

BR2207 Quantitative Analysis

Academic Year	2022/2023	Semester	1
Course Coordinator	Adam Shao		
Course Code	BR2207		
Course Title	Quantitative Analysis		
Pre-requisites	AB1202		
No of AUs	3		
Contact Hours	3 x 13 = 39 hours		
Proposal Date	13 June 2022		

A) Course Aims

This course covers basic knowledge in probability and statistics, regression and simulation. This course draws on applications from a variety of areas where risk analysis and data analytics have become important. Some of these applications include financial risk management, insurance risk management, corporate risk management and personal financial planning. The purpose of the course is to equip students with right mindsets and necessary knowledge and skillsets of completing *Quantitative Analysis* in the GARP FRM® Exam Part I.

B) Intended Learning Outcomes (ILO)/Objectives

By the end of this course, you should be able to:

1. Analyse exploratory data and summary statistics with appropriate tools
2. Use univariate distributions to calculate probabilities, quantiles and moments
3. Use joint distributions to calculate probabilities, quantiles and moments
4. Calculate conditional expectations and conditional probabilities
5. Explain the concepts of random sampling, statistical inference and sampling distribution
6. Apply methods of estimation to point estimation
7. Construct an appropriate null hypothesis and alternative hypothesis and distinguish between the two.
8. Conduct goodness-of-fit test
9. Describe the relationship between a t-statistic, its p-value and a confidence interval.
10. Use regression model to analyze data
11. Construct, apply and interpret hypothesis tests and confidence intervals for regression coefficient(s) in a regression model.
12. Describe the basic steps to conduct a Monte Carlo simulation.
13. Describe the disadvantages of the simulation approach to financial problem solving.

C) Course Content

- Discrete and continuous probability distributions
- Estimating the parameters of distributions
- Population and sample statistics
- Bayesian analysis
- Statistical inference and hypothesis testing
- Measures of correlation
- Linear regression with single and multiple regressors
- Simulation methods

D) Assessment (includes both continuous and summative assessment)

Component	ILO Tested	NBS Learning Goal (Refer to Annex D for list)	Weighting	Team/Individual	Assessment Rubrics (Please insert rubrics as Appendix)
1. Final Exam	ILO1-13	Acquisition of knowledge & Problem Solving	45%	Individual	N.A.
2. Midterm	ILO1-7	Acquisition of knowledge & Problem Solving	20%	Individual	Problem Solving
3. Assignments	ILO1-13	Acquisition of knowledge & Problem Solving	15%	Individual	Problem Solving
4. Class participation	ILO1-13	Oral Communication & Critical Thinking	10%	Individual	Class Participation
5. Class presentation	ILO1-13	Oral Communication & Critical Thinking	10%**	Individual	Class Presentation Rubric
Total			100%		

**For class presentation component, the presentation should provide highlights related to an academic study, government report, or media coverage about a topic of common interests, broadly construed. Suggested presentation components to be included: 1) Brief background introduction 2) What is the sample and/or analysis done? 3) Summary of findings or conclusion from the statistics. You are encouraged to include critiques and/or some reflections if you find any. Note that the main assessment point of this assignment is on the presentation itself. Thus, you are advised to focus on the plot, design, and style, rather than statistical technicalities. See Annex C for the assessment criteria.

E) Formative feedback

Feedback is central to this course. In addition to receiving feedback on your coursework: assignments and midterm, we will also rely on the “interactive classroom response system” via Kahoot to provide instant feedback to you and to evaluate your in-class participation.

F) Learning and Teaching approach

Approach	How does this approach support you in achieving the learning outcomes?
Seminars	Key concepts introduced in this module will be explained in detail in the seminars supported with examples and exercises. The seminars provide opportunities for open discussion on the conceptual questions, which allow you to think critically and share your ideas with the class. The seminars involve the interaction between the instructor and the entire class, making sure that the targeted learning outcomes could be successfully achieved.
Assignments	The assignments require you to generate, analyze and deliver materials in a guided manner.
In-Class activities	Interactions are encouraged in class to enhance critical thinking and class engagement. We will use the “interactive classroom response system” to provide instant feedback to your understanding and learning of the course material, thereby ensuring the learning goals/objectives are attained.

G) Reading and References

Basic Text

M&M: Miller, I. and M. Miller, John E. Freund's Mathematical Statistics with Applications, 8-Edition, 2014.

Other supplementary notes will be posted in NTUlearn.

H) Course Policies and Student Responsibilities

(1) General

You are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take all scheduled assignments and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions they have missed. You are expected to participate in all seminar discussions and activities.

(2) Absenteeism

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. If you miss a lecture, you must inform the course instructor via email prior to the start of the class.

(3) No Food

You are not allowed to bring food in the classroom. You may have a meal during breaks.

I) Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

J) Course Instructors

Instructor	Office Location	Phone	Email	Consultation Hours
Adam Shao		8031 9058		30 mins immediately after each seminar, or by prior appointment via email

K) Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
1	Review Exploratory Data Analysis & Probability Random Variables & Distributions	ILO1-2	Chapters 1, 2, 3
2	Joint Distributions, Mathematical Expectation	ILO3-4	Chapters 3,4
3	Some Discrete Probability Distributions Some Continuous Probability Densities	ILO2-3	Chapters 5,6

4	Functions of Random Variables	ILO3-4	Chapter 7
5	Sampling Distributions & the Central Limit Theorem	ILO5	Chapter 8
6	Statistical Inference: Point & Interval Estimations	ILO6-7	Chapters 10, 11
7	Hypothesis Testing & Goodness of Fit	ILO7-8, 9	Chapters 12, 13
8	Recess		
9 & 10	Regression & Correlation Analysis of Variance	ILO10-11	Chapters 14, 15
11	Simulation	ILO 12-13	Handout
12	Class presentation		
13	Review		

ANNEX A: ASSESSMENT CRITERIA**Quantitative Literacy Skills Rubric – Mapped to Problem Solving and Decision Making Learning Goal**

Learning Objective: Quantitative Literacy (QL) – also known as Numeracy or Quantitative Reasoning (QR) – is a "habit of mind," competency, and comfort in working with numerical data. Individuals with strong QL skills possess the ability to reason and solve quantitative problems from a wide array of authentic contexts and everyday life situations. They understand and can create sophisticated arguments supported by quantitative evidence and they can clearly communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc., as appropriate).

Traits		Performance										
<u>Interpretation</u>	Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).	Not Yet Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means.									Substantially Developed Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information.	
		Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed										
<u>Representation</u>	Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words).	Not Yet Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.									Substantially Developed Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.	
		Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed										
<u>Calculation</u>	Ability to perform calculations.	Not Yet Calculations are attempted but are both unsuccessful and are not comprehensive.									Substantially Developed Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.).	
		Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed										
<u>Application/ Analysis</u>	Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis.	Not Yet Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is uncertain about drawing conclusions from this work.									Substantially Developed Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.	
		Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed										
<u>Presentation</u>	Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized).	Not Yet Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support.									Substantially Developed Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	
		Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed										

Reference: [VALUE Rubrics - Quantitative Literacy | AAC&U \(aacu.org\)](https://www.aacu.org/value/rubrics-quantitative-literacy)

ANNEX B: ASSESSMENT CRITERIA**Class Participation Rubric**

Traits	Performance		
	1	2	3
Engagement	Hardly focuses in class (e.g. using mobile phone, unnecessary chatting)	Occasionally engages in distracting activities (e.g. using mobile phone, unnecessary chatting) in class.	Engages fully in class
Contribution frequency	Does not speak up/contribute in class	Occasionally speaks up/contributes in class	Speaks up/contributes in all classes
Contribution quality	No contributions/Contributions lack substance	Contributions demonstrate knowledge of subject matter	Contributions are constructive and insightful

ANNEX C: ASSESSMENT CRITERIA**Class presentation assessment criteria**

Category	Scoring Criteria			Total Points	Score
	Fail standard (<40 %)	Pass standard (40%-70%)	High standard (70%-100%)		
Content (30%)	Content is attention-getting and provoke thinking.			20	
	Presentation contains accurate information.			10	
	Material included is relevant to the overall message/purpose.			10	
	Appropriate amount of material is prepared			10	
Presentation (70%)	Provide references to source of information whenever required			10	
	Speaker maintains good eye contact with the audience			10	
	Visual aids are well prepared, informative, and effective			10	
	Length of presentation is within the assigned time limits.			10	
	Speakers handle queries raised by the audience appropriately			10	
Score	Total Points			100	

ANNEX D: LIST OF NBS LEARNING GOALS

LEARNING GOAL	LEARNING OBJECTIVE	CHECK
TASK SKILLS		
Acquisition of Knowledge	Students should be able to demonstrate understanding of the various concepts and methods introduced in the module.	<input checked="" type="checkbox"/>
Ethical Reasoning	The ability to recognize and understand ethical issues, and apply sound ethical reasoning.	<input type="checkbox"/>
Critical Thinking & Creative Thinking	The ability to define, examine, evaluate, analyze and synthesize various arguments and knowledge to form independent judgment.	<input checked="" type="checkbox"/>
	The ability to provide insight in an innovative way characterized by high degree of adaptiveness.	<input type="checkbox"/>
Problem Solving & Decision Making	The ability to identify problem, generate a plan to solve problem, implement and evaluate the plan and make sound business decision.	<input checked="" type="checkbox"/>
Planning & Execution	The ability to set clear priorities and plans of action for the task and define task objectives to fulfill goals within a planned schedule for execution.	<input type="checkbox"/>
PEOPLE SKILLS		
Oral Communication & Written Communication	The ability to communicate well with others verbally so that it clearly expresses the intended message and is understandable and useful to the receiving party.	<input checked="" type="checkbox"/>
	The ability to communicate well with others in writing so that it clearly expresses the intended message and is understandable and useful to the receiving party.	<input type="checkbox"/>
Negotiation	The ability to systematically plan and prepare for negotiation and apply negotiation skills in personal and professional practice.	<input type="checkbox"/>
Cultural Intelligence	The ability to function effectively in situations characterized by cultural diversity.	<input type="checkbox"/>
Teamwork & Interpersonal Skills	The ability to work effectively with others in a group setting.	<input type="checkbox"/>
Motivation & Development of Self & Others	The ability to develop a better understanding of one's strengths and weaknesses, and learn to view others and mistakes positively as sources of personal and professional development.	<input type="checkbox"/>