Errata and Updates for ASM Exam MLC (Thirteenth Edition) Sorted by Page

Practice Exam 4:17 (page 1359), 5:21 (page 1370), 8:27 (page 1404), 9:28 (page 1415), 10:21 (page 1422), 11:23 (page 1434), 11;26 (page 1435), 12:21 (page 1445), 13:29 (page 1459), 14:22 (page 1467), and 15:22 (page 1476) should be corrected as listed below.

[11/24/2014] On page 15, in the solution to exercise 1.11, on the last line, put a right parenthesis after $\Pr(X < 1/2$.

[2/7/2015] On page 22, 9 lines above equation (2.4), change "sam" to "same".

[8/19/2014] On page 33, in the solution to exercise 2.1, on the third line, the denominator should be $S_0(32)$.

[1/10/2014] On page 34, in the solution to exercise 2.7, on the first displayed line, change ${}_{20}p_{40}\,{}_5q_{45}$ to ${}_{20}p_{20}\,{}_5q_{40}$.

[12/2/2013] On page 38, on the first line of the first paragraph, remove the apostrophe from Bower's.

[12/2/2013] On page 38, on the third line of the first paragraph, delete the sentence beginning "On the exam".

[10/29/2014] On page 51, in exercise 3.42, on the last line, change "form" to "from".

[9/18/2014] On page 54, in the solution to exercise 3.13III, dx should be moved to the left of the first equals sign, right after $(x+1)^n$.

[1/20/2014] On page 82, the first two displayed lines should be replaced with

$$\begin{aligned} &= -\frac{1}{(\omega-x)^\alpha}\,\frac{(\omega-x-t)^{\alpha+1}}{\alpha+1}\Bigg|_0^{\omega-x} \\ &= \frac{(\omega-x)}{\alpha+1} \end{aligned}$$

[11/24/2014] On page 101, in the solution to exercise 5.17, on the second displayed line, cube the first 50 in the numerator and denominator so that it reads

$$\frac{50^3\Big/\big(50+(20+t)\big)^3}{50^3/(50+20)^3}$$

[3/24/2014] On page 103, in the solution to exercise 5.26, in the paragraph beginning "Either way", on the first line, change "than" to "then".

[11/24/2014] On page 106, in the solution to exercise 5.34, on the second line, change "probability of death at" to "probability of death after".

[12/2/2013] On page 149,2 lines above the last table on the page, change ${}_kp_x$ to ${}_kp_{[x]}$. In Example 8F and on the last line of the page, change ${}_3p_{40}$ to ${}_3p_{[40]}$.

[7/17/2014] On page 157, in exercise 8.30, in the table, change $\mathring{e}_x$ to $\mathring{e}_{[x]}$.

[12/2/2013] On page 162, in the solution to exercise 8.15, on the first line change ${}_3p[60]+1$ to ${}_3p_{[60]+1}$. On the third line, change ${}_3q[60]+1$ to ${}_3q_{[60]+1}$.

[12/14/2014] On page 167, in the solution to exercise 8.30, the parts should be numbered (a), (b), (c) rather than 1., 2., 3. On the second line of the solution to part (c), change $1-0.882353t$ to $1-(1-0.882353)t$.

[10/12/2014] On page 178, on the first line of the second paragraph, change "calculate" to "calculating".

[2/22/2014] On page 180, in Table 10.1, on the line for Deferred term insurance, in the second column, change $n \le K_x \le n+m$ to $n \le K_x < n+m$ and change $K_x > n+m$ to $K_x \ge n+m$.

[12/2/2013] On page 181, 3 lines above equation (8.3), change presubscript to presuperscript.

[12/2/2013] On page 183, 2 lines from the end of the page, change "we developed" to "we will develop in the next lesson".

[10/21/2014] On page 207, in the solution to exercise 10.29, on the last line, change $A^{(4)}$ to $A_x^{(4)}$.

[12/14/2014] On page 211, in the solution to exercise 10.48, on the second line, put a negative sign before Bc^{50}.

[2/12/2015] On page 231, on the last line, delete "F05:35".

[7/17/2014] On page 245, two lines above Example 12E, change "expected value" to "present value".

[1/6/2014] On page 254, in exercise 12.28(ii), change $(l+i)$ to $(1+i)$.

[12/14/2014] On page 255, in exercise 12.29(c), change Z^8 to Z^B. Also change "0f" to "of".

[3/24/2014] On page 257, in the solution to exercise 12.9, on the second line, change "year 2" to "years 2 and 3".

[1/20/2014] On page 263, in the solution to exercise 12.29(c), on the first line, replace $({}^2\bar{A}^1_{x):\overline{n}|}$ with $({}^2\bar{A}^1_{x:\overline{n}|})$.

[10/12/2014] On page 272, on the second line of Section 13.5, change π^p to π_p.

[3/24/2014] On page 273, on the first line of the answer to Example 13J part 2, change $u =$ to $Z =$.

[12/16/2013] On page 280, in the solution to exercise 13.5, on the second line of I, change T_{50} to T_{40}. On the second line of II, change T_{30} to T_{40}.

[10/24/2014] On page 286, in the solution to exercise 13.23, on the third displayed line of the page, change 0.0870320 to 0.870320.

[2/27/2014] On page 287, in the solution to Quiz 13-2, replace the second and third lines with Z is at its maximum when $K_x = 10$, and is then equal to v^{11}, or

$$0.9^{11} = 0.313811 > 0.1$$

[1/20/2014] On page 307, in exercise 14.34, on the first line, replace the four unusual characters after "Elizabeth" with an apostrophe: "Elizabeth's".

[12/14/2014] On page 311, in the solution to exercise 14.15, the parts should be numbered (a) and (b) instead of 1. and 2. In part (a), on the last line, change ${}_{10|}q_{60}$ to ${}_{10|}q_{50}$.

[3/3/2015] On page 316, in the solution to exercise 14.34, on the second line, put a negative sign before $(0.05t + 0.01t^2)$ at the right: $\exp\left(-(0.05t + 0.01t^2)\right)$.

