

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

Practice Exam 7:25 (page 1386) is defective,

Practice Exam 5:21 (page 1364), 8:25 (page 1397), 14:22 (page 1455), and 15:22 (page 1464) 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, 8 lines above equation (2.4), change “sam” to “same”.

[9/10/2014] On page 32, exercise 2.21 belongs in Lesson 5.

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

[9/19/2014] On page 36, in the solution to exercise 2.21, on the sixth line, change 2011 to 2016.

[10/29/2014] On page 49, in exercise 3.42, on the last line, change “form” to “from”.

[9/18/2014] On page 52, in the solution to exercise 3.13III, dx should be moved to the left of the first equals sign, right after $(x + 1)^n$.

[11/24/2014] On page 98, 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

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

[1/6/2015] On page 98, in the solution to exercise 5.19, on the second displayed line, change ${}_{20}p_1 0$ to ${}_{20}p_{10}$.

[11/24/2014] On page 103, in the solution to exercise 5.34, on the second line, change “probability of death at” to “probability of death after”.

[7/17/2014] On page 155, in exercise 8.31, in the table, change \ddot{e}_x to $\ddot{e}_{[x]}$.

[7/17/2014] On page 156, in exercise 8.32, on the last line, change the first numerator $A(0.9^{5-t} - 1)$ to $A(0.9^{5-t} - 0.9^5)$.

[12/14/2014] On page 165, in the solution to exercise 8.31, 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 $1 - (1 - 0.882353)t$.

[7/17/2014] On page 166, in the solution to exercise 8.32, on the last two lines (once apiece), change $0.9^{5-t} - 1$ to $0.9^{5-t} - 0.9^5$.

[7/10/2014] On page 186, in the answer to Example 10H, on the second displayed line, change 0.01 to 0.005. On the third displayed line, change 0.03 to 0.02 and 0.01485 to 0.0099. On the last line, change 0.01 to 0.005, 0.01485 to 0.0099, and 0.046554 to 0.027822.

[10/21/2014] On page 208, in the solution to exercise 10.27, on the last line, change $A^{(4)}$ to $A_x^{(4)}$.

[12/14/2014] On page 214, in the solution to exercise 10.51, on the second line, put a negative sign before Bc^{50} .

[2/12/2015] On page 232, on the last line, delete “F05:35”.

[7/17/2014] On page 247, two lines above Example 12E, change “expected value” to “present value”.

[12/14/2014] On page 256, in exercise 12.29(c), change “0f” to “of”.

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

- [10/24/2014] On page 287, in the solution to exercise 13.23, on the third displayed line of the page, change 0.0870320 to 0.870320.
- [10/29/2014] On page 306, in exercise 14.31(i), change the strange symbol near the end of the line to an ellipsis: 0,1,...,9.
- [3/4/2015] On page 307, one line above “Solutions”, S14:5 is an old SOA Exam MLC question.
- [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 317, in the solution to exercise 14.34, on the second line, put a negative sign before $(0.05t + 0.01t^2)$ at the right: $\exp(-(0.05t + 0.01t^2))$.
- [9/30/2014] On page 326, in the solution to exercise 15.8, on the second displayed line, change $-$ to $=$.
- [8/7/2015] On page 338, on the first line of Section 17.2, replace “life annuity-due” with “whole life annuity-immediate”.

- [7/22/2014] On page 363, replace the last two lines of the solution to exercise 17.38 with

$$\begin{aligned} 12a_{85:\overline{2}|} &= \left(\frac{0.85}{1.06}\right)^{1/12} \left(\frac{1-0.85/1.06}{1-(0.85/1.06)^{1/12}}\right) + \frac{0.85}{1.06} \left(\frac{0.8}{1.06}\right)^{1/12} \left(\frac{1-0.8/1.06}{1-(0.8/1.06)^{1/12}}\right) \\ &= (0.981769)(10.86698) + \frac{0.85}{1.06}(0.976822)(10.58249) = \boxed{18.96} \end{aligned}$$

