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# STA501: Data-based Decision Making

Swiss Institute of Artificial Intelligence  
MSc in Data Science & MBA in AI BigData

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<b>Instructor:</b>	Keith Lee	<b>Class Location:</b>	Teams channel (Online)
<b>Email:</b>	keith.lee@siai.org	<b>Class Day/Time:</b>	Recorded video
<b>Office Hours:</b>	Channel & Before final exam	<b>Credit Hours:</b>	3-hour Class & 1-hour TA session
<b>TA Session:</b>	Sat 14:30 – 15:30	<b>Academic Term:</b>	1st Term, Fall
<b>Language:</b>	English	<b>Hours:</b>	33 contact hours, 92 self-learning hours
<b>Credits:</b>	5 ECTS	<b>Intended audience:</b>	MBA in AI/BigData

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## 1. Course Description

The course runs through basic concepts in microeconomics that are key frameworks in data-based decision making. With the benefit of applied statistical models widely used in microeconomics literature, such as treatment effects, diffs-and-diffs, and propensity score matching, microeconomic theories are re-accessed in terms of data analysis.

The reason the program emphasizes economics training at the early stage of the coursework is because economics is a stream of social science that most leverages hard science tools in mathematics and statistics, and it is highly likely you will see not laboratory data but social science data in real world. Many people are confused that data-based research is just about data and its visualization, but what truly research work is based on is mathematical and statistical tools that help interpreting data in deeper level with robust logic. Economics so far has achieved a status of the most advanced social science discipline in this regard.

Although the course is self-contained, for the student with little prior exposure to economics are recommended to read any basic text for economic intuition. Some recommendations are listed in the reading section.

Economics topics discussed will be

- Comparative advantage
- Consumer choice
- Difference-in-differences
- Partial effect
- Demand & Supply curve estimation

Some of the business cases that we will apply above economics topics are

- Spirits vs. Beer: are they complements?
- Top school admission: is it really DNA? or is it money?
- Salary negotiation: why my salary won't go up?

Weekly problem sets are due a day before the TA sessions. Together with the problem sets, comprehensive final exam also strongly emphasize the fundamental understanding of core concepts. Together with math, stat and structural mind set for programming, economics is one of the most important skill sets required to successfully finish the program. Students must be familiar with every concept discussed in the lecture for the final exam, and the dissertation.

## 2. Structure of the course

Hours	Topics	Assignments and Readings
3 hours - Class (3)	Comparative advantage : Absolute vs. comparative advantage Division of labor Individual vs. Group - Why my salary won't go up?	Lecture note 1 Problem Set 1
4 hours - Class (3) - TA (1)	Consumer choices : Substitution and income effects Complements: Beer vs. Spirits Causality vs. Correlations - Spurious regression	Lecture note 2 Problem Set 2
4 hours - Class (3) - TA (1)	Difference-in-differences : Average Treatment Effect (ATE) ATE with respect to time effects Multivariate (linear) regression to control	Lecture note 3 Problem Set 3
4 hours - Class (3) - TA (1)	Dummy variables and index : ANOVA & ANCOVA Heterogeneity & Homogeneity index Are two group equal? How equal?	Lecture note 4 Problem Set 4
4 hours - Class (3) - TA (1)	Partial effect : Logistic regression (Probit vs. Logit) 2-Stage-Least-Square (2SLS) Propensity score matching	Lecture note 5 Problem Set 5
4 hours - Class (3) - TA (1)	Regression in real life data : Omitted variable bias & Measurement error - AI recruiting for resume screening? HR evaluation? Simultaneous equations - Global warming?	Lecture note 6 Problem Set 6
4 hours - Class (3) - TA (1)	Review I	Problem Set 7
4 hours - Class (3) - TA (1)	Review II	No Problem Set
2 hours	Final examination : 2 questions, 120 minutes Extended and aggregated version of problem sets Exam office hours are TBA	

## 3. Course delivery methods

The course combines lectures, handouts, problem sets and weekly TA sessions.

All lecture videos are provided at the beginning of the course. In addition to the regular weekly class, TA sessions for problem set discussion will be held on every Saturdays from week 2 to week 8. The TA sessions are primarily live-streamed, but can be video-taped version can be uploaded depending on the contents.

Should students have questions regarding lecture materials and problem sets, Teams' channel for the course is the most ideal way of discussion. Although students are not disallowed to contact professor and TA directly, it is strongly recommended to share class-related questions to the Teams' channel for the benefit of all students in the same class.

#### 4. Self-learning activities

Students are required to submit personally tried answer to the problem sets prior to the beginning of next week's class. There will be total 7 problem sets due in week 2 to week 8. Assignments are not graded in detail, but students must put in satisfactory level of understanding. If failed, the grade for the particular assignment will be marked 0. For example, a blank sheet or gibberish solution will NOT be counted.

#### 5. Homepage and Course Material

Class materials are all uploaded to Teams' channel. All files will be stored in Sharepoint folder attached to the Team's channel. For important notice, make sure to check the Wiki board in the same channel. Final exam grade will be available on school's main homepage. Detailed instruction to check the grade is available on Personal Management section.

#### 6. Recommended readings

Although lecture materials are self-sufficient, students are welcome to use extra contents. Not required, but recommended readings are

- (a) *Principles of Economics*, N. Gregory Mankiw 9/E
- (b) *Mostly Harmless Econometrics: An Empiricist's Companion*, Jörn-Steffen Pischke, Joshua Angrist (2009)

#### 7. Examinations and Grading Procedures

Activity	Weight
Assignments	10%
Final Exam	90%

Individual assignments(eg. written answers to problem sets) have to be submitted by the TA session for that particular problem set. Although it is not compulsory due to the nature of online based program, students are strongly recommended to attend the weekly live TA sessions.

Students must attend the final exam on the scheduled date and time, unless you have prior arrangement with the instructor. Otherwise, the mark for exam is 0.

## 8. Intended Learning Outcomes

- Develop a set of tools for modeling and understanding complex data sets and understand how those models capture the characteristics of such data in many real-world application
- Equip themselves with strong background knowledge for further studies like AI applications in business, machine learning and deep learning courses.

## 9. Final examination

**Exam format:** A final examination (2 hours) will take the format of questions requiring essay style answers. Please note that the final exam will be based on a comprehensive extension of the weekly problem sets.