[9/30/2014] On page 326, in the solution to exercise 15.8, on the second displayed line, change $-$ to $=$.

[11/3/2014] On page 351, in the solution to exercise 17.21, on the last line, insert "20,000" before $\left(\frac{1-\bar{A}_x}{\delta}\right)$.

[11/2/2014] On page 382, in the solution to exercise 18.39, on the second displayed line, put a negative sign before $\int_{75}^{76}$.

[12/15/2014] On page 397, in exercise 19.27, on the second line, change v_x^T to v^{T_x}.

[10/24/2014] On page 409, in the solution to exercise 19.25, on the first line, change 6-year to 5-year.

[11/6/2014] On page 431, in the solution to exercise 20.19, on the fifth displayed line, change $\sqrt{\bar{a}_{\overline{T_x}|}}$ to $\sqrt{\text{Var}(\bar{a}_{\overline{T_x}|})}$.

[10/21/2014] On page 440, in exercise 21.4, on the fourth, seventh, and ninth lines, add "expected" before "present value".

[10/21/2014] On page 444, in the solution to exercise 21.4, on the second line after the timelines, change "its increases" to "its decreases" and change "second annuity's decreases" to "second annuity's increases".

[3/21/2014] On page 445, in the solution to exercise 21.5, three lines below the timelines, change EPVS's to EPVs. On the first displayed line of the page, remove the double-dot from $\ddot{a}_{30:\overline{15}|}$.

[9/4/2014] On page 455, in Table 22.1, on the third line of the section of formulas labeled "Woolhouse formula with two terms", change $\ddot{a}_x$ to $\ddot{a}_{x:\overline{n}|}$.

[3/25/2014] On page 477, three lines above Example 24B, delete "out".

[3/25/2014] On page 479, on the line after equation (24.6), change "replace" to "replaced".

[3/25/2014] On page 481, on the fifth line below Table 24.1, change "an" to "a".

[12/18/2014] On page 492, in the solution to exercise 24.16, on the second to last line, change 2.58047 to 2.58046.

[11/10/2014] On page 492, in the solution to exercise 24.18, on the third displayed line, change π to P.

[2/12/2014] On page 517, in Table 26.1, formulas (26.6) and (26.7), change every P_x to P. (4 corrections) P does not even have to determined by the equivalence principle.

[10/7/2014] On page 517, in Example 26D(iii), change "net" to "gross".

[1/20/2014] On page 555, in exercise 28.21(vii), change the first sentence to

Renewal per 1000 expenses are payable at the rate of 0.125 at the beginning of each quarter.

[11/10/2014] On page 560, in the solution to exercise 28.21, on the third line, replace "calculate" with "calculates".

[1/20/2014] On page 567, in exercise 29.14, on the last line, change ${}_0L$ to L.

[1/21/2014] On page 571, in the solution to exercise 29.8, on the first displayed line, delete "b" from "$\dfrac{bP}{\delta}$".

[1/20/2014] On page 573, in the solution to exercise 29.14, on the displayed line, change ${}_0L$ to L.

[1/20/2014] On page 573, in the solution to exercise 29.15, on the second line, delete the right parenthesis after P.

[12/18/2014] On page 574, in the solution to exercise 29.20, on the second displayed line, put a bar over the A in $\bar{A}_x^2$ and put an exponent 2 over $\left(1+\dfrac{\pi}{\delta}\right)$

[2/20/2014] On page 576, in the solution to exercise 29.23(b), on the second line of the page, change $\ddot{a}_{\overline{10}|}$ to $\bar{a}_{\overline{10}|}$ and remove the double-dot from G.

[2/12/2015] On page 588, one line above "Solutions", add "F05:35" to the "Additional old CAS Exam 3/3L questions" list.

[11/10/2014] On page 589, in the solution to exercise 30.3, on the first displayed line, some $150{,}000^2$s are missing. The line should read

$$\text{Var}(L) = 150{,}000^2\left(\frac{{}^2A_x - A_x^2}{(1-A_x)^2}\right) = 150{,}000^2\left(\frac{0.0143-0.0653^2}{(1-0.0653)^2}\right) = 150{,}000^2(0.011487)$$

[1/20/2014] On page 607, in exercise 31.4(ii), delete "to".

[11/11/2014] On page 613, in the solution to exercise 31.7, on the second to last line, replace 31.1.1 with 599.

[11/12/2014] On page 614, the solution to exercise 31.11 is incorrect. The correct solution is

The loss for death in year k is

$${}_0L = 10{,}000v^k + \big(10(0.50)+4\big)\ddot{a}_{\overline{k}|} + \big(10(4)+26\big) - 0.95(320)\ddot{a}_{\overline{k}|} + 0.45(320)$$

$$= 10{,}000v^k - 295\left(\frac{1-v^k}{0.04/1.04}\right) + 210$$
$$= 17{,}670v^k - 7{,}460$$

Setting this equal to 0,

$$v^k = \frac{7460}{17{,}670} = 0.42218$$
$$k = -\frac{\ln 0.42218}{\ln 1.04} = 21.9862$$

The loss will be positive if death occurs in year 21 or earlier. The probability of that is ${}_{21}q_{30} = 21/80 =$ **0.2625**.

[2/13/2014] On page 615, in the solution to exercise 31.12, change the last two lines to

$$100{,}000e^{-0.05(46.2098)} - P\left(\frac{1-e^{-0.05(46.2098)}}{0.05}\right) = 9921.26 - 18.015749P$$

So the answer is $9921.26/18.015749 =$ **550.70**.

[1/20/2014] On page 627, in exercise 33.10, on the last line, change "snet" to "net".

[1/20/2014] On page 631, in the solution to exercise 33.10, on the fifth line, change $\delta + 0.06$ to $\delta = 0.06$.

[4/24/2014] On page 632, in the solution to exercise 33.12, on the second displayed line, change $40\ddot{x}_x$ to $60\ddot{a}_x$.

[10/12/2014] On page 637, one line before Example 34D, delete "st" after "$n+1^{\text{st}}$".

