



MASTER OF BIOTECHNOLOGY PROGRAM

Elective Course



BTC 2120H

– Topics in Biotechnology –
DECISION ANALYTICS IN
BUSINESS, HEALTHCARE &
MANAGEMENT

Ningyuan Chen

Winter/Spring Term, 2022

MASTER OF BIOTECHNOLOGY

UNIVERSITY OF TORONTO MISSISSAUGA

BTC 2120H – Decision Analytics in Business, Healthcare & Management

Course Outline (Winter 2022)

Class Location: Kaneff Centre, Room 112 (KN-112)
Class Times: Tuesday, 6:00-8:00PM, 11-Jan to 12-Apr
Instructor: **Prof. Ningyuan Chen**
Office Hours: Tuesday 4:00-6:00PM
Contact: ningyuan.chen@utoronto.ca

Course Description

Data analysis and decision making are two core components in the business world. In this course, we will walk through major techniques in both components. The methods and tools taught are implemented in modern programming languages such as Python and R.

Course Objectives

Upon completion of this course, students are expected to (1) develop skills to analyze data for various purposes, (2) understand the distinction between descriptive analytics, predictive analytics and prescriptive analytics, (3) become comfortable making decisions and providing recommendations through practice with quantitative evidence, and (4) gain Python/R programming skills

Course Structure & Delivery

The course is taught using a combination of lectures and class presentations.

Recommended Readings

Since this class covers a wide range of various topics, you may contact me if you want to read more about a particular topic. Here are a few good ones (you shouldn't expect to read them all)

- *An Introduction to Statistical Learning* by Gareth James, Daniela Witten, Trevor Hastie & Rob Tibshirani
- *Data Science for Business* by Foster Provost & Tom Fawcett
- *The Analytics Edge* by Dimitris Bertsimas, Allison O'Hair & William Pulleyblank

Topics

The following topics will be covered in the course.

- Descriptive and exploratory data analysis
- Predictive analytics and linear regression
- Causal inference and prescriptive data analytics
- Linear programming and decision making under constraints
- Decision making dynamically

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- Cross validation
 - Deal with missing data
 - Simulation to assess risk and uncertainty

Marking Scheme

The breakdown of the grade for the course will be as follows:

| | |
|---------------------------|-------------|
| Class Participation | 15% |
| Assignments | 25% |
| Final Presentation | 60% |
| TOTAL | 100% |

Your class participation will be assessed primarily on quality, not quantity. Please participate actively in the class discussions.

Assignments are given once every two to three weeks. They usually involve numerical experiments using Python. It is recommended to use Jupyter Notebook to complete both theoretical and numerical questions and submit PDF files. Alternatively, if you are familiar with R, you may use R Notebook. The final project presentation takes place in the last two lectures. You will form groups of size 2 to 4 and conduct a thorough analytics project based on public datasets starting in March. I will be in the process helping you finding topics and selecting methodologies.

No assignments will be accepted late. If you have to miss the midterm for an excused absence, your final exam will be worth 50% of your grade. If you miss the final exam, it will be made up with an oral exam. Note that for an absence to be excused, the documentation must follow the procedures outlined at <http://www.illnessverification.utoronto.ca/>

Accessibility

The University of Toronto is committed to accessibility. If you require accommodations for a disability or have any accessibility concerns about the course or course materials, please contact Accessibility Services as soon as possible: access.utm@utoronto.ca.

Classroom Norms

Starting in Winter 2022, we will deliver the lectures in person. Because it is a small class, you are encouraged to ask questions at any time, which will help me get feedback and adjust the pace accordingly.

Communication

The online course page for this course is accessed through Quercus. If you are registered for the class, you should be able to access the course page at <https://q.utoronto.ca>. If you have any issues, you can explore the FAQ and help section at <http://www.portalinfo.utoronto.ca/students>.

Academic Integrity

Do not cheat in this course, I will treat any offences very seriously. Please see the University of Toronto's Code of Behaviour on Academic Matters for full details on behaviours that constitute misconduct, and the procedures for addressing offenses. The full code can be found here:

<http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppiun011995.pdf>

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SCHEDULE OF ACTIVITIES

Part I: Descriptive and Exploratory Analytics

SESSION 1: Basics of Jupyter Notebook, Summary Statistics and Data Visualization

SESSION 2: Handling Missing Data

Part II: Predictive Analytics

SESSION 3: Linear Regression

SESSION 4: Other Considerations of Regression

SESSION 5: Cross Validation

Part III: Causal Inference

SESSION 6: The Golden Rule: Random Control Trials

SESSION 7: Controlling the Covariates and Propensity Scores

SESSION 8: DiD and Instrumental Variables

Part IV: Decision Making and Simulation

SESSION 9: Linear Programming

SESSION 10: Dynamic Programming

SESSION 11: Simulation

Part V: Project Presentation

SESSION 12-13: Presentations