

Errata and updates for ASM Exam MLC (Seventh Edition Second Printing) sorted by page

Practice exam 4:20 is defective in that none of the five answer choices is correct.

[7/2/2009] On page xii, on the last line of the fourth paragraph of “Tables”, change 0.8859 to 0.8860.

[2/14/2009] On page xiii, replace the last two bulleted paragraphs on the page with:

- From Spring 2000 through Fall 2004, the exam included frequency and severity models, ruin theory, and some simulation.
- From Spring 2005 through Fall 2006, the exam included frequency and severity models, and some simulation, but not ruin theory.

[8/4/2009] On pages 5–6, in Section 1.3, $\Pr(B) \neq 0$ and $f(y) \neq 0$ are necessary for the definitions of conditional probability.

[1/20/2009] On page 16, in the solution to exercise 1.12, 3 lines from the end, change the denominator x to m .

[7/9/2009] On page 16, in the solution to exercise 1.14, on the 7th line, change $g(x)$ to $g(n)$.

[8/4/2009] On page 20, one line after Example 2A, add the word “independent”: “. . . from n independent identically distributed . . .”.

[12/29/2008] On page 21, the second displayed line has three errors and should read

$$\Pr(X < 100) = 0.6(1 - e^{-100/100}) + 0.4(1 - e^{-100/200}) = 0.6(0.6321) + 0.4(0.3935) = \boxed{0.5367}$$

[1/24/2010] On page 29, in the solution to exercise 2.4, on the fourth line, change $\text{Var}(mn)$ to $\text{Var}(mN)$.

[8/31/2009] On page 32, in the solution to exercise 2.14, on the second line from the end, delete a plus sign between 0.0064 and 0.183125.

[6/11/2009] On page 42, in the solution to exercise 3.6, on the third line, replace David with Dick.

[7/13/2009] On page 43, in the solution to exercise 3.8, on the displayed line, change the subscript $x + t$ to $x + 5$.

[7/13/2009] On page 44, in the solution to exercise 3.9, replace 0.948574 with 0.948514 on the third from last line and the last line.

[8/31/2009] On page 46, replace the paragraph in the answer to part 3 of Example 4A with

This can be evaluated as ${}_{10}p_{40} - {}_{30}p_{40}$ or as ${}_{10}p_{40} {}_{20}q_{50}$; either way, we need two integrals to evaluate this. We’ll use the former expression. We already saw in the previous two solutions that for this force of mortality, ${}_t p_x = (65 + x)/(65 + x + t)$.

[8/31/2009] On page 53, in exercise 4.21, on the third line, change q_x to q_{30} .

[8/24/2009] On page 59, in the solution to exercise 4.14 part 2, put dx after the integrand $0.05(1.01)^x$.

[8/2/2009] On page 63, in the solution to exercise 4.34, put a negative sign before the integral in the first and second displayed lines.

[1/24/2010] On page 66, on the second line of the answer to Example 5A, change $\omega = 70$ to $\omega - x = 70$.

[12/27/2008] On page 73, in equation (6.2), a 2 is missing:

$$E[T(x)^2] = 2 \int_0^{\infty} t {}_t p_x dt$$

[1/28/2009] On page 87, the solution to exercise 6.12 is incorrect. The correct solution is:

We can use either a logical approach or an algebraic/geometric approach.

The logical approach is to split the universe into two groups, the ones that survive to age 60 and the ones who don't. The ones who survive to age 60 have an expected lifetime of 40 plus \dot{e}_{60} , or 65. The ones who don't have an expected lifetime of 20, since survival is uniform between ages 20 and 60. Expected lifetime at 20 is the weighted average of the expected lifetime of these two groups:

$$\begin{aligned}\dot{e}_{20} &= {}_{40}p_{20}(65) + (1 - {}_{40}p_{20})(20) \\ 60 &= 20 + 45 {}_{40}p_{20} \\ {}_{40}p_{20} &= \frac{40}{45} = \frac{8}{9}\end{aligned}$$

But ${}_{40}p_{20} = s(60)/s(20)$, so it follows that $s(60) = (8/9)s(20) = \boxed{0.8}$.

