

Each problem is worth 10 points. Show all work for full credit, and use correct notation. Unless implied or told otherwise, premiums are level.

1. Use SULT actuarial assumptions to determine the premium $10000 \cdot P_{20:\overline{10}|}^{\frac{1}{}}$

$$10000 \cdot P_{20:\overline{10}|}^{\frac{1}{}} = \frac{10000 \cdot A_{20:\overline{10}|}^{\frac{1}{}}}{\ddot{a}_{20:\overline{10}|}} = \frac{10000 \cdot {}_{10}E_{20}}{\ddot{a}_{20:\overline{10}|}} = 755.94$$

2. Use SULT actuarial assumptions to determine the net annual premium for a fully discrete whole life insurance of 5000 issued to (20) with premiums payable for a maximum of 20 years.

$$\pi = \frac{5000 \cdot A_{20}}{\ddot{a}_{20:\overline{20}|}} = 18.85$$

3. For a fully continuous whole life insurance of 1000 on (x), you are given:

(i) $\delta = 0.04$

(ii) $\bar{A}_x = 0.6$

(iii) Expenses are

(a) 20 initial expense

(b) 3 per year, payable continuously

Determine the gross annual premium using the equivalence principle.

$$\pi = \frac{1000 \cdot \bar{A}_x + 20 + 3 \cdot \bar{a}_x}{\bar{a}_x} = \frac{1000 \cdot \bar{A}_x + 20 + 3 \cdot \left(\frac{1 - \bar{A}_x}{\delta}\right)}{\left(\frac{1 - \bar{A}_x}{\delta}\right)} = 65$$

4. For a fully discrete whole life insurance of 100,000 on (x), with premiums paid at the beginning of each year, you are given:

(i) $A_x = 0.52$

(ii) $d = 0.06$

(iii) Non-settlement expenses are incurred at the beginning of the year.

(iv) Percent of premium expenses are 10% in the first year and 2% thereafter.

(v) Per policy expenses are 500 in the first year and 100 thereafter.

(vi) A settlement expense of 3000 is incurred at the time of benefit payment.

Determine the gross annual premium using the equivalence principle.

$$\pi \cdot \ddot{a}_x = 100000 \cdot A_x + 0.08\pi + 0.02\pi \cdot \ddot{a}_x + 400 + 100 \cdot \ddot{a}_x + 3000 \cdot A_x$$

$$\ddot{a}_x = \frac{1-A_x}{d} = 8$$

$$\therefore \pi = 7057$$

5. A discrete whole life insurance of 100,000 issued to (20) has a return of premium feature whereby if (20) dies in the next 10 years, the return of premium, without interest, is paid at the end of the year of death, in addition to the benefit of 100,000. This policy is purchased with a single premium. Determine the premium using SULT actuarial assumptions and the equivalence principle.

$$\pi = 100000 \cdot A_{20} + \pi \cdot A_{\overline{10}|} = 100000 \cdot A_{20} + \pi \cdot (A_{20:\overline{10}|} - {}_{10}E_{20})$$

$$\therefore \pi = 4932$$