

COURSE OUTLINE: BA3201 LIFE CONTINGENCIES AND DEMOGRAPHY

Academic Year	2022/2023	Semester	1
Course Coordinator	Yeo Keng Leong		
Course Code	BA3201		
Course Title	Life Contingencies and Demography		
Pre-requisites	BA2204 Models		
No of AUs	4		
Contact Hours	4 x 13 = 52 hours		
Proposal Date	7 June 2021		

A) Course Aims/Description

This course prepares students interested in working in the field of actuarial science in life insurance with the basic skillsets required for it. Specifically, you will be able to price and set reserves for various life insurance contracts after completing the course. This course builds on the knowledge of BA2202 Mathematics of Finance and BA2204 Models.

B) Intended Learning Outcomes (ILO)/Objectives

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

- 1) Define various assurance and annuity contracts.
- 2) Develop formulae for the means and variances of the payments under various assurance and annuity contracts, assuming constant deterministic interest rate.
- 3) Use assurance and annuity functions involving two lives.
- 4) Use methods of valuing cashflows that are contingent upon multiple transition events.
- 5) Use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events.
- 6) Apply the gross random future loss under an insurance contract and the principle of equivalence.
- 7) Calculate net and gross premiums and reserves of assurance and annuity contracts.
- 8) Calculate, for a single policy or a portfolio of policies, death strain at risk, expected death strain, actual death strain and mortality profit for various assurance and annuity contracts.
- 9) Project expected future cashflows for various assurance and annuity contracts, incorporating multiple decrement models as appropriate.
- 10) Show how, for unit-linked contracts, non-unit reserves can be established to eliminate ("zeroise") future negative cashflows, using a profit test model.
- 11) Explain orally any of the above actuarial concepts to an audience with financial background.

C) Course Content

- Life Insurance Contracts
- Life Annuity Contracts
- Life Table
- Evaluation of Life Insurance and Life Annuities
- Net Premiums
- Net Premium Reserves
- Variable Benefits
- With-Profits Policies
- Unit-Linked Insurance Contracts
- Accumulating With-Profits and Unitised (Accumulating) With-Profits Contracts
- Gross Premiums
- Gross Premium Reserves
- Simple Annuities and Assurances Involving Two Lives
- Contingent and Reversionary Benefits
- Competing Risks
- Multiple Decrement Tables
- Profit Testing (Cashflow) Method
- Reserving via Profit Testing (Cashflow) Method

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 Annex A)
1. Final Examination	1,2,3,4,5,6,7,8,9,10	Acquisition of Knowledge	70%*	Individual	N.A.
2. Mid-Term Test ^	1,2,6,7,8	Acquisition of Knowledge	10%	Individual	N.A.
3. Class Participation	1,2,3,4,5,6,7,8,9,10	Acquisition of Knowledge	10%	Individual	N.A.
4. Individual Presentation (Presentation of tutorial question)	11	Oral Communication	10%	Individual	Oral communication
Total			100%		

*70% weightage for final examination is required by the accreditation agreement with the Institute and Faculty of Actuaries.

^In view of current Covid-19 situation, the **Mid-Term** test will be replaced by a **Take-Home Assignment**. The weightage remains at 20% for this component.

E) Formative feedback

Tutorial questions will be discussed in class every week to cover the topic lectured in the previous week, in order to reinforce the concepts learnt then. You will identify your own areas of weakness and have ample opportunity to clarify your doubts through discussion.

After the mid-term assessment, the full solutions together with the marking scale will be made available to you. You will learn the importance of showing all relevant working steps and correct any misconceptions you may have up till then about any topics.

Individualised written feedback will be sent to you after your oral presentation for that week. You will learn which parts of your presentation went well and which parts can be improved on in your future work presentations.

F) Learning and Teaching approach

Approach	How does this approach support you in achieving the learning outcomes?
Seminars	There will be delivery of lectures covering all topics. Many examples of how these concepts are applicable in actuarial work in life insurance will be provided as part of the lectures. Time will be set aside for you to ask conceptual questions. Time permitting, higher level conceptual questions will be asked by the lecturer and discussion of them with you will follow.
Tutorials	You will try problems of various difficulties to assess your ability to recall and apply the various concepts. Solutions to these problems will be discussed in class. Presentations of pre-assigned tutorial questions will test students' ability to explain these concepts.
Mid-term assessment	A mid-term assessment covering roughly half the topics of the entire course tests your ability to recall and apply the concepts of those topics.

