Solutions to MLCM454 Exercises

1) (See Video Solution)

$${}_{10}V = 65.56$$

2)

$${}_{10}V = 1000\left(1 - \frac{\ddot{a}_{40:\overline{10|}}}{\ddot{a}_{30:\overline{20|}}}\right)$$

$$\ddot{a}_{40:\overline{10|}} = \ddot{a}_{40} - {}_{10}E_{40} \cdot \ddot{a}_{50} \overset{\text{ILT}}{=} 7.6967 \cdots \boxed{1}$$

$$\ddot{a}_{30:\overline{20|}} = \ddot{a}_{30} - {}_{20}E_{30} \cdot \ddot{a}_{50} \overset{\text{ILT}}{=} 11.9591 \cdots \boxed{2}$$

$${}_{10}V = 1000\left(1 - \frac{\boxed{1}}{\boxed{2}}\right) = 356.41$$

3) $$ {}_{10}V = 10000\left(1 - \frac{\ddot{a}^{(12)}_{40}}{\ddot{a}^{(12)}_{30}}\right) $$

$$ \ddot{a}^{(12)}_{40} \overset{\text{UDD}}{=} \alpha(12)\,\ddot{a}_{40} - \beta(12) \overset{\text{ILT}}{=} 14.3526\cdots \ \boxed{1} $$

$$ \ddot{a}^{(12)}_{30} \overset{\text{UDD}}{=} \alpha(12)\,\ddot{a}_{30} - \beta(12) \overset{\text{ILT}}{=} 15.3924\cdots \ \boxed{2} $$

$$ \therefore\ {}_{10}V = 10000\left(1 - \frac{\boxed{1}}{\boxed{2}}\right) = 675.52 $$

4) $$ {}_{10}V = 10000\left(1 - \frac{\bar{a}_{40}}{\bar{a}_{30}}\right) $$ (old guys first!)

$$ = 10000\left(1 - \tfrac{14}{15}\right) = 666.67 $$

5) (See Video Solution)

$$ Var({}_{10}L) = .030123 $$

6) $Var({}_{10}L) = 500^2 \left(\frac{1}{1-\bar{A}_x}\right)^2 \left[{}^2\bar{A}_{x+10} - (\bar{A}_{x+10})^2\right]$

$$\bar{A}_x \stackrel{CF}{=} \frac{\mu}{\mu+\delta} = \bar{A}_{x+10} = .4$$

$$^2\bar{A}_{x+10} \stackrel{CF}{=} \frac{\mu}{\mu+2\delta} = .25$$

$\therefore Var({}_{10}L) = 62,500$

7) (See Video Solution)

$${}_{10}V = 72.05$$

8) (See Video Solution)

$${}_{10}V = 600$$

9) Since $E[{}_0L] \stackrel{EP}{=} 0$, ${}_{10}V =$ "net premium" reserves ^(not level)

$\therefore$ we can look retrospectively, and when doing so at time $t=10$, what we see "looks like" a FDWL insurance of 9000 issued to (30) with level net premiums

$$\therefore \quad {}_{10}V = 9000\left(1 - \frac{\ddot{a}_{40}}{\ddot{a}_{30}}\right) = 600$$

10) (See Video Solution)

$$_2V = 59.03$$

11) (See Video Solution)

$$_{10}V = .012838$$

12) We're given $1000 = S\left(A^{\,1}_{x+10:\overline{10}|} - P^{1}_{x:\overline{20}|} \cdot \ddot{a}_{x+10:\overline{10}|}\right)$

We seek $_{10}V = S\,\bar{A}^{\,1}_{x+10:\overline{10}|} - \pi\,\ddot{a}_{x+10:\overline{10}|}$

where $\pi = \dfrac{S\,\bar{A}^{\,1}_{x:\overline{20}|}}{\ddot{a}_{x:\overline{20}|}}$

$$\text{UDD} \Rightarrow \bar{A}^{\,1}_{y:\overline{n}|} = \frac{i}{\delta} \cdot A^{\,1}_{y:\overline{n}|}$$

$$\therefore\ \pi = \frac{i}{\delta} \cdot \frac{S\,A^{\,1}_{x:\overline{20}|}}{\ddot{a}_{x:\overline{20}|}} = \frac{i}{\delta} \cdot S \cdot P^{1}_{x:\overline{20}|}$$

$$\therefore\ {}_{10}V = S \cdot \frac{i}{\delta} \cdot A^{\,1}_{x+10:\overline{10}|} - \frac{i}{\delta} \cdot S \cdot P^{1}_{x:\overline{20}|} \cdot \ddot{a}_{x+10:\overline{10}|}$$

$$= \frac{i}{\delta} \cdot S\left(A^{\,1}_{x+10:\overline{10}|} - P^{1}_{x:\overline{20}|} \cdot \ddot{a}_{x+10:\overline{10}|}\right)$$

$$= \frac{.05}{\ln(1.05)} \cdot 1000 = 1024.80$$