0208

Math 402 Quiz 5 Spring 2019 Name____________________

1) Suppose that for fully continuous whole life insurance on (x) you are given that the force of mortality is constant. Then $\overline{A}_x = \overline{A}_{x+t}$ and $\overline{a}_x = \overline{a}_{x+t}$ do not depend on $t \geq 0$. Hence $Var({}_tL) = Var({}_0L) = Var({}_t\overline{L}(\overline{A}_x)) = {}^2\overline{A}_x$. Find $Var({}_t\overline{L}(\overline{A}_x)) = Var({}_tL)$ if $\mu = 0.01$ and $\delta = 0.04$.

$$= \frac{\mu}{\mu+2\delta} = \frac{.01}{.01+.08} = \boxed{\frac{1}{9} = 0.1111}$$

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2) For discrete whole life insurance on (45), mortality follows the illustrative life table and $i = 0.06$. Calculate ${}_{15}V_{45}$ using

a) the annuity ratio formula

$$1 - \frac{\ddot{a}_{60}}{\ddot{a}_{45}} = 1 - \frac{11.1454}{14.1121} = \boxed{0.2102}$$

b) the insurance ratio formula. $= \frac{A_{x+t} - A_x}{1-A_x}$ table gives $1000A_x$ $= \frac{A_{60} - A_{45}}{1-A_{45}}$

$$= \frac{.36913 - .2012}{1 - .2012} = \boxed{0.2102}$$

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3) Suppose $\overline{a}_x = 16.77$, and $\overline{a}_{x+20} = 12.62$. Find the terminal reserve ${}_{20}\overline{V}(\overline{A}_x)$.

$$1 - \frac{\overline{a}_{x+20}}{\overline{a}_{20}} = 1 - \frac{12.62}{16.77} = \boxed{0.2475}$$

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4) Calculate $\overline{a}_{x+t}$ given ${}_t\overline{V}(\overline{A}_x) = 0.1$, $\overline{P}(\overline{A}_x) = 0.0105$ and $\delta = 0.03$.
Hint: $\overline{A}_{x+t} = 1 - \delta\overline{a}_{x+t}$. Use the formula for ${}_t\overline{V}(\overline{A}_x)$ and solve for $\overline{a}_{x+t}$.

$$.1 = {}_t\bar{V}(\bar{A}_x) = \bar{A}_{x+t} - \bar{P}(\bar{A}_x)\,\bar{a}_{x+t} = 1 - \delta\,\bar{a}_{x+t} - \bar{P}(\bar{A}_x)\,\bar{a}_{x+t}$$

$$= 1 - \bar{a}_{x+t}\,[.03 + .0105] \quad \text{so}$$

$$\bar{a}_{x+t} = \frac{1 - .1}{.03 + .0105} = \frac{0.9}{.0405} = \boxed{22.2222}$$

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5) For h-pay insurance, if $t \geq h$ then there are no benefits premiums left to pay, so ${}_tV$ = (APV insurance) - (APV future benefits) = APV insurance at time t. Consider a fully discrete 20-pay whole life insurance of 1000 on (50) where mortality follows the illustrative life table, $i = 0.06$. Calculate ${}_{20}V \quad (= {}^{20}_{20}V)$, the 20th terminal benefit reserve.

$${}^h_tV = A_{x+t} \text{ for } t \geq h$$

$$\text{so } {}^{20}_{20}V = 1000\,A_{50+20} = 1000\,A_{70}$$

$$= \boxed{514.95}$$

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