(New) M2S2 Exercises (Solutions)

1) $APV = 5000\,\ddot{a}_{35} \overset{ILT}{=} 5000\,(15.3926) = 76963$

2) $APV = 5000\,a_{35}$

$$a_{35} = \ddot{a}_{35} - 1 \overset{ILT}{=} 14.3926$$

$\therefore APV = 71963$

3) $APV = 500 \cdot {}_{17|}\ddot{a}_{35} = 500 \cdot {}_{17}E_{35} \cdot \ddot{a}_{52}$

$${}_{17}E_{35} = v^{17} \cdot {}_{17}p_{35} \overset{ILT}{=} (1.06)^{-17} \cdot \frac{l_{52}}{l_{35}} \overset{ILT}{=} .3485\ldots$$

$$\ddot{a}_{52} \overset{ILT}{=} 12.8879$$

$\therefore APV = 2245.749\ldots$

4) $APV = 500 \cdot {}_{17|}a_{35} = 500 \cdot {}_{17}E_{35} \cdot a_{52}$

${}_{17}E_{35} \overset{ILT}{=} .3485\ldots$ (See #3)

$a_{52} = \ddot{a}_{52} - 1 \overset{ILT}{=} 11.8879$

$\therefore APV = 2071.497\ldots$

5) $APV = 750\,\ddot{a}_{32:\overline{2}|} \overset{VEP}{=} 750 + 750\nu P_{32} \overset{ILT}{=} 1456.344\ldots$

6) $APV = 8000\,\ddot{a}_{35:\overline{17}|}$

$\ddot{a}_{35:\overline{17}|} = \ddot{a}_{35} - {}_{17}E_{35} \cdot \ddot{a}_{52} \overset{ILT}{=} 10.9011\ldots$

$\therefore APV = 87208.804\ldots$

7) $APV = 8000\,a_{35:\overline{17}|}$

$a_{35:\overline{17}|} = \ddot{a}_{35:\overline{17}|} - 1 + {}_{17}E_{35}$

OR $a_{35:\overline{17}|} = (\ddot{a}_{35} - 1) + {}_{17}E_{35}(\ddot{a}_{52} - 1)$ $\Big\}$ $\therefore a_{35:\overline{17}|} \overset{ILT}{=} 10.2496\ldots$

$\therefore APV = 81996.845\ldots$

8) $APV = 2000\,\ddot{a}_{\overline{35:17|}}$

$$\ddot{a}_{\overline{35:17|}} = \ddot{a}_{\overline{17|}} + {}_{17|}\ddot{a}_{35} = \ddot{a}_{\overline{17|}} + \underbrace{{}_{17}E_{35}\cdot \ddot{a}_{52}}_{\text{see \#3}}$$

$$\ddot{a}_{\overline{17|}.06} \overset{TVM}{=} 11.1058\ldots$$

$$\therefore APV \overset{TLT}{=} 31,194.789\ldots$$

9) $APV = 2000\,a_{\overline{35:17|}} = 2000\left(a_{\overline{17|}} + \underbrace{{}_{17}E_{35}\cdot a_{52}}_{\text{see \#4}}\right)$

$$a_{\overline{17|}.06} \overset{TVM}{=} 10.4772\ldots$$

$$\therefore APV \overset{TLT}{=} 29240.507\ldots$$

10) $APV = 1000\,\ddot{a}_{30:\overline{4D}} \overset{TLT}{=} 14206.8$

11) $APV = 1000\,\ddot{a}_{30:40:\overline{10|}}$

$$\ddot{a}_{30:40:\overline{10|}} = \underbrace{\ddot{a}_{30:40}}_{\overset{TLT}{=} 14.2068} - {}_{10}E_{30:40}\cdot \underbrace{\ddot{a}_{40:50}}_{\overset{TLT}{=} 12.4784}$$

${}_{10}E_{30:40} = v^{10}\cdot {}_{10}P_{30:40} = v^{10}\cdot {}_{10}P_{30}\cdot {}_{10}P_{40}$ Do directly, OR

trick $(1.06)^{10}\cdot v^{10}\cdot {}_{10}P_{30}\cdot v^{10}\cdot {}_{10}P_{40} = (1.06)^{10}\cdot {}_{10}E_{30}\cdot {}_{10}E_{40}$

