MAP 4176 / 5178
Test 3

Name:________________________

Date: February 1, 2016

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

1. A 10-year deferred whole life insurance is issued to (40) with a benefit of 100,000 payable at the end of the quarter of death. Using ILT actuarial assumptions and the claims acceleration approach, determine the single net premium for this insurance.

$$SNP = 100000 \cdot {}_{10|}A_{40}^{(4)} = 100000 \cdot {}_{10}E_{40} \cdot A_{50}^{(4)}$$

$${}_{10}E_{40} \overset{ILT}{=} .53667 \qquad A_{50}^{(4)} \overset{CAA}{=} (1+i)^{3/8} \cdot A_{50} \overset{ILT}{=} (1.06)^{3/8} \cdot (.24905)$$

$$\therefore SNP = 100000(.53667)(1.06)^{3/8}(.24905) = 13661.03$$

2. A 25-year term life insurance is issued to (30) with a benefit of 10,000 payable at the end of the semiannual period of death. Using ILT actuarial assumptions and the UDD assumption between integer ages, determine the actuarial present value of the insurance.

$$APV = 10000 \cdot A^{(2)\,1}_{30:\overline{25|}} \overset{UDD}{=} 10000 \cdot \frac{i}{i^{(2)}} \cdot A^{1}_{30:\overline{25|}}$$

$$\frac{i}{i^{(2)}} \overset{ILT}{=} 1.01478 \qquad A^{1}_{30:\overline{25|}} = A_{30} - {}_{25}E_{30} \cdot A_{55}$$

$$= A_{30} - {}_{5}E_{30} \cdot {}_{20}E_{35} \cdot A_{55} \overset{ILT}{=} .0378\ldots$$

$$\therefore APV = 10000(1.01478)(.0378\ldots) = 383.80$$

3. A whole life insurance of 50,000 issued to (40) pays the death benefit at the end of the month of death. Using DML($\omega = 100$) mortality, $i = .05$, and the claims acceleration approach, determine the expected present value of this insurance.

$$EPV = 50000 \cdot A_{40}^{(12)} \overset{CAA}{=} 50000(1+i)^{11/24} \cdot A_{40}$$

$$i = .05 \qquad A_{40} \overset{DML}{\underset{\omega=100}{=}} \frac{1}{60} \cdot a_{\overline{60|}.05} = .3154\ldots$$

$$\therefore EPV = 50000(1.05)^{11/24}(.3154\ldots) = 16{,}131.13$$

4. A 20-year endowment insurance of 5,000 is issued to (x). The death benefit is payable at the moment of death. Using CF$(\mu = .02, \delta = .03)$, determine the actuarial present value of this insurance.

$$APV = 5000 \cdot \bar{A}_{x:\overline{20}|} = 5000\left(\bar{A}^{\,1}_{x:\overline{20}|} + {}_{20}E_x\right)$$

$$\bar{A}^{\,1}_{x:\overline{20}|} \overset{CF}{=} \frac{\mu}{\mu+\delta}\left(1 - {}_{20}E_x\right) \qquad {}_{20}E_x = e^{-20(\mu+\delta)} = e^{-1}$$

$$\therefore\ APV = 5000 \cdot \left(\frac{.02}{.05}(1-e^{-1}) + e^{-1}\right) = 3103.64$$

5. A 30-year term insurance of 100,000 is issued to (30). The death benefit is payable at the moment of death. Using DML$(\omega = 100)$ mortality and $i = .06$, determine the expected present value of the present value of the benefit random variable.

$$EPV = 100000 \cdot \bar{A}^{\,1}_{30:\overline{30}|}$$

$$\bar{A}^{\,1}_{30:\overline{30}|} \underset{\omega=100}{\overset{DML}{=}} \frac{1}{70} \cdot \bar{a}_{\overline{30}|.06} = \frac{1}{70} \cdot \frac{1 - v^{30}_{.06}}{\ln(1.06)} = .2024\ldots$$

$$\therefore\ EPV = 100000\,(.2024\ldots) = 20{,}248.24$$