



**DE LA SALLE UNIVERSITY**  
**College of Science**  
**Mathematics and Statistics Department**



**LIFECO1 – Life Contingencies 1**  
*Prerequisite: STATHE1, THEOINT*

*Prerequisite to: LIFECO2, RISKTHE*

**Instructor:** \_\_\_\_\_  
**Consultation Hours:** \_\_\_\_\_

**Contact details:** \_\_\_\_\_  
**Class Schedule and Room:** \_\_\_\_\_

**Course Description**

This is course for Actuarial Science students that covers the measurement of mortality, life annuities, life insurance, benefit premiums and benefit reserves for single life functions.

**Learning Outcomes**

On completion of this course, the student is expected to present the following learning outcomes in line with the Expected Lasallian Graduate Attributes (ELGA) and the outcomes prescribed by the CHED Memorandum Order for the BS Mathematics program.

| ELGA  | Learning Outcome  | Program Outcome |   |   |   |   |   |   |   |   |    |    |    |    |    |
|---|---|-----------------|---|---|---|---|---|---|---|---|----|----|----|----|----|
|   |   | 1               | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Critical and Creative Thinker<br>Effective Communicator<br>Lifelong Learner | At the end of the course, the student will  |                 |   |   |   |   |   |   |   |   |    |    |    |    |    |
|   | apply appropriate mathematical and statistical concepts and processes, tools and mathematical and statistical softwares in the modeling of actuarial science variables and concepts in the construction of life tables involving single life functions. | ✓               | ✓ | ✓ | ✓ | ✓ | ✓ |   |   |   | ✓  |    | ✓  | ✓  | ✓  |

**Program Outcomes (BS Statistics)**

- A graduate of the program should be able to
1. Demonstrate broad and coherent knowledge and understanding of the core areas of statistical theory and statistical modeling .
  2. Apply critical and problem solving skills using the scientific method.
  3. Interpret scientific data and make judgments that include reflection on relevant scientific and ethical issues.
  4. Carry out basic mathematical and statistical computations and use appropriate technologies in (a) the analysis of data; and ( b) In pattern recognition, generalization, abstraction, critical analysis and problem solving.
  5. Communicate information, ideas problems and solutions, both, orally and in writing, to other scientists, decision makers and the public.
  6. Relate science and mathematics with other disciplines.
  7. Design and perform safe and responsible techniques and procedures in laboratory or field practices.
  8. Critically evaluate input from others.
  9. Appreciate the limitations and implications of science in everyday life.
  10. Commit to the integrity of data.
  11. Demonstrate broad and coherent knowledge and understanding in the core areas of statistics, computing and mathematics.
  12. Generate information involving the conceptualization of a strategy for generating timely and accurate/reliable data, organizing a process for putting together or compiling the needed data, and transforming available data into relevant and useful forms.
  13. Translate real-life problems into statistical problems.
  14. Identify appropriate statistical tests and methods and their proper use for the given problems, select optimal solutions to problems and make decision in the face of uncertainty.

### Final Course Output

As evidence of attaining the above learning outcomes, the student is required to submit the following during the indicated dates of the term.

| Learning Outcome   | Required Output  | Due Date |
|--|--|----------|
| By the end of the course, the student will apply appropriate mathematical and statistical concepts and processes, tools and mathematical and statistical softwares in the modeling of actuarial science variables and concepts in the construction of life tables involving single life functions. | Collaborative activity on the construction of additional life table functions on known life tables of several countries and the computation of certain life insurance products and life annuities issued at certain ages based on the life tables above. This includes an analysis and comparison of the results across different countries. | Week 13  |