Either way, ${}_{10}E_{30:40} \overset{TLT}{=} .5260\ldots$

$$\therefore APV \overset{TLT}{\approx} 7643$$

12) $APV = 500\,\ddot{a}_{\overline{30:40}} = 500\left(\ddot{a}_{30} + \ddot{a}_{40} - \ddot{a}_{30:40}\right) \overset{ILT}{=} 8232.95$

13) $APV = 500\,\ddot{a}_{\overline{30:40}:\overline{10}|}$

$$\ddot{a}_{\overline{30:40:10}|} = \ddot{a}_{30:\overline{10}|} + \ddot{a}_{40:\overline{10}|} - \underbrace{\ddot{a}_{30:40:\overline{10}|}}_{\text{See \#11}}$$

$$\ddot{a}_{x:\overline{10}|} = \ddot{a}_x - {}_{10}E_x \cdot \ddot{a}_{x+10}$$

$\therefore \ddot{a}_{30:\overline{10}|} \overset{ILT}{=} 7.746\ldots$

$\ddot{a}_{40:\overline{10}|} \overset{ILT}{=} 7.696\ldots$

$\therefore APV \overset{ILT}{=} 3900$

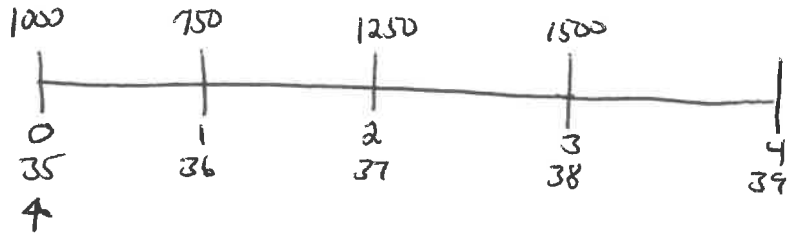
14) $APV = 1000\,\ddot{a}_{30:40} + 750\,\ddot{a}_{40|30} + 500\,\ddot{a}_{30|40}$

$$\ddot{a}_{y|x} = \ddot{a}_x - \ddot{a}_{xy}$$

$\therefore APV = 1000\,\ddot{a}_{30:40} + 750\left(\ddot{a}_{30} - \ddot{a}_{30:40}\right) + 500\left(\ddot{a}_{40} - \ddot{a}_{30:40}\right)$

$\therefore APV = 750\,\ddot{a}_{30} + 500\,\ddot{a}_{40} - 250\,\ddot{a}_{30:40} \overset{ILT}{=} 15748.675$

15)



$v = 1 - d = .95$

APV $\overset{VEP}{=}$ $1000 + 750v\,{}_1p_{35} + 1250v^2\,{}_2p_{35} + 1500v^3\,{}_3p_{35}$

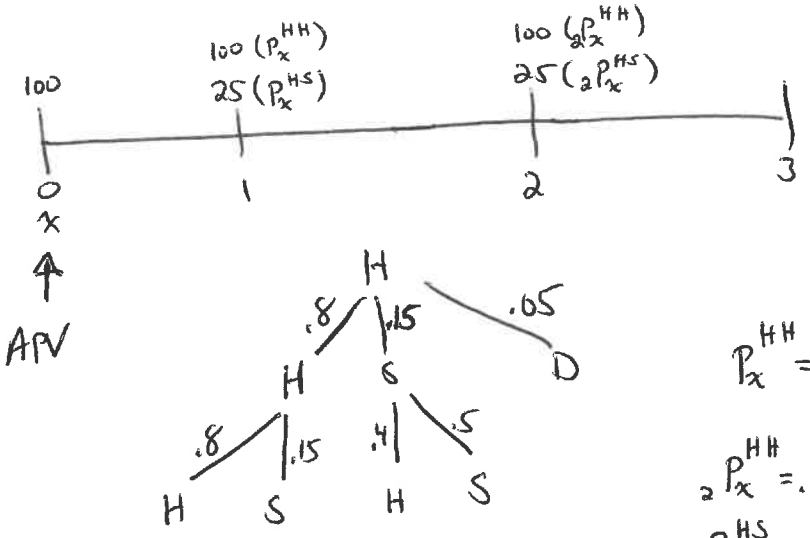
$q_{35} = .02$ $\quad {}_2p_{35} = p_{35} \cdot p_{36}$

$q_{36} = .025$ $\quad {}_3p_{35} = p_{35} \cdot p_{36} \cdot p_{37}$

$q_{37} = .03$

$\therefore$ APV $= 3968$

16)