The algebraic/geometric approach starts with the recursive formula, equation (7.1), to relate the given \dot{e}_x 's.

$$\begin{aligned}\dot{e}_{20} &= \dot{e}_{20:\overline{40}|} + {}_{40}p_{20} \dot{e}_{60} \\ 60 &= \dot{e}_{20:\overline{40}|} + \left(\frac{y}{0.9}\right) \dot{e}_{60}\end{aligned}$$

$\dot{e}_{20:\overline{40}|}$ is the integral of ${}_t p_{20}$ from $t = 0$ to 40, and ${}_t p_{20}$ is linear on $(0, 40]$ since $s(x)$ is linear on $(20, 60]$. So the integral is the area of a trapezoid with bases 1 (at $t = 0$ or $x = 20$) and ${}_{40}p_{20} = s(60)/s(20) = y/0.9$ (at $t = 40$ or $x = 60$) and height 40. So we have

$$60 = 0.5(40) \left(1 + \frac{y}{0.9}\right) + \frac{25y}{0.9}$$

Multiply through by 0.9,

$$\begin{aligned}54 &= 20(0.9 + y) + 25y = 18 + 45y \\ 45y &= 36 \\ y &= \boxed{0.8}\end{aligned}$$

[2/14/2009] On page 89, in the solution to exercise 6.24, on the last line of the page, change $\text{Var}(T(30 \wedge 30))$ to $\text{Var}(T(30 \wedge 10))$.

[2/7/2009] On page 95, on the fifth line, insert an n in the formula: ${}_n L_x = 0.5n(l_x + l_{x+n})$.

[2/21/2009] On page 96, on the first displayed line of the page, delete the 7 at the end of the line.

[7/14/2009] On page 108, in the solution to exercise 7.24, on the third line from the end, change $+\frac{0.6931}{2}$ to $-\frac{0.6931}{2}$.

[12/29/2008] On page 119, on the 7th and 8th lines, replace 0.471132 with 0.447576.

[9/3/2009] On page 119, on the third line of the answer to Example 8J part 2, add ds after the left hand side integral.

[7/2/2009] On page 132, in the solution to exercise 8.12, on the second line from the end, change $1 - 0.5(0.6)$ to $1 - 0.5(0.06)$.

[9/3/2009] On page 132, in the solution to exercise 8.13, 3 lines from the end of the page, delete one of the 1's after "are".

[9/3/2009] On page 133, in the solution to exercise 8.14, on the 6th line, the left hand side should be $\mathbf{E}[T^2 \wedge 2]$.

[7/14/2009] On page 133, in the solution to exercise 8.15, the page reference should be page 115, not page 8.7.

[7/14/2009] On page 134, in the solution to exercise 8.19, on the fourth displayed line, $\frac{5}{24}$ should be $-\frac{5}{24}$.

[7/7/2009] On page 135, in the graph for the solution to exercise 8.20, change l_x to ${}_{x-20}P_{20}$.

[8/20/2009] On page 138, in the solution to exercise 8.38, in II, change the numerator from 13 to $\frac{1}{3}$.

[7/8/2009] On page 139, in the solution to exercise 8.40, on the second displayed line, change ${}_{2|0.5}q_{x+2}$ to ${}_{2|0.5}q_x$.

[7/15/2009] On page 143, on the first 2 displayed lines of the page, change 9,683,267 to 9,683,297.

[7/15/2009] On page 154, in the solution to exercise 9.9, on the fifth line, change l_{98} to q_{98} .

[7/2/2009] On pages 159–201, change “actuarial present value” to “present value” in:

- Section 10.1, third paragraph, third sentence.
- Example 10D, the sentence starting “Let Z be”.
- Solution to exercise 11.22, first sentence.
- Solution to exercise 11.23, first sentence.

