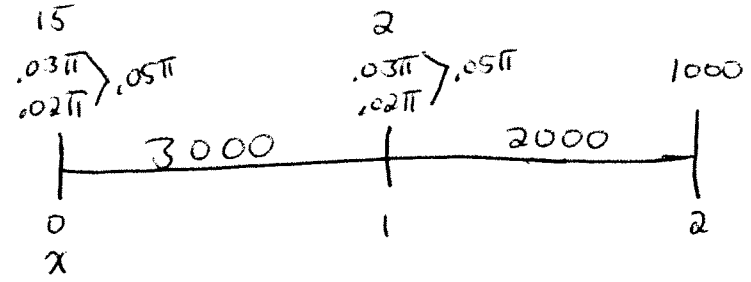
Solutions to MLCM455 Exercises

1)



B&E:

$\pi = 735.68$; $e_0 = 15 + .05\pi = 51.784$; $e = 2 + .05\pi = 38.784$

(a) acquisition expense $= e_0 - e = 13$

(b) ${}_1V^g = 2000 v q_{x+1} + 1000 v p_{x+1} + 38.784 - 735.68$

$\Rightarrow {}_1V^g = 456.95$

Remark: Since π is determined using the EP, we can use the retrospective method also.

${}_1V^g$ retro $\dfrac{735.68 - (3000 v q_x + 51.784)}{v p_x}$

$\Rightarrow {}_1V^g = 456.95$ ✓

(c) ${}_1V^{\wedge}$ Pro $2000 v q_{x+1} + 1000 v p_{x+1} - 689.93 = 463.92$

Remark: ${}_1V^{\wedge}$ Retro $\dfrac{689.93 - 3000 v q_x}{v p_x} = 463.92$ ✓

(d) ${}_1V^e = {}_1V^g - {}_1V^{\wedge} = -6.97 \Rightarrow$ (DAC at $t=1$) $= 6.97$

Remark: 1) $\pi^e = \pi^g - \pi^{\wedge} = 45.75$

$\therefore {}_1V^e = APV_{x+1}(FE) - APV_{x+1}(FP^e) = 38.784 - 45.75 = -6.97$ ✓

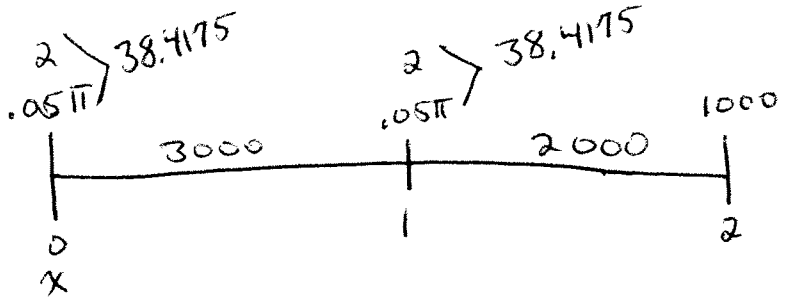
2) Since premiums were determined using the EP, we can use retro

${}_1V^e$ Retro $\dfrac{45.75 - 51.784}{v p_x} = -6.97$ ✓

$\pi = \pi^g = 728.35$

2)

B&E:



(a) $e_0 = e \Rightarrow$ acquisition expense $= 0$

(b) ${}_1V^g = 2000\, v\, q_{x+1} + 1000\, v\, p_{x+1} + 38.4175 - 728.35 = 463.91$

(Could have used retro as in #1)

(c) ${}_1V^{\wedge} = 463.92$ (as in #1)

(d) ${}_1V^g = {}_1V^{\wedge}$ (round-off error)

${}_1V^e = {}_1V^g - {}_1V^{\wedge} = 0$ (There is no DAC)

Remark: $\pi^e = \pi^g - \pi^{\wedge} = 728.35 - 689.93 = 38.42$

Every year's expense $= 38.42 = \pi^e$

3) $${}_5V = EPV_{x+5}(FB\&FE) - EPV_{x+5}(FP^g)$$

$$\therefore \quad {}_5V = \bar{A}_{x+5} + .003\,\bar{a}_{x+5} - .072\,\bar{a}_{x+5:\overline{5}|}$$

$$\bar{A}_{x+5} \overset{CF}{=} \frac{\mu}{\mu+\delta} = .4$$

$$\bar{a}_{x+5} \overset{CF}{=} \frac{1}{\mu+\delta} = 10 \quad (= \bar{a}_y \text{ for any } y)$$

$$\bar{a}_{x+5:\overline{5}|} = \bar{a}_{x+5} - {}_5E_{x+5}\,\bar{a}_{x+10} \qquad {}_5E_{x+5} = e^{-5(\mu+\delta)}$$

$$= 10 - e^{-5(.1)}(10)$$

$$\therefore \quad {}_5V = .4 + .003(10) - .072(10)(1 - e^{-.5})$$

$$= .1467$$

4) ${}_{20}V^{FPT} = {}_{19}V^{n}$ (for a FDWL insurance of 10000 issued to (41))

$$\therefore {}_{20}V^{FPT} = 10000\left(1 - \frac{\ddot{a}_{60}}{\ddot{a}_{41}}\right) \overset{ILT}{=} 2411$$

5) ${}_{6}V^{FPT} = {}_{5}V^{n}$ (for a FD 10-year term insurance of 50000 issued to (40))

$$\therefore {}_{6}V^{FPT} = 50000\, A^{1}_{45:\overline{5}|} - \pi\, \ddot{a}_{45:\overline{5}|}$$

$$\text{where } \pi = 50000\, P^{1}_{40:\overline{10}|} = \frac{50000\, A^{1}_{40:\overline{10}|}}{\ddot{a}_{40:\overline{10}|}}$$

$$A^{1}_{45:\overline{5}|} = A_{45} - {}_{5}E_{45} \cdot A_{50} \overset{ILT}{=} .0194\cdots \boxed{1}$$

$$\ddot{a}_{45:\overline{5}|} = \ddot{a}_{45} - {}_{5}E_{45} \cdot \ddot{a}_{50} \overset{ILT}{=} 4.4289\cdots \boxed{2}$$

$$A^{1}_{40:\overline{10}|} = A_{40} - {}_{10}E_{40} \cdot A_{50} \overset{ILT}{=} .0276\cdots \boxed{3}$$

$$\ddot{a}_{40:\overline{10}|} = \ddot{a}_{40} - {}_{10}E_{40} \cdot \ddot{a}_{50} \overset{ILT}{=} 7.6967\cdots \boxed{4}$$

$$\therefore {}_{6}V^{FPT} = 50000\left(\boxed{1} - \frac{\boxed{3}}{\boxed{4}} \cdot \boxed{2}\right) = 175$$