**Department of Statistical and Actuarial Sciences**

**FM 9528A Banking Analytics**

**Course outline for Winter 2024**

**1. Course Information**

**Course Information**

This course will give students a mix of knowledge and practice in the use of business analytics tools, from using Excel for pricing a bond and calculating credit risk, to advanced deep learning models which will provide tools to tackle sophisticated problems using the latest computational tools. These models will be applied to several business problems within modern financial institutions, covering topics such as credit scoring, LGD and EAD modelling, and advanced models to extract complex non-linear patterns from large amounts of diverse data in topics such as collections, consumer fraud and other applications. The focus will be on the underlying principles, modelling methodologies, and implementation using appropriate software packages.

Mondays 8:30 a.m – 9:30 a.m. WSC 248. In-person.

Tuesdays 8:30 a.m – 9:30 a.m. WSC 248. In-person.

Wednesdays 8:30 a.m – 9:30 a.m. WSC 248. In-person.

**List of Prerequisites**

No courses are required.

Basic financial and statistical knowledge is required to understand the concepts and underlying mathematical processes. Previous programming experience required, but not in Python. Resources will be provided to learn the language we will use during the course. The course assumes a working knowledge of any other programming language (C, C++, R, Matlab, etc.) but no Python knowledge. The course will cover Excel and Python, with tutorials and online resources to support the analyses.

**2. Instructor Information**

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| **Employee badge** | |  |  | | --- | --- | | **Course Coordinator** | **Contact Information** | | Daniel Abib | dbarboza@uwo.ca |  |  |  | | --- | --- | | **Instructor(s) or Teaching Assistant(s)** | **Contact Information** | | Mahsa Tavakoli | mtavako5@uwo.ca |  |  |  |  | | --- | --- | --- | | **Office Hours** | **Method** | **Names** | | TBD | In-Person WSC 180 | Daniel | | TBD | In-Person WSC 263 | Mahsa | |

Students must use their Western (@uwo.ca) email addresses when contacting their instructors. We strive to answer all emails within 24 business hours.

**3. Course Syllabus, Schedule, Delivery Mode**

The topics covered in this module will include:

* Introduction and overview of banking analytics: CRISP-DM, Analytics problems, designing a data-driven problem-solving strategy in financial institutions.
* Fixed income credit risk: Government bonds, bills, and notes: bond auctions and after-market trading Interest rate conventions (simple, compound, continuous compound), Decomposing bonds into cash flows of coupons. Pricing bonds: day count convention, clean and dirty price. The Yield Curve. The idea of the yield curve and its empirical phenomenology.
* Retail credit risk modelling: Credit Scoring models, LGD and EAD models, basic concepts, working with software, dealing with difficulties.
* Advanced non-linear models and deep learning: basic principles, ensembles (Random Forest, XGBoosting), data interpretability.
* Introduction to deep learning and alternative data modelling: neural networks, architecture design, advanced models (CNN, LSTM, etc) and their applications in banking analytics.

**Learning Outcomes**

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| Bullseye | Having successfully completed the course, you will be able to demonstrate knowledge and understanding of:  A1. The Basic principles of data science in Banking: CRISP-DM and the definition of analytics  A2. The Underlying theory of predictive modelling  A3. Solutions and technologies specifically designed for handling and extracting patterns from big data |

Having successfully completed this course, you will be able to:

B1. Work with relevant software packages to develop banking analytics solutions

B2. Handle various types of data sources

B3. Work with current software packages to create models using complex data sources.

**Table of Contents and Schedule**

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| Teacher | |  |  |  | | --- | --- | --- | | **Week** | **Dates** | **Topic** | | 1 | Jan 10 – 13 | Intro to Banking Regulation | | 2 | Jan 16 – 20 | Bonds and credit instruments | | 3 | Jan 23 – 27 | Provisions and capital requirements | | 4 | Jan 30 – Feb 3 | CRISP-DM and analytics in banking | | 5 | Feb 6 – 10 | Midterm | | 6 | Feb 13 – 17 | Credit scoring and GLM applied in banking I | | 7 | Feb 20 – 24 | Reading Week. No lectures or activities. | | 8 | Feb 27 – Mar 3 | Credit scoring and GLM applied in banking II | | 9 | Mar 6 – 10 | LGD and EAD models –Ensembles | | 10 | Mar 13 – 17 | Model interpretation and transparency | | 11 | Mar 20 – 24 | Introduction to deep learning | | 12 | Mar 27 – 31 | Convolutions and architecture design I | | 13 | Apr 3 – 7 | Convolutions and architecture design II | |

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| **Daily calendar** | |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Classes Start** | **Reading Week** | **Classes End** | **Study day(s)** | **Exam Period** | | January 10 | Feb 17- 25 | April 9 | April 10 | April 11 - 22 | |

**Contingency plan for an in-person class pivoting to 100% online learning**

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, synchronously (i.e., at the times indicated in the timetable). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

Please note a recording of the lecture will be made available in OWL for students who cannot attend the in-person lectures.

**4. Course Materials**

There is no assigned textbook for the course. The course incorporates multiple sources, publications, and books that can be used as reference:

Books:

**Core**

Chollet, F. (2021) Deep Learning with Python, second edition. Manning Publications (last five weeks)

Davison, M. (2017) Quantitative Finance: A Simulation-Based Introduction using Excel. CRC Press 2014 (weeks 1-3)

Siddiqi, N. (2017) Intelligent Credit Scoring: Building and Implementing Better Credit Risk Scorecards, Second Edition. Wiley. (Week 5-6)

Hastie, T., Tibshirani, R. and Friedman, J. (2013) The Elements of Statistical Learning,10th ed. NI, USA: Springer. Available freely online at https://statweb.stanford.edu/~tibs/ElemStatLearn/. Only some chapters are relevant to the course. They will be posted on OWL in each week’s description. (Weeks 4 – 9)

Verbeke, W., Baesens, B. and Bravo, C. (2017) Profit Driven Business Analytics. Wiley and Sons. Chapter 5 (Week 6 and 8)

**Additional Reading**

Goodfellow, I., Bengio, Y. and Courville, A. (2017) Deep Learning. Freely available online at http://www.deeplearningbook.org/: MIT Press.