[2/21/2009] On page 163, in the answer to Example 10B:

- On the second displayed line, put a minus sign in the first exponent: $e^{-n(\mu+2\delta)}$.
- The last two lines are incorrect. They should read:

$$\text{Var}(Z') = 0.111344 - 0.218359^2 = 0.063663$$

$$\text{Var}(Z) = 1,000,000(0.063663) = \boxed{63,663}$$

[9/25/2009] On page 164, in the answer to Example 10C, on the second displayed line, change the first exponent to $-[0.01 + 2(0.03)](10)$

[1/3/2009] On page 164, in the answer to Example 10C, on the fifth displayed line, the one for $E[Z_2^2]$, change the two exponents -0.11 to -1.1 .

[1/3/2009] On page 164, in the answer to Example 10D, on the first displayed line, change $\frac{e^{-0.4}}{4}$ to $\frac{1-e^{-0.4}}{4}$. On the second displayed line, change $\frac{e^{-0.7}}{7}$ to $\frac{1-e^{-0.7}}{7}$ and change 0.070941 to 0.071916. On the last line, change 0.070941 to 0.071916 and change 0.064148 to 0.065123. The last two lines will then be

$$E[Z^2] = \frac{0.01}{0.01 + 2(0.03)} (1 - e^{-0.01+2(0.03)}) = \frac{1 - e^{-0.7}}{7} = 0.071916$$

$$\text{Var}(Z) = 0.071916 - 0.082420^2 = \boxed{0.065123}$$

[7/16/2009] On page 174, in the solution to exercise 10.5, on the first line, change \bar{A}_{x+t} to \bar{A}_{x+3} .

[7/16/2009] On page 174, in the solution to exercise 10.8, on the second line, change $e^{-1.6}$ to $100,000e^{-1.6}$.

[8/8/2009] On page 175, in the solution to exercise 10.7, the proof is inadequate, since it is not given that force of mortality is constant. Replace the passage after **(B)** to the end of the solution with

To prove the inequalities:

First consider adding a constant to δ . Since $\bar{A}_x = \mathbf{E}[v^T]$, $\bar{A}_x'' = \mathbf{E}[v^T e^{-cT}]$. For any two functions $g_1(t)$ and $g_2(t)$ of a random variable T , if $g_1(t) < g_2(t)$ always, then $\mathbf{E}[g_1(t)] < \mathbf{E}[g_2(t)]$. Here, $g_1(t) = e^{-ct}v^t$ and $g_2(t) = v^t$, and $g_1(t) < g_2(t)$ since $e^{-ct} < 1$. So $\mathbf{E}[v^T e^{-cT}] < \mathbf{E}[v^T]$ and we have proved that $\bar{A}_x'' < \bar{A}_x$.

Now consider adding a constant to μ . For \bar{a}_x , adding a constant to μ results in a lower value, since $\bar{a}_x = \int_0^\infty v^t {}_t p_x dt$, and adding a constant to μ lowers ${}_t p_x$. However, $\bar{A}_x = 1 - \delta \bar{a}_x$, so making \bar{a}_x higher results in making \bar{A}_x lower.

[9/9/2009] On pages 175–176, the solution to exercise 10.13 should use continuously compounded rates of benefit growth rather than effective rates. The revised solution is:

Let A be the single benefit premium. The continuous rate of increase offsets the interest, so in effect we have $\delta = -0.04$ in the first 10 years and $\delta = 0.01$ thereafter. Then

$$\bar{A} = \frac{0.05}{0.05 - 0.04}(1 - e^{-0.01(10)}) + e^{-0.01(10)} \frac{0.05}{0.05 + 0.01} = \boxed{1.2298} \quad (\text{A})$$

[2/7/2009] On page 176, in the solution to exercise 10.14, on the third line, the last exponent should be $-25(0.04 + 0.02)$ instead of $-25(0.04 + 0.06)$.

[7/16/2009] On page 178, in the solution to exercise 10.27, on the last line, remove the second of the three minus signs; $(7/3)^2$ should be multiplied by the parenthesized expression.

[1/21/2010] On page 194, in the solution to exercise 11.5, on the second line, delete $\int_0^{60} e^{-0.06t} dt$. On the fourth line, change “interest rate” to “force of interest”.

