BOB JONES UNIVERSITY
Department of Mathematics

Ma 345 ~ Probability

Fall Semester 2026-27

Professor:	Dr. Melissa Gardenghi, mgardeng@bju.edu
Office:	Al 38
Office Hours:	Daily by appointment, `https://calendly.com/mgardeng/20min`
Preferred Contact:	MS Teams; personal correspondence by personal chat and general course/content related questions in the course general channel
Textbooks:	*Freund's Mathematical Statistics* 8^{th} by Miller and Miller
Technology:	Calculator: TI-89 or TI-Nspire CAS
Course Website:	`http://math.bju.edu/ma345/`

Course Description

Elementary combinatorial analysis, independence and dependence, random variables, distribution functions, expectations, moment-generating functions, standard discrete and continuous single and multi-variate distributions, central limit theorem, order statistics. Required Calculator: TI 89 or TI NSpire CAS.

Prerequisite: Ma 299, Corequisite: Ma 235

Course Context

This course supports the following objectives of the mathematics and actuarial program:

- 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.
- AS1: 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.
- AS2: Apply mathematics to actuarial problems (such as financial math and probability modeling) in exercising the biblical mandate to have dominion over the earth.
- AS3: Use technology as a tool for understanding as well as a labor-saving or problem-solving tool.

Course Goals

The student will . . .

- CG1: Develop foundational principles in probability.
- CG2: Develop the structure, theory, and use of standard probability models.
- CG3: Develop the basic multi-variate model and the applications of functions of random variables.

Course Objectives

The student will be able to ...

1. Develop and use standard enumeration/combinatorial techniques.
2. Develop and use elementary probability laws.
3. Develop key properties of single and multi-variate probability models.
4. Develop and use standard discrete and continuous probability models.
5. Develop and use change of variable methods.
6. Develop sampling distributions and introduce the Central Limit Theorem and its application.

Course Requirements

The course grade will consist of

- Approximately four unit in-class tests (Chs 1-2, 3-4, 5-6, 7-8) as announced in class, worth 200 points.** Tentative Test Dates: Dates may shift depending on when material is finished in class. To better anticipate test dates, note the number of sections remaining in the chapter. See Canvas for current schedule.
  Ch 1-2 Sept 17; Ch 3-4 Oct 10; Ch 5-6 Nov 7; Ch 7-8 Dec 10
- Approximately 20 quizzes, worth 5 pts each, completed on the Coaching Actuaries (CA) platform (see Canvas for instructions on accessing CA). Practice problems are available in Coaching Actuaries and recommended problems from the text are posted on the course webpage. Homework should be completed to develop mastery. Mastery is assessed by the CA quizzes. Homework problems themselves will NOT be collected.
- Homework engagement assignments for each test: 10 points each, see engagement homework, https://forms.office.com/r/dTXD4SMEuP?origin=lprLink
- TPD (Theory/Proof Development) for each chapter, worth 104 points total (variable per chapter).
- Cumulative Introduction to R assignment, worth 40 points.
- Other assignments/quizzes as announced in class.
- A cumulative final exam, worth 300 points.

** Dates and point assignments are subject to change.

Course Evaluation

All course/assignment grades are based on the evaluation of the work communicated by the student. Unclear or incomplete communication of the solutions, which includes the process, may result in a penalty at the professor's discretion.

Letter grades will be based on a standard 10-point scale. Final grades for this course will not automatically be rounded up. Rounding is contingent on the student's homework/engagement grades throughout the semester.

Office Hours

Office hour appointments can be made using the Calendly site (appointments may be made up to two weeks in advance), https://calendly.com/mgardeng/20min. If there are no available times at which you are able to meet, send Dr. Gardenghi a message including some days/times between 7:30am and 3pm when you are available.

General Policies

Deportment

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.

Emergencies During Class

In case of emergency requiring evacuation, students will go down the stairs on the Student Center side and exit the door facing Wade Hampton underneath the stairs. Students will immediately cross the street and gather by the fence with their class. If we are unable to exit the building, the professor will instruct the students on the best course of action. To be able to respond quickly to external threats, professors may keep classroom doors locked. If you are late arriving to class, you may need to knock on the door and be let in.

Inclement Weather/Class Cancellation

In case of inclement weather or other unforeseen circumstances requiring that class be cancelled, you should expect to receive direction from the professor indicating how class content will be covered during that period. This may include class meeting at the usual time on Teams, a recorded lecture, or a written assignment. Attendance/engagement expectations will be given and failure to participate as instructed may result in a class absence or/and a zero on an assignment.

Absences

BJU 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 discussing 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 an in-class test because you feel you are not prepared to take it is not acceptable. Work missed for this reason will not be 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. See late policy for details on missed assignments.
- Students who must be reinstated due to excessive absences/lates may earn at most a $B+$ in the course.

PRESENTATION OF WORK

The goal is professional, fluent, and clear communication of what you know.

PW 1: Proper use of mathematical notation is expected. The structure of notation conveys specific meaning and should be used appropriately.

PW 2: Mathematical presentation is like grammar. There are subjects, verbs ($=, \leq, >$, etc.), and objects. Always write in "complete sentences."

PW 3: Tests/presentations/projects are not about what you know, but about what you can communicate about what you know – so the presentation of your work/logic should always be neat, orderly, clearly defined, and with the appropriate amount of supporting detail. (Excessive steps are not required; however, answers alone are not (usually) acceptable.)

PW 4: Always work down the page. (Working in multiple columns is generally not acceptable.) There should be one problem worked in each "row" because this contributes to clarity and the development of your logical argument.

PW 5: Skip lines between problems (and within problems as necessary for clear communication). If you have dense handwriting, skip every other line and skip 2-3 lines between problems.

