Department of Mathematics & Statistics
Concordia University

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MAST 223
Introduction to Stochastic Methods of Operations Research
Winter 2024

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Instructor: Dr. Debaraj Sen, Office: LB 921-03 (SGW), Phone: 514-848-2424, Ext. 3241
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Class Schedule: Tuesdays & Thursdays, 13:15-14:30.

Office Hours: Thursdays, 11:00-12:30.

Textbook: *Operations Research: Applications and Algorithms*, 4th Edition, by W. L. Winston.

Calculators: Only calculators approved by the Department (with a sticker attached as a proof of approval), are permitted for the class test and final examination. For the list of Approved calculators see www.concordia.ca/artsci/math-stats/services.html.

Assignments: Assignments are compulsory. There will be 5 assignments. Students are expected to submit his/her assignment in class. **Late assignments will not be accepted.**

Midterm Test: There will be one midterm test, based on the material of Weeks 1-6, which will contribute up to 25% to your final grade (see the Grading Scheme below). Missed tests cannot be made up. The midterm test will be held on **Tuesday, March 5, 2024** in class. This exam and the final will be closed book exams.

NOTE: It is the Department's policy that tests missed for any reason, **including illness,** cannot be made up. If you miss the midterm test because of illness (Short-Term Absence form or valid medical note required); the final exam will count for 85% of your final grade, and the assignments will count for the remaining 15%.

Final Exam: The final examination will be three hours long and will cover all the material in the course.

NOTE: Students are responsible for finding out the date and time of the final exams once the schedule is posted by the Examinations Office. Conflicts or problems with the scheduling of the final exam must be reported directly to **the Examinations Office**, **not to your instructor**. It is the Department's policy and the Examinations Office's policy that **students are to be available until the end of the final exam period. Conflicts due to travel plans will not be accommodated.**

Final Grade: The final grade will be based on the higher of **(a) or (b):**

    a) 15% for the assignments, 25% for the class test, and 60% for the final exam.
    b) 15% for the assignments, 15% for the class test, and 70% for the final exam.

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

IMPORTANT: **PLEASE NOTE THAT THERE IS NO "100% FINAL EXAM" OPTION IN THIS COURSE.**

Weeks	Chapters

1	**Chapter 12: Review of Probability**
	   Basic Rules of Probability.
	   Bayes' Rule.
	   Random Variables, Mean, Variance, and Covariance.
	   The Normal Distribution.
	   Z-Transforms

2 & 3	**Chapter 15: Deterministic Inventory Models**
	   Introduction to Basic Inventory Models.
	   Basic Economic Order Quantity Model.
	   Computing the Optimal Order Quantity.
	   The Continuous Rate EOQ Model.
	   The EOQ Model with Back Orders Allowed.
	   When to Use EOQ Models.
	   Multiple Product EOQ Models.

4 & 5	**Chapter 16: Probabilistic Inventory Models**
	   Single-Period Decision Models.
	   The Concept of Marginal Analysis.
	   The News Vendor Problem: Discrete Demand.
	   The News Vendor Problem: Continuous Demand.
	   Other One-Period Models.
	   The EOQ with Uncertain Demand.
	   Periodic Review Policy.
	   Exchange Curves.

6 & 7	**Chapter 17: Markov Chains**
	    Introduction to Stochastic Process.
	    Introduction to Markov Chain.
	    n-step Transition Probabilities.
	    Classification of States in a Markov Chain.
	    Mid-Term Test

8	**Chapter 17: Markov Chains**
	    Steady-State Probabilities.
	    Mean First Passage Times.
	    Absorbing Chains.
	    Work-Force Planning Models.

9, 10 & 11	**Chapter 20: Queuing Theory**
	    Introduction.
	    Modeling Arrival and Service Processes.
	    Birth-Death Processes.
	    The $M/M/1/GD/\infty/\infty$ Queuing System.
	    The $M/M/1/GD/c/\infty$ Queuing System.
	    The $M/M/s/GD/\infty/\infty$ Queuing System.
	    The $M/G/\infty/GD/\infty/\infty$ and $GI/G/\infty/GD/\infty/\infty$ Models.
	    The $M/G/1/GD/\infty/\infty$ Queuing System.
	    Finite Source Models.
	    Exponential Queues in Series and Open Queuing Networks.
	    Checking Inter-arrival Times & Service Times.

12 & Review	**Chapter 21: Simulation & Review**
	    Introduction.
	    Discrete Event Simulation.
	    Monte Carlo Simulation.
	    Simulation with Continuous Random Variables.

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: https://www.concordia.ca/conduct/academic-integrity.html" *[Undergraduate Calendar, Sec 17.10.2]*

Behaviour
All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

Intellectual Property
Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

Extraordinary circumstances

In the event of extraordinary circumstances and pursuant to the <u>Academic Regulations</u> the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.