[3/24/2009] On page 195, in the solution to exercise 11.7, on the 4th line of the page, there should be a negative sign before the expression:

$$= - \left(\frac{0.02}{0.1} \left(\frac{1}{1 + 0.1t} \right) \right) \Big|_0^{50}$$

[1/21/2010] On page 195, in the solution to exercise 11.9, replace $\bar{a}_{\overline{75}|}$ with $\bar{a}_{\overline{25}|}$ on the first and fourth displayed lines.

[7/17/2009] On page 197, in the solution to exercise 11.15, on the 5th displayed line, change $\frac{4}{15}$ to $\frac{4}{14}$.

[7/17/2009] On page 210 in the solution to exercise 12.3, on the 6th line, replace the second sentence with

We want $\Pr(1.864707e^{-0.06T} > 0.5)$, or $\Pr(e^{-0.06T} > 0.5/1.864707)$ and $0.5/1.864707 = 0.268139$, or $\Pr(T < -\ln 0.268139/0.06)$, and $-\ln 0.268139/0.06 = 21.9375$.

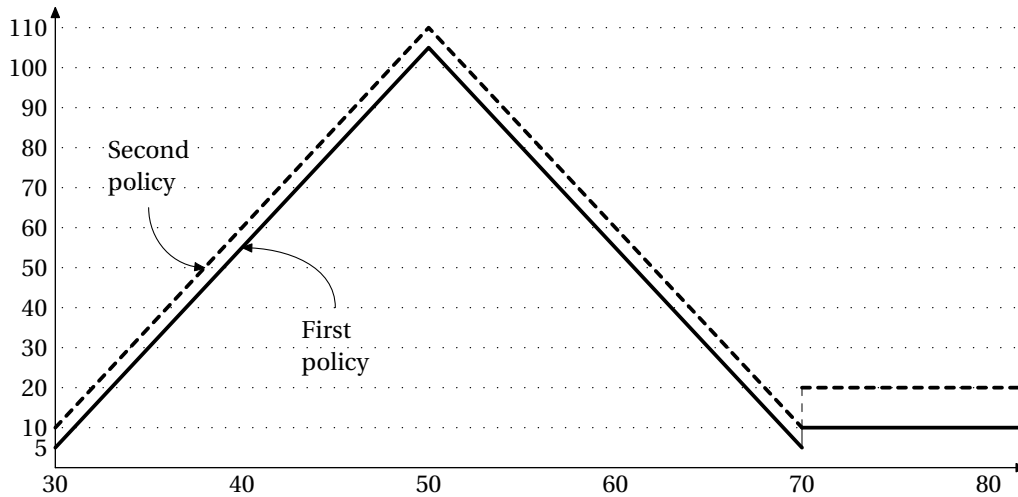
[2/16/2009] On page 211, in the solution to exercise 12.6, on the last line, $\Pr(T(35)) < 14.2067$ should be $\Pr(T(35) < 14.2067)$.

[9/9/2009] On page 212, in the solution to exercise 12.10, on the first line, replace λ with δ .

[5/4/2010] On page 218, on the third line before the answer to Example 13A, change “or” to “of”.

[9/9/2009] On page 230, in exercise 13.36, on the second line after the table, add “age 49” at the end of the sentence after “100 lives”.

[3/4/2009] On page 235, Figure 13.1 is incorrect. The correct figure is



[7/19/2009] On page 239, in the solution to exercise 13.34, on the second line from the end, change 0.21546 to 0.021546.

[7/20/2009] On page 242, change the third sentence of Section 14.2 to

The symbols for the actuarial present values for the functions paying at the end of the year of death are the same as for the functions paying at the moment of death, except there is no bar on the A.

