# Math 5068

Spring 2018

# *Examples: Lectures 16 & 17*

*Topics:*

* *Contingent Probabilities*
* *Insurance for Multiple Lives*
* *Insurance for Contingent Statuses*
* *Annuities for Multiple Lives*
* *Reversionary Annuities*

1. (*x*) and (*y*) independent lives are subject to constant forces of mortality  and , respectively. Find the following probabilities:
   * 1. The probability that (*x*) dies before (*y*).
     2. The probability that (*x*) dies before (*y*) and in the next 4 years.
     3. Find the probability that both (*x*) and (*y*) will die in the next 4 years with (*x*) dying first.
2. For two independent lives (40) and (50), mortality is uniformly distributed with 

Calculate the probability that (40) dies before age (50) but after (50) dies.

1. You are given:
2. The future lifetimes of (40) and (50) are independent
3. The survival function for (40) is based on a constant force of mortality, 
4. The survival function for (50) follows 

Calculate the probability that (50) dies within 10 years and dies before (40)

1. For two lives age 50, you are given:
2. Future lifetimes of the two lives are independent
3. Mortality for the two lives follows the Illustrative Life Table
4. 

A whole life insurance pays 1000 at the end of the year of the last death of these two lives. Let Z be the present value of the insurance. Calculate Var(Z).

1. An insurance policy paying 100,000 at the time of the second death is issued to two independent lives, both age 35. The force of mortality for both lives is constant, and the force of interest is .

Calculate the expected present value of the death benefit.

1. For two independent lives (*x*) and (*y*), you are given:
   1. 
   2. 
   3. 

Calculate .

1. For two independent lives (*x*) and (*y*), you are given:
   1. 
   2. 
   3. 

A fully continuous insurance pays 1000 on the first death if it occurs within the first 10 years and 2000 on the second death if it occurs within 20 years. Premiums are payable while both are alive, but no longer than 20 years. Calculate the level annual benefit premium.

1. You are given:
   1. (30) and (50) are independent lives, each subject to a constant force of mortality, 
   2. 

Find 

1. For a temporary life annuity- immediate on independent lives (30) and (40):
   1. Mortality follows the Illustrative Life Table.
   2. *i* = 0.06

Calculate 

1. For a special fully continuous last survivor insurance of 1 on (x) and (y), you are given:
   1. ** and ** are independent.
   2.  for *t* > 0
   3.  for *t* > 0
   4. 
   5. π is the annual benefit premium payable until the first of (x) and (y) dies.

Calculate π .

1. A fully continuous insurance on two independent lives (x) and (y) pays 1000 at the moment of the last death. Premiums are reduced by one third of the initial level upon the first death. You are given:
2. 
3. 
4. 

Calculate the initial annual benefit premium.

1. A life annuity due on (65) and (70) pays 10 per year while both are alive and 8 per year when exactly one of them is alive. The two lives are assumed independent. You are given:
   1. ****
   2. ****
   3. ****

Calculate the actuarial present value of this annuity.

1. An annuity due on (65) and (70) independent lives pays the following benefits:
   * + - 10 per year while both are alive
       - 5 per year while (70) is alive after the death of (65), but only until the end of 10 years from issue.
       - 7 per year while (65) is alive after the death of (70) but only starting 10 years from issue
       - You are also given:
   1. **** , ****
   2. **** , ****
   3. **** , ****

Calculate the actuarial present value of this annuity.

1. An insurance on two lives (xy) pays a continuous life annuity of 100 per years after the first death of one of the lives to the survivor. You are given:
2. 
3. 
4. 

Calculate the expected present value of the insurance.