Faculty of Science Course Syllabus
Department of Mathematics and Statistics
Probability — STAT/MATH 3360
Fall 2020 online course

Instructor(s): Hong Gu   hgu@dal.ca
Lectures: Asynchronous on Brighspace
Laboratories: None
Tutorials: None
Office hours An online synchronous session on Thur. 11:35-12:55 will be used to discuss the course materials, attendancy is optional. Other appointments of meetings can be made by emails.

Course Description
The concepts and application of probability. Topics include the classical discrete and continuous distributions, including the binomial, hypergeometric, multinomial, Poisson, uniform, exponential and normal; definitions and properties of random variables; independence; sums of independent random variables, including the law of large numbers and central limit theorem; conditional probability; and the bivariate normal distribution. Examples will be taken from the natural and physical sciences.

Course Prerequisites
STAT/MATH 2060 and MATH 2001

Course Objectives/Learning Outcomes

- Apply the basic principal of counting, permutations and combinations for counting the number of different ways that a certain event can occur.

- Calculate probabilities for various events when sample space having equally likely outcomes.

- Calculate probabilities using the definition for conditional probability, independence, multiplication rule, Bayes’ theorem and the law of total probability.
- Calculate probability mass functions, cumulative distribution functions, the expected value and variance for discrete random variables.

- Calculate the expectation of sums of random variables.

- Understand various properties of a continuous random variable, including uniform distribution, normal distribution and exponential distribution.

- Derive the distribution of a function of a random variable given probability density function or probability mass function of the random variable.

- Calculate probabilities and marginal distributions based on joint probability functions.

- Calculate the joint probability distribution of functions of random variables.

- Calculate the probability density functions or cumulative distribution functions for sums of independent random variables.

- Calculate the conditional probability mass function and conditional probability distribution function.

- Using the property of expectation of sums of random variables to solve expected value problems or calculate probabilities.

- Calculate moment generating functions for either a discrete random variable or a continuous random variable and compute moments of a random variable by differentiating the moment generating function of the random variable.

- Use Markov’s inequality, Chebyshev’s Inequality and Chernoff bounds to obtain bounds on the probabilities of some events.

- Solve probability problems for large samples by applying Central limit theorem, the weak law of large numbers or the strong law of large numbers.

**Course Materials**


**Note:** Textbook (either hard copy or digital) can be purchased through Dalhouse University bookstore or elsewhere online. Although the 10th edition is recommended, the earlier versions are also acceptable.

**Course Brightspace page:** All course material can be accessed through https://dal.brightspace.com/d2l/home/131655
Course Assessment

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight (% of final grade)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>24</td>
<td>8 assignments, approximately weekly</td>
</tr>
<tr>
<td>Tests</td>
<td>40</td>
<td>4 tests, approximately bi-weekly</td>
</tr>
<tr>
<td>Final Exam</td>
<td>36</td>
<td>Dec. 11th, an 3 hour online exam</td>
</tr>
</tbody>
</table>

Other Course Requirements

Course Work and method of assessment

The course covers 8 chapters in the textbook. There will be 4 online 1.5 hour tests, each covers approximately 2 chapters. This may be changed, depending on the progress in lectures. There is no make-up for the tests. If the missed test is due to illness, the weight for the test will be transferred to the final exam. If there is no decent reason for the missed test, the test grade will be zero. The final exam will be a three hour comprehensive exam.

Students in different time zones who can’t finish the tests and the final exam at the scheduled time need to let me know in advance and a different time will be arranged to suit you.

There will also be (approximately) weekly homework assignments, which must be handed in before the due date. After this, I will put the model solutions on Brightspace. **No credit can be given for late homework.** The assignment weights will be shifted to the rest of the assignments if the missed assignments are due to illness. The overall homework mark will be made up of an average of the weekly homework marks.

The homework sheet will be divided into 2 sections: The *basic questions* section tests the basic concepts covered in the course: everyone should be able to do all these questions. The *standard questions* section has questions where the concepts covered in the course can be applied to more realistic situations, or questions which involve a stronger theoretical insight; these questions are mostly straightforward, though there may be the occasional tricky question included. There may also be some *bonus questions* section which includes questions either more challenging, or else raising interesting or important issues that are not central to this course.

