

HERIOT-WATT UNIVERSITY

M.SC. IN ACTUARIAL SCIENCE

Life Insurance Mathematics I

Tutorial 5

HOMEWORK 2 - please prepare answers to Questions 1 and 4 for submission in the week beginning Monday 12 February 2007

The other questions will be discussed in tutorials that week.

1. Consider a decreasing term assurance, issued to a life age x , with term n years, initial sum assured n decreasing by 1 per annum on each policy anniversary, and level premiums payable annually in advance.
 - (a) State and prove the relation between policy values at integer durations.
 - (b) If $x = 30$ and $n = 30$, find the policy value just before payment of the 29th premium, on the basis of A1967–70 Ultimate mortality and 4% interest.
 - (c) What problems do you think this policy value could cause in practice? Can you think of any changes to the terms of the policy that would help?

2. Calculate the following on the basis of AM92 Ultimate mortality and 4% interest, stating any approximations you use:
 - (a) $6.5V_{35:\overline{25}|}$
 - (b) $16.25V_{35:\overline{25}|}$
 - (c) $16.75V_{35:\overline{25}|}^{(4)}$ and $16.5V_{35:\overline{25}|}^{(4)}$.

3. Consider the illness-death model in Figure 1. A life age x takes out a policy with a term of n years that pays an annuity of £1 per year continuously during any period of illness, and a sum assured of £100 on death. A premium of \bar{P} per annum is payable continuously while healthy.

Let ${}_t\bar{V}_x^{(j)}$ be the prospective policy value at age $x + t$, conditional on then being in state j ($j = 0, 1, 2$).

 - (a) Write down Thiele's differential equations for this model.
 - (b) State what are the boundary conditions you would use in solving Thiele's differential equations.

4. A life insurer issued a special endowment insurance policy to a life age 40, with term 5 years. The death benefit, payable at the end of the year of death, is equal

to £1,000 *plus* the reserve that would have been held at the end of the year had the policyholder been alive. The maturity benefit is £1,000. The premium is £179.30, payable annually in advance. By using the recursive relation between reserves, or otherwise, find the reserve just before payment of the 3rd premium. The basis for all calculations is A1967–70 Ultimate mortality and 4% interest.

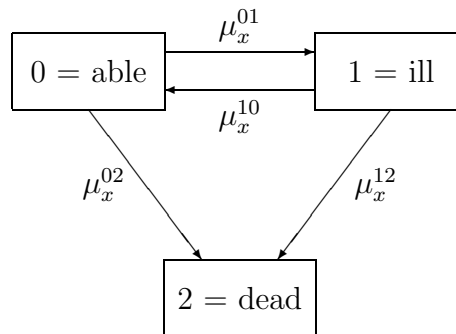


Figure 1: An illness-death model