**Department of Mathematics & Statistics**
**Concordia University**

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**MACF 491 (ACTU 491/STAT 380/MAST 679), Sec. H**
Topics in Mathematical & Computational Finance: Statistical
Learning
***Winter 2021***

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| **Preface:** | **Due to exceptional circumstances, this course will be taught and all assessments will be done completely ONLINE**. |
| **Instructor**: | Dr. F. Godin<br>Email: frederic.godin@concordia.ca |
| **Office Hours:** | Please contact the instructor by email; online appointments through Zoom can be arranged. |
| **Class Schedule:** | Officially: Tuesdays and Thursdays, 11:45-13:00. However, the class is fully online, and lectures are pre-recorded and available on Moodle (no live lecture is given). Therefore, the official class schedule only has an impact for the scheduling of the mid-term exam. |
| **Texts:** | *An introduction to statistical learning,* by G. James, D Witten, T. Hastie and R. Tibshirani, Springer. Available for free online at http://faculty.marshall.usc.edu/gareth-james/ISL/<br><br>*The elements of statistical learning,* by J. Friedman, T. Hastie and R. Tibshirani, Springer series in statistics. Available for free online at https://web.stanford.edu/~hastie/ElemStatLearn/ |
| **Outline:** | This course is an introduction to statistical learning techniques. Some applications to finance and insurance will be illustrated. Topics covered include: |

- Cross-validation
- Regression methods
  - Linear and non-linear models (GLMs, GAMs)
  - Variable selection methods
  - Shrinkage methods: ridge regression and LASSO
- Classification methods
  - K-nearest neighbors
  - Linear and quadratic discriminants
  - Logistic regression

- Support vector machines
- Tree-based methods
- An introduction to neural networks
- Unsupervised learning
  - Clustering: K-means, hierarchical clustering
  - Principal component analysis

**Evaluation:** The total score is determined according to the following rule:

**Undergraduate students:** assignments (20%), mid-term exam (30%), and final exam (50%).

**Graduate students:** assignments (20%), mid-term exam (20%), term project (20%), final exam (40%).

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.

**CIA Accreditation:** This course is accredited by the Canadian Institute of Actuaries (CIA) under the University Accreditation Program (UAP). A grade of B+ or better in this course is needed to apply to the CIA for the exemption of Exam SRM. For more information, click here.

In addition to the university's internal policies on conduct, including academic misconduct, candidates pursuing credits for writing professional examinations shall also be subject to the Code of Conduct and Ethics for Candidates in the CIA Education System and the associated Policy on Conduct and Ethics for Candidates in the CIA Education System. For more information, please visit Obtaining UAP Credits and the CIA FAQ.

**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: concordia.ca/students/academic-integrity." [*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 Academic Regulations 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.