PW 6: Clearly label/number problems/sub-problems. Problems do not necessarily have to be worked in order but must be clearly labeled either way. Your professor will communicate their expectation on presenting problems out of order.

PW 7: Answers are to be presented as the logical conclusion of your work, not as the only important thing (e.g. at the start of the problem and/or unconnected with any justifying work).

PW 8: Work should be submitted on clean 8.5×11 inch (standard-size) paper and should not be submitted with "spiral"/ripped edges.

PW 9: Take-home tests (when time is not limited) should be neatly presented (rewritten, organized, no scratchwork, etc.) as a final polished piece.

PW 10: Follow any additional instructions given.

Your professor may refuse to accept work that does not meet the minimum presentation requirements above, or they may choose to deduct up to 10% from the assignment.

PROBLEMS EXPECTATIONS

The goal is to prove your mastery (not your just barely comprehending). Failure to meet these expectations will be reflected in lower test scores.

PE 1: Read all words carefully in a question. Everything is important, so know what the meanings of all words are and how those words tell you to respond.

PE 2: Theory is a precise expression of important ideas. While it is not graded word for word, jot for jot, the precise ideas must be maintained. Embrace thorough, smooth learning and presentation. Can you recite the theory from the last class period quickly, comfortably, and conversationally?

PE 3: Theory tells us how to solve problems. Know exactly what problems connected to each theorem or definition look like, and know how to solve them.

PE 4: Know what the key steps of each problem are. Present only the key steps (or the minimum needed to get the answer right and show all your logic).

PE 5: Do enough practice for each type of problem so that you are smooth.

Homework

Homework is intended as a space for you to develop conceptual understanding and skill at communicating your understanding. All homework problems completed should align will the presentation guidelines to ensure you are prepared to present well on the test. Failure to present appropriately on tests will result in a penalty.

You are "done" with homework when you can anticipate test questions, solve them, and appropriately communication those solutions regardless of how many or few problems you have completed.

Engagement homework will be assessed at the start of the corresponding test period.

Late Policy

Assignments not submitted as directed by the due date will incur the following late penalty.

- Homework is due by the start of the class period. No late homework/in-class assignments are accepted.
- Written assignments/projects/take-home tests are penalized at 15% if submitted within 3 calendar days of the due date and are a 0 after that. Oral presentations are a 0% if not presented on the day assigned.

  Late paper submissions must include the date and time the paper is submitted.
- In-class tests must be taken by the date given in class (or selected time in the case of an oral exam) unless there is incapacitating illness (see attendance policy). Missing a test/taking the test late (including an oral exam) may result in a penalty unless excused by the professor.

  In-class tests will be made up without penalty for the first occurrence. Each subsequent time a test is missed, the penalty for taking the test late will increase by 10% with each occurence.

  Tests should be made up prior to the next class period unless other arrangements have been made with the professor.
- Work may always be completed early (contact your professor if you wish to take a test early).

Academic Integrity Policies

The university's Academic Integrity Policy is in effect (see `https://home.bju.edu/bju-policies/` for additional details).

Definitions of Integrity Violations

Integrity is the reflection of the character and nature of God in our actions; therefore, students will be expected to work with integrity. In academia, violations of integrity generally fall into one or more of the following categories:

- Cheating: unauthorized use or attempted use of assistance, information, or aids in any academic assignment
- Falsification: submitting work done by others, changing work after submitting an assignment, reporting false information about the completion of an assignment
- Unacceptable collaboration: working with others when not permitted, using AI to generate ideas, thoughts, or content without the explicit permission of the professor
- Facilitation of Cheating: helping another student violate academic integrity, communicating quiz/test questions to other students
- Plagiarism: the intentional or unintentional use to any degree of the ideas or words of one's source material without proper acknowledgement

All work done for this class must represent your own effort, your own understanding, and your own communication of the material.

Course Integrity Policies

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.
- Tests (In-Class and Take-Home): No resources may be used while taking the test unless permitted by the professor. The presence of any unauthorized material on your desk, in your calculator, on your laptop, etc. while taking a test will be construed as cheating and will be dealt with as such.

  Internet/AI enabled devices or any communication devices (including but not limited to smart glasses, watches, earbuds, etc.) are not permitted to be used and should be stored out of sight during the testing period. Access these type of devices during the test will be construed as cheating and will be dealt with as such.

  Cheating on a test will likely result in a zero on the test and will be submitted to the Academic Integrity Committee.

- Projects: You are encouraged to discuss the general ideas needed to complete the project 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, your own work, and your own communication of your work.

Assignment submissions will be evaluated for plagiarism and AI usage at the discretion of the professor. If you have a question about any source you are considering using, it is wise to 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.

AI Usage Policy

The goal of the assignments in this course is to learn to develop the skills covered, NOT to complete the tasks assigned. The use of AI to complete or jumpstart tasks defeats the goal of the assignments. Therefore, you may not use generative AI tools in this course for any assignment without the professor's express permission. AI tools include, but are not limited to, CoPilot, Apple Intelligence, Chat GPT, Bing Chat, Google Bard, Grok, Deepseek, Grammarly, and language translators.

Use of generative AI to develop code (such as Python or R) 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. If you do use it, you must document it as indicated above. You may NOT use AI to generate the text/discussion in your project.

Documentation of Permitted AI Use

Should an AI tool be used with permission, its use must be documented according to the expectations of the professor. Expectations may include the tool used, a summary of the prompts provided and the portions of the assignment that were based on AI generated work. See `https://style.mla.org/citing-generative-ai/` and `https://guides.lib.purdue.edu/c.php?g=1371380&p=1013507` for details on citing the use of AI.