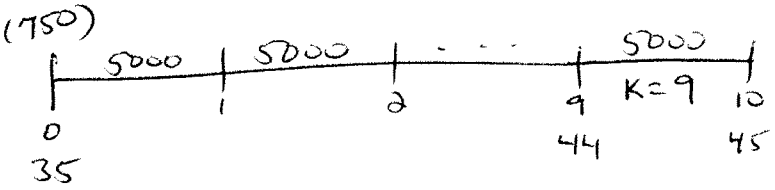
MLCM3S2 Exercises

1)



(a): $({}_0L \mid K=9) = 5000\, v_{.06}^{10} - 750 = 2041.97$

(b): $E[{}_0L] = 5000\, A_{35} - 750 \overset{ILT}{=\!=} -106.4$

(c): ${}_0L = 5000\, Z_{35} - 750$

$\Rightarrow Var({}_0L) = 5000^2 \left({}^2A_{35} - (A_{35})^2\right) \overset{ILT}{=\!=} 457779.04$

(d) and (e):

	${}_0L$	Pr
(>250)	$5000v - 750$	$Pr(K=0) = q_{35}$
(>250)	$5000v^2 - 750$	$Pr(K=1) = {}_1|q_{35}$
	⋮	⋮
(>250)	$5000v^n - 750$	$Pr(K=n-1) = {}_{n-1}|q_{35}$
(<250)	$5000v^{n+1} - 750$	$Pr(K=n) = {}_n|q_{35}$
	⋮	

$\Sigma = {}_nq_{35}$

Find n such that $5000v^n - 750 > 250$ but $5000v^{n+1} - 750 < 250$. Set $5000v^n - 750 = 250$

$\Rightarrow n = 27+$

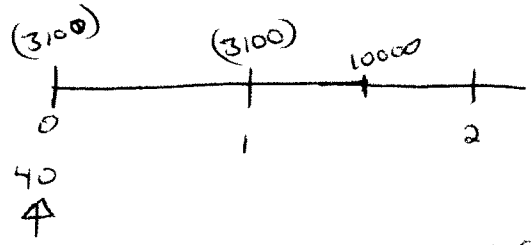
Check: $5000\, v_{.06}^{27} - 750 \approx 287 > 250$ ✓

$5000\, v_{.06}^{28} - 750 \approx 228 < 250$ ✓

$n=27$: $\therefore Pr({}_0L > 250) = Pr(K = 0, 1, 2, \ldots, 26)$

$= {}_{27}q_{35} = \frac{l_{35} - l_{62}}{l_{35}} \overset{ILT}{=\!=} .15567$

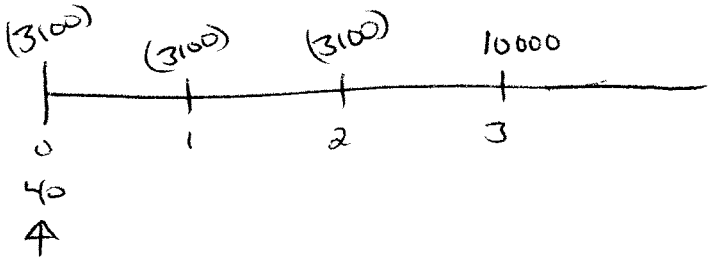
2) (a) $({}_0L \mid T=41.5)$:



$$({}_0L \mid T=41.5) = 10000\, v^{1.5}_{.05} - 3100 - 3100\, v_{.05}$$

$$= 3241.91$$

(b) $({}_0L \mid T=4.5)$:

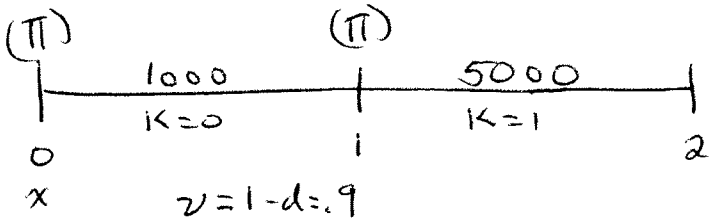


$$({}_0L \mid T=4.5) = ({}_0L \mid T>3) = 10000\, v^{3}_{.05} - 3100\, \ddot{a}_{\overline{3}|.05}$$

$$= -225.80$$

(See Video Solution)

