(New) M255 Exercises Solutions

1) $\bar{A}_{x:\overline{n}|} = \bar{A}^{1}_{x:\overline{n}|} + {}_nE_x$

$= (\bar{A}_x - {}_nE_x \cdot \bar{A}_{x+n}) + {}_nE_x = 0.72$

2) $APV = 5000\,\bar{A}_{60}$

(a) $\bar{A}_{60} \overset{\substack{DML \\ \omega=100}}{=} \frac{1}{40} \cdot \bar{a}_{\overline{40}|}$ $\left(= \frac{1}{40} \cdot \frac{i}{\delta} \cdot a_{\overline{40}|}\right.$ – yes, but easier to use CRF$\left.\right)$

$= \frac{1}{40} \cdot \frac{1-v^{40}}{\delta} \qquad v^{40} = e^{-40\delta}$

$\therefore APV = 2161.661\ldots$

(b) $\bar{A}_{60} \overset{CF}{=} \frac{\mu}{\mu+\delta}$

$\therefore APV = 1875$

3) $APV = 1000 \cdot {}_{20|}\bar{A}_{60} = 1000 \cdot {}_{20}E_{60} \cdot \bar{A}_{80}$

(a) ${}_{20}E_{60} = v^{20} \cdot {}_{20}p_{60} \overset{\substack{DML \\ \omega=100}}{=} e^{-20\delta} \cdot \frac{100-60-20}{100-60}$

$\bar{A}_{80} \overset{\substack{DML \\ \omega=100}}{=} \frac{1}{20} \cdot \bar{a}_{\overline{20}|} = \frac{1}{20} \cdot \frac{1-v^{20}}{\delta}$

$\therefore APV = 116.272\ldots$

(b) ${}_{20}E_{60} = v^{20} \cdot {}_{20}p_{60} \overset{CF}{=} e^{-20(\mu+\delta)}$

$\bar{A}_{80} \overset{CF}{=} \frac{\mu}{\mu+\delta}$

$\therefore APV = 75.711\ldots$

4) $APV = 3000 \cdot \bar{A}_{60:\overline{20}|} = 3000 \cdot (\bar{A}^{1}_{60:\overline{20}|} + {}_{20}E_{60})$

(a) ${}_{20}E_{60} = v^{20} \cdot {}_{20}p_{60} \overset{\text{DML}}{\underset{\omega=100}{=}} e^{-20\delta} \cdot \frac{100-60-20}{100-60}$

$\bar{A}^{1}_{60:\overline{20}|} \overset{\text{DML}}{\underset{\omega=100}{=}} \frac{1}{40} \cdot \bar{a}_{\overline{20}|} = \frac{1}{40} \cdot \frac{1-v^{20}}{\delta}$

$\therefore APV = 1500$

(b) ${}_{20}E_{60} = v^{20} \cdot {}_{20}p_{60} \overset{CF}{=} e^{-(\mu+\delta)\cdot 20}$

$\bar{A}^{1}_{60:\overline{20}|} = \bar{A}_{60} - {}_{20}E_{60} \cdot \bar{A}_{80}$

$= \frac{\mu}{\mu+\delta}(1 - {}_{20}E_{60})$

$\therefore APV = 1503.555\ldots$

5) $APV = 5 \cdot \bar{A}^{1}_{xy} + 20\bar{A}^{2}_{xy} + 10\bar{A}^{2}_{xy} + 15\bar{A}^{1}_{xy}$

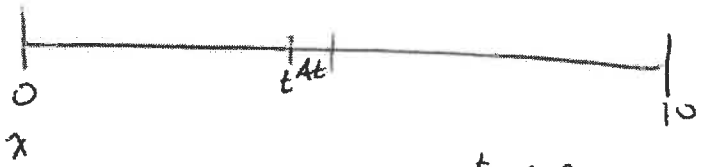
$= 5\bar{A}^{2}_{xy} + 5\bar{A}_{x} + 5\bar{A}^{2}_{xy} + 15\bar{A}_{y}$

$= 5\bar{A}_{x} + 15\bar{A}_{y} + 5\bar{A}_{\overline{xy}}$

$= 5\bar{A}_{x} + 15\bar{A}_{y} + 5(\bar{A}_{x} + \bar{A}_{y} - \bar{A}_{xy})$

$= 10\bar{A}_{x} + 20\bar{A}_{y} - 5\bar{A}_{xy}$

6)



$PV = 100000v^t$ (if death by any reason)
$= 50000v^t$ (if death by accident)

$$\therefore APV = \int_0^{10} 100000 v^t \cdot {}_tP_x^{(t)} \cdot \mu_{x+t}^{(t)} dt + \int_0^{10} 50000 v^t \cdot {}_tP_x^{(t)} \cdot \mu_{x+t}^{(\text{accident})} dt$$

$$v^t = e^{-.05t} \qquad {}_tP_x^{(t)} = e^{-.025t}$$

$$\therefore APV = \int_0^{10} 100000 e^{-.075t} \cdot (.025)\, dt + \int_0^{10} 50000 e^{-.075t} \cdot (.005)\, dt$$

$$= 2500 \int_0^{10} e^{-.075t} dt + 250 \int_0^{10} e^{-.075t} dt$$

$$= \frac{2750}{.075} e^{-.075t} \Big|_{10}^{0} = 19346.559\ldots$$

7) $APV = 1000 \cdot \bar{A}_{40}$

(a) $\bar{A}_{40} \overset{UDD}{=} \frac{i}{\delta} \cdot A_{40}$ Note: $\frac{i}{\delta} = \frac{i}{i^{(\infty)}}$

$\therefore APV \overset{\substack{UDD \\ ILT}}{=} 166.112\ldots$

(b) $\bar{A}_{40} \overset{CAA}{=} (1+i)^{1/2} \cdot A_{40}$

$\therefore APV \overset{\substack{CAA \\ ILT}}{=} 166.089\ldots$

8) $APV = 1000\,\bar{A}_{40:\overline{20}|} = 1000\left(\bar{A}^{1}_{40:\overline{20}|} + {}_{20}E_{40}\right)$

(a) $\bar{A}^{1}_{40:\overline{20}|} \overset{UDD}{=} \frac{i}{\delta} \cdot \left(A_{40} - {}_{20}E_{40} \cdot A_{60}\right)$

$\therefore APV \overset{UDD}{\underset{ILT}{=}} 336.053\ldots$

(b) $\bar{A}^{1}_{40:\overline{20}|} \overset{CAA}{=} (1+i)^{1/2} \cdot \left(A_{40} - {}_{20}E_{40} \cdot A_{60}\right)$

$\therefore APV \overset{CAA}{\underset{ILT}{=}} 336.044\ldots$