any questions about completing this requirement.
- If another class this semester has this same requirement, you only need to take the online module once but be sure to upload a screenshot of the certificate so that we know you completed the module.

CMDA Statement on Academic Integrity:

The field of Computational Modeling and Data Analytics requires professionals who act with the highest ethical standards. CMDA teaches skills that empower you to have a tremendous impact upon the world. We teach you these skills with the expectation that you will exercise them responsibly.

Responsible practice is a habit forged during your undergraduate studies. CMDA majors demonstrate their sound ethical foundation by completely adhering to the Virginia Tech Honor Code in all of their courses. Not only do these policies prepare you for a rewarding professional life; they are designed to help you learn as much as possible from your courses.

Unless a faculty member explicitly states a different policy, the following rules apply to all work submitted in your CMDA classes.

- You are free to discuss general ideas about projects and homework problems with your classmates. You may not show a completed solution to another classmate, nor may you view theirs.
- You must state the names of any classmates whom you have helped or received help from. State these names clearly at the top of your assignment.
- The work you turn in must be your own write-up: you may not copy solutions from another student, even if you worked together to understand the underlying techniques. Your write-up must be prepared separately from your classmates.
- The use of solutions or assignments from prior sections of the class (or similar classes at other institutions, GitHub, Stack Overflow, rent-a-coder sites, etc.) is strictly prohibited, regardless of how they are obtained.
- Be sure to clean up your public workspace when you are done: for example, erase the whiteboards and do not leave code print-outs behind in the CMDA Collaboration Center.
- You are free to discuss general ideas about computer programming, algorithms, and debugging strategies at a conceptual level.
- You may not view one another's code. You may not debug someone else's code. You may not share code or receive code. This rule applies to source code and scripts, as well as LaTeX code. Copying from a screenshot, a photo of a screen, a print-out, or by any other mechanism, electronic or otherwise, is prohibited. You cannot provide this assistance to students in classes you have already taken, unless you are serving in an official capacity as an Undergraduate Learning Assistant or CMDA Computing Consultant.
- You are free to get help on programming issues and assignments from the course instructor, Graduate Teaching Assistants (GTAs), Undergraduate Learning Assistants (ULAs), and CMDA Computing Consultants (provided they are not enrolled in your class).
- You may not post solutions (or any other course material) online, outside of Canvas. Sharing any course materials on third party "study resource" sites is strictly prohibited.
- You are expected to report any violations of the Virginia Tech Honor Code and this policy to the course instructor, the CMDA academic advisors, or the CMDA division leader.

If you are uncertain or concerned that a behavior might be a violation
of the Honor Code, please ask your instructor for clarification.
The CMDA faculty are eager to help.

Special Requests:

If for any reason you need special considerations please let me know as soon as possible. We can work together to make sure your needs are met. All requests must be approved by the university. Feel free to visit www.ssd.vt.edu for additional information

Note:

The policies in this syllabus and related course schedule are subject to reasonable adjustments as the class progresses. In such instances, the instructor will provide students with sufficient notice in the form of announcements in class and on Canvas.