MAP 4176 / 5178 Name:______________________________

Test 10 Date: April 4, 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. A fully continuous whole life insurance of 3000 issued to (x) has an annual premium rate of 90 that's payable for a maximum of 20 years. Using $CF(\mu = .02, \delta = .04)$ actuarial assumptions, determine the reserve at time 20.

$${}_{20}L = 3000 \cdot \bar{Z}_{x+20}$$ (since no more premiums are to be paid.)

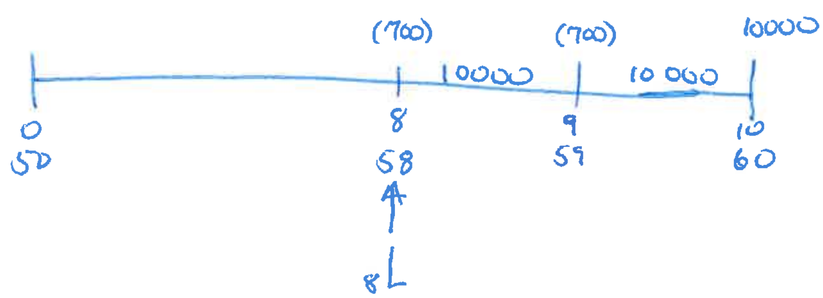
$$\therefore\ {}_{20}V = 3000 \cdot \bar{A}_{x+20} \overset{CF}{=} 3000 \cdot \frac{\mu}{\mu+\delta} = 3000 \cdot \frac{2}{6} = 1000$$

2. A fully discrete 10-year endowment insurance of 10000 with annual premiums of 700 is issued to (50). You are given:

   (i) $q_{58} = 0.01$

   (ii) $d = 0.10$

   Determine $Var({}_8L)$.



${}_8L$	Pr
$10000v - 700$	q_{59}
$10000v^2 - 700 - 700v$	p_{59}

$v = .9 \Longrightarrow$

${}_8L$	Pr
8300	.01
6770	.99

$$\therefore\ E[{}_0L] = (8300)(.01) + (6770)(.99) = 6785.3$$

$$E[({}_6L)^2] = (8300)^2(.01) + (6770)^2(.99) = 46{,}063{,}471$$

$$\Rightarrow Var({}_0L) = 23{,}174.91$$

3. Each of 100 independent lives, each age 40, purchases a fully discrete whole life insurance of 1000 with annual premiums of 12. Using ILT actuarial assumptions and the normal approximation, determine the probability the insurer's aggregate loss at issue is positive.

$$S = \sum_{1}^{100} ({}_0L)_i \qquad {}_0L = 1000\,Z_{40} - 12\cdot\ddot{Y}_{40} \quad \left(= \left(1000 + \tfrac{12}{d}\right)\cdot Z_{40} - \tfrac{12}{d}\right)$$

$$Pr(S>0) = Pr\left(SND > \frac{0 - E[S]}{\sqrt{Var(S)}}\right)$$

$$E[S] = 100\cdot E[{}_0L] = 100\cdot(1000A_{40} - 12\ddot{a}_{40}) \overset{ILT}{=} -1647.92$$

$$Var(S) = 100\cdot\left(1000 + \tfrac{12}{d}\right)^2\cdot[{}^2A_{40} - (A_{40})^2] \overset{ILT}{=} 3{,}320{,}673.889$$

$$= Pr(SND > 0.9) = 1 - .8159 = 0.1841$$

4. For a fully discrete whole life insurance of 1000 issued to (35) that has annual premiums of 9, use ILT actuarial assumptions to determine the reserve at time 10.

$${}_{10}V = 1000A_{45} - 9\cdot\ddot{a}_{45} \overset{ILT}{=} 74.1911$$

5. For a fully discrete whole life insurance of 1000 issued to (35) that has annual premiums of 9, use ILT actuarial assumptions to determine $Var({}_{10}L)$.

$${}_{10}L = 1000Z_{45} - 9\cdot\ddot{Y}_{45} = \left(1000 + \tfrac{9}{d}\right)\cdot Z_{45} - \tfrac{9}{d}$$

$$\therefore Var({}_{10}L) = \left(1000 + \tfrac{9}{d}\right)^2\cdot[{}^2A_{45} - (A_{45})^2] \overset{ILT}{=} 36{,}992.024\ldots$$