Mathematics of Life Insurance 1

Final test

Max: 20 points   Necessary: 14 points

Part 1 (2 points)

You want to buy an annuity that makes a regular series of payments, each amounting to $200 per year for a period of 15 years. You are to receive level payments at the beginning of every year. What premium should you be willing to pay for this annuity, assuming that the effective rate of interest is 13.5%?

Part 2 (3 points)

If the force of mortality μ_{x+t}, $0 \le t \le 1$, changes to $\mu_{x+t} - c$ where c is a positive constant, find the value of c for which the probability that life aged x will die within a year will be halved. Express the answer in terms of q_x.

Part 3 (3 points)

With use of l_x define $_kp_x$, $_kq_x$, C_x and D_x.

Suppose that an insurance contract has the following parameters.

- $100,000 is paid at the end of the year of death if it comes during first 10 years.

- Then this value is lowered by $10,000 each year (for the 11th year SI is $90,000).

- After that this contract expires.

Formulate random variable Z (present value of future benefits) and express the net single premium in the sum form.

Part 4 (4 points)

Formulate the assumption of linearity. Derive the relation between $\overline{A}_x$ and A_x.

Part 5 (4 points)

Consider 20-years deferred temporary life annuity in advance for 30 years, where the annual net premium is paid during the deferment period. Moreover, during the first 10 years of the deferment period, the premium refund agreement is active, i.e., in the case of death of the insured person, all premiums paid until the death are returned to the beneficiary at the end of the year of death. Derive the total loss and the annual net premium with use of actuarial notation.

Part 6 (4 points)

Consider m-years deferred endowment for n years, where the annual net premium is paid m years. Derive the annual net premium and the net premium reserve.