Life Insurance and Finance (STK4500)

Exercises 4, 12.3.2026

Problem 1 (Term insurance in discrete time) A 10-year policy is issued to a life aged 50. The sum insured, payable at the end of the year of death, is 200000$ and premiums P are paid yearly throughout the term.

Assume that the intensity rate $\delta = 2.5\%$ and that

$$\mu_{*\dagger}(t) = 0.002 + 0.0005(t - 50).$$

Use the equivalence principle to calculate the annual premium P and the prospective reserves $V_*^+(t), t = 0, 1, ..., 10$.

Problem 2 (Permanent disability insurance in discrete time) Consider a permanent disability insurance. Let $x = 45$ years be the initial age of the insured and let 65 be the age at maturity. Further assume that $\delta = 3\%$ (intensity rate) and that the yearly disability pension is given by 12000$.

Compute the reserves of the disability pension for each of the following cases (see Exercises 1, Problem 4):

(i)

$$\mu_{*\diamond}(t) = 0.0279, \mu_{*\dagger}(t) = 0.0229, \mu_{\diamond\dagger}(t) = \mu_{*\dagger}(t).$$

(ii) Gompertz-Makeham model

$$\mu_{*\diamond}(t) = a_1 + b_1 \exp(c_1 t), \mu_{*\dagger}(t) = a_2 + b_2 \exp(c_2 t), \mu_{\diamond\dagger}(t) = \mu_{*\dagger}(t),$$

where $a_1 = 4 \cdot 10^{-4}, b_1 = 3.4674 \cdot 10^{-6}, c_1 = 0.138155$ and $a_2 = 5 \cdot 10^{-4}, b_2 = 7.5858 \cdot 10^{-5}, c_2 = 0.087498$.

Problem 3 (Endowment policy in discrete time) Consider an endowment for a life aged 35 years with 60 years as age at maturity. Suppose that $\delta = 3.5$ % and that the death benefit is given by 250000$. The endowment is assumed to be 125000$. Further, let

$$\mu_{*\dagger}(t) = 0.0015 + 0.0004(t - 35).$$

Calculate the (constant) annual premiums P based on the equivalence principle and the prospective reserves.