

## TABLEAU C1 – PLAN DE COURS-CADRE

*Ce document doit décrire brièvement le contenu du cours, les objectifs, les méthodes pédagogiques et l'évaluation.*

<b>SIGLE</b>	IFT 6XXX
<b>NOMBRE DE CRÉDITS</b>	4
<b>TITRE LONG</b>	Causal inference with machine learning
<b>TITRE COURT</b>	Causal inference with machine learning

### 1. CONTENU DU COURS

Traditionally, the field of causal inference has drawn upon statistics and computer science to develop theory and methods for estimating causal relationships between variables of interest. Increasingly, there is a growing recognition that the tools of machine learning --- prediction methods, unsupervised methods, representation learning, to name a few --- can be adapted in service of causal inference. Moreover, the theory of causality can shed light on developing new machine learning objectives and methods that yield fair and robust conclusions. This course focuses on the intersection of machine learning and causality. We'll begin with an introduction to the theory behind causal inference and delve into recent advances that combine machine learning methods and causality. We'll cover work on causal estimation with neural networks, representation learning for causal inference, and flexible sensitivity analysis. We'll conclude with work that draws upon causality to make machine learning methods fair or robust.

### 2. OBJECTIFS ET COMPÉTENCES VISÉS

Learn the foundations of causality and understand the technical challenges to causal inference addressed by recent advances in machine learning. This is an advanced course in machine learning that aims to:

- introduce the fundamentals of causal inference, and articulate the opportunities and challenges for machine learning to help causality, and for causality to help machine learning.
- develop skills to undertake independent research.
- develop skills to read, critique and draw new ideas from research articles.

### 3. PRINCIPALES MÉTHODES PÉDAGOGIQUES

The first two weeks will consist of lectures on the foundations of causality with assigned readings for each lecture.

Thereafter, students will each in turn present assigned research articles to facilitate discussion in class. All students will complete the assigned reading. With each assigned reading, all students will complete a 1/2-1 page "Question, Comment, Research" (QCR) report:

- Summarize the paper in 1-2 paragraphs.
- Note questions about the paper.
- Comment on the impact, significance and limitations of the paper.
- Brainstorm at least 1 research idea based on the paper.

Students will also complete a final project in groups of 2-3. They will be required to submit an "aspirational abstract" of their project by week 4 and a project summary by week 10.

#### 4. DÉMARCHE ÉVALUATIVE ET PONDÉRATION (*à titre indicatif seulement*)

70% - final project

30% - In-class participation and completion of the QCR reports.