Mathematics of Life Insurance 2

Final test

Max: 15 points Necessary: 10 points

Unless otherwise stated, consider insurance benefit payments paid at the end of the year of death

Part 1 (3 points)

An annuity is payable continuously at the rate of

- 1 per year while both (x) and (y) are alive,
- $\frac{2}{3}$ per year while one of (x) or (y) is alive and the other is dead.

Derive expression for the annuity's present value in such a form that single life table probabilities $_{t}p_{x}$ and $_{t}p_{y}$ are used.

Part 2 (3 points)

Consider standard increasing term insurance for n years with premium paid during first m years (m < n). Derive the expense-loaded premium and decomposed reserve. Specify what α, β and γ stand for.

Part 3 (3 points)

Given $\mu_{j,x+t} = \frac{j}{150}$ for j = 1, 2, 3 and t > 0. Determine E[T|J = 3].

Hint: Use the properties of exponential distribution to avoid integral calculation

Part 4 (2 points)

Write down the recursive formula for general net-premium (discrete) reserve. Moreover, assuming the life annuity in arrear deferred by m years with a net single premium, write down how c_k and Π_k would look like.

Part 5 (2 points)

Derive the total loss L of m-years deferred standard decreasing life annuity in advance with duration n years, where the net annual premium is paid during the deferment period.

Part 6 (2 points)

Write down the Lee-Carter model, name its components and suggest how the unknown elements could be estimated.