COURSE OUTLINES: BA2204 Models

Academic Year	2022-2023	**Semester**	2
Course Coordinator	Jinggong Zhang		
Course Code	BA2204		
Course Title	Models		
Pre-requisites	AB1202		
No of AUs	4		
Contact Hours	52		

A) Course Aims/Description

This course introduces statistical models that are used to model actuarial, insurance, and finance data. Fundamental principles and techniques of modelling stochastic and life processes are discussed. The aim of the course is to provide students with a set of actuarial tools and techniques that can be applied in a more general setting in life, health, general insurance, and financial areas.

This course is mandatory for students in Bachelor of Business with a specialization in Actuarial Science. Students in the Risk Analytics (Risk Management and Insurance) Program and students in Bachelor of Business who are interested in quantitative and statistical models may also take this course.

This is a fundamental course for students who want to pursue an actuarial career in the future, and they will learn important topics such as actuarial models and statistical inference in this course. Quantitative models take a major part of the daily jobs for actuaries, and they need to understand very well how to build models, test models, analyze model outputs and communicate the results. It would be also helpful for other quantitative roles in finance and insurance to effectively analyze data using various quantitative models.

B) Intended Learning Outcomes (ILO)/Objectives

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

1. Describe the principles of actuarial modelling.
2. Describe the general principles of stochastic processes, and their classification into different types.
3. Apply a Markov chain.
4. Apply a Markov process.
5. Explain the concept of survival models.
6. Describe estimation procedure for lifetime distributions.
7. Derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.
8. Describe how to estimate transition intensities depending on age, exactly of using the census approximation.
9. Describe how to test crude estimates for consistency with a standard table or a set of graduated estimates, and describe the process of graduation.
10. Describe the methods for mortality projections.

C) Course Content

1. Principles of actuarial modelling.
2. Stochastic processes.
3. Markov chains.
4. The two-state Markov Model.
5. Time-homogeneous and Time-inhomogeneous Markov jump processes.
6. Survival models.
7. Estimating the lifetime distribution function.
8. The Cox regression model.
9. Exposed to risk.
10. Graduation and statistical tests.
11. Methods of graduation.
12. Mortality projection.

D) Assessment (includes both continuous and summative assessment)

Component	ILO Tested	NBS Learning Goal (Refer to Appendix 1 for list)	Weightage	Team/Individual	Assessment Rubrics (attach rubrics in appendix)
1. Final Examination	ILO1-10,	Critical Thinking, Acquisition of knowledge	70%	Individual	N.A.
2. Midterm Examination	ILO1-7,	Acquisition of knowledge & Problem Solving	10%	Individual	Problem Solving and Decision Making
3. Class Presentation	ILO1-10,	Acquisition of knowledge & Critical Thinking	10%	Individual	Problem Solving and Presentation
4. Class Participation	ILO1-10,	Acquisition of knowledge & Critical Thinking	10%	Individual	Critical Thinking
Total			100%		

Note: this course is an actuarial course with IFoA credit which is highly quantitative, so it is important for the final exam to have a relatively large weight of 70%.

E) Formative feedback

You will receive written feedback for written homework, and verbal feedback for in-class discussion and other in-class participations. Emails to individual students are also used when it is needed.

Informally stay after each class provides you informal feedback and interactions with you.

F) Learning and Teaching approach

Approach	How does this approach support you in achieving the learning outcomes?
Seminars	You will be introduced to the statistical models that are used to model actuarial, insurance, and finance data. Theories and mathematical derivations will be provided as the foundation of the course, and example will be used to illustrate how they can be applied in practice. You are welcome to question and critique in class and take part in the problem solving process.
Individual assignment(s)	You will get the chance to practice to review the knowledge learnt in class and to apply it to solve exercise problems. This will help you better grasp the essence of the course and achieve the course objective.
In-Class activities	Interactions are encouraged in class to enhance critical thinking and class engagement. This will permit sharing of ideas amongst students and instant feedback on questions.

G) Reading and References

Benjamin, The Analysis of Mortality and Other Actuarial Statistics, Heinemann, 1980 (HG8783.B468)

Durrett, Essentials of Stochastic Processes, Springer, 1999 (QA274.D965)

Lawler, Introduction to Stochastic Processes, Chapman & Hall, 2006 (QA274.L418)

Neill, Life Contingencies, Heinemann, 1977 (HG8781.N411)

H) Course Policies and Student Responsibilities

1. General:

   You are expected to read ahead for each session, be ready to participate in the class discussions and present solutions to the questions assigned. 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.

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
Jinggong Zhang	Block S3-B1A-6	6790-4653	jgzhang@ntu.edu.sg	TBA

K) Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
1	• Principles of actuarial modelling • Stochastic Processes	ILO1&2	Handout
2	• Markov chains	ILO3	Handout
3	• Time-homogeneous	ILO4	Handout

	Markov jump processes		
4	• Time-inhomogeneous Markov jump processes	ILO4	Handout
5	• Survival models	ILO5	Handout
6	• Estimation of lifetime distribution function	ILO6	Handout
7	• Estimation in the Markov Model	ILO7	Handout
8	RECESS		
9	• Midterm test	ILO1-6	Handout
10	• Proportional hazard models • Exposed to risk	ILO8	Handout
11	• Graduation tests	ILO9	Handout
12	• Graduation techniques	ILO9	Handout
13	• Mortality projection	ILO10	Handout

Annex B

List of NBS Learning Goals

LEARNING GOAL	LEARNING OBJECTIVE	CHECK
TASK SKILLS		
Acquisition of Knowledge	The process of extracting, structuring and organizing knowledge from one particular source.	☑
Ethical Reasoning	The ability to recognize and understand ethical issues, and apply sound ethical reasoning.	☐
Critical Thinking & Creative Thinking	The ability to define, examine, evaluate, analyze and synthesize various arguments and knowledge to form independent judgment.	☑
	The ability to provide insight in an innovative way characterized by high degree of adaptiveness.	☐
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.	☑
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.	☐
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.	☑
	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.	☐
Negotiation	The ability to systematically plan and prepare for negotiation and apply negotiation skills in personal and professional practice.	☐
Cultural Intelligence	The ability to function effectively in situations characterized by cultural diversity.	☐
Teamwork & Interpersonal Skills	The ability to work effectively with others in a group setting.	☐
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.	☐

Please write to NBS Accreditation office (nbsaccro@ntu.edu.sg) for sample rubrics.