Ma 444 ~ Regression and Time Series
Spring Semester 2024 – 2025

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Office Hours:	Daily by appointment, see https://calendly.com/mgardeng/20min or https://calendly.com/clacey-bju
Preferred Method of Communication:	MS Teams; personal correspondence by personal chat and general course/content related questions in the course general channel
Email:	mgardeng@bju.edu or clacey@bju.edu
Textbook:	*Regression Modeling with Actuarial and Financial Applications* by Edward W. Frees, Cambridge University Press. ISBN 978-0-521-13596-2 *An Introduction to Statistical Learning with Applications in R* by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani
Calculator:	TI-30XS MultiView (TI 89/Nspire only by permission of the instructor for non-actuarial majors) and R/R-studio software installed
Course Website:	http://math.bju.edu/ma444/

Catalog Description: Linear regression, linear time series analysis, development and evaluation of regression and time series models, and forecasting. Exposure to a common analysis software package. *Second semester, three credits. Prerequisite: Ma 441*

Course Context:
This course supports the following objectives of the mathematics and actuarial programs:

MM1: Progress logically from premises to valid conclusions in a variety of mathematical contexts.
MM2: Apply mathematics to model real-life situations.
MM3: Select and use technology for understanding, as well as a labor-saving or problem-solving tool.

ASM1: Solve problems using standard mathematical techniques.
ASM2: Progress logically from premises to valid conclusions in a variety of mathematical and applied contexts including analysis, statistics (both theoretical and applied), probability and finance.
ASM3: Apply mathematics to actuarial problems (such as financial math and probability modeling) in exercising the biblical mandate to have dominion over the earth.
ASM4: Use technology as a tool for understanding as well as a labor-saving or problem-solving tool.

Course Goals:
CG1: Develop mathematical maturity in creating and interpreting statistical models, specifically regression and time series. MM1-3, ASM1- 4.
CG2: Develop the ability to communicate technical results to a broad audience. MM2-3, ASM3-4.

Course Objectives: The student will be able to:
1. Understand the basic theory of regression analysis
2. Develop and interpret linear regression models (develop the least squares regression estimators for single and multiple regression models)

3. Perform and interpret hypothesis tests and create confidence intervals for linear regression models (under single and multiple regression including the development of estimators of the prediction variance)
4. Understand the basic theory of time series analysis
5. Develop and interpret time series models (including linear trend models, modeling seasonality components, differencing to find stationary series, and developing ARIMA models)

Experiential Learning Context: This course has been approved for EXP (Bruins Engage!) credit and addresses each of the five criteria for experiential learning: engagement, mentorship, challenge, ownership, reflection. **To receive EXP and course credit students must satisfactorily complete all EXP elements within the required timeframe, including**:
- EXP pre-test (if given in 2025)
- EXP post-test (if given in 2025)
- C- (28 points out of 40) or higher on the summative reflection questions
  - EXP Summative Reflection – approximately 150-word minimum for each of the four elements.
  - Students may revise their summative reflection one time to meet the C- standard.
- ***Failure to complete any of the above will result in an F for the course.***

Course Requirements: All assignments and points are tentative and will be revised as the semester progresses. See course webpage for homework assignments. See Canvas for updated schedules.
1. Three in-class tests (100-150 pts per test)
     Tentative test dates: Ch 1-2   2/7; Ch 3-6   4/4; Ch 7-9   4/25
2. Approximately 7 quizzes in Coaching Actuaries focusing on the SRM portion of the course (5 pts per quiz)
3. Weekly homework rubrics – 8 points each, for 15 weeks. Recommended problems are posted on the course webpage. Homework problems themselves will NOT be collected.

   Homework grades will intentionally be optional. You are expected to put in the time and effort to learn the material and stay current whether you submit these or not. Any homework not submitted by the due date will be ignored/excused (and will reduce your total points possible in the course). No late homework will be accepted.
4. Data analysis projects – expect two projects with oral and written components (approximately 800 pts total) (one project to select a data set and develop a thorough regression model for the dependent variable, one project to select a time series data set and develop an appropriate model). These projects represent about 50% of the overall grade.
5. Cumulative final exam (250 pts)

Grading Scale: Standard 10 point scale.

General Policies:
1. Compliance with student handbook policies is expected during class. The classroom is to be a professional environment. That means you are to come to class prepared for the day's discussion, your attention is expected to be on course related material, and you are expected to positively contribute to the class.

