ASC498: Independent Study in Models for Life Contingencies - II
Section A
Spring 2017

Instructor: John Symms
Office: Math House 204
Phone: 262-524-7143 (email preferred)
Email: jsymms@carrollu.edu
Office Hours: 9:00-9:50 am and 4:00-4:50 pm TR, or by appointment
Calculator: A Society of Actuaries approved calculator
Prerequisite: ASC302

Course Overview
Independent study continuation of the fall ASC402 offering, the course will continue development of theoretical basis of life contingencies and the application of those models to insurance and other financial risks. Topics include survival models, Markov Chain models, life insurances and annuities, and Poisson processes.

Course Objective
Complete topics needed to pass Exam MLC.

Learning Outcomes
To pass MLC, students must show mastery in the following:

1. Demonstrate understanding of key concepts concerning tabular or parametric survival models and single or multiple-life states.
   
   (a) Explain and interpret the effects of transitioning between states, the survival models and their interactions. Calculate and interpret standard probability functions including survival and mortality probabilities, force of mortality, and complete and curtate expectation of life.

   (b) For models dealing with multiple lives and/or multiple states, explain the random variables associated with the model; calculate and interpret marginal and conditional probabilities, and moments.

   (c) Using the factors mentioned in Learning Outcomes 1(a) and 1(b), construct and interpret survival models for cohorts consisting of non-homogeneous populations, for example, smokers and non-smokers or ultimate-and-select groups.

   (d) Describe the behavior of continuous-time and discrete-time Markov chain models, identify possible transitions between states, and calculate and interpret the probability of being in a particular state and transitioning between states.

   (e) Apply to calculations involving these models appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

2. Perform calculations on the present value random variables associated with benefits and expenses for any of the models mentioned in the Learning Outcomes 1.
(a) Calculate and interpret probabilities, means, percentiles and higher moments.
(b) Calculate and interpret the effect of changes in underlying assumptions such as mortality and interest.
(c) Apply to calculations involving these random variables appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

3. Both calculate with and explain premium-calculation methodologies such as the equivalence principle, the portfolio-premium principle, and premiums determined by specified profit objectives.
   (a) Calculate and interpret probabilities, means, percentiles and higher moments of random variables associated with these premiums, including loss-at-issue random variables.
   (b) Using any of the models mentioned in the Learning Outcomes of Learning Objective 1, calculate and interpret the effect of changes in policy design and underlying assumptions such as changes in mortality, benefits, expenses, interest and dividends.
   (c) Perform the calculations mentioned in Learning Outcomes 3a and 3b for contracts associated with specified contingent cash flows including
      • Non-interest-sensitive insurances;
      • Annuities;
      • Universal life insurances; and
      • Participating insurances.
   (d) Apply to calculations involving these premiums appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

4. Understand reserves for insurances and annuities for models mentioned in the Learning Outcomes 1 and 3.
   (a) Calculate and interpret any of (i) several reserve types including benefits reserves, gross premium reserves, expense reserves or any of (ii) several reserve methods such as Full Preliminary Term (FPT) or modified reserves.
   (b) Calculate and interpret probabilities, means, percentiles and higher moments of random variables associated with these reserves, including future-loss random variables.
   (c) Calculate and interpret asset shares, expected profit, actual profit, gain, gain by source and period, internal rate of return and other common profit measures.
   (d) Calculate and interpret the effect of policy modifications.
   (e) Calculate and interpret contract account values, contract surrender values and profit measures on universal life insurance contracts.
   (f) Compare and contrast non-interest-sensitive and participating insurances with universal life insurances.
   (g) Calculate and interpret the effect of changes in policy design and underlying assumptions such as changes in mortality, benefits, expenses, interest and dividends.
   (h) Apply to calculations involving these reserves appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

5. Understand how the models from previous Learning Objectives apply to pension plans and retirement benefits.
(a) Describe and compare defined contribution and defined benefit pension plans including final salary and career average earning plans.

(b) Identify and interpret the common states and decrements for pension plans, and the parametric and tabular models, including Markov chain models, associated with these decrements.

(c) Given particular participant data, plan provisions, and valuation assumptions, apply the models mentioned in learning outcome 5b to defined benefit pension plans and calculate and interpret replacement ratios, accrued benefits, and their expected values with adjustments such as the early retirement reduction factor.

(d) Given particular participant data, plan provisions, and valuation assumptions, calculate and interpret the actuarial accrued liability and the normal cost for a defined benefit plan under the projected unit credit (PUC) cost method and the traditional unit credit (TUC) cost method.

(e) Calculate and interpret the effect of changes in underlying valuation assumptions such as mortality, salary increase changes, other decrements and interest on the quantities mentioned in learning outcomes 5c and 5d.

(f) Apply to calculations involving these defined benefit pension plans appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

Assessment of all learning objectives will be conducted via journals of solved problems and weekly meetings.

**Attendance**
Students are expected to attend all classes. Classes will frequently involve activities that will impact your overall grade.

**Professional Exam Preparation**
Recall that the rule-of-thumb in this industry is that for each hour of an exam, one should study 100 hours. Exam MLC is a four hour exam. Studying means trying to understand content in the textbook, working practice problems or trying to figure them out, deconstructing provided solutions to ferret out errors or to improve understanding, and exam simulations.

To do this independent study, it is expected that you will sit for the exam in May 2017. To successfully pass, you should expect to study an average of 20 hours a week leading up to May.

**Work**
We will meet weekly to discuss your progress in the material. You need to do lots of practice problems. Get a notebook, which we’ll refer to as your *journal*, to record your work. Bring the journal to my office each week, and I will use it to gauge work completed.

**Academic Honesty**
All work on assignments, quizzes and tests is expected to be your own and represent your ability in course content. The Carroll University Academic Integrity Policy is located in your student handbook. Please familiarize yourself with this policy. If a student violates this policy in any way, the instructor or College reserves the right to impose a sanction of failure on the assignments/assessment or failure in the course.
Grades
The grading scheme is as follows:

<table>
<thead>
<tr>
<th>Assignments</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percent Interval</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>[92, 100)</td>
<td>A</td>
</tr>
<tr>
<td>(88, 92]</td>
<td>AB</td>
</tr>
<tr>
<td>(82, 88)</td>
<td>B</td>
</tr>
<tr>
<td>(78, 82)</td>
<td>BC</td>
</tr>
<tr>
<td>(68, 78]</td>
<td>C</td>
</tr>
<tr>
<td>(58, 68]</td>
<td>D</td>
</tr>
<tr>
<td>(0, 58)</td>
<td>F</td>
</tr>
</tbody>
</table>

Final day to drop: April 5.

Carroll Portal (LMS)
This course will use the Carroll Portal for various purposes, including for your grades. Keep track of your grades, and notify the instructor should you spot an error.

Final Notes
1. Special accommodations for this course may be granted via direct orders from the Walter Young Center (WYC). It is your responsibility to notify the WYC of your special needs. (They will require certain forms of verifiable documentation or diagnoses.) Such accommodations will be made only after the instructor has received notification from the WYC, and will not be given retroactively for previous assignments or exams.

2. The instructor and the College reserve the right to modify, amend, or change the syllabus (course requirements, grading policy, etc.) as the curriculum and/or program require(s).