$v = .95$

$p_x^{HH} = .8$ $\quad p_x^{HS} = .15$

${}_2p_x^{HH} = .8^2 + .15(.4) = .7$

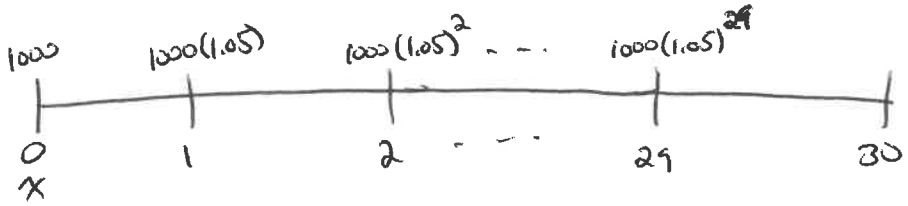
${}_2p_x^{HS} = .8(.15) + (.15)(.5) = .195$

APV $\overset{VEP}{=}$ $100 + 100v(.8) + 25v(.15) + 100v^2(.7) + 25v^2(.195)$

$\therefore$ APV $= 247.137\ldots$

17) See daily notes on 1/18/18

18)



$$APV \overset{VEP}{=} 1000 + 1000\underbrace{(1.05)v_{.05}}_{=1} \cdot {}_1P_x + 1000\underbrace{(1.05)^2 \cdot v_{.05}^2}_{=1} \cdot {}_2P_x + \cdots + 1000\underbrace{(1.05)^{29} \cdot v_{.05}^{29}}_{=1} \cdot {}_{29}P_x$$

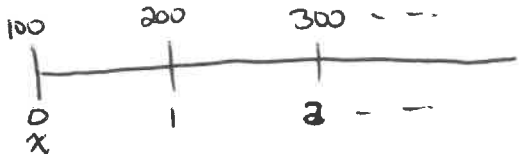
$$= 1000\left(1 + {}_1P_x + {}_2P_x + \cdots + {}_{29}P_x\right)$$

Recall, $e_{x:\overline{30}|} = {}_1P_x + {}_2P_x + \cdots + {}_{30}P_x$

$\therefore \quad 20.7 = {}_1P_x + {}_2P_x + \cdots + {}_{29}P_x + 0.4$

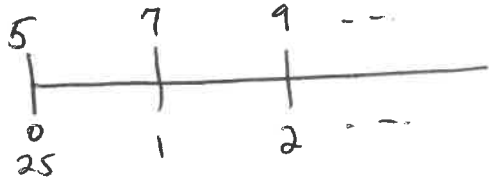
$\therefore \quad APV = 1000\left(1 + (20.7 - 0.4)\right) = 21{,}300$

19)



$$APV = 100 \cdot (I\ddot{a})_x$$

20)

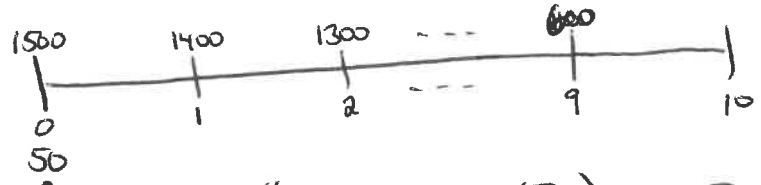


$$APV = 5\ddot{a}_{\overline{25}|} + 2(Ia)_{\overline{25}|}$$

OR $$APV = 3\ddot{a}_{\overline{25}|} + 2(I\ddot{a})_{\overline{25}|}$$

} 2 "intuitive" answers, other possible correct answers

21)



$$APV = 1500\ddot{a}_{50:\overline{10}|} - 100(Ia)_{50:\overline{9}|}$$

OR $$APV = 1600\ddot{a}_{50:\overline{10}|} - 100(I\ddot{a})_{50:\overline{10}|}$$

OR $$APV = 500\ddot{a}_{50:\overline{10}|} + 100(D\ddot{a})_{50:\overline{10}|}$$

} There are other correct answers!