Sometimes a question will be started on one sheet, but continued on the following sheet, after the relevant material has been covered. In this case, the full question will be given on the earlier sheet, but the parts that should only be attempted with the later sheet are clearly marked, and are repeated on the later sheet.

Weekly Readings

Since class time is limited, I will be using it for explaining concepts and going over examples, rather than reading through the textbook. You should therefore read through the relevant sections of the textbook. The sections of the textbook that will be covered in each lecture will be listed on the course website.
Sections of the text covered

We expect to cover most of the material in Chapters 1–8 in the textbook.

Conversion of numerical grades to Final Letter Grades follows the
Dalhousie Common Grade Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>90–100</td>
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</tr>
<tr>
<td>A</td>
<td>85–89</td>
<td></td>
</tr>
<tr>
<td>A-</td>
<td>80–84</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>77–79</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>73–76</td>
<td></td>
</tr>
<tr>
<td>B-</td>
<td>70–72</td>
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</tr>
<tr>
<td>C+</td>
<td>65–69</td>
<td></td>
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<tr>
<td>C-</td>
<td>55–59</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>50–54</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>&lt; 50</td>
<td></td>
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</tbody>
</table>

Course Policies

Credit cannot be given for late assignments. The assignment weights will be shifted to the rest of the assignments if the missed assignments are due to illness. There is no make-up for the tests. If the missed test is due to illness, the weight for the test will be transferred to the final exam. If there is no decent reason for the missed test, the test grade will be zero. For the above weight transfer to apply, students need to provide the Student Declaration of Absence form for missed academic requirement in this course. Each student can use the Student Declaration of Absence form maximally twice in the term. Students need to contact the instructor prior to the start of the exam if students cannot write a final exam, in which case the make-up final will be arranged. Final exam weight cannot be shifted to the other course components.

Students need to finish all assignment, test and final exam questions independently, collaboration or copying solutions from any other sources are not allowed and thus deemed as plagiarism for this course.

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Missed or Late Academic Requirements due to Student Absence

As per Senate decision instructors may not require medical notes of students who must miss an academic requirement, including the final exam, for courses offered during fall or winter 2020-21 (until April 30, 2021). Information on regular policy, including the use of the Student Declaration of Absence can be found here: https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html.
Academic Integrity
At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility
The Advising and Access Services Centre is Dalhousie’s centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).
Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct
Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students dont follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal mannerperhaps through a restorative justice process. If an informal resolution cant be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Diversity and Inclusion - Culture of Respect
Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness.
Statement: http://www.dal.ca/cultureofrespect.html

Recognition of Mikmaq Territory
Dalhousie University would like to acknowledge that the University is on Traditional Mikmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca). Information: https://www.dal.ca/campus_life/communities/indigenous.html
Important Dates
in the Academic Year (including add/drop dates)
https://www.dal.ca/academics/important_dates.html

University Grading Practices
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Student Resources and Support

Advising
General Advising: https://www.dal.ca/campus_life/academic-support/advising.html
Science Program Advisors: https://www.dal.ca/faculty/science/current-students/academic-advising.html
Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html
Black Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html
International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports
Library: https://libraries.dal.ca/
Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html
Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html
Copyright Office: https://libraries.dal.ca/services/copyright-office.html
Fair Dealing Guidelines: https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services
Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html
Student Advocacy: https://dsu.ca/dsas
Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-
Safety

**Biosafety:** [https://www.dal.ca/dept/safety/programs-services/biosafety.html](https://www.dal.ca/dept/safety/programs-services/biosafety.html)

**Chemical Safety:** [https://www.dal.ca/dept/safety/programs-services/chemical-safety.html](https://www.dal.ca/dept/safety/programs-services/chemical-safety.html)

**Radiation Safety:** [https://www.dal.ca/dept/safety/programs-services/radiation-safety.html](https://www.dal.ca/dept/safety/programs-services/radiation-safety.html)

**ScentFree Program:** [https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html](https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html)