- [11/2/2014] On page 364, in the solution to exercise 17.40, on the second displayed line, put a negative sign before \int_{75}^{76} .
- [11/3/2014] On page 385, in the solution to exercise 18.22, on the last line, insert “20,000” before $\left(\frac{1-\bar{A}_x}{\delta}\right)$.
- [12/15/2014] On page 399, in exercise 19.27, on the second line, change v_x^T to v^{T_x} .
- [10/24/2014] On page 411, in the solution to exercise 19.25, on the first line, change 6-year to 5-year.
- [11/6/2014] On page 433, in the solution to exercise 20.19, on the fifth displayed line, change $\sqrt{\bar{a}_{T_x}}$ to $\sqrt{\text{Var}(\bar{a}_{T_x})}$.
- [10/21/2014] On page 442, in exercise 21.4, on the fourth, seventh, and ninth lines, add “expected” before “present value”.
- [10/21/2014] On page 446, 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”.
- [9/4/2014] On page 457, in Table 22.1, on the third line of the section of formulas labeled “Woolhouse formula with two terms”, change \ddot{a}_x to $\ddot{a}_{x:\overline{m}|}$.
- [10/7/2014] On page 501, in Example 25D(iii), change “net” to “gross”.
- [2/25/2015] On page 502, on the third displayed line of the answer to Example 25E, change $\bar{a}_{60:\overline{10}|}$ to $\ddot{a}_{60:\overline{10}|}$.
- [1/24/2015] On page 519, in the solution to exercise 25.27, on the third line, change 0.18930 to 0.189965. On the last line, change 18,930 to 18,996.5 and change 2931.54 to 2941.82.
- [12/18/2014] On page 543, in the solution to exercise 27.13, on the second to last line, change 2.58047 to 2.58046.
- [11/10/2014] On page 544, in the solution to exercise 27.15, on the third displayed line, change π to P .
- [8/16/2015] On page 561, in the solution to exercise 28.19, change a_{41} to a_{40} in two places: on the second line and on the seventh line.

[11/10/2014] On page 562, in the solution to exercise 28.21, on the third line, replace “calculate” with “calculates”.

[8/1/2014] On page 563, on the line below equation (25.6), delete “+c” after “ $a^2 \text{Var}(X)$ ”.

[12/18/2014] On page 574, in exercise 29.23, the first column of the table is missing. The table should be:

	Percent of premium	Per policy
First year	65%	150
Renewal	5%	15

[11/10/2014] On page 574, in the solution to exercise 29.3, on the first displayed line, some 150,000²s are missing. The line should read

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

[8/15/2014] On page 580, in the solution to exercise 29.23, change the third line from the end to

$$= 0.042 \left(10,000 + \frac{260(0.95) - 15}{0.06/1.06} \right)^2 = 8,348,441$$

Change the last line to

$$1 - \Phi \left(\frac{0 - (-42398.7)}{\sqrt{834,844,100}} \right) = 1 - \Phi(1.47) = \boxed{0.0708}$$

[10/19/2014] On page 583, in formula (30.2), change the denominator from $1 - \bar{A}_x^2$ to $(1 - \bar{A}_x)^2$.

[2/12/2015] On page 592, one line above “Solutions”, add “F05:35” to the “Additional old CAS Exam 3/3L questions” list.

[12/18/2014] On page 597, in the solution to exercise 30.20, on the second displayed line, put a bar over the A in A_x^2 and put an exponent 2 over $\left(1 + \frac{\pi}{\delta}\right)$.

[11/11/2014] On page 617, in the solution to exercise 31.7, on the second to last line, replace 31.1.1 with 603.

