Actuarial Mathematics II
MTH5125

Problem Set 3 Solutions

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Spring Term

Exercise on Death Strain

On 1 January 2004, a life insurance company issued Whole Life assurances to lives then aged 45 exact. The sum assured was $\$50\ 000$ with benefits payable at the end of the year of death. Premiums are payable annually in advance.
On 1 January 2020, there were 845 of these policies still in force and, during 2020, nine of these policyholders died.
(i) Calculate the mortality profit during 2020, assuming the insurance company uses the following basis for both premiums and reserves. Mortality AM92 ultimate. Interest 4% per annum.Expenses none.
(ii) Explain why the result in part (i) has arisen.

Exercise on Death Strain

$$E\left(L_0^n\right) = 50,000 A_{45} - P\ddot{a}_{45} = 0$$

Using the AM92 $A_{45} = 0.27605$ and $\ddot{a}_{45} = 18.823$ we get
$P = \$733.28$
For calculating the mortality profit in 2020 we need to look at the reserve at the end 2020 - duration of 17 years

$$_{17}V = \$50,000 A_{62} - \$733.28\ddot{a}_{62} = \$14,402.31$$

$A_{62} = 0.48458$
$\ddot{a}_{62} = 13.401$

Exercise on Death Strain

Death Strain at Risk is:

$$DSAR = 50,000 - 14,402.31 = 35,597.69$$

Expected Death Strain at Risk per policy:

$$\begin{aligned} EDS &= q_{61} \times DSAR \\ &= 0.009009 \times 35,597.69 \\ &= 320.70 \end{aligned}$$

Total EDS

$$320.70 \times 845 = 270,991.5$$

Exercise on Death Strain

Actual DSAR:

$$9 \text{ claims} \times DSAR = 320,379.20$$

Mortality Profit

$$EDS - ADS = -49,387.7$$

Loss in this case!

Exercise on Death Strain

ii) $q_{61} = 0.009009$
Expected number of claims in 2020:

$$845 \times q_{61} = 7.6 < 9$$

There were more claims than expected for a whole life policy. This has lead to a loss for that year.