

Solutions to MLCM456 Exercises

$$1) ^{(a)} {}_0V = 1000 A_{30} - 7 \ddot{a}_{30} \stackrel{\text{ILT}}{=} -8.5127$$

$${}_1V = 1000 A_{31} - 7 \ddot{a}_{31} \stackrel{\text{ILT}}{=} -3.1312$$

$${}_2V = 1000 A_{32} - 7 \ddot{a}_{32} \stackrel{\text{ILT}}{=} 2.4983$$

(b) (Recursions) Verify the following equations hold using ${}_0V$, ${}_1V$, and ${}_2V$ above and ILT values

~~$${}_0V = 1000 v q_{30} - 7 + v \cdot {}_1V$$~~

$${}_0V = 1000 v q_{30} - 7 + v \cdot {}_1V \quad \checkmark \text{ (round-off error)}$$

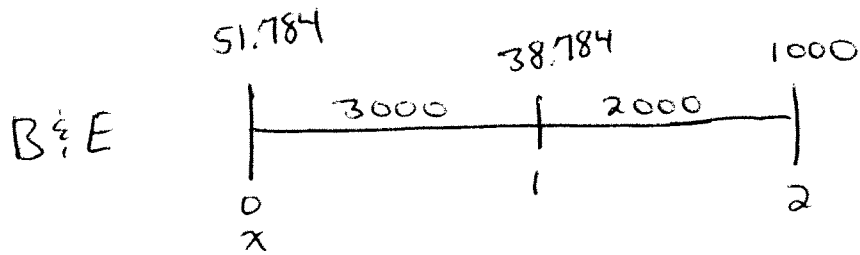
$${}_1V = 1000 v q_{31} - 7 + v \cdot {}_2V \quad \checkmark \text{ (round-off error)}$$

Remark: A 2-year recursion is

$${}_0V = 1000 v q_{30} + 1000 v^2 \cdot {}_{11}q_{30} - 7 - 7v p_{30} + v \cdot v^2 \cdot {}_2P_{30} \quad \checkmark$$

(Round-off error)

2) As in #1 from last section,



$$(a) \quad {}_0V^g = 3000v_{0x}^g + 51.784 - 735.68 + {}_1V^g \cdot v_{P_x}^g$$

${}_0V^g = 0 \Rightarrow {}_1V^g = 456.95$ which matches the answer in #1 from last section, as it should

$$(b) \quad {}_1V^g = 2000v_{1x+1}^g + 38.784 - 735.68 + {}_2V^g \cdot v_{P_{x+1}}^g$$

$${}_2V^g = 1000 \Rightarrow {}_1V^g = 456.95 \quad \checkmark$$

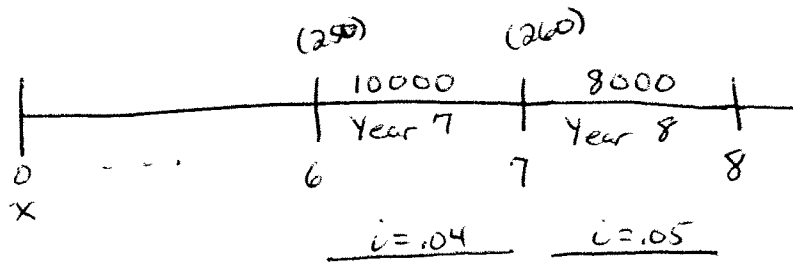
$$(c) \quad {}_0V^a = 3000v_{0x}^a - 689.93 + {}_1V^a \cdot v_{P_x}^a$$

${}_0V^a = 0 \Rightarrow {}_1V^a = 463.92$ which matches the answer in #1 from last section, as it should

$$(d) \quad {}_1V^a = 2000v_{1x+1}^a - 689.93 + {}_2V^a \cdot v_{P_{x+1}}^a$$

$${}_2V^a = 1000 \Rightarrow {}_1V^a = 463.92 \quad \checkmark$$

3)



Use 2-year recursion from $t=6$ to $t=8$

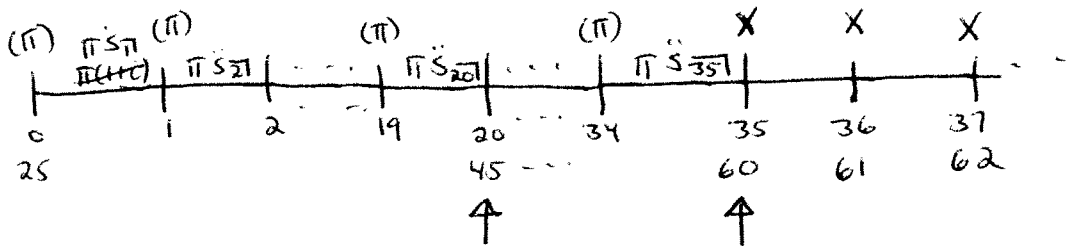
$${}_6V = 10000 v_{0.04}^9 P_{x+6} + 8000 v_{0.05} v_{0.04} P_{x+6} v_{x+7}$$

$$- 250 - 260 v_{0.04} P_{x+6}$$

$$+ {}_8V \cdot v_{0.05} v_{0.04} P_{x+6} P_{x+7}$$

$${}_6V = 3000 \Rightarrow {}_8V = 1812.08$$

4) $\pi = 1$



(a) Since premiums are returned with interest,

$${}_{20}V = AV(\text{premiums paid}) = \pi \ddot{s}_{\overline{20}|} \stackrel{\pi=1}{=} \ddot{s}_{\overline{20}|.06} = 38.99$$

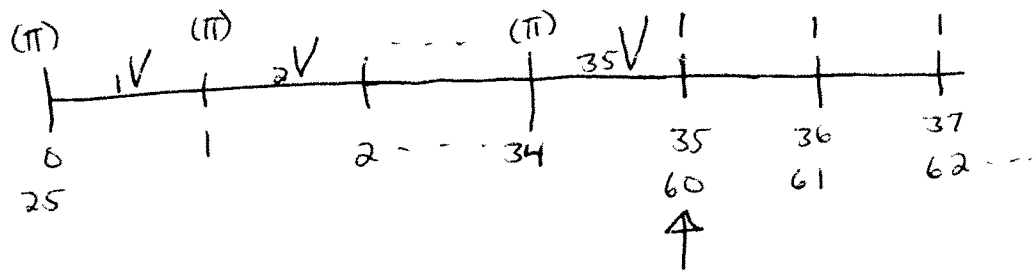
↳ not AAV, just AV

(b) As in part (a), ${}_{35}V = \pi \ddot{s}_{\overline{35}|} = \ddot{s}_{\overline{35}|.06}$

Also, ${}_{35}V \stackrel{\text{Pro}}{=} X \cdot \ddot{a}_{60}$

(c) $X \cdot \ddot{a}_{60} = \ddot{s}_{\overline{35}|} \Rightarrow X \stackrel{\text{ILT}}{=} \frac{\ddot{s}_{\overline{35}|.06}}{11.1454} = 10.60$

5)



Since the death benefit at ~~the~~ time k is kV ,
 this is equivalent to a refund of premium with interest
 feature on the contract.

$$\therefore 35V = \underbrace{\pi \ddot{S}_{\overline{35}|}}_{\text{recursively}} = \underbrace{\ddot{a}_{60}}_{\text{prospectively}}$$

$$\Rightarrow \pi = \frac{\ddot{a}_{60}}{\ddot{S}_{\overline{35}|}}$$

b) (See Video Solution)

$$(a) \quad 6.5V = 286.40$$

$$(b) \quad 5.5V = 227.06$$