[11/12/2014] On page 618, the solution to exercise 31.11 is incorrect. The correct solution is

The loss for death in year k is

$$\begin{aligned} {}_0L &= 10,000v^k + (10(0.50) + 4)\ddot{a}_{\overline{k}|} + (10(4) + 26) - 0.95(320)\ddot{a}_{\overline{k}|} + 0.45(320) \\ &= 10,000v^k - 295 \left(\frac{1 - v^k}{0.04/1.04} \right) + 210 \\ &= 17,670v^k - 7,460 \end{aligned}$$

Setting this equal to 0,

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

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.

[10/12/2014] On page 641, one line before Example 34D, delete “st” after “ $n + 1^{\text{st}}$ ”.

[5/3/2015] On page 646, in exercise 34.7(iii), delete the strange symbol before 13.

[8/20/2014] On page 651, in exercise 34.25(b), on the second line, change ${}_kV$ to ${}_{k+t}V$.

[12/18/2014] On page 652, on the second to last line of the solution to exercise 34.5, delete 1000 before ${}_{10}V$.

[8/24/2014] On page 689, 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:

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

[12/18/2014] On page 702, in exercise 37.21, on the displayed line, replace $l - K$ with $1 - K$.

[12/21/2014] On page 709, 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 711, in the solution to exercise 37.21, 2 lines from the bottom of the page, change $0.0021\ddot{a}_{40}$ to $0.0021v\ddot{a}_{40}$.

[9/16/2014] On page 719, in the answer to Example 38C, on the second displayed line, change E to e .

[10/12/2014] On page 733, 2 lines from the end of the page, the line should end with a period rather than a semicolon.

[5/3/2015] On page 754, in exercise 39.47(ii), delete one of the “reserves”.

[5/3/2015] On page 757, in exercise 39.60, on the first line, change “life” to “life”.

[12/21/2014] On page 764, 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 770, in the solution to exercise 39.35(c), change $T_{x+1} = 1$ to $T_{x+1} \leq 1$.

[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 776, in the solution to exercise 39.63, on the first line, change ${}_0V^3$ to ${}_0V^g$.

[5/3/2015] On page 796, on the third line of the page, change “the policy is a” to “the policy if a”.

[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 813, in the solution to exercise 41.17(b), on the sixth line, 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 41.32, on the first displayed line, delete 50,000.

[10/28/2015] On page 819, in the solution to exercise 41.34, change the final answer from 0.1425 to 0.1415 in two places.

[10/12/2015] On page 861, in exercise 44.16, on the second-to-last line, change ${}_2p_1^{12}$ to ${}_2p_0^{12}$.

