MAP 4176 / 5178 Name:____________________________
Test 10 Date: April 5, 2017

Show all work for full credit, use correct notation., and clearly mark your answer.

1. A fully discrete whole life insurance of 5000 issued to (35) has annual premiums of $\pi$. Using ILT actuarial assumptions, the reserve at time 15 is 781. Determine $\pi$.

$${}_{15}V = 781 = 5000A_{50} - \pi \cdot \ddot{a}_{50}$$

$$\xRightarrow{ILT} \pi = 35$$

2. Using ILT actuarial assumptions, determine the net premium reserve at time 20 for a fully discrete 30-year endowment insurance of 1000 issued to (30).

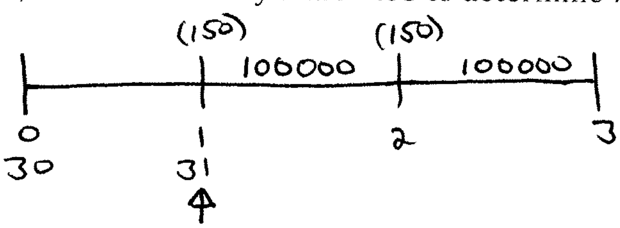
$${}_{20}V = 1000 \cdot \left(1 - \frac{\ddot{a}_{50:\overline{10|}}}{\ddot{a}_{30:\overline{30|}}}\right)$$

$$\ddot{a}_{50:\overline{10|}} = \ddot{a}_{50} - {}_{10}E_{50} \cdot \ddot{a}_{60} \overset{ILT}{=} 7.573\cdots$$

$$\ddot{a}_{30:\overline{30|}} = \ddot{a}_{30} - {}_{30}E_{30} \cdot \ddot{a}_{60} \overset{ILT}{=} 14.183\cdots$$

$$\therefore {}_{20}V = 466$$

3. For a 3-year fully discrete term insurance of 100,000 issued to (30) that has annual premiums 150, use ILT mortality and $i$ = .05 to determine $Var({}_{1}L)$.




$v = \frac{1}{1.05}$

| ${}_1L$ | Pr |
|---|---|
| $100000v - 150$ | $q_{31} = .00161$ |
| $100000v^2 - 150 - 150v$ | ${}_{1|}q_{31} = .00169\cdots$ |
| $-150 - 150v$ | ${}_2p_{31} = .99669\cdots$ |

Use TI-30XS Multiview : $Var({}_1L) = 28{,}515{,}880$

or use $Var({}_1L) = E[({}_1L)^2] - (E[{}_1L])^2$

4. For a fully discrete whole life insurance of 10,000 issued to (30) that has annual premiums of 70, use ILT actuarial assumptions to determine $\sqrt{Var({}_{10}L)}$.

$${}_{10}L = 10000\, Z_{40} - 70 \cdot \ddot{Y}_{40} \qquad \ddot{Y}_{40} = \frac{1 - Z_{40}}{d}$$

$$\Rightarrow {}_{10}L = \left(10000 + \frac{70}{d}\right) Z_{40} - \frac{70}{d}$$

$$\Rightarrow Var({}_{10}L) = \left(10000 + \frac{70}{.06}(1.06)\right)^2 \left[{}^2A_{40} - (A_{40})^2\right]$$

$$\Rightarrow \sqrt{Var({}_{10}L)} \overset{ILT}{=} 1689.46$$

5. For a semi-continuous whole life insurance issued to (40), you are given:

(i) A benefit of 25,000 is paid at the moment of death

(ii) Premiums, determined by the equivalence principle, are paid at the beginning of each year.

(iii) Mortality follows the Illustrative Life Table

(iv) $i = 0.06$

(v) There is a uniform distribution of deaths between integer ages.

Determine the reserve at the end of year 10.

$${}_{10}V = 25000\, \bar{A}_{50} - \pi \cdot \ddot{a}_{50} \qquad \pi = \frac{25000\, \bar{A}_{40}}{\ddot{a}_{40}} \overset{UDD}{=} 25000 \cdot \frac{i}{\delta} \cdot \frac{A_{40}}{\ddot{a}_{40}}$$

$$= 25000 \cdot \frac{i}{\delta} \cdot A_{50} - 25000 \cdot \frac{i}{\delta} \cdot \frac{A_{40}}{\ddot{a}_{40}} \cdot \ddot{a}_{50}$$

$$= 25000 \cdot \frac{i}{\delta} \underbrace{\left[A_{50} - \frac{A_{40}}{\ddot{a}_{40}} \cdot \ddot{a}_{50}\right]}_{= \left(1 - \frac{\ddot{a}_{50}}{\ddot{a}_{40}}\right) = \text{reserve at } t=10 \text{ for FDWL of 1 issued to (40)}}$$

$$\therefore {}_{10}V \overset{ILT}{=} 25000 \cdot (1.0297) \cdot \left(1 - \frac{13.2668}{14.8166}\right) = 2692.66$$