G) Reading and References**Basic Text**

Nil

Readings and References

Institute and Faculty of Actuaries Subject CM1 Actuarial Mathematics Core Principles Core Reading for the 2020 exams

ActEd Study Materials - 2020 Institute and Faculty of Actuaries Subject CM1 Actuarial Mathematics Core Principles, The Actuarial Education Company

Bowers, Newton L. et al., Actuarial Mathematics, 2nd ed., Schaumburg for Society of Actuaries (HG8781.A188)

Benjamin, B. and Pollard, J. H., The Analysis of Mortality and Other Actuarial Statistics, 3rd ed., Faculty of Actuaries and Institute of Actuaries (not in NTU library)

Neil, A., Life Contingencies, Heinemann (HG8781.N411)

Gerber, H. U., Life Insurance Mathematics, 3rd ed., Springer for Swiss Association of Actuaries (HG8782.G362)

Booth, P. M. et al., Modern Actuarial Theory and Practice, 2nd ed., Chapman & Hall (HG8781.M689)

H) Course Policies and Student Responsibilities

(1) General

You are expected to attend all seminar classes punctually, try all tutorial questions, participate in seminar discussions, prepare presentation slides and deliver the presentation for the pre-assigned tutorial question, and take the mid-term assessment. You are also expected to take responsibility to follow up with course handouts and course related announcements for seminar sessions you may have missed.

(2) Absenteeism

If you miss a seminar, you must inform the course instructor via e-mail 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
Yeo Keng Leong			klyeo@ntu.edu.sg	By prior appointment via email

K) Planned Weekly Schedule

Week	Topic	ILO	Readings/Activity
1	Life Insurance Contracts	1,2,11	Handouts*
2	Life Annuity Contracts	1,2,11	Handouts*
3	Life Table Evaluation of Life Insurances and Life Annuities	2,11	Handouts*
4	Net Premiums Net Premium Reserves	6,7,8,11	Handouts*
5	Variable Benefits With-Profits Policies Unit-Linked Insurance Contracts Accumulating With-Profits and Unitised (Accumulating) With-Profits Contracts	6,7,11	Handouts*
6	Gross Premiums Gross Premium Reserves	6,7,11	Handouts*
7	Simple Annuities and Assurances Involving Two Lives	3,11	Handouts*
	Recess		
8	Mid-term Assessment		Handouts*
9	Contingent and Reversionary Benefits	3,11	Handouts*
10	Competing Risks Multiple Decrement Tables	4,5,11	Handouts*
11	Profit Testing (Cashflow) Method	5,9,11	Handouts*
12	Reserving via Profit Testing (Cashflow) Method	10,11	Handouts*
13	Review		

*Handouts will be uploaded onto NTULearn one week in advance of every class.

ANNEX A: ORAL COMMUNICATION RUBRIC

Traits		Performance	
Design Factors	Communication Outcome <ul style="list-style-type: none"> Has a clear message for audience Maximizes likelihood of audience accepting the message 	Not Yet Central message is not explicitly stated in the presentation. Main points are not clearly identified, audience unsure of the direction of the message.	Substantially Developed Central message is precisely stated; main points are clearly identified.
	Evaluation:		
	Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed		
	Structure <ul style="list-style-type: none"> Organises content coherently Signals transitions between points 	Not Yet Organizational pattern (specific introduction and conclusion, sequenced materials within the body, and transitions) is not observable.	Substantially Developed Organizational pattern is clearly and consistently observable and makes the content of the presentation cohesive.
	Evaluation:		
	Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed		
	Verbal <ul style="list-style-type: none"> Speaks at appropriate speed and volume Uses correct grammar and pronunciation 	Not Yet Grammar, pronunciation and word choice are deficient. Vocal delivery is too soft or too fast to understand; gap-fillers interfere with expression.	Substantially Developed Free of errors in grammar and pronunciation; good choices of word enhance clarity of expression. Vocal delivery is varied and dynamic. Speech rate, volume, and tone facilitate audience comprehension. Minimal gap fillers.
	Evaluation:		
	Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed		
	Non-Verbal <ul style="list-style-type: none"> Establishes eye contact Uses gestures and movement to convey energy and confidence 	Not Yet Eye contact, posture, gestures, movement and facial expressions are inappropriate and significantly distracting.	Substantially Developed Eye contact, posture, gestures, movement and facial expressions make the presentation compelling, and speaker appears polished and confident.
	Evaluation:		
	Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed		

^ In view of current Covid-19 situation, non-verbal design factor will not be scored if students have to carry out the presentation online.

