MAP 4176 / 5178 Name:______________________________

Test 4 Date: February 10, 2016

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

1. Using ILT actuarial assumptions and the claims acceleration approach, determine the expectation of the present value random variable for an insurance on independent lives (30) and (40), with death benefit payable at moment of death as follows:

    if (30) dies first, 30 is paid when (30) dies and 40 is paid when (40) dies

    if (40) dies first, 20 is paid when (30) dies and 50 is paid when (40) dies

$$EPV = 30\,\bar{A}_{\overset{1}{30}:40} + 40\,\bar{A}_{30:\overset{2}{40}} + 20\,\bar{A}_{\overset{2}{30}:40} + 50\,\bar{A}_{30:\overset{1}{40}}$$

$$= 20\,\bar{A}_{30} + 10\,\bar{A}_{\overset{1}{30}:40} + 40\,\bar{A}_{40} + 10\,\bar{A}_{30:\overset{1}{40}}$$

$$= 20\,\bar{A}_{30} + 40\,\bar{A}_{40} + 10\,\bar{A}_{30:40}$$

$$\underset{i=.06}{\overset{CAA}{=}} \sqrt{1.06}\left(20A_{30} + 40A_{40} + 10A_{30:40}\right) \qquad ILT \Rightarrow \begin{array}{l} A_{30} = .10248 \\ A_{40} = .16132 \\ A_{30:40} = .19584 \end{array}$$

$$\therefore EPV \doteq 10.77$$

2. Determine the actuarial present value of a 10-year deferred whole life insurance issued to (30) with a benefit of 5000 payable at the moment of death, using ILT actuarial assumptions and the UDD assumption between integer ages.

$$APV = 5000 \cdot {}_{10|}\bar{A}_{30} = 5000 \cdot {}_{10}E_{30} \cdot \bar{A}_{40}$$

$$\overset{UDD}{=} 5000 \cdot {}_{10}E_{30} \cdot \frac{i}{\delta} \cdot A_{40}$$

$$\overset{ILT}{=} 5000(.54733)(1.02971)(.16132)$$

$$\therefore EPV = 454.59$$

3. Using ILT actuarial assumptions, determine the expected present value of a 20-year deferred whole life annuity immediate issued to (35) with annual payments of 1000.

$$EPV = 1000\ {}_{20|}a_{35} = 1000 \cdot {}_{20}E_{35} \cdot a_{55} = 1000 \cdot {}_{20}E_{35}\left(\ddot{a}_{55} - 1\right)$$

$$\overset{ILT}{=} 1000\,(.286)(12.2758 - 1)$$

$$\therefore EPV = 3224.88$$

4. Using ILT actuarial assumptions, determine the actuarial present value of a 30-year temporary life annuity due issued to (30) with annual payments of 5000.

$$APV = 5000\ \ddot{a}_{30:\overline{30|}} = 5000\left(\ddot{a}_{30} - {}_{30}E_{30} \cdot \ddot{a}_{60}\right)$$

$${}_{30}E_{30} = {}_{20}E_{30} \cdot {}_{10}E_{50} \overset{OR}{=} {}_{10}E_{30} \cdot {}_{20}E_{40} \overset{OR}{=} v^{30} \cdot \frac{l_{60}}{l_{30}}$$

$$\overset{ILT}{=} .1500$$

$$\therefore APV = 5000\left(15.8561 - .15\,(11.1454)\right) \doteq 70920$$

5. Using ILT actuarial assumptions, determine the expected present value of a 12-year certain-and-life annuity due issued to (40) with annual payments of 2000

$$EPV = 2000\ \ddot{a}_{\overline{40:\overline{12|}}} = 2000\left(\ddot{a}_{\overline{12|}} + {}_{12}E_{40} \cdot \ddot{a}_{52}\right)$$

$${}_{12}E_{40} = v^{12} \cdot \frac{l_{52}}{l_{40}} \overset{ILT}{=} .47176$$

$$\therefore \cancel{AP}EPV = 2000\left(8.8869 + .47176\,(12.8879)\right) = 29935$$