- [8/30/2015] On page 864, on the second-to-last line of the solution to exercise 44.7, change (44.8) to (44.9).
- [12/21/2014] On page 941, in the solution to exercise 47.27, on the first displayed line, remove the parentheses around the subscript (T, J) .
- [12/21/2014] On page 959, in the solution to exercise 48.18, on the twelfth line, replace $q_{64}^{(2)}$ with ${}_2q_{64}^{(1)}$.
- [10/12/2014] On page 963, two lines below formula (49.1), change the period after “ages” to a comma.
- [3/29/2015] On page 972, in exercise 49.17, on the last line, a negative sign is missing on the right hand side of the equation, which should be $-q_{30}^{(1)} \cdot q_{30}^{(2)} / (\ln q_{30}^{(1)})$.
- [12/21/2014] On page 972, 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 974, in the solution to exercise 49.5, on the last line, change $p_{41}^{(1)}$ to $q_{41}^{(1)}$.
- [3/29/2015] On page 978, 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 $\frac{q_{30}^{(1)} q_{30}^{(2)}}{\ln(1 - q_{30}^{(1)})}$.
- [12/23/2014] On page 1087, in exercise 56.16(ii), the end of the line after the comma should read “ $i = 0.05$ ”.
- [11/24/2014] On page 1089, in the solution to exercise 56.1, on the last line, change t in the exponent of the numerator to 5.
- [10/22/2015] On page 1093, in the solution to exercise 56.16, on the displayed line, change the left side to ${}_{10}q_{50:40}^1$.
- [12/23/2014] On page 1103, in the solution to exercise 57.1, change ${}_t p_{50:55}^{00}$ to ${}_{20}p_{50:55}^{00}$.
- [10/12/2014] On page 1104, in the solution to exercise 57.7, on the second line, an integral sign is missing. The line should read
- $$= \frac{1}{50} \int_0^{10} e^{-0.07t} dt - \int_0^{10} \frac{1}{2500} t e^{-0.07t} dt$$
- [5/3/2015] On page 1126, in exercise 58.45(2), change “8ill” to “Bill”.
- [5/3/2015] On page 1126, in exercise 58.46, on the second line, change “m9ment” to “moment”.
- [5/3/2015] On page 1129, in exercise 58.53, on the third-to-last line, delete the first “that”.
- [12/23/2014] On page 1136, in the solution to exercise 58.27, on the second to last line, change “first death” to “last death”.
- [9/9/2014] On page 1137, 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
- $$\frac{d}{dt} {}_t V^{(0)} = \delta {}_t V^{(0)} - B_t - \mu_{x+t:y+t}^{01} (b_t^{01} + {}_t V^{(1)} - {}_t V^{(0)}) - \mu_{x+t:y+t}^{02} (b_t^{02} + {}_t V^{(2)} - {}_t V^{(0)})$$
- [12/23/2014] On page 1137, in the solution to exercise 58.29 part 1, on the first line, insert v^t before ${}_t p_{xy}$:
- $$\bar{a}_{xy} = \int_0^{\infty} v^t {}_t p_{xy} dt$$
- [12/23/2014] On page 1155, in exercise 59.17, in answer choice (D), change the last summand to ${}_{15}n| \bar{a}_y$.

- [11/26/2014] On page 1166, 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 1178, on the last line of the answer to Example 61A part 1, change 3.2787 to 3.2887.
- [4/12/2015] On page 1182, 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.
- [10/15/2015] On page 1183, on the eighth line of the answer to Example 61G, change “to age 65” to “from age 65 to age 60”.
- [3/16/2015] On page 1193, in the solution to exercise 61.3, on the last line, replace ddx with dx .
- [12/23/2014] On page 1193, 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 1195, 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 1196, 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.
- [5/3/2015] On page 1203, in exercise 62.4, on the first line, change “an effective” to “as effective”.
- [10/21/2014] On page 1206, in exercise 62.18(iv), change the strange symbol after the second “equals” to -0.02 .
- [11/26/2014] On page 1207, in the solution to exercise 62.3, on the last line, put “ -1 before the second equals sign.
- [11/26/2014] On page 1210, in the solution to exercise 62.15, on the seventh line, change 825 to 2500.
- [10/12/2014] On page 1214, on the third displayed line of the page, change $E[n \text{Var}(L^p | I)]$ to $E[n \text{Var}(L^1 | I)]$. On the fourth displayed line, change $\text{Var}(L^p | I)$ to $\text{Var}(L^1 | I)$. In formula (63.1), change $\text{Var}(L^p | I)$ to $\text{Var}(L^1 | I)$.
- [10/12/2014] On page 1216, in formula (63.1), change $\text{Var}(L^p | I)$ to $\text{Var}(L^1 | I)$.
- [10/12/2014] On page 1240, in formula (65.1), $q^{(w)}$ should be $q_{x+k-1}^{(w)}$.
- [10/12/2014] On page 1241, 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 . In the second table, change the heading l_t to l_k .
- [10/3/2014] On page 1241, in both the first and second tables, in the second to last column, change ${}_k p_{[50]}^{(\tau)}$ to ${}_{k-1} p_{[50]}^{(\tau)}$.
- [5/3/2015] On page 1241.9, one line above Section 65.2, change “too” to “to”.
- [8/9/2014] On page 1243, one line below the heading “DPP”, change discountt to discount.
- [8/9/2014] On page 1245, 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, $\text{Pr}_2 = 97.73$.
- 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.
- [10/3/2014] On page 1247.5, in Table 65.1, in the definition of profit signature, replace p_{x+k-1} with ${}_{k-1}p_x$.