[1/20/2014] On page 644, in exercise 34.16, on the last line, delete ", before the sixth premium is paid".

[8/20/2014] On page 647, in exercise 34.25(b), on the second line, change ${}_kV$ to ${}_{k+t}V$.

[12/18/2014] On page 648, on the second to last line of the solution to exercise 34.5, delete 1000 before ${}_{10}V$.

[8/24/2014] On page 685, in the solution to exercise 36.14 part 1, the formulas for premium difference should be negative of what is shown. In other words, they should be:

$$(P_{x+5:\overline{15|}} - P_{x:\overline{20|}})\ddot{a}_{x+5:\overline{15|}}$$
$$({}_{15}P_{x+5} - {}_{20}P_x)\ddot{a}_{x+5:\overline{15|}}$$

[12/18/2014] On page 699, in exercise 37.21, on the displayed line, replace $l - K$ with $1 - K$.

[12/21/2014] On page 705, in the solution to exercise 37.13, on the last displayed line, change $1 - \frac{13.2668}{14.8166}$ to $1000\left(1 - \frac{13.2668}{14.8166}\right)$.

[11/14/2014] On page 708, in the solution to exercise 37.21, on the fifth displayed line, change $0.0021\ddot{a}_{40}$ to $0.0021v\ddot{a}_{40}$.

[9/16/2014] On page 715, in the answer to Example 38C, on the second displayed line, change E to e.

[10/12/2014] On page 729, 2 lines from the end of the page, the line should end with a period rather than a semicolon.

[12/21/2014] On page 761, in the solution to exercise 39.10, on the first displayed line, delete "1000" before $P_{68}\ddot{a}_{85:\overline{3|}}$".

[12/21/2014] On page 767, in the solution to exercise 39.35(c), change $T_{x+1} = 1$ to $T_{x+1} \le 1$.

[2/1/2015] On page 775, in the solution to exercise 39.59, on the first displayed line, change the first minus sign to an equals sign.

[11/13/2014] On page 773, in the solution to exercise 39.63, on the first line, change ${}_0V^3$ to ${}_0V^g$.

[3/16/2014] On page 778, the answer to Example 40B is incorrect. The correct answer is

Based on the previous example, the difference in valuation premiums under Full Preliminary Term is $47.17212-20.11321=27.05891$. Let β be the renewal valuation premium for this example. Then $\beta-0.5(27.05891)=\beta-13.52946$ is the first year valuation premium. By the equivalence principle,

$$\begin{aligned}1000A_{65}&=\beta\ddot{a}_{65}-13.52946\\439.80&=9.8969\beta-13.52946\\\beta&=\frac{439.80+13.52946}{9.8969}=45.80520\end{aligned}$$

The modified reserve at time 10 is

$${}_{10}V^{\text{mod}}=1000A_{75}-\beta\ddot{a}_{75}=591.49-45.80520(7.2170)=\boxed{\mathbf{260.91}}$$

[1/20/2014] On page 786, in the solution to exercise 40.13, replace the last two lines with

The reserve at the end of year 15 is

$$\begin{aligned}\ddot{a}_{60:\overline{5}|}&=\ddot{a}_{60}-{}_5E_{60}\,\ddot{a}_{65}\\&=11.1454-(0.68756)(9.8969)=4.3407\\{}_{15}V^{\text{mod}}&=10{,}000A_{60}-\beta\ddot{a}_{60:\overline{5}|}\\&=3691.3-(180.26)(4.3407)=\boxed{\mathbf{2908.85}}\end{aligned}$$

[1/20/2014] On page 786, in the solution to exercise 40.15, on the first line, replace $beta$ with β. On page 787, starting with the third line on the page, replace the solution with

$$\begin{aligned}{}_{20}E_{55}&=v^{20}\,{}_{20}q_{55}=\frac{1-0.30265}{1.05^{20}}=0.262824\\\ddot{a}_{55:\overline{20}|}&=\ddot{a}_{55}-{}_{20}E_{55}\,\ddot{a}_{75}=14.3561-(0.262824)(9.6749)=11.8133\\{}_{1|}\ddot{a}_{55:\overline{19}|}&=\ddot{a}_{55:\overline{20}|}-1=10.8133\\{}_{20|}\ddot{a}_{55}&=\ddot{a}_{55}-\ddot{a}_{55:\overline{20}|}=14.3561-11.8133=2.5428\end{aligned}$$

We're now ready to calculate β.

$$\begin{aligned}31{,}637.62&=858.10+10.8133\beta+2.5428(2203.78)\\\beta&=\frac{31{,}637.62-858.10-2.5428(2203.78)}{10.8133}=\boxed{\mathbf{2328.22}}\end{aligned}$$

[10/12/2014] On page 799, in Table 41.2, on the line above formula (41.9), change "face amount b" to "face amount ${}_tW_x$".

[12/21/2014] On page 808, in exercise 41.37, on the last line, change $1000b_{20}$ to b_{20}.

[11/17/2014] On page 812, in the solution to exercise 41.13, on the last line, change $0.556617-0.556659$ to $0.556659-0.556617$.

[12/21/2014] On page 814, in the solution to exercise 41.17(b), on the first line of the page, change ${}_{t-h}p_{x+t}$ to ${}_{t-h}p_{x+h}$.

[11/17/2014] On page 815, in the solution to exercise 41.23, on the fifth line, change A_{65} to $\bar{A}_{65}$.

[12/21/2014] On page 817, in the solution to exercise 41.31, on the first displayed line, delete 50,000.

[5/1/2014] On page 893, in the solution to exercise 45.20, 4 lines before the end, change $e^{-0.7-0.2t}$ to $e^{0.7-0.2t}$.

[4/19/2014] On page 940, in the solution to exercise 47.16, on the last line, change the denominator to $8{,}188{,}074^2$.

[12/21/2014] On page 943, in the solution to exercise 47.26, on the first displayed line, remove the parentheses around the subscript (T, J).

