

MATH 556: MATHEMATICAL STATISTICS I

- Instructor:** David A. Stephens, Burnside Hall 1225
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Teaching hours: Monday, Wednesday; 10:05 am – 11:25 am
Office hours: Monday, Wednesday; 12:00pm – 2:00pm.
Textbook: *Elements of Distribution Theory*, T. Severini, Cambridge University Press
see also *Statistical Inference (2nd Ed)*, G. Casella and R. L. Berger.
Prerequisites: MATH 356 or equivalent.

TARGET SYLLABUS

1 Preliminaries

- 1.1 Basics of Probability and Random Variables
- 1.2 Univariate Distributions
- 1.3 Transformations
- 1.4 Expectations and Moments
- 1.5 Some Inequalities
 - Concentration inequalities; Markov's inequality; Chebyshev's inequality; Chernoff bounds; Cauchy-Schwarz Inequality; Jensen's Inequality
- 1.6 Generating Functions and The Characteristic Function

2 Multivariate distributions

- 2.1 Joint, marginal and conditional distributions
- 2.2 Dependence, covariance and correlation
- 2.3 Exchangeability

3 Families of distributions

- 3.1 Parametric Families
- 3.2 Location-Scale Families
- 3.3 Exponential and Exponential Dispersion Families
- 3.4 Convolution Families and Sums of Random Variables
- 3.5 Hierarchical Models

4 Sampling Distributions

- 4.1 Definitions
- 4.2 Sampling from a Location-Scale Family
- 4.3 Sampling from an Exponential Family
- 4.4 Sampling from a Normal Family
- 4.5 Order and Rank statistics

5 Convergence concepts & Asymptotic Theory

- 5.1 Convergence in Probability: The Weak Law of Large Numbers
- 5.2 Convergence Almost Surely: The Strong Law of Large Numbers
- 5.3 Convergence in Distribution & Large Sample Approximations
- 5.4 A Central Limit Theorem
- 5.5 The Delta Method
- 5.6 Approximation Methods

6 Numerical methods, Random Number Generation and Monte Carlo

EVALUATION

Coursework:	Four assignments
Midterm exam:	In class, Date to be confirmed.
Final exam:	3 hours, to be held in the final exam period Date and venue to be confirmed by the University.

The final mark for the course will be calculated as the larger of

20% assignments + 20% midterm + 60% final exam

and

20% assignments + 80% final exam

NB. In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme is subject to change.

COURSE WEBSITE

The course website will be accessible via **myCourses** and **WebCT** at <http://webct.mcgill.ca> and hosted on

www.math.mcgill.ca/dstephens/556/

You will be able to access all online course material through this website. If you encounter any problems, please ask the course instructor.

MCGILL UNIVERSITY POLICY STATEMENTS

The following three statements are included in this course outline, in keeping with Senate resolutions:

- 1 *McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the **Code of Student Conduct and Disciplinary Procedures**. For more information, see*

www.mcgill.ca/students/srr/honest/

[Approved by Senate on 29 January 2003]

- 2 *In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.*

[Approved by Senate on 21 January 2009]

- 3 *Instructors who may adopt the use of text-matching software to verify the originality of students' written course work must register for use of the software with Educational Technologies and must inform their students before the drop/add deadline, in writing, of the use of text-matching software in a course.*

[Approved by Senate on 1 December 2004]

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