### Rubric for assessment

| CRITERIA                            | Excellent (4)   | Good (3)   | Satisfactory (2)   | Needs Improvement (1)  |
|-------------------------------------|---|--|--|--|
| Content                             | Demonstrates in-depth understanding of concepts and skills with no error                | Demonstrates understanding of concepts and skills with one or two errors                               | Demonstrates some understanding of concepts and skills with minimal errors                                   | Demonstrates minimal understanding of concepts and skills with so many errors        |
| Organization                        | Presented concepts/skills which were logically organized with complete supporting ideas | Presented concepts/skills which were logically organized with some supporting ideas                    | Presented concepts/skills which were minimally organized with minimal supporting ideas                       | Presented concepts/skills which were poorly organized and lacked supporting evidence |
| Integration                         | Demonstrates integration of the concepts presented                                      | Demonstrates some integration of the concepts presented  | Demonstrates limited integration of the concepts presented   | Demonstrates no integration of the concepts presented                                |
| Accuracy of Computations/ Solutions | Computations/solutions are correct and explained correctly                              | Computations/solutions are correct but not explained well.   | Computations/solutions have some errors.   | Incorrect computations /solutions  |
| Overall Presentation and creativity | Overall presentation is creative and artistic with innovative ideas                     | Overall presentation shows some effort in its creativity and artistic value with some innovative ideas | Overall presentation shows limited effort in its creativity and artistic value with limited innovative ideas | Overall presentation is neither creative nor artistic with no innovative ideas       |

### Group Member Assessment

| Criteria      | Excellent/4  | Good/3   | Satisfactory/2   | Needs Improvement/1  |
|---------------|--|--|--|--|
| Contribution  | Group member completed an equal share of work and strived to maintain that equity throughout the project | Group member contributed significantly, but other members clearly contributed more | Group member contributed little toward the project                                   | Group members contributions were insignificant or nonexistent            |
| Dependability | Group member provided contributions with 100% punctuality and always                                     | Group member contributions were mostly punctual and almost always                  | Group member contributions were regularly late and often missed scheduled group work | Group member was undependable forcing other members to take up the slack |

|            |   |  |  |  |
|------------|---|--|--|--|
|            | appeared for group work   | appeared for group work  |  |  |
| Efficiency | Work performed was very useful and contributed significantly to the final product | Participation was inefficient and thus contributions were less than expected | Work performed was inappropriate and mostly useless toward the final product | Work performed was completely ineffective and useless in the final product |
| Attitude   | Group member was very positive and pleasant to work with                          | Group member didn't complain but offered little enthusiasm                   | Group member sometimes complained and was somewhat of a burden               | Group member often complained and generally demoralized the group          |

### Additional Requirements

At least 3 Quizzes (1.5 hours per quiz) , 1 Final Exam, Seatwork, Assignment, Recitation, Group Work

### Grading System

|   |                                     |                             |               |
|---|-------------------------------------|-----------------------------|---------------|
|   | <b>FOR STUDENTS with FINAL EXAM</b> |                             | <b>Scale:</b> |
|   | <i>with no missed quiz</i>          | <i>With one missed quiz</i> | 95-100% 4.0   |
|   |                                     |                             | 89-94% 3.5    |
|   |                                     |                             | 83-88% 3.0    |
|   |                                     |                             | 78-82% 2.5    |
|   |                                     |                             | 72-77% 2.0    |
|   |                                     |                             | 66-71% 1.5    |
| Average of quizzes                        | 60%                                 | 50%                         | 60-65% 1.0    |
| Seatworks, Boardwork, Assignment, Project | 10%                                 | 10%                         | <60% 0.0      |
| Final exam                                | 30%                                 | 40%                         |               |

### Learning Plan

| Learning Outcome   | Culminating Topics  | Week No.           | Learning Activities   |
|--|---|--------------------|---|
| By the end of the course, the student will apply appropriate mathematical and statistical concepts and processes, tools and mathematical and statistical softwares in the modeling of actuarial science variables and concepts in the construction of life tables involving single life functions. | <b>I. SURVIVAL DISTRIBUTION AND LIFE TABLE</b><br>1.1 Age-at-Death, Time-Until death and Curtate Future Lifetime random variables<br><br>1.2 Survival Function<br>1.3 Force of Mortality<br>1.4 Life Table and Life Table functions<br>1.5 Deterministic survivorship group<br>1.6 Assumptions on fractional ages (Linear, Exponential, Harmonic)<br>1.7 Some Analytical Laws of Mortality (De Moivre, Gompertz, Makeham) | Week 1-3 (9 hours) | Group discussions<br>Library work<br>Computer Laboratory Work<br>Problem Sets |
|  | <b>II. LIFE INSURANCE</b><br>2.1 The present value random variable Z<br>2.2 Insurances payable at the moment of death (Level benefit and varying benefit)   | Week 4-6 (9 hours) |   |