- [10/12/2014] On page 1247, in Table 65.1, in formula (65.1), $q^{(w)}$ should be $q_{x+k-1}^{(w)}$.
- [10/3/2014] On page 1250, in exercise 65.8(vi), change 1000 to 100.
- [12/23/2014] On page 1259, in the solution to exercise 65.17, on the last line of the page, replace 25 in the denominator with 26; it is $1/d$.
- [8/26/2014] On page 1266, on the second and third displayed lines of the page, change 0.00576 to 0.005576.
- [12/23/2014] On page 1271, 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.
- [10/12/2014] On page 1281, in Table 67.1, in formula (67.11), change γ_t to γ .
- [10/12/2014] On page 1307, in formula (65.1), $q^{(w)}$ should be $q_{x+k-1}^{(w)}$.
- [11/8/2014] On page 1313, in exercise 68.7(iv)(a), change $_{death}q^{(i)}39$ to $_{death}q^{(i)}40$.
- [12/23/2014] On page 1317, in the solution to exercise 68.7, replace the last line with
 The gain, the excess of actual over expected profits is $25.9 - 62.1125 = \boxed{-36.2125}$.
- [7/20/2014] On page 1364, in question 21, the last line should be
- $$\sum_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}$$
- [8/23/2015] On page 1386, question 25 is defective since it is missing the expected present value of the retirement annuity. Answers to (b) and (c) should be multiplied by that expected present value.
- [7/20/2014] On page 1397, in question 25(a), on the second line, change $l_{60}^{(\tau)}$ to $l_{62}^{(\tau)}$.
- [7/23/2014] On page 1404, in question 26(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.
- [7/28/2014] On page 1455, in question 22, change (vi) to
 The multiple-decrement death rate at ages 60 through 64 is ${}_kq_{60}^{(d)} = 0.01$, $k = 0, 1, 2, 3, 4$, before withdrawal. The death rate is ${}_kq_{60}^{(d)} = 0.01$, $k = 0, 1, 2, 3, 4$, after withdrawal.
- [7/29/2014] On page 1464, in question 22(c), add "Deaths are uniformly distributed between integral ages." before "Using Woolhouse's formula...".
- [3/3/2015] On page 1483, 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 1484, 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)"
- [5/3/2015] On page 1524, the correct answer choice for question 20 is (B). Correct the table on page 1516 as well.
- [9/30/2014] On page 1524, in the solution to question 21, on the first line, the formula should be $0.5(0.5p_{70.3} + p_{70.3})$. The 0.5 factor is missing. On the first displayed line of the solution to part (a), $0.7p_{70.8}$ should be $0.7p_{70.3}$.
- [7/21/2014] On page 1525, in the solution to question 22(a), on the last line of the page, change ${}_tP_{x+k}$ to ${}_{t-k}P_{x+k}$.
- [7/21/2014] On page 1525, 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 1526, in the solution to question 25(a), on the last line, change the denominator $0.96(17.625 - 0.76)$ to $0.96(17.625) - 0.76$.
- [10/1/2014] On page 1528, in the solution to question 29(a), on the second line, place an exponent “2” on 960 : $960^2 n^2 \dots$
- [10/7/2014] On page 1538, in the solution to question 26(a), on the third line, replace 0.22415 with 0.23047 .
- [10/12/2014] On page 1545, in the solution to question 15, on the fifth line, change “if” to “is”.
- [7/23/2014] On page 1548, in the solution to question 23(b), on the last displayed line, change $100,000$ to $100,100$. In the solution to question 23(c), on the displayed line, change $100,000$ to $100,100$ and change the final answer to 3055.76 .
- [7/20/2014] On page 1549, in the solution to question 25(b), on the third displayed line, the expression after the first equals sign is missing the denominator, and should be