[12/21/2014] On page 962, in the solution to exercise 48.18, on the sixth line of the page, replace $q_{64}^{(2)}$ with ${}_2q_{64}^{(1)}$.

[10/12/2014] On page 965, two lines below formula (49.1), change the period after "ages" to a comma.

[3/29/2015] On page 974, in exercise 49.17, on the last line, a negative sign is missing on the right hand side of the equation, which should be $-q_{30}'^{(1)} \cdot q_{30}'^{(2)} \big/ \left(\ln q_{30}'^{(1)}\right)$.

[12/21/2014] On page 975, in the solution to exercise 49.1, 2 lines from the end, replace ${}_{2.5}p_x'^{(d)}$ with ${}_{2.5}p_{65}'^{(d)}$.

[11/23/2014] On page 976, in the solution to exercise 49.5, on the last line, change $p_{41}'^{(1)}$ to $q_{41}'^{(1)}$.

[3/29/2015] On page 980, in the solution to exercise 49.17, 4 lines from the end, put negative signs in front of $\ln p_{30}'^{(1)}$ and $\ln(1-q_{30}'^{(1)})$. 3 lines from the end, put negative signs in front of each of the two fractions. On the last line, put a negative sign in front of $\dfrac{q_{30}'^{(1)} q_{30}'^{(2)}}{\ln(1-q_{30}'^{(1)})}$.

[12/23/2014] On page 1093, in exercise 56.16(ii), the end of the line after the comma should read "$i = 0.05$".

[11/24/2014] On page 1095, in the solution to exercise 56.1, on the last line, change t in the exponent of the numerator to 5.

[12/23/2014] On page 1109, in the solution to exercise 57.1, change ${}_tp_{50:55}^{00}$ to ${}_{20}p_{50:55}^{00}$.

[10/12/2014] On page 1110, in the solution to exercise 57.7, on the second line, an integral sign is missing. The line should read

$$= \frac{1}{50}\int_0^{10} e^{-0.07t}\,\mathrm{d}t - \int_0^{10} \frac{1}{2500}\,t\,e^{-0.07t}\,\mathrm{d}t$$

[12/23/2014] On page 1145, in the solution to exercise 58.27, on the second to last line, change "first death" to "last death".

[9/9/2014] On page 1145, in the solution to exercise 58.28, on the second to last line, the superscripts on the reserves on the right hand side are reversed. Also, although S is used in the textbook for face amount, the ASM manual uses the letter b. Therefore, that line should be replaced with

$$\frac{\mathrm{d}}{\mathrm{d}t}{}_tV^{(0)} = \delta_t\,{}_tV^{(0)} - B_t - \mu_{x+t:y+t}^{01}(b_t^{01} + {}_tV^{(1)} - {}_tV^{(0)}) - \mu_{x+t:y+t}^{02}(b_t^{02} + {}_tV^{(2)} - {}_tV^{(0)})$$

[12/23/2014] On page 1145, in the solution to exercise 58.29 part 1, on the first line, insert v^t before ${}_tp_{xy}$:

$$\bar{a}_{xy} = \int_0^{\infty} v^t\,{}_tp_{xy}\,\mathrm{d}t$$

[12/23/2014] On page 1163, in exercise 59.17, in answer choice (D), change the last summand to $15\,{}_{n|}\bar{a}_y$.

[11/26/2014] On page 1174, in the solution to exercise 59.28, on the second line, change 0.06 to 0.6 and 0.13 to 1.3. On the last line, change 0.06 to 0.6.

[4/12/2015] On page 1188, on the last line of the answer to Example 61A part 1, change 3.2787 to 3.2887.

[3/6/2014] On page 1191, on the fourth line of the answer to Example 61E, change 57,908.59 to 57,980.59.

[4/12/2015] On page 1192, the final answer to Example 61E part 1 should be 143,002.3 instead of 153,830.1. The answer to part 2 should be 191,114.8 instead of 205,872.4.

[3/16/2015] On page 1203, in the solution to exercise 61.3, on the last line, replace $d\,d\,x$ with $\mathrm{d}x$.

[12/23/2014] On page 1203, in the solution to exercise 61.5, on the last displayed line, change $r^{361}-r$ in the numerator to $r-r^{361}$.

[3/9/2015] On page 1205, in the solution to exercise 61.13,change $l_{44}^{(\tau)}-l_{42}^{(\tau)}$ to $l_{42}^{(\tau)}-l_{44}^{(\tau)}$.

[4/14/2015] On page 1206, in the solution to exercise 61.18, on the last line, change 9,146,051 to 9,164,051 and change the final answer to 50,639.21.

[10/21/2014] On page 1216, in exercise 62.18(iv), change the second 0.02 to -0.02.

[11/26/2014] On page 1217, in the solution to exercise 62.3, on the last line, put "-1 before the second equals sign.

[11/26/2014] On page 1220, in the solution to exercise 62.15, on the seventh line, change 825 to 2500.

[10/12/2014] On page 1224, on the third displayed line of the page, change $\mathbf{E}[n\,\mathrm{Var}(L^p \mid I)]$ to $\mathbf{E}[n\,\mathrm{Var}(L^1 \mid I)]$. On the fourth displayed line, chagne $\mathrm{Var}(L^p \mid I)$ to $\mathrm{Var}(L^1 \mid I)$. In formula (63.1), change $\mathrm{Var}(L^p \mid I)$ to $\mathrm{Var}(L^1 \mid I)$.

[10/12/2014] On page 1226, in formula (63.1), change $\mathrm{Var}(L^p \mid I)$ to $\mathrm{Var}(L^1 \mid I)$.

[10/12/2014] On page 1250, in formula (65.1), $q^{(w)}$ should be $q_{x+k-1}^{(w)}$.

[8/9/2014] On page 1251, one line above the first table, change 40.28(0.89) to 400.28(0.89). In the first table, in the heading row, change "Year t" to "Year k" and Pr_t to Pr_k.

[10/3/2014] On page 1241, in both the first and second tables, in the second to last column, change ${}_kp_{[50]}^{(\tau)}$ to ${}_{k-1}p_{[50]}^{(\tau)}$.