References:

- Garnett, J.L. (1992). "Applying a Strategic Model to Government Communication." *Communicating for Results in Government*. San Francisco, CA: Jossey-Bass.
- Munter, M. (2009). *Guide to Managerial Communication*. Upper Saddle River, NJ: Prentice Hall.
- Roger, P.S. & Hildebrandt, H.W. "Competing Values Instruments for Analyzing Written and Spoken Management Messages", *Human Resource Management*; 1993; 32, 1.
- Trevino, L.K., Daft, R.L. & Lengel, R.H. (1990). "Understanding Managers' Media Choices: A Symbolic Interactionist Perspective". *Organizations and Communication Technology*. (eds. Fulk, J. & C. Steinfeld). Sage Publications.
- Oral Communication Rubrics - Mississippi Gulf Coast Community College*. Retrieved from http://www.mgccc.edu/instruction/rubrics/MGCCC_oral_communication_rubric.pdf
- Oral Communication Value Rubric - Association of American Colleges and Universities*. Retrieved from <http://www.aacu.org/value/rubrics/pdf/OralCommunication.pdf>
- Rubric for the Assessment of Oral Communication – Valencia College*. Retrieved from <http://valenciacollege.edu/learningevidence/documents/rubrics.pdf>

Acquisition of Knowledge Rubric

Traits	Performance	
<p>Representation Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words).</p>	<p>Not Yet Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.</p>	<p>Substantially Developed Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.</p>
<p>Evaluation: Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed</p>		
<p>Calculation Ability to perform calculations.</p>	<p>Not Yet Calculations are attempted but are both unsuccessful and are not comprehensive.</p>	<p>Substantially Developed Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.).</p>
<p>Evaluation: Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed</p>		
<p>Application/ Analysis Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis.</p>	<p>Not Yet Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is uncertain about drawing conclusions from this work.</p>	<p>Substantially Developed Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.</p>
<p>Evaluation: Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed</p>		

^ In view of current Covid-19 situation, the Mid-Term test will be replaced by a Take-Home Assignment. This rubric is therefore included for the Take Home Assignment component only. It will only be announced to the students should the Take Home Assignment component be required.

ANNEX B: 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 models 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 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 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"/>

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

ANNEX C: TAXONOMY FOR LEARNING OUTCOMES/OBJECTIVES

Action Words for Bloom's Taxonomy					
Knowledge	Understand	Apply	Analyze	Evaluate	Create
define	explain	solve	analyze	reframe	design
identify	describe	apply	compare	criticize	compose
describe	interpret	illustrate	classify	evaluate	create
label	paraphrase	modify	contrast	order	plan
list	summarize	use	distinguish	appraise	combine
name	classify	calculate	infer	judge	formulate
state	compare	change	separate	support	invent
match	differentiate	choose	explain	compare	hypothesize
recognize	discuss	demonstrate	select	decide	substitute
select	distinguish	discover	categorize	discriminate	write
examine	extend	experiment	connect	recommend	compile
locate	predict	relate	differentiate	summarize	construct
memorize	associate	show	discriminate	assess	develop
quote	contrast	sketch	divide	choose	generalize
recall	convert	complete	order	convince	integrate
reproduce	demonstrate	construct	point out	defend	modify
tabulate	estimate	dramatize	prioritize	estimate	organize
tell	express	interpret	subdivide	find errors	prepare
copy	identify	manipulate	survey	grade	produce
discover	indicate	paint	advertise	measure	rearrange
duplicate	infer	prepare	appraise	predict	rewrite
enumerate	relate	produce	break down	rank	role-play
listen	restate	report	calculate	score	adapt
observe	select	teach	conclude	select	anticipate
omit	translate	act	correlate	test	arrange
read	ask	administer	criticize	argue	assemble
recite	cite	articulate	deduce	conclude	choose
record	discover	chart	devise	consider	collaborate
repeat	generalize	collect	diagram	critique	collect
retell	give examples	compute	dissect	debate	devise
visualize	group	determine	estimate	distinguish	express
	illustrate	develop	evaluate	editorialize	facilitate
	judge	employ	experiment	justify	imagine
	observe	establish	focus	persuade	infer
	order	examine	illustrate	rate	intervene
	report	explain	organize	weigh	justify
	represent	interview	outline		make
	research	judge	plan		manage
	review	list	question		negotiate
	rewrite	operate	test		originate
	show	practice			propose
	trace	predict			reorganize
	transform	record			report
		schedule			revise
		simulate			schematize
		transfer			simulate
		write			solve
					speculate
					structure
					support
					test
					validate