22) $APV = 4000\,\ddot{a}^{(4)}_{40}$

(a) $\ddot{a}^{(4)}_{40} \overset{UDD}{=} \alpha(4)\cdot\ddot{a}_{40} - \beta(4) \overset{ILT}{=} 1.00027\cdot(14.8166) - .38424$

$\therefore APV = 57,745.441\ldots$

(b) $\ddot{a}^{(4)}_{40} \overset{3WH}{=} \ddot{a}_{40} - \frac{3}{8} - \frac{15}{192}(\mu+\delta)$ $\quad e^{-2\mu} = {}_2p_{39} = \frac{l_{41}}{l_{39}} \Rightarrow \mu = .00269\ldots$

$\delta = \ln(1.06) = .058\ldots$

$\therefore APV = 57,747.349\ldots$

23) $APV = 400\cdot {}_{20|}\ddot{a}^{(4)}_{40} = 400\cdot {}_{20}E_{40}\cdot\ddot{a}^{(4)}_{60}$

${}_{20}E_{40} \overset{ILT}{=} .27414$

(a) $\ddot{a}^{(4)}_{60} \overset{UDD}{=} \alpha(4)\cdot\ddot{a}_{60} - \beta(4) \overset{ILT}{=} 1.00027(11.1454) - .38424$

$\therefore APV = 1180.355\ldots$

(b) $\ddot{a}^{(4)}_{60} \overset{3WH}{=} \ddot{a}_{60} - \frac{3}{8} - \frac{15}{192}(\mu+\delta)$ $\quad e^{-2\mu} = {}_2p_{59} = \frac{l_{61}}{l_{59}} \Rightarrow \mu = .0132\ldots$

$\delta = \ln(1.06) = .058\ldots$

$\therefore APV = 1180.426\ldots$

24) $APV = 4000\,\ddot{a}^{(4)}_{40:\overline{20}|}$

$\ddot{a}^{(4)}_{40:\overline{20}|} = \ddot{a}^{(4)}_{40} - {}_{20}E_{40}\cdot\ddot{a}^{(4)}_{60}$

${}_{20}E_{40} \overset{ILT}{=} .27414$

$\ddot{a}^{(4)}_{40} \overset{UDD}{\underset{ILT}{=}} 1.00027(14.8166) - .38424 = 14.436\ldots$

$\ddot{a}^{(4)}_{60} \overset{UDD}{\underset{ILT}{=}} 1.00027(11.1454) - .38424 = 10.764\ldots$

$\therefore APV = 45941.884\ldots$

25)

(Redo 22) $APV = 4000\,\ddot{a}^{(12)}_{40}$

(a) $\ddot{a}^{(12)}_{40} \overset{UDD}{=} \alpha(12)\,\ddot{a}_{40} - \beta(12) \overset{ILT}{=} 1.00028\,(14.8166) - .46812$

$\therefore APV = 57{,}410.514\ldots$

(b) $\ddot{a}^{(12)}_{40} \overset{3WH}{=} \ddot{a}_{40} - \frac{11}{24} - \frac{143}{1728}(\mu+\delta)$ $\quad e^{-2\mu} = {}_2p_{39} = \frac{l_{41}}{l_{39}} \Rightarrow \mu = .00269\ldots$

$\therefore APV = 57{,}412.887\ldots$ $\quad \delta = \ln(1.06) = .058\ldots$

(Redo 23) $APV = 400 \cdot {}_{20|}\ddot{a}^{(12)}_{40} = 400\ {}_{20}E_{40} \cdot \ddot{a}^{(12)}_{60}$

${}_{20}E_{40} \overset{ILT}{=} .27414$

(a) $\ddot{a}^{(12)}_{60} \overset{UDD}{=} \alpha(12)\,\ddot{a}_{60} - \beta(12) \overset{ILT}{=} 1.00028(11.1454) - .46812$

$\therefore APV = 1171.170\ldots$

(b) $\ddot{a}^{(12)}_{60} \overset{3WH}{=} \ddot{a}_{60} - \frac{11}{24} - \frac{143}{1728}(\mu+\delta)$ $\quad e^{-2\mu} = {}_2p_{59} = \frac{l_{61}}{l_{59}} \Rightarrow \mu =$

$\therefore APV = 1171.251\ldots$

(Redo 24) $APV = 4000 \cdot \ddot{a}^{(12)}_{40:\overline{20|}}$

$\ddot{a}^{(12)}_{40:\overline{20|}} = \ddot{a}^{(12)}_{40} - {}_{20}E_{40} \cdot \ddot{a}^{(12)}_{60}$

${}_{20}E_{40} \overset{ILT}{=} .27414$

$\ddot{a}^{(12)}_{40} \overset{UDD}{\underset{ILT}{=}} 1.00028(14.8166) - .46812$

$\ddot{a}^{(12)}_{60} \overset{UDD}{\underset{ILT}{=}} 1.00028(11.1454) - .46812$

$\therefore APV = 45{,}698.814\ldots$