|  |   |                         |  |
|--|---|-------------------------|--|
|  | <p>2.3 Insurances payable at the end of the year of death (Level benefit and varying benefit)</p> <p>2.4 Relationship between insurances payable at the end of the year of death and at the moment of death</p>   |                         |  |
|  | <p><b>III. LIFE ANNUITY</b></p> <p>3.1 The Present Value random variable Y</p> <p>3.2 The current payment technique and the aggregate payment technique in finding the actuarial present value of a life annuity</p> <p>3.3 Continuous life annuity</p> <p>3.4 Discrete life annuities</p> <p>3.5 Life annuities with mthly payments</p> <p>3.6 Apportionable annuities</p> | Week 6-9<br>(9 hours)   |  |
|  | <p><b>IV. BENEFIT PREMIUMS</b></p> <p>4.1 The Equivalence Principle</p> <p>4.2 Fully continuous premiums</p> <p>4.3 Fully discrete premiums</p> <p>4.4 True mthly payment premiums</p> <p>4.5 Apportionable premiums</p>  | Week 9-11<br>(9 hours)  |  |
|  | <p><b>IV. BENEFIT RESERVES</b></p> <p>5.1 Fully continuous benefit reserves</p> <p>5.2 Fully discrete benefit reserves</p> <p>5.3 Other benefit reserves(based on mthly benefit premiums, apportionable premiums)</p>   | Week 10-11<br>(6 hours) |  |
|  | <b>FINAL EXAMINATION</b>  | ( 3 hours)              |  |

\*Problem sets are given weekly and the students are expected to work on the solutions for their fourth hour activity. At the end of the term, the solutions to the problems will be compiled and submitted as one of the course outputs.

#### References

Bowers, Gerber, Hickman, Jones and Nesbitt., (1997). *Actuarial Mathematics, (2<sup>nd</sup> edition)*  
 Jordan C. W. Jr., (2003), *Life Contingencies*. 50A

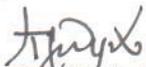
#### Online Resources

[http://www.ssa.gov/OACT/NOTES/as120/LifeTables\\_Body.html](http://www.ssa.gov/OACT/NOTES/as120/LifeTables_Body.html)  
<http://www.ssa.gov/OACT/STATS/table4C6.html>  
[http://www.paho.org/english/dd/ais/be\\_v24n4\\_Life\\_tables.htm](http://www.paho.org/english/dd/ais/be_v24n4_Life_tables.htm)

## Class Policies

1. The required minimum number of quizzes for a 3-unit course is 3, and 4 for 4-unit course. No part of the final exam may be considered as one quiz.
2. Cancellation of the lowest quiz is not allowed even if the number of quizzes exceeds the required minimum number of quizzes.
3. As a general policy, no special or make-up tests for missed exams other than the final examination will be given. However, a faculty member may give special exams for
  - A. approved absences (where the student concerned officially represented the University at some function or activity).
  - B. absences due to serious illness which require hospitalization, death in the family and other reasons which the faculty member deems meritorious.
4. If a student missed two (2) examinations, then he/she will be required to take a make up for the second missed examination.
5. If the student has no valid reason for missing an exam (for example, the student was not prepared to take the exam) then the student receives 0% for the missed quiz.
6. Students who get at least 89% in every quiz are exempted from taking the final examination. Their final grade will be based on the average of their quizzes and other prefinal course requirements. The final grade of exempted students who opt to take the final examination will be based on the prescribed computation of final grades inclusive of a final examination. Students who missed and/or took any special/make-up quiz will not be eligible for exemption.
7. Learning outputs are required and not optional to pass the course.
8. Mobile phones and other forms of communication devices should be on silent mode or turned off during class.
9. Students are expected to be attentive and exhibit the behavior of a mature and responsible individual during class. They are also expected to come to class on time and prepared.
10. Sleeping, bringing in food and drinks, and wearing a cap and sunglasses in class are not allowed.
11. Students who wish to go to the washroom must politely ask permission and, if given such, they should be back in class within 5 minutes. Only one student at a time may be allowed to leave the classroom for this purpose.
12. Students who are absent from the class for more than 5 meetings will get a final grade of 0.0 in the course.
13. Only students who are officially enrolled in the course are allowed to attend the class meetings.

Approved by:



**DR. JOSE TRISTAN F. REYES**  
Chair, Mathematics and Statistics