

## Ma 418 ~ Actuarial Mathematics I

Fall Semester 2019 – 2020

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Instructor: Dr. Melissa Gardenghi  
Office: Alumni 38  
Office Hours: MWF 10:00 – 10:50 am; TTh 8:30 – 9:15 am; others by appointment  
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Course Webpage: <https://math.bju.edu/ma418/>

### Course Description:

Actuarial modeling, including life states, survival models, and relevant random variable calculations; premium and reserves calculations; pension and retirement calculations. First semester, odd-numbered calendar years, Corequisite: Ma 404

### Textbook/Calculator:

*Actuarial Mathematics for Life Contingent Risks*, 2<sup>nd</sup> edition, by Dickson, Hardy, & Waters (ISBN# 9781107044074). Please note that this text is not a statistics book. You may find it useful to have access to a mathematical statistics book for referencing information on various distributions. *Solutions Manual for Actuarial Mathematics for Life Contingent Risks* (ISBN# 9781107620261) is optional but not required.

Students may ONLY use the TI BA II Plus, TI-30Xa, TI-30X II, and TI-30X MultiView (adapted from SOA Exam guidelines, exceptions for non-actuarial students are made on a case by case basis).

**Course Context:** This course supports the following objectives of the actuarial program:

- ASM1: 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.
- ASM2: Apply mathematics to actuarial problems (such as financial math and probability modeling) in exercising the biblical mandate to have dominion over the earth.
- ASM3: Use technology as a tool for understanding as well as a labor-saving or problem-solving tool.
- ASM4: Build the communication skills necessary to effectively communicate technical information to a quasi-technical audience and provide the information necessary for data-based decisions.
- ASM5: Construct a biblically consistent philosophy of topics encountered in actuarial science.

### Course Goals:

- CG1: Review foundational and necessary statistical techniques. ASM1, ASM3
- CG2: Introduce the student to actuarial models. ASM1, ASM3
- CG3: Develop the student's ability to communicate information about technical aspects of actuarial science as well as a general understanding of what the discipline entails. ASM2, ASM3
- CG4: Encourage the appropriate use of technological tools to efficiently develop actuarial models. ASM1, ASM4
- CG5: Prepare the student, with the foundational material that will allow them to start preparing for the Modeling Life Contingencies Exam (Exam MLC). ASM2, ASM3
- CG6: Encourage the student to place the professional ethic code within the context of Scripture. ASM5

**Course Objectives:** The student will be able to\*

1. Describe the basic components/uses of actuarial science. CG 3
2. Address ethical considerations pertinent to actuaries from a biblical perspective. CG 6
3. Use statistical tools appropriate for modeling risk. CG1, CG4, CG5
4. Calculate and interpret standard probability functions including survival and mortality probabilities, force of mortality, and complete and curtate expectation of life. CG2, CG5
5. Calculate and interpret basic reserve types and methods. CG2, CG5
6. Calculate and interpret probabilities, means, percentiles and higher moments in the context of survival models, present value RVs, premiums, and reserves. CG1, CG4, CG5
7. Calculate and interpret the effect of changes in underlying assumptions in the context of present value RVs, premiums, and reserves. CG 2, CG5
8. Apply appropriate approximation methods such as uniform distribution of deaths and constant force in the context of survival models, present value RVs, premiums, and reserves. CG2, CG5
9. Recognize and answer those questions on Exam LTAM that are covered in chapters 1 – 7 of the textbook. CG5

\* Objectives 4-8 are based on the Learning Objectives stated in the syllabus for Exam LTAM (see <https://www.soa.org/globalassets/assets/files/edu/2019/fall/fall-2019-ltam-syllabus.pdf>, retrieved July 30, 2019).

These objectives are subject to the completion of relevant content. There may not be time to complete all of chapters 1-7 during one semester.

**Course Requirements and Evaluation:** The course grade will consist of

1. Two unit tests as announced in class. Each test will be worth 150 points. \*\*  
Tentative Test Schedule: Sept 26 Ch 2-3; Nov 19 Ch 4- 6
2. Weekly homework sets\*\*\*, rubric due at the beginning of class on Tuesdays, and will be worth 5 points each.
3. Homework handouts, approximately 5, worth 5 points each
4. Actuarial roles defined with ethical analysis 30 points. Due date: Sept 17
5. Evaluation of ethical concerns 70 points. Due date: Oct 31
6. Semester project: life tables, worth 75 points due Oct 10; policy valuation worth 100 points due Dec 12
7. A cumulative final exam will be worth 250 points.

\*\* Point assignments are subject to change.

\*\*\* Tentative homework assignments and project instructions can be found on the course webpage.

**Grading Scale:** Standard 10 point scale with approximately 800 points in the class.

**General Policies:**

1. Compliance with student handbook policies is expected during class.
2. No assignment will be accepted after the due date without prior permission of the instructor. Work may always be completed early (see your professor if you wish to take a test early).

Exceptions may be granted by your professor in emergencies. Contact your professor asap by email to notify them of the emergency. Requests for exceptions should be made in person asap.

3. University attendance policy is in effect (see <https://home.bju.edu/bju-policies/> for more 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 to get 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. 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.

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 in order to make arrangements for making 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.

4. You may work on homework with other students but you must master the material yourself. In working on homework problems together you will often accomplish more than you would have working alone, but never claim someone else's work as your own and don't mistake their understanding for your own.
5. University academic integrity policy is in effect (see <https://home.bju.edu/bju-policies/> for more details).

All work submitted is to represent your own mastery/understanding of the material. Actual answers are not important, but the representation of your understanding is what your course grade is based on. Anything that subverts this purpose should be considered as cheating.

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.

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.

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. Your projects must represent your own ideas and your own work. You may help each other "debug," but this project must represent your own work.

Papers: You may discuss the general ideas included in your papers, but you must craft your own positions and the writing should represent your own work.

Tests: In today's age of technology, cheating includes getting unapproved help from a source on the internet and/or using an Excel/SPSS file to provide you with additional information during a test. The presence of any unauthorized material on your desk or open on your computer (including but not limited to notes, email, chat windows, help websites, etc.) while taking a test, will be construed as cheating and will be dealt with as such. Cheating on a test will 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.