[8/9/2014] On page 1251, in the second table, in the heading, change I_t to I_k.

[8/9/2014] On page 1253, one line below the heading "DPP", change discountt to discount.

[8/9/2014] On page 1255, change the last 6 lines of Section 65.3, starting with "In year 2" to the following:

In year 2, ignoring ${}_1V$ and setting ${}_2V=656.79$, the profit is

$$(2200-110)(1.06)-1500-36.41-656.79(1-0.1-0.015)=97.73$$

Year 2 profit is positive, so we set ${}_1V=0$, and as a result, $\mathrm{Pr}_2=97.73$.

In year 1, profit is $(2200-110)(1.06)-1000=1215.40$. In year 0, profit is -950.

These zeroized reserve increase the NPV significantly. The profit signature is

$$(-950, 1215.40, 97.73(0.89), 0, 0, 0)$$

with NPV at 10% of 226.79.

[10/12/2014] On page 1257, in Table 65.1, in formula (65.1), $q^{(w)}$ should be $q_{x+k-1}^{(w)}$.

[10/3/2014] On page 1257, in Table 65.1, in the definition of profit signature, replace p_{x+k-1} with ${}_{k-1}p_x$.

[10/3/2014] On page 1260, in exercise 65.8(vi), change 1000 to 100.

[12/23/2014] On page 1269, in the solution to exercise 65.17, replace the x in seven subscripts of A and $\ddot{a}$ with 50. On the sixth line, the formula for P, replace 25 in the denominator with 26; it is $1/d$.

[3/10/2014] On page 1274, on the last line of the third bulleted paragraph, change "donation" to "duration".

[8/26/2014] On page 1276, on the second and third displayed lines of the page, change 0.00576 to 0.005576.

[12/23/2014] On page 1281, in the solution to exercise 66.3, on the second line, replace $0.29327-(0.71124)(0.42522)+0.42522$ with $0.29327-(0.49247)(0.42522)+0.49247$. On the third line, change 0.41606 to 0.57633.

Dividends of 360 translate into $360/0.57631 = 624.64$ of reversionary bonuses. If the bonus on the original amount is $0.014(20{,}000) = 280$, the bonus on the reversionary bonuses must be $624.64-280 = 344.64$, which is a rate of $344.64/4500 = \boxed{\mathbf{0.0766}}$.

[4/5/2014] On page 1281, in the solution to exercise 66.4, on the last line, change 0.29327 to 0.30514 and change the final answer from 122.08 to 117.34.

[3/10/2014] On page 1284, in the paragraph beginning "For either design", on the first line, delete "we will".

[10/12/2014] On page 1291, in Table 67.1, in formula (67.11), change γ_t to γ.

[10/12/2014] On page 1317, in formula (65.1), $q^{(w)}$ should be $q^{(w)}_{x+k-1}$.

[11/8/2014] On page 1323, in exercise 68.7(iv)(a), change ${}_{death}q^{\prime()}39$ to ${}_{death}q^{\prime()}40$.

[12/23/2014] On page 1327, in the solution to exercise 68.7, replace the last line with

The gain, the excess of actual over expected profits is $25.9-62.1125 = \boxed{\mathbf{-36.2125}}$.

[2/3/2014] On page 1343, in question 17 choice (A), change "nnly" to "only".

[3/29/2014] On page 1359, in question 17, add "at risk discount rate 0.1 " on the last line before "for this product".

[2/3/2014] On page 1361, delete 1339 at the bottom of the page.

[7/20/2014] On page 1370, in question 21, the last line should be

$$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$$

[4/18/2014] On page 1392, on the first line of question 25, change "ia" to "is".

[7/20/2014] On page 1404, in question 27, on the second line, change $l^{(\tau)}_{60}$ to $l^{(\tau)}_{62}$. In the table, change $d^{(2)}_x$ to $d^{(w)}_x$.

[7/23/2014] On page 1404, in question 28(b), it is inappropriate to use the normal approximation here, because the asymptotic distribution is only normal if conditioned on q_{45}; otherwise, it is a bimodal distribution. However, you can still calculate the variance of the present value of the payments.

[3/3/2014] On page 1415, in question 28(iv), change 20% to 25%.

[7/17/2014] On page 1422, in question 21, on the last line, change the first numerator $A(0.9^{5-t}-1)$ to $A(0.9^{5-t}-0.9^5)$.

[3/4/2014] On page 1434, in question 23(b), on the first line, add "$\delta = 0.1$ and " after "assuming".

[3/4/2014] On page 1435, in question 26(c), on the last line, change $\delta = 0.05$ to $\delta = 0.06$.

[3/4/2014] On page 1445, in question 21, statement (a)(i) should be statement (vii) in the listing above (a), since the gross premium is 7000 in both (a) and (b).

[3/5/2014] On page 1459, add the following sentence at the end of question 29(b): "In this calculation, include the precontract expenses in the first year."

[7/28/2014] On page 1467, in question 22, replace (vi) with

The multiple-decrement death rate at ages 60 through 64 is ${}_{k|}q_{60}^{(d)} = 0.01$, $k = 0,1,2,3,4$, before withdrawal. The death rate is ${}_{k|}q_{60}^{(d)} = 0.01$, $k = 0,1,2,3,4$, after withdrawal.

Add

(x) Pensions are paid as annual life annuities-immediate beginning at age 65.
(xi) Withdrawal benefits are paid as deferred annual life annuities-immediate beginning at age 65.
(xii) $a_{65} = 10$.

[3/3/2015] On page 1495, in the solution to question 14, on the third line, change $s+1$ to $x+1$ and change the last "is" to "to".

[4/23/2015] On page 1496, in the solution to question 17, change the last sentence to "III is false since p_{03} is not necessarily 0 whether or not the lives are independent. **(E)**"

[4/17/2014] On page 1523, in the solution to question 17, twice on the last four lines, change 0.02968 to 0.029578.