[3/10/2009] On page 252, the solution to exercise 14.2 is incorrect. The correct solution is

The benefit premium is

$$10,000A_{63} = \frac{5233}{1.12} = 4672.32,$$

so $A_{63} = 0.467232$. We use the equation

$$A_{63} = vq_{63} + v^2p_{63}q_{64} + v^2{}_2p_{63}A_{65}$$

and the values of $q_{63} = 0.01788$, $q_{64} = 0.01952$, $l_{63} = 7,823,879$, $l_{65} = 7,533,984$ to obtain:

$$\begin{aligned} {}_2p_{63} &= \frac{l_{65}}{l_{63}} = \frac{7,533,984}{7,823,879} = 0.962947 \\ 0.467232 &= \frac{0.01788}{1.05} + \frac{(1 - 0.01788)(0.01952)}{1.05^2} + \frac{0.962947}{1.05^2}A_{65} \\ 0.467232 &= 0.017029 + 0.017389 + 0.873422A_{65} \\ A_{65} &= \frac{0.467232 - 0.017029 - 0.017389}{0.873422} = 0.49554 \end{aligned}$$

The contract premium at 65 is $1.12(10,000)(0.49554) = 5550$. The earnings rate needed is $\left(\frac{5550}{5233}\right)^{1/2} - 1 =$

0.030. (A)

[7/27/2009] On page 256, in the solution to exercise 14.23, on the first line, change vq_{50} to $1000vq_{50}$.

[7/21/2009] On page 264, in the solution to exercise 15.3, delete the half-sentence “We calculate . . . formula”.

[7/21/2009] On page 264, in the solution to exercise 15.4, on the sixth line, change ${}^2_{10}E_{38}$ to ${}^2_{10}E_{38}$.

[2/23/2009] On page 267, on the second line of the third paragraph, change “present variable” to “present value”.

[2/21/2010] On page 269, on the first line, replace $a_{\overline{T}|}$ with $\bar{a}_{\overline{T}|}$.

[9/15/2009] On page 279, in the solution to exercise 16.7, on the 6th line, replace $0.09 + 0.3 = 0.09$ with $0.09 + 0.03 = 0.12$.

[1/15/2009] On page 284, on the last line of the solution to Example 17B, replace ${}_{30}\ddot{a}_{35}$ with $\ddot{a}_{35:\overline{30}}$.

[9/9/2009] On page 305, in the solution to exercise 17.14, the last line should read

$$i a_{x:\overline{n}} + (1+i)A_{x:\overline{n}} - 1 = 1 + i - i + i_n E_x - 1 = \boxed{i_n E_x} \quad (\mathbf{B})$$

[7/24/2009] On page 313, in equation (18.6), replace $\ddot{a}_{T(x)}$ with $\ddot{a}_{\overline{K(x)+1}}$.

[7/26/2009] On page 314, on the 12th line under “Variance of a deferred annuity”, replace $\text{Var}(Y | I)$ with $\text{Var}_I(\mathbf{E}[Y | I])$.

[8/6/2009] On page 316, on the last line of the page, (-1266.67^2) should be $(-1266.67)^2$.

[7/24/2009] On page 319, in exercise 18.6, change “continous” to “continuous whole”

[2/13/2010] On page 322, on the second line of the answer to Example 16D, delete δ from the denominator.

[11/18/2009] On page 324, in the solution to exercise 18.1, in the second bullet, change $E[T(x)]^2$ to $E[T(x)^2]$.

[9/9/2009] On page 324, in the solution to exercise 18.2, on the second displayed line, move the double-dot off the E to $a_{x:\overline{30}}$.

[9/9/2009] On page 330, in the solution to exercise 18.9, on the fourth line, change ${}_t q_{30}$ to ${}_t q_{30}$.

[4/9/2010] On page 332, in the solution to exercise 18.27, change “is” to “if”.

[8/6/2009] On page 346, in the solution to exercise 19.6, on the last line, remove the minus sign from the exponent.

[12/5/2009] On page 348, in the solution to exercise 19.14, on the 6th displayed line, change t to T .

[4/21/2010] On page 348, in the solution to exercise 19.15, change the left hand side of the second displayed line from ${}_3\bar{a}_t$ to ${}_3\bar{a}_{t-3}$.

[7/26/2009] On page 349, in the solution to exercise 19.16, on the second displayed line, $e^{-0.02(20)}$ should be $e^{-0.02(20)}$.
On the 7th displayed line, $e^{-1.2(0.08)}$ should be $\frac{e^{-1.2}}{0.08}$.

[3/31/2009] On page 352, in the solution to exercise 19.31, on lines 5, 4, and 3 from the bottom of the page, change ${}_9\ddot{a}_x$ to ${}_9\ddot{a}_{x+1}$.