3)



$E[{}_0L] = 0 \Rightarrow \pi = ?$

${}_0L$	Pr
$900 - \pi = 1000v - \pi$	$Pr(K=0) = {}_1q_x = .1$
$4050 - 1.9\pi = 5000v^2 - \pi - \pi v$	$Pr(K=1) = {}_1p_x \cdot {}_1q_{x+1} = .18$
$-1.9\pi = -\pi - \pi v$	${}_2p_x = .72$

(a) $E[{}_0L] = (900-\pi)(.1) + (4050 - 1.9\pi)(.18) + (-1.9\pi)(.72)$

$= 819 - 1.81\pi = 0 \Rightarrow \pi = 452.49$

(b)

${}_0L$	Pr
447.51	.1
3190.27	.18
-859.73	.72

$\pi = 452.49$

$E[{}_0L] = 0$ (as expected)

$E[({}_0L)^2] = 2384212.29 = Var({}_0L)$ since

(c) gain $\Leftrightarrow {}_0L < 0$ $\quad Pr(\text{gain}) = .72$

(d) no loss during year 1 $\Leftrightarrow 900 - \pi \leq 0 \Rightarrow \pi \geq 900$

(e) no loss during year 2 $\Leftrightarrow 4050 - 1.9\pi \leq 0 \Rightarrow \pi \geq 2131.58$

4) $$_0L = X \cdot Z_{50:\overline{10}|} - 150\,\ddot{Y}_{50:\overline{10}|}$$

$$E[{}_0L] = X \cdot A_{50:\overline{10}|} - 150\,\ddot{a}_{50:\overline{10}|} = 0$$

$$\Rightarrow X = \frac{150\,\ddot{a}_{50:\overline{10}|}}{A_{50:\overline{10}|}} = \frac{150\,\ddot{a}_{50:\overline{10}|}}{1 - d\,\ddot{a}_{50:\overline{10}|}}$$

$$\therefore X = 2000$$

5) $_0L = 10000\,\bar{Z}_x - \pi \cdot \bar{Y}_x$

$$E[{}_0L] = 10000\,\bar{A}_x - \pi\,\bar{a}_x = 0$$

$$\Rightarrow \pi = \frac{10000\,\bar{A}_x}{\bar{a}_x} = \frac{10000\,\bar{A}_x}{\left(\frac{1-\bar{A}_x}{\delta}\right)} = \frac{10000\,\delta \cdot \bar{A}_x}{1-\bar{A}_x}$$

$$\therefore \pi = 600$$

6) $$_0L = 100000\, Z_{\overline{30:35}} - 4000\, \ddot{Y}_{30:35}$$

$$E[_0L] = 100000\, A_{\overline{30:35}} - 4000\, \ddot{a}_{30:35}$$

$$\ddot{a}_{30:35} = \frac{1 - A_{30:35}}{d} = \frac{1-.6}{.05} = 8$$

$$A_{50} = 1 - d\,\ddot{a}_{50} = 1 - .05(9.4) = .53$$

$$\therefore A_{\overline{30:35}} = A_{30} + A_{50} - A_{30:50} = .38 + .53 - .6 = .31$$

$$\therefore E[_0L] = 100000\,(.31) - 4000\,(8) = -1000$$

7) $${}_0L = 60000 \cdot {}_{20|}\ddot{Y}_{40} - \cancel{21000}\ 16000\ \ddot{Y}_{40:\overline{20|}}$$

$$E[{}_0L] = 60000 \cdot {}_{20|}\ddot{a}_{40} - \cancel{21000}\ 16000\ \ddot{a}_{40:\overline{20|}}$$

$$\ddot{a}_{40:\overline{20|}} = \ddot{a}_{40} - {}_{20}E_{40} \cdot \ddot{a}_{60} \overset{ILT}{=} 11.7612 \quad [1]$$

$${}_{20|}\ddot{a}_{40} = {}_{20}E_{40} \cdot \ddot{a}_{60} \overset{ILT}{=} 3.0554 \quad [2]$$

$$\therefore E[{}_0L] = 60000\,([2]) - \cancel{21000}\ 16000\,([1]) = -4855.20$$