STA502: Math & Stat for MBA
Swiss Institute of Artificial Intelligence
MBA in AI/ BigData

Instructor:	Keith Lee	**Class Location:**	Teams channel (Online)
Email:	keith.lee@siai.org	**Class Day/Time:**	Recorded video
Office Hours:	Channel & Before final exam	**Credit Hours:**	3-hour Class & 1-hour TA session
TA Session:	Sat 13:00 – 14:00	**Academic Term:**	1st Term, Fall
Language:	English	**Hours:**	33 contact hours, 92 self-learning hours
Credits:	5 ECTS	**Intended audience:**	MBA in AI/BigData

1. Course Description

The purpose of this course is to introduce mathematical and statistical techniques that are necessary to follow any STEM-based hard skill MBA programs or undergraduate students with proper basic training in linear algebra, differential equations, and some statistical analysis. Although the course is designed to be self-contained, nonetheless, students are expected to have either some level of elementary probability and calculus, or, at least, high school level mathematical and statistical understanding.

Although the course is not for technically oriented students for hard science, it does cover all necessary issues to understand later courses in the STEM MBA program for what AI really is and what the right approach for BigData analysis can be. Topics covered are

- What is Non-linear regression?
- Optimization in mathematics
- Information and vector space
- Regressions and hypothesis testing
- Endogeneity and instrumental variables
- Dummy variables and seasonal effect

Note that the key concepts and techniques of this course will be used over and over in many of the later courses in the program. Students are required to have in-depth understanding of this course's key concepts, not necessarily in mathematical sense, but at least in logical sense.

Weekly problem sets are due a day before the TA sessions. Together with the final exam, all questions strongly emphasize the fundamental understanding of core concepts, not the detailed mathematical derivation. Since the program is a variant of STEM MBA, some problem sets unavoidably require some level of mathematical derivation, but the overall focus of this course is to equip students with an ability to translate math and stat tools in plain English for the rest of the program.

2. Structure of the course

Hours	Topics	Assignments and Readings

3 hours
- Class (3)
	Mean and variance
	: Hypothesis testing
	  1 variable vs. multi-variable cases
	  Linear Regressions - A1-A5 assumptions
		Lecture note 1, 2, 3
		Problem Set 1

4 hours
- Class (3)
- TA (1)
	Regression topics
	: Regression diagnotics
	  Linear vs. Non-linear regressions,
	  Non-parametric statistics
		Lecture note 4, 5
		Problem Set 2

4 hours
- Class (3)
- TA (1)
	Dummification
	: Dummy variables and A1 assumption
	  Seasonality cases,
	  Categorical variables
	  Experimental design
		Lecture note 6, 7
		Problem Set 3

4 hours
- Class (3)
- TA (1)
	Generalied Least Square
	: Heterogeneity in regression
	  Autocorrelations - AR, MA processes
	  (In)Feasible Generalized Least Square
		Side note 1, 2
		Problem Set 4

4 hours
- Class (3)
- TA (1)
	Endogeneity
	: Omitted variable bias
	  Measurement error,
	  Simultaneous equations
		Side note 3
		Problem Set 5

4 hours
- Class (3)
- TA (1)
	Instrumental variables
	: How to tackle enedogeneity - Vector space viewpoint
	  Relevance / Orthogonality conditions
	  Examples
		Side note 4,5
		Problem Set 6

4 hours - Class (3) - TA (1)	Review session I	Problem Set 7
4 hours - Class (3) - TA (1)	Review session 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) *Lecture note*, Chapter 1 to 6

(b) *Side note*, Chapter 1 to 5

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.