STAT 472
Quiz 6
Spring 2021

April 22, 2021

1. A 20 year endowment insurance to (50) pays a death benefit of 100,000 at the end of the year of death.

   You are given:

   a. Mortality follows the Standard Ultimate Life Table.

   b. $i = 5\%$

   c. Net premiums are determined using the equivalence principle.

   Determine the net premium reserve at the end of ten years.

   Solution:

   $$PVP = PVB$$

   $$P\ddot{a}_{50:\overline{20}|} = 100,000 A_{50:\overline{20}|}$$

   $$P(12.8424) = (100,000)(0.38844)$$

   $$P = \frac{38,844.00}{12,8424} = 3024.57$$

   $${}_{10}V^{n} = PVFB - PVFP = (100,000)A_{60:\overline{10}|} - 3024.57\ddot{a}_{60:\overline{10}|}$$

   $$= (100,000)(0.62116) - (3024.57)(7.9555) = 38,054.03$$

2. A whole life insurance policy on (70) pays a death benefit of 150,000 at the end of the year of death.

   You are given:

   a. Mortality follows the Standard Ultimate Life Table.

   b. $i = 4\%$

   c. ${}_{15}V^{n} = 70,000.00$

   d. ${}_{16}V^{n} = 74,918.42$

   Determine the net premium for this policy.

   Solution:

$$({}_{15}V^{n} + P)(1+i) = (S_{16})q_{x+15} + {}_{16}V^{n}(1-q_{x+15})$$

$$(70,000 + P)(1.04) = (150,000)(0.057665) + (74,918.42)(1-0.057665)$$

$$P = \frac{(150,000)(0.057665) + (74,918.42)(1-0.057665)}{1.04} - 70,000 = 6200$$

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Spring 2021

April 22, 2021

1. A 20 year term insurance to (40) pays a death benefit of 100,000 at the end of the year of death.

   You are given:

   a. Mortality follows the Standard Ultimate Life Table.

   b. $i = 5\%$

   c. Net premiums are determined using the equivalence principle.

   Determine the net premium reserve at the end of ten years.

   Solutions:

   $PVP = PVB$

   $P\ddot{a}_{40:\overline{20}|} = 100,000 A^{1}_{40:\overline{20}|}$

   $P(12.9935) = (100,000)(0.38126 - 0.36663)$

   $P = 112.59476$

   ${}_{10}V^{n} = PVFB - PVFP = (100,000) A^{1}_{50:\overline{10}|} - 112.59476\ddot{a}_{50:\overline{10}|}$

   $= (100,000)(0.61643 - 0.60182) - (112.59476)(8.0550) = 554.05$

2. A whole life insurance policy on (80) pays a death benefit of 150,000 at the end of the year of death.

   You are given:

   a. Mortality follows the Standard Ultimate Life Table.

   b. $i = 4\%$

   c. ${}_{15}V^{g} = 90,000$

   d. The gross premium is 13,000.00.

   e. Commissions are 100% in the first year and 8% thereafter

   f. Issue Expenses are 1000 at the beginning of the first year.

   g. Maintenance expenses are 35 per policy at the beginning of every year including the first year.

   Determine ${}_{16}V^{g}$.

   Solution:

$$({}_{t}V + P_{t} - e_{t} - X_{t}^{BOY})(1+i) = (S_{t+1} + E_{t+1})(q_{+t}) + {}_{t+1}V(1-q_{+t})$$

$$(90,000 + 13,000 - (0.08)(13,000) - 35)(1.04) = (150,000 + 0)(0.173599) + {}_{16}V(1 - 0.173599)$$

$${}_{16}V = \frac{(90,000 + 13,000 - (0.08)(13,000) - 35)(1.04) - (150,000 + 0)(0.173599)}{(1 - 0.173599)}$$

$$= 96,759.50$$