SFU

Stochastic Processes In Biology

MATH 468/768

Instructor Info

Ailene MacPherson

Office Hrs: Tu&Fr 12:30-1:30

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Course Info

https://amacp.github.io/PopGen/

Math 360 or equiv

MWF

12:30-1:20

Overview*

The natural world is inherently random. Describing, understanding, and predicting phenomena in Ecology, Evolution, and Epidemiology therefore requires the use of mathematical models that explicitly include this randomness. In this course we will cover methods and applications of probability, stochastic processes, and computer simulation to these three fields.

*This is for the Spring 2024 offering. Content may vary.

Course Objectives

- Mastery of the principals of probability and stochastic processes.
- Learn to develop and analyze probabilistic and stochastic models for applications in Ecology, Evolution, and Epidemiology.
- Use computational methods to simulate and analyze random events and processes in biology.
- Develop and sharpen your ability to formulate scientific questions and address those questions with mathematics.
- Gain skills in scientific writing, this involves the formulation and communication of perspectives and the expression scientific findings in a clear and concise manner.

Selected Texts

The following texts will be used in this course but are not required.

- Otto, Sarah P. & Day, Troy. *A Biologists Guide to Mathematical Modelling in Ecology and Evolution.* 2007.
- Durrett, Rick. *Essentials of Stochastic Processes.* 1999. ISBN: 0-387-98836-X
- Karlin, Samuel & Taylor, Howard. *A Second Course in Stochastic Processes.* 1981. ISBN 0-12-398650-8.

Grading Scheme

Component	Weight
Bi-Weekly Homework[1] x 6	30% (5% each)
Midterm[2]	15%
Literature Review	20%
Presentation	10%
Final[2]	25%

[1] 768 will include an additional challenge question
[2] 768 will include an additional take-home portion

Literature Review

Length Requirement: 2pg max, 1 figure

Section	Description	Grade
Title	A clear and descriptive title (≈ 10 words)	5%
Intro.	Provides background, context, and motivation. Must include a thesis statement (e.g., "This works evaluates...").	20%
Methods[1]	Summarize what methods were used. Why are these methods were appropriate.	30%
Results	What were the key findings of this work?	15%
Discussion	What are the implications of what you found? What are the limitations of your work?	15%
Figure	Figure/table that supports the content of the methods or results	10%
References[2]	Reference list of additional literature	5%

[1] 768 required to have an appendix with a key derivation
[2] 468(768) required to have at least 1(3) additional reference.

Diversity and Inclusivity Statement

In this course you will treat others and be treated with respect. We welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, orientations, national origins, abilities, and other visible and non-visible differences. All members of this course are expected to contribute respectfully and in return each contribution will be appreciated and treated with respect.

Academic Integrity

As your instructor, I strive to create a learning environment that supports a diversity of thoughts, experiences and identities, including gender identity, race, religion, age, national origin, sexual orientation, neurodiversity, and ability. I value your participation in the course. Please let me know if there is any way that I can better support your learning needs. As a student, I expect you to review and adhere to the SFU Student Conduct Policy: `http://www.sfu.ca/policies/gazette/student/s10-05.html`

The Mathematics Equity, Diversity, and Inclusion Advisory Group is a committee that works towards ensuring that the department is a safe, respectful, and inclusive working and learning environment. We encourage you to reach out to the EDI Advisory Group with any equity, diversity, and inclusion concerns and/or ideas.

Class Schedule*

*Schedule subject to change

Week	Monday	Wednesday	Friday	Assignments
Wk 1: Jan 8	Intro	1.1	1.2	
Wk 2: Jan 15	1.3	1.4	1.5	Assign 1.
Wk 3: Jan 22	2.1	2.2	2.3	
Wk 4: Jan 29	2.4	2.5	2.6	Assign 2.
Wk 5: Feb 5	3.1	3.2	4.1	
Wk 6: Feb 12	4.2	4.3	4.4	Assign. 3
Wk 7: Feb 26	4.5	*Review*	*Midterm*	
Wk 8: Mar 4	5.1	5.2	5.3	Assign 4
Wk 9: Mar 11	5.4	5.5	5.6	Literature Review
Wk 10: Mar 18	5.7	5.8	6.1	Assign 5
Wk 11: Mar 25	6.2	7.1	Good Friday	
Wk 12: April 1	Easter Monday	7.2	7.3	Assign 6
Wk 13: April 8	*Review*	*Presentations*	*Presentations*	