[2/27/2014] On page 1525, the solution to question 24(c) is incorrect. The correct solution is

The net premium P is determined from

$$P\ddot{a}_{60:\overline{20}|} = 500\bar{A}_{60} + 500\bar{A}^{1}_{60:\overline{20}|} + P\left((I\bar{A})^{1}_{60:\overline{20}|} + 20_{20|}\bar{A}_{60}\right)$$

Solving for P,

$$\frac{500\bar{A}^{1}_{60:\overline{20}|} + 500\bar{A}_{60}}{\ddot{a}_{60:\overline{20}|} - (I\bar{A})^{1}_{60:\overline{20}|} - 20_{20|}\bar{A}_{60}} = \frac{500(0.199526) + 500(0.25)}{10.38067 - 1.585684 - 20(0.25 - 0.199526)} = 28.86943$$

The gross premium is determined from

$$G\ddot{a}_{60:\overline{20}|} = 502\bar{A}_{60} + 500\bar{A}^{1}_{60:\overline{20}|} + P\left((I\bar{A})^{1}_{60:\overline{20}|} + 20_{20|}\bar{A}_{60}\right) + 1.5\ddot{a}_{60} + 8.5 + G(0.05\ddot{a}_{60:\overline{20}|} + 0.6)$$

So G equals

$$G = \frac{502(0.25) + 500(0.199526) + (28.86943)\left(1.585684 + 20(0.25 - 0.199526)\right) + 1.5(13.00667) + 8.5}{0.95(10.38067) - 0.6} = \boxed{\mathbf{35.4358}}$$

[4/20/2014] On page 1526, in the solution to question 26(a), change ${}_2V$ to -123.61 and change ${}_3V$ to 32.63. Make the same changes in the solution to question 26(b), where each reserve appears twice. The gains for the second year are mortality 76.14 and surrender -1423.60 The gains for the third year are mortality 103.51 and surrender -940.00.

[9/30/2014] On page 1537, in the solution to question 21, on the first line, the formula should be $0.5({}_{0.5}p_{70.3} + p_{70.3})$. The 0.5 factor is missing. On the first displayed line of the solution to part (a), ${}_{0.7}p_{70.8}$ should be ${}_{0.7}p_{70.3}$.

[7/21/2014] On page 1538, in the solution to question 22, on the first displayed line, change ${}_tp_{x+k}$ to ${}_{t-k}p_{x+k}$. The second displayed line should be

$$\int_k^{k+0.5} v^t\, {}_tp_x\, \mu_{x+t}\, dt = {}_kp_x\, q_{x+k} \int_k^{k+0.5} v^t\, dt = {}_kp_x\, q_{x+k}\left(\frac{v^k(1 - v^{0.5})}{\delta}\right)$$

[7/21/2014] On page 1538, in the solution to question 23(a), on the first line, delete "100" from the numerator of the fraction at the start of the line.

[7/21/2014] On page 1539, in the solution to question 25(a), on the last line, change the denominator $0.96(17.625-0.76)$ to $0.96(17.625)-0.76$.

[3/2/2014] On page 1541, in the solution to question 28(a), on the first line of the page, change $\mu^{(1)}_{48+t}$ to $\mu^{(1)}_{80+t}$.

[10/1/2014] On page 1541, in the solution to question 29(a), on the third line, place an exponent "2" on 960: $960^2 n^2 \ldots$. On the fourth line, change 960,000 to 96,000.

[3/3/2014] On page 1550, in the solution to question 23(a), change u to u_k.

[4/18/2014] On page 1552, in the solution to question 25(b), on the first line, change both 0.36s to 0.27 and change 54,000 to 40,500. On the last line, change both 54,000s to 40,500 and change the final answer to 27,288.82.

[10/7/2014] On page 1552, in the solution to question 26(a), on the third line, replace 0.22415 with 0.23047.

[10/12/2014] On page 1558, in the solution to question 15, on the fifth line, change "if" to "is".

[3/3/2014] On page 1560, in the solution to question 22(a), on the first line of the second paragraph, change $PT_{50}-1$ to $1-PT_{50}$.

[7/23/2014] On page 1561, in the solution to question 24(a), on the last line, change 100,000 (in the numerator) to 100,100. Also change 100,000 to 100,100 on the last line of the solution to question 24(b) and change the final answer to 3055.76.

[7/20/2014] On page 1563, in the solution to question 27(a), in the table, change $d^{(2)}_x$ to $d^{(w)}_x$. The solution to question 27(b) is incorrect and should be

The EPV of the benefits in the first year is

$$\begin{aligned}
100{,}000\int_0^1 v^t\,{}_tp^{(\tau)}_x\mu^{(d)}_{x+t}\,\mathrm{d}t &= 100{,}000\int_0^1 \frac{1}{1.04^t}e^{-0.17t}(0.02)\mathrm{d}t \\
&= 2000\int_0^1 e^{-(0.17+\ln 1.04)t}\,\mathrm{d}t \\
&= 2000\frac{1-e^{-(0.17+\ln 1.04)}}{0.17+\ln 1.04} = 1804.638
\end{aligned}$$

In the other years, multiply this by $(l^{(\tau)}_x - d^{(r)}_x)/l^{(\tau)}_{62}$ for $x = 63, 64$. Then discount at $i = 0.04$ and add up the 3 numbers:

$$1804.638\left(100{,}000+\frac{84{,}366-16{,}873}{1.04}+\frac{56{,}942-11{,}388}{1.04^2}\right)\Big/100{,}000 = \boxed{\mathbf{3735.86}}$$

[7/20/2014] On page 1564, in the solution to question 29(b), 3 lines before the end, change 657.11 to 659.22.

[10/25/2014] On page 1568, in the solution to question 10, on the fourth line, invert the fraction so that it is $\frac{12.54585}{13.19578}$.

[3/3/2014] On page 1574, in the solution to question 23(b), on the second displayed line, change 113.5335 to 1135.335.