Thomas, L.C., Crook J.N. and Edelman. (2017) Credit Scoring and Its Applications, 2nd Edition. Philadelphia, PA, USA: SIAM Press.

Students are responsible for checking the course OWL site (http://owl.uwo.ca) regularly for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance, they can seek support on the [OWL Help page](https://owlhelp.uwo.ca/students/index.html). Alternatively, they can contact the [Western Technology Services Helpdesk](https://wts.uwo.ca/helpdesk/). They can be contacted by phone at 519-661-3800 or ext. 83800.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

[Google Chrome](https://www.google.ca/chrome/?brand=CHBD&gclid=CjwKCAjwxLH3BRApEiwAqX9arfg8JaH6fWGASk9bHTkfW_dyBir93A1-TliP-7u1Kguf-WZsoGAPhBoC9NYQAvD_BwE&gclsrc=aw.ds) or [Mozilla Firefox](https://www.mozilla.org/en-CA/) are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click [here.](https://www.google.com/search?q=internet+speed+test+google&rlz=1C5CHFA_enCA702CA702&oq=internet+speed+test+google&aqs=chrome..69i57j0l7.3608j0j4&sourceid=chrome&ie=UTF-8)

**Technical Requirements**

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| Wireless | Stable internet connection | Laptop | Laptop or computer |
| Radio microphone | Working microphone | Web cam | Working webcam |

We will use either Google Colab (<https://colab.research.google.com>) or Kaggle Kernels (<https://www.kaggle.com/code>) for the computational part of the course, depending on available access in your location. Instructions will also be provided for local installations, although **this is not recommended unless students have an Nvidia video card and at least 8GB of RAM**.

**5. Methods of Evaluation**

The course is mostly applied and will have one midterm, one exam and a group coursework, distributed via OWL after each topic is covered in the lectures:

* 25%: Fixed income and introduction to lending midterm. Pricing bonds, yield curves and mortgages. TBD
* 40%: Retail credit risk project, **groups of two or three students**.TBD
* 35%: Exam. Date TBD.

**Students MUST obtain a weighted average mark above 50% between the midterm and exam to pass the course.** There are NO exceptions to this rule.

**Accommodated Evaluations**

* Late assessments without illness self-reports will be subject to a late penalty discount of 10%/day (this means if your coursework gets an 80%, and you submit one day late, your final mark will be 80% - 10% = 70%). The day late starts at 00:00 of the day after the deadline posted above. There are **NO EXCEPTIONS** to this policy.
* Late assessments with illness self-reports should be submitted within 24 hours of submission of the last illness self-report. Late assessment with valid medical reports must be submitted at the date agreed upon with the counsellors.
* An assessment cannot be submitted after it has been returned to the class. An oral, open book, exam with computer support covering the topics that were missed will be given instead.
* If a make-up assessment is missed, the student will receive an INC and complete the task the next time the course is offered.
* If permission to waive the requirement that students receive an evaluation on work totalling 15% of their final grade at least three days prior to the deadline for withdrawal without academic penalty has been obtained from the Dean’s Office, a statement to this effect must be made.

**6. Student Absences**

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

1. For medical absences, get a Student Medical Certificate (SMC) signed by a licensed medical or mental health.

2. Get appropriate documentation for non-medical absences.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered to get approved unless otherwise instructed in the course outline.

**7. Accommodation and Accessibility**

**Religious Accommodation**

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

https://multiculturalcalendar.com/ecal/index.php?s=c-univwo.

**Accommodation Policies**

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic\_policies/appeals/Academic Accommodation\_disabilities.pdf.

**8. Academic Policies**

The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies\_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual’s official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

For the assessments and exams, all electronic devices are permitted. During the midterm and exam it is allowed to connect to the internet and consult forums (open book and open internet), however it is NOT allowed to post on any platform nor engage with other people either via chats, forums, or any other format.

**Scholastic offences** are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic\_policies/appeals/scholastic\_discipline\_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

**Professionalism & Privacy**

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| Lock | Western students are expected to follow the [Student Code of Conduct](https://www.uwo.ca/univsec/pdf/board/code.pdf). Additionally, the following expectations and professional conduct apply to this course:  Students are expected to follow online etiquette expectations provided on OWL  All course materials created by the instructor(s) are copyrighted and cannot be sold/shared  Recordings are not permitted (audio or video) without explicit permission  Permitted recordings are not to be distributed  Students will be expected to take an academic integrity pledge before some assessments  All recorded sessions will remain within the course site or unlisted if streamed |

**Copyright Statement**

Please be aware that all course materials created by the instructor(s) are copyrighted and cannot be **sold/shared**. Those include materials used in tests/quizzes, midterms, and finals. Any posting/sharing of such materials in part or whole without the owner’s consent is considered a violation of the Copyright Act and will be considered a scholastic offence.

In addition, online services such as Chegg are actively monitored. Such an activity will be considered a scholastic offence and will result in an academic penalty

**9. Support Services**

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic-related matters: https://www.uwo.ca/sci/counselling/.

Students who are in emotional/mental distress should refer to Mental Health@Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student\_support/survivor\_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Learning-skills counsellors at the Student Development Centre (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

Additional student-run support services are offered by the USC,  https://westernusc.ca/services/.