MAP 4176 / 5178 Name:____

Test 9 Date: March 28, 2018

Each problem is worth 10 points. Show all work for full credit, and use correct notation. Simplify answers completely. See other side for additional problems.

1. Using ILT actuarial assumptions, determine $1000P_{50:\overline{10|}}^{\;\;\,1}$

$$1000P_{50:\overline{10|}}^{\;\;\,1} = \frac{1000A_{50:\overline{10|}}^{\;\;\,1}}{\ddot{a}_{50:\overline{10|}}} = \frac{1000\cdot{}_{10}E_{50}}{\ddot{a}_{50} - {}_{10}E_{50}\cdot\ddot{a}_{60}} \overset{ILT}{=} 67.445\ldots$$

2. Using ILT actuarial assumptions, use the equivalence principle to determine the level annual premium for an insurance that pays 25000 at the end of the year of the last death of independent lives, ages 40 and 50, with premiums paid at the beginning of each year that both are alive.

$$\pi\cdot\ddot{a}_{40:50} = 25000A_{\overline{40:50}} = 25000\cdot(A_{40} + A_{50} - A_{40:50})$$

$$\Rightarrow \pi = 233.783\ldots$$

3. Using ILT actuarial assumptions and the UDD assumption throughout, use the equivalence principle to determine the level monthly premium for a whole life insurance issued to (30) that pays 100,000 at the moment of death.

$$12\pi\cdot\ddot{a}_{30}^{(12)} = 100000\bar{A}_{30}$$

$$\overset{UDD}{\Longrightarrow} \pi = \frac{100000\cdot\frac{i}{\delta}\cdot A_{30}}{12\cdot(\alpha(12)\cdot\ddot{a}_{30} - \beta(12))} \overset{ILT}{=} 57.130\ldots$$

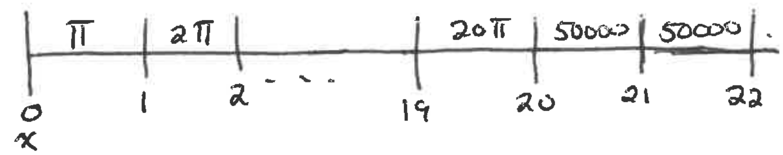
4. A 20-year deferred whole life insurance of 50000 issued to (x) with benefit paid at the end of the year of death, and premiums paid at the beginning of each year during the deferred period, has a premium refund feature that returns premiums without interest if death occurs during the deferred period. You are given:

(i) $\quad {}_{20|}A_x = 0.108$

(ii) $\quad (IA)^{1}_{x:\overline{20|}} = 1.85$

(iii) $\quad \ddot{a}_{x:\overline{20|}} = 11.36$

Benefits



Determine the annual premium using the equivalence principle.

$$EP \Rightarrow \pi \cdot \ddot{a}_{x:\overline{20|}} = \pi \cdot (IA)^{1}_{x:\overline{20|}} + 50000 \cdot {}_{20|}A_x$$

$$\Rightarrow \pi = \frac{50000 \cdot {}_{20|}A_x}{\ddot{a}_{x:\overline{20|}} - (IA)^{1}_{x:\overline{20|}}} = 567.823\ldots$$

5. For a fully discrete 15-year endowment insurance of 100,000 on (x), you are given:

(i) $\quad \ddot{a}_{x:\overline{15|}} = 10$

(ii) $\quad d = 0.04$

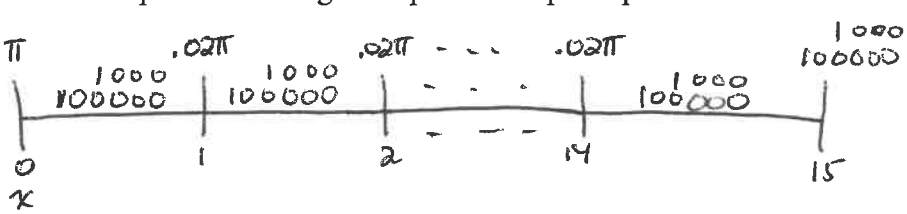
(iii) Expenses are incurred at the beginning of the year.

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

(vi) A settlement expense of 1000 occurs when the benefit is paid.

Determine the gross annual premium using the equivalence principle.

Benefits & Expenses



$$EP \Rightarrow \pi \cdot \ddot{a}_{x:\overline{15|}} = 101000 \cdot A_{x:\overline{15|}} + .08\pi + .02\pi\, \ddot{a}_{x:\overline{15|}}$$

$$\Rightarrow \pi = \frac{101000\, A_{x:\overline{15|}}}{.98\, \ddot{a}_{x:\overline{15|}} - .08} = \frac{101000\left(1 - d \cdot \ddot{a}_{x:\overline{15|}}\right)}{.98\, \ddot{a}_{x:\overline{15|}} - .08} = 6234.567\ldots$$