

Name: KEYQuiz Score: /20Quiz 4: Thursday, February 26, 2015

1. An insurer issues a ten-year term insurance policy with sum insured \$50,000 to a life aged 47. Level annual premiums are payable throughout the term of the policy. The death benefit is payable at the end of the year of death.

- (a) Write down the equation you would solve, using the equivalence principle, to find the annual premium, P . (Use standard actuarial notation. No need to solve it for P . You may use π for the premium if you prefer.)

$$50,000 A_{47:\overline{10}}^1 - P \ddot{a}_{47:\overline{10}} = 0$$

- (b) Find an expression for the future loss random variable, L_7 . (HINT: There will be several cases.)

$$L_7 = \begin{cases} 50,000v - P & \text{w/prob. } q_{54} \\ 50,000v^2 - P(1+v) & \text{w/prob. } 1-q_{54} = (1-q_{54})q_{55} \\ 50,000v^3 - P(1+v+v^2) & \text{w/prob. } 1-q_{54} = (1-q_{54})(1-q_{55})q_{56} \\ -P(1+v+v^2) & \text{w/prob. } 3P_{54} = (1-q_{54})(1-q_{55})(1-q_{56}) \end{cases}$$

- (c) Find $E[L_7]$ if $P = 700$, $i = 0.06$, and $q_x = 0.01$, for all x .

$$\begin{aligned} E[L_7] &= (50,000v - P) q_{54} + (50,000v^2 - P - Pv) 1-q_{54} + (50,000v^3 - P - Pv - Pv^2) 21q_{54} \\ &\quad + (-P(1+v+v^2)) 3P_{54} \\ &= [50,000(1.06)^{-1} - 700] (0.01) + [50,000(1.06)^{-2} - 700(1+1.06^{-1})] (0.99)(0.01) \\ &\quad + [50,000(1.06)^{-3} - 700(1+1.06^{-1}+1.06^{-2})] (0.99)(0.99)(0.01) \\ &\quad + [-700(1+1.06^{-1}+1.06^{-2})] (0.99)(0.99)(0.99) \end{aligned}$$

- (d) Find $V[L_7]$ under the same conditions.

$$\begin{aligned} &= (46,469.81)(0.01) + (43,139.44)(0.99)(0.01) \\ &\quad + (39,997.59)(0.99)^2(0.01) + (-1983.37)(0.99)^3 \end{aligned}$$

$$\approx \underline{\underline{-640.67}}$$

(d) moment: $E[L_7^2] = (46,469.81)^2(0.01) + (43,139.44)^2(0.99)(0.01)$
 $+ (39,997.59)^2(0.99)^2(0.01) + (-1983.37)^2(0.99)^3$
 $\approx 59,515,097.96$ $\left[\text{so standard deviation is } \sqrt{7687.95} \right]$
 $\therefore \text{Var}[L_7] = E[L_7^2] - E[L_7]^2 \approx (59,515,097.96) - (-640.67)^2 \approx \underline{\underline{59,104,639.91}}$