[7/23/2014] On page 1575, in the solution to question 25, on the sixth displayed line, change the integrand to ${}_tp^{01}_0\mu^{13}_t\,\mathrm{d}t$. On the seventh displayed line, change ${}_{5-u}p^{11}_u$ to ${}_{t-u}p^{11}_u$. On the ninth displayed line, change the upper bound of the integral from 5 to t. On the second line of page 1576, change μ^{12}_t to μ^{13}_t.

[7/21/2014] On page 1576, the solution to question 27(a) and 27(b) is incorrect. The correct solution is

(a) Pension will be 60% of 3-year average final salary. That average will be

$$100{,}000\left(\frac{1.03^{27}+1.03^{28}+1.03^{29}}{3}\right)=228{,}859.4$$

So the annual pension will be $0.6(228{,}859.4)=$ **137,315.6**.

(b) The life annuity-due has EPV at age 65 of $137{,}315.6\ddot{a}_{65}=137{,}315.6(9.8969)=1{,}358{,}999$. Discounting to age 35,

$$1{,}358{,}999\,{}_{30}E_{35}=1{,}358{,}999(0.54318)(0.25634)=\boxed{\textbf{189,225}}$$

In the solution to question 27(c), on the last line, change ${}_{20}E_{45}$ to ${}_{20|}\ddot{a}_{45}$.

[7/23/2014] On page 1577, in the solution to question 28(a), on the line for $t=0$ in the table, move 875 to the Expense column. In the solution to question 28(c), replace the second displayed line with

$$0.03(8739.12+2.49689x)=36.55635+1.961433x$$

[7/17/2014] On page 1585, in the solution to exercise 21, on the last two lines (once apiece), change $0.9^{5-t}-1$ to $0.9^{5-t}-0.9^5$.

[7/22/2014] On page 1586, in the solution to question 22(b), on the fourth displayed line, replace ${}^2E20_{45}$ with ${}^2_{20}E_{45}$. Four lines from the end, change 500,000,000 to 5,000,000.

[3/4/2014] On page 1589, the solution to question 28 should be numbered (a), (b), (c) instead of 1., 2., 3. Replace the last three lines of the solution to question 28(c) with

$$\begin{aligned}(\Delta_5 V)(1.06)&=-8.072\\ \Delta_5 V&=-7.615\end{aligned}$$

The revised reserve is $620-7.615=$ **612.385**.

[3/4/2014] On page 1598, in the solution to question 23(b), on the last line, insert 1000 after the first equals sign.

[3/4/2014] On page 1599, in the solution to question 24(a), on the third line, change ${}_{20|}\ddot{a}_{45}$ to ${}_{20|}\ddot{a}_{42}$.

[3/4/2014] On page 1599, replace the solution to question 25(a) with

$$\begin{aligned}\frac{\mathrm{d}}{\mathrm{d}t}{}_tV^{(0)}&=(\ln 1.03)\,{}_tV^{(0)}+P-\mu_{y+t}({}_tV^{(1)}-{}_tV^{(0)})-\mu_{x+t}({}_tV^{(2)}-{}_tV^{(0)})\\ \frac{\mathrm{d}}{\mathrm{d}t}{}_tV^{(1)}&=(\ln 1.03)\,{}_tV^{(1)}-\mu_{x+t}(100{,}000-{}_tV^{(1)})\\ \frac{\mathrm{d}}{\mathrm{d}t}{}_tV^{(2)}&=(\ln 1.03)\,{}_tV^{(2)}-5000-\mu_{y+t}(100{,}000-{}_tV^{(2)})\end{aligned}$$

[3/4/2014] On page 1600, in the solution to question 25(b), on the second line, replace ${}_{19.9}V^{(2)}$ with ${}_{19.8}V^{(2)}$.

[3/4/2014] On page 1602, the solution to question 30 should be numbered (a), (b) instead of 1., 2.

[7/27/2014] On page 1610, in the solution to question 22, on the first displayed line, delete 100 and delete the parentheses.

[3/4/2014] On page 1611, in the solution to question 24(d), on the third line, delete the first equals sign.

[3/4/2014] On page 1612, in the solution to question 25(a), on the fifth and seventh lines, $\ln 1.06$ should be in parentheses: $(\ln 1.06)$.

[7/27/2014] On page 1614, in the solution to question 27(c), on the last line, change the numerator $1-0.6^{0.5}$ to $0.6^{0.5}-1$.

[7/27/2014] On page 1622, in the solution to question 21(e), delete the 1000 after the second equals sign.

[7/28/2014] On page 1624, in the solution to question 26(a), on the first displayed line change μ_{30}^{12} to μ_{65}^{12}. On the third displayed line change $\mu_{29.9}^{12}$ to $\mu_{64.9}^{12}$. In the solution to question 26(b), on the first displayed line change the two subscripts to 65. On the third displayed line change the two subscripts to 64.9.

[7/28/2014] On page 1633, the solution to question 22 parts (a) and (b) should be replaced with the following:

(a) Cumulative salary through age 64 inclusive is

$$1{,}500{,}000+100{,}000\sum_{k=0}^{4}1.03^k=1{,}500{,}000+100{,}000\left(\frac{1.03^5-1}{0.03}\right)=2{,}030{,}914$$

Probability of retirement is probability of not dying or withdrawing for 5 years, which is $1-5(0.04+0.01)=0.75$. Multiplying cumulative salary by 0.04 and by $a_{65}=10$ and by 0.75 and discounting for 5 years,

$$\frac{0.75(0.04)(10)(2{,}030{,}914)}{1.05^5}=\boxed{\mathbf{477{,}382.27}}$$

(b) Since salaries increase once a year, half of the year's salary is earned in half a year. The cumulative salaries for retirement in each year are:

$1{,}550{,}000$ at age 60
$1{,}600{,}000+0.5(100{,}000)(1.03)=1{,}651{,}500$ at age 61
$1{,}651{,}500+0.5(100{,}000)(1.03+1.03^2)=1{,}756{,}045$ at age 62
$1{,}756{,}045+0.5(100{,}000)(1.03^2+1.03^3)=1{,}863{,}726$ at age 63
$1{,}863{,}726+0.5(100{,}000)(1.03^3+1.03^4)=1{,}974{,}638$ at age 64