2. Late Policy:

    • Written assignments/projects are penalized at 15% off if turned in within 3 calendar days of the due date and are a 0 after that for the first late.   Additional late papers will incur an additional 10% penalty per incident (2nd is 25%, 3rd is 35%, etc.).

    • Oral presentations are a 0 if not presented on the day assigned.

    • In-class tests must be taken by the date given in class unless there is incapacitating illness (see attendance policy below).

    • Work may always be completed early (contact your professor if you wish to take a test early).

    Exceptions may be granted by your professor in emergencies. Contact your professor asap by Teams to notify them of the emergency.

3. University attendance policy is in effect (see https://home.bju.edu/bju-policies/ for details).

    Scheduled tests/quizzes should be taken before your *planned absence*; please contact your professor to make arrangements for doing so. You are personally responsible for getting notes from your classmates and discuss the missed material with them. You should not expect your professor to privately re-teach you the material you missed. Your professor is always available to help you with specific questions.   If an unannounced quiz/assessment is taken during the class that you miss, you will NOT be allowed to make it up, and you WILL receive a zero on the assignment. Work may always be completed early (see your professor if you wish to take a test early).

    Missing a test because you feel you are not prepared to take it is **not** acceptable. Work missed for this reason will not made up and you will receive a zero on the assignment.

    For *absences due to incapacitating illness or emergency*, you should contact the instructor as soon as you realize you will not be in class to make arrangements to make up any missed work. Tests will be made up without penalty for the first occurrence. Each subsequent time a test is missed because of incapacitating illness or emergency, an additional 10 percent grade penalty for that test will be incurred. A 10% penalty will be assessed for a late submission of take-home tests.

4. University academic integrity policy is in effect (see https://home.bju.edu/bju-policies/ for details).

    Since the goal of the assignments in this course is to learn to develop the skills covered NOT complete the tasks assigned, and since the use of AI to complete or jumpstart tasks usually defeats the goal of the assignments, you may not use generative AI tools (i.e. Chat GPT, Bing Chat, Google Bard, etc.) in this course for any assignment without the professor's express permission. Should an AI tool be used with permission, its use must be documented (including the tool used and the portions of the assignment that were based on AI generated work).

    Cheating is defined as any use of unauthorized helps, and plagiarism is defined as taking someone else's words and/or ideas and claiming them as your own. At no time may you copy solutions from the internet or a solutions manual. The work you present should represent your own effort and your own understanding of the work.

    Doing your own work brings glory to God. The claiming of someone else's work as your own is cheating and is a sin. All work done for this class needs to be your own. If information is taken

from other sources (which is at times appropriate), it always needs to be referenced and credit given where it is due. Use standard referencing techniques as taught in En 102. Solutions found on the internet are not to be copied.

Homework: While you are encouraged to work together on the homework assignments, simply copying someone else's solution is neither useful nor acceptable. Your homework should represent your work and your understanding of the work.

Projects: You are encouraged to discuss the general ideas of data analysis as discussed in this course with your classmates but are **not** permitted to "work together" on your project (outside of your own team and any faculty appointed advisors). Your projects must represent your own ideas and your own work. Use of generative AI code may be helpful during the project (each student has permission to use AI for only this purpose, other purposes require express permission). It would be wise to consult with your professor before incorporating it into your work. Reliance on AI to generate code has not yet resulted in an acceptable paper. <u>If you do use it, you must document it as indicated above</u>. You may NOT use AI to generate the text/discussion in your project.

In-Class Tests: In today's age of technology, cheating includes getting unapproved help from a source on the internet and/or using your calculator to provide you with additional information during a test. The presence of any unauthorized material on your desk/computer while taking a test will be construed as cheating and will be dealt with as such. Cheating on a test may result in a zero on the test plus any penalties imposed by the Academic Integrity Committee.

Take-Home Tests: Take-home tests are also expected to represent your own work. All guidelines for in-class tests also apply to take-home tests unless explicitly stated otherwise in the directions. No collaboration, discussion, consultation, etc. with any person is permitted. Cheating on a test may result in a zero on the test plus any penalties imposed by the Academic Integrity Committee.

If you have a question about any source you are considering using, please gain your professor's approval before using it. You are always permitted to ask your professor for help. Any help they choose to provide is acceptable.