$$2000 \frac{1 - e^{-(0.17 + \ln 1.04)}}{0.17 + \ln 1.04}$$

- [7/20/2014] On page 1551, in the solution to question 27(b), 3 lines before the end, change 657.11 to 659.22 .
- [10/25/2014] On page 1555, in the solution to question 10, on the fourth line, invert the fraction so that it is $\frac{12.54585}{13.19578}$.
- [7/23/2014] On page 1562, in the solution to question 24(c), on the first displayed line, change the integrand to ${}_t p_0^{01} \mu_t^{13} dt$. On the second displayed line, change ${}_{5-u} p_u^{11}$ to ${}_{t-u} p_u^{11}$. On the fourth displayed line, change the upper bound of the integral from 5 to t . On the second to last line, change μ_t^{12} to μ_t^{13} .
- [7/22/2014] On page 1563, the solution to question 26 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 $0.6(228,859.4) = \boxed{137,315.6}$.

- (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,

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

- (c) (i) The benefit based on 10 years of service is 20% of 3-year average salary, $0.2(145,000) = 29,000$. It is paid at age 65. The expected present value of a 20-year deferred whole life annuity-due of 1 is

$${}_{20} \ddot{a}_{45} = E p {}_{20} a_{45} \ddot{a}_{65} = (0.25634)(9.8969) = 2.5370$$

So the accrued liability is $2.5370(29,000) = \boxed{73,572.17}$.

- (ii) Projected 3-year average salary is

$$150,000 \left(\frac{1.03^{17} + 1.03^{18} + 1.03^{19}}{3} \right) = 255,439.34$$

The accrued liability, using the annuity value for ${}_{20} \ddot{a}_{45}$ from part (i), is $2.5370(0.2)(255,439.34) = \boxed{129,609.92}$.

(iii) We calculated projected 3-year average salary as 255,439.34 in part (ii). Multiplying by ${}_{20}\ddot{a}_{45}$ and by 0.4, the projected liability is $2.5370(0.4)(255,439.34) = \boxed{259,216.91}$.

[7/23/2014] On page 1564, in the solution to question 27(c), replace the second displayed line with

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

[7/22/2014] On page 1572, in the solution to question 21(b), on the fourth displayed line, replace ${}^2E_{20}{}_{45}$ with ${}_{20}{}^2E_{45}$.

[7/25/2014] On page 1573, in the solution to question 22(c),

1. On the first displayed line, change $\ddot{a}_{[41]}$ to $\ddot{a}_{[41]+1}$ and change $P_{[41]}$ to $P_{[41]+1}$.
2. On the third displayed line, put a double-dot on $a_{[41]+1}$ and change $p_{[41]}$ to $p_{[41]+1}$.

[7/25/2014] On page 1584, the solution question 21(c) and 21(d) is incorrect and should be replaced with the following:

3. The probability of survival, for $t \leq 19$, is $\left(\frac{20-t}{20}\right)^{0.5}$.

Let N be the number of lives in the nursing home at the end of 2 years. For a life entering at time $2-t$, the expected number of lives at time 2 is a Bernoulli random variable with mean ${}_t p_{80}$. Adding up these means over the two lives:

$$E[N] = p_{80} + {}_2 p_{80} = \left(\frac{19}{20}\right)^{0.5} + \left(\frac{18}{20}\right)^{0.5} = \boxed{1.92336}$$

4. The variance of the Bernoulli variable is ${}_t p_{80} {}_t q_{80}$. Adding up these variances.

$$\text{Var}(N) = \left(\frac{19}{20}\right)^{0.5} \left(1 - \left(\frac{19}{20}\right)^{0.5}\right) + \left(\frac{18}{20}\right)^{0.5} \left(1 - \left(\frac{18}{20}\right)^{0.5}\right) = \boxed{0.07336}$$

[7/27/2014] On page 1596, in the solution to question 22, on the first displayed line, delete 100 and delete the parentheses.