We multiply each of these by the 0.04 probability of withdrawal in each year, by the 0.04 accrual rate, and by $a_{65}=10$. We discount each for 5 years, and multiply by the probability of not dying for 5 years, which is $1-0.01t$, where t is the amount of time to age 65. We multiply the result by a_{65}.

$$\frac{(0.04)(0.04)(10)(1{,}550{,}000(0.955)+1{,}651{,}500(0.965)+1{,}756{,}045(0.975)+1{,}863{,}726(0.985)+1{,}974{,}638(0.995))}{1.05^5}=\boxed{\mathbf{107{,}639.5}}$$

[3/3/2014] On page 1635, in the solution to question 26, replace the first displayed line with

$$\mu_{50+t}^{(1)}=\frac{\mathrm{d}_t q_{50}'^{(1)}/\mathrm{d}t}{{}_tp_{50}'^{(1)}}$$

and replace the third displayed line with

$$\mu_{50+t}^{(2)}=\frac{\mathrm{d}_t q_{50}'^{(2)}/\mathrm{d}t}{{}_tp_{50}'^{(2)}}$$

[7/28/2014] On page 1645, in the solution to question 21(c), on the first line, change ${}_tq_{40}=0.25$ to ${}_tq_{40}=0.75$ and change ${}_tp_{40}=0.75$ to ${}_tp_{40}=0.25$.

[3/5/2014] On page 1645, in the solution to question 22(b), change the first displayed line to

$$\ddot{a}^{(4)}_{75:\overline{1.5|}} = 0.25\left(1+v^{0.25}\,{}_{0.25}p\right)+v^{0.5}\,{}_{0.5}p_{75}\,\ddot{a}^{(4)}_{75.5:\overline{1|}}$$

[7/29/2014] On page 1646, in the solution to question 24(b), change $\frac{i}{\delta}A_{53}$ to $1000\left(\frac{i}{\delta}\right)A_{53}$.

[3/5/2014] On page 1647, in the solution to question 25(a), on the AV_2 line, replace 10,085.54 with 10,033.22. On the AV_3 line, replace 10,216.81 with 10,151.91 and replace 265.3224 with 266.0965. In the solution to question 25(b), replace the AV_2 on the third line with AV_3.

[7/29/2014] On page 1647, in the solution to question 26(a), on the fourth displayed line, change 0.07751 to 0.077514. On the second line from the end, $\ddot{a}_{40:\overline{30|}}$ on the left hand side should be $\ddot{a}^{(4)}_{40:\overline{30|}}$. Also, the G on that line is the gross premium payable annually, whereas the G on the last line is the gross premium payable quarterly.

[4/15/2015] On page 1650, in the solution to question 26, on the last line, change "age 25" to "age 20".

[4/29/2014] On page 1654, in the solution to question 36, on the first displayed line, P_1^2 is missing from the left side, which should be

$$P_1^2\left({}^2A_{60:\overline{1|}}-A^2_{60:\overline{1|}}\right)$$

[4/17/2014] On page 1657, in the solution to question 17, twice on the last four lines, change 0.02968 to 0.029578.

[2/26/2015] On page 1688, in the solution to question 12, on the second line, change $\ddot{a}_{x:\overline{2|}}$ to $a_{x:\overline{2|}}$.

[9/11/2014] On page 1689, in the solution to question 6, on the second to last line, change ${}_2q^{(w)}_{x+1}$ to ${}_2q^{(w)}_x$.

[1/11/2014] On page 1716, in the solution to question 12, on the second to last line, change the negative sign to an equals sign: $=13.32313$.

[3/21/2015] On page 1720, in the solution to question 8, on the second line, change $v(kt)$ to $v(t)^k$.

[9/18/2014] On page 1721, in the solution to question 11, on the last line, change $b/2a$ to $-b/2a$.

[4/20/2015] On page 1722, in the solution to question 15, 4 lines from the end, the expression $\left(b+\frac{G-e}{d}\right)$ should be squared: $\left(b+\frac{G-e}{d}\right)^2$.

[2/4/2014] On page 1723, in the solution to question 19, e_{66} should be $\mathring{e}_{66}$, e_{67} should be $\mathring{e}_{67}$, e_{x+1} should be $\mathring{e}_{x+1}$, $e_{[65]}$ should be $\mathring{e}_{[65]}$, and $e_{[66]}$ should be $\mathring{e}_{[66]}$, wherever they appear (10 times).

[4/29/2014] On page 1728, the solution to question 12 has several typos. The correct solution is

We will use primes for revised survival and annuity functions.

Use the recursive formula $\ddot{a}_x = 1+vp_x\ddot{a}_{x+1}$ and the corresponding formula expressing $\ddot{a}_{x+1}$ in terms of $\ddot{a}_{x+2}$.

$$\begin{aligned}
\ddot{a}_x &= 1+vp_x\ddot{a}_{x+1} = 1+\frac{0.988(10.904)}{1.06} = 11.16335\\
v\ddot{a}_{x+2} &= \frac{\ddot{a}_{x+1}-1}{p_{x+1}} = \frac{10.904-1}{0.985} = 10.05482\\
p'_{x+1} &= 1-q'_{x+1} = 1-0.015-0.01 = 0.975\\
\ddot{a}'_{x+1} &= 1+vp'_{x+1}\ddot{a}_{x+2} = 1+(0.975)(10.05482) = 10.80345
\end{aligned}$$

$$\ddot{a}'_x = 1 + v\,p_x\,\ddot{a}'_{x+1} = 1 + \frac{0.988(10.80345)}{1.06} = 11.06963$$

For a \$1000 annuity, the decrease in actuarial present value is $1000(11.16335-11.06963) = \boxed{\mathbf{93.72}}$. **(B)**

[2/12/2015] On page 1741, the lesson reference for Fall 2005 Question 35 should be 30 instead of 11.

[12/9/2013] On page 1745, in the fourth Q column, 3 lines from the bottom, 315 should be 316.