[7/27/2014] On page 1599, in the solution to question 26(b), on the displayed line, change the numerator 0.15 to 150.

[7/27/2014] On page 1600, in the solution to question 26(c), on the last line, change the numerator $1 - 0.6^{0.5}$ to $0.6^{0.5} - 1$.

[7/27/2014] On page 1607, in the solution to question 21(e), delete the 1000 after the second equals sign.

[8/25/2015] On page 1610, in the solution to question 25(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 25(b), on the first displayed line change the two subscripts to 65. On the third displayed line change the two subscripts to 64.9. In the solution to question 25(c), on the first displayed line, add dt at the end. On the fourth displayed line, change ${}_t p_{40+t}^{11}$ to ${}_{10-t} p_{40+t}^{11}$. On the second to last line, put a minus sign in front of $\frac{0.02}{0.015}$. Change the last line to

$$= -\frac{4}{3} e^{-0.8125} \left(e^{-0.0075(15^2)} - e^{-0.0075(5^2)} \right) = \boxed{0.381059}$$

[7/28/2014] On page 1619, in the solution to question 22(b), change the sentence starting 3 lines from the end with "We discount" to

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.

Change the displayed line to

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

[7/28/2014] On page 1631, 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 ${}_tp_{40} = 0.25$.

[7/29/2014] On page 1632, in the solution to question 24(b), change $\frac{i}{\delta}A_{53}$ to $1000\left(\frac{i}{\delta}\right)A_{53}$.

[7/29/2014] On page 1633, in the solution to question 26(a), on the fourth displayed line, change 0.07751 to 0.07714. On the second-to-last line, change $\ddot{a}_{40:\overline{30}|^{(4)}}$ to $\ddot{a}_{40:\overline{30}|}^{(4)}$.

[4/15/2015] On page 1636, in the solution to question 26, on the last line, change “age 25” to “age 20”.

[2/26/2015] On page 1673, 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 ${}_2q_{x+1}^{(w)}$ to ${}_2q_x^{(w)}$.

[3/21/2015] On page 1705, in the solution to question 8, on the second line, change $v(kt)$ to $v(t)^k$.

[9/18/2014] On page 1706, in the solution to question 11, on the last line, change $b/2a$ to $-b/2a$.

[4/20/2015] On page 1707, in the solution to question 15, 4 lines from the end, the expression $\left(b + \frac{G-e}{d}\right)$ should be squared: $\left(b + \frac{G-e}{d}\right)^2$.

[4/29/2015] On page 1709, in the solution to question 21, on the first displayed line, change ${}_{10|\ddot{a}}_x$ to ${}_{10|\bar{a}}_x$.

[8/8/2014] On page 1728, in the solution to question 11, change the last displayed line to

$$1 + \frac{p_{\overline{30}|}}{1+i} = 1 + \frac{1-0.0016}{1.05} = 1.9509$$

[12/3/2014] On page 1731, in the solution to question 2(a), on the second displayed line, change μ_t^{00} to μ_t^{10} . On the second and third displayed lines, change μ_t^{02} to μ_t^{12} once apiece on each line.

[12/4/2014] On page 1731, in the solution to question 2(c), on the first line, change 1.04^2 to $1.04^2 - 1$. On the second line, change ${}_1p_0^{02}$ to $({}_1p_0^{02} - {}_{0.5}p_0^{02})$.

[12/3/2014] On page 1732, in the solution to question 3(d), on the first and third-to-last lines, once apiece, change “nubmer” to “number”.

[12/3/2014] On page 1733, in the solution to question 4(d), replace the last two lines with

Actual number of deaths is 70, whereas pricing is $10,000p_{45}q_{46} = 10,000(1-0.004)(0.00431) = 43$. Higher mortality than pricing leads to a mortality loss.

[12/4/2014] On page 1734, in the solution to question 6(a), on the first displayed line, change $e = \text{COI}$ to $e - \text{COI}$.

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