[9/15/2009] On page 353, in the solution to exercise 19.32, on the last line, replace $u(65)$ with $u(64)$.

[7/26/2009] On page 360, in the solution to exercise 20.5, on the third and fourth lines, replace 0.095897 by 0.0956897, once on each line.

[3/4/2009] On page 360, in the solution to exercise 20.9, on the first displayed line, replace $\frac{1}{1.05}$ with $\frac{0.05}{1.05}$.

[9/15/2009] On page 361, in the solution to exercise 20.14, on the first displayed line, interchange \bar{A}_{70} and A_{70} .

[9/23/2009] On page 379, in exercise 22.3, on the first line, change fullyY to fully.

[1/24/2009] On page 385, the information in the box at the top should be used for questions 22.20–22.23 (not just for 22.20 and 22.21).

[7/28/2009] On page 394, in the solution to exercise 22.1, on the first displayed line, change ${}_{k-1}q_0$ to ${}_{k-1}|q_0$. On the third displayed line, change 0.5 to 0.05.

[4/7/2010] On page 395, in the solution to exercise 22.3, on the first displayed line, change the t 's to k 's, and insert ${}_{k-1}p_x$:

$$A = \sum_{k=1}^3 b_k {}_{k-1}p_x q_{x+k-1} v^k$$

In the fourth displayed equation, change px to p_x .

[7/28/2009] On page 397, in the solution to exercise 22.7, on the last line, the denominator should be 14, not 13.236242.

[7/28/2009] On page 397, in the solution to exercise 22.9, on the third displayed line, the denominator should be $40(0.05)$ instead of 40.

[9/23/2009] On page 402, in the solution to exercise 22.25, on the 6th and 8th lines, put double-dots on the three a 's that don't have them.

[11/18/2009] On page 408, in the solution to exercise 22.47, on the first line of the page, change $\frac{1}{\ddot{a}_{20}}$ to \ddot{a}_{20} .

[7/28/2009] On page 408, replace the last line of the solution to exercise 22.49 with

$$1000 \left(\frac{dA'_{60}}{1 - A'_{60}} \right) = 1000 \left(\frac{0.06(0.36986)}{1.06(1 - 0.36986)} \right) = \boxed{33.22}$$

[4/3/2009] On page 410, in the solution to exercise 22.53, move the right parenthesis of the second line past d :

$${}_{15}E_{30} \left(d + \frac{1}{\ddot{a}_{30:\overline{15}|}} - d \right) = \frac{1}{\ddot{s}_{30:\overline{15}|}}$$

[7/31/2009] On page 411, on the last line of Example 23A, delete the word "benefit".

[8/2/2009] On page 415, the solution to exercise 23.7 should read

$$1000A_{25} - \pi_b \ddot{a}_{25} = 1000(0.259800) - 31.1857 \left(\frac{(1 - 0.259800)(1.05)}{0.05} \right) = \boxed{-224.96}$$

[8/2/2009] On page 427, in the solution to exercise 24.16, on the fifth line from the bottom of the page, change " v^T otherwise" to " v^n otherwise".

[7/29/2009] On page 438, in the solution to exercise 25.7, on the fourth displayed line, the line should end with 1.7763, and $\frac{P}{d} = 0.7763$ should be placed a separate line.

[9/23/2009] On page 439, in the solution to exercise 25.11, replace the third displayed line with

$$\Pr(S > 45) = \Pr \left(\frac{S - 33}{\sqrt{36}} > \frac{45 - 33}{\sqrt{36}} \right) = \Pr \left(\frac{S - 33}{6} > 2 \right)$$

[8/17/2009] On page 443, in the solution to Example 26A:

- Change $A_{60} - {}_{20}E_{60}A_{80}$ to $1000A_{60} - 1000 {}_{20}E_{60}A_{80}$ on the first displayed line.
- Change $\bar{A}_{60:\overline{20}|}$ to $1000\bar{A}_{60:\overline{20}|}$ on the last displayed line.

[8/3/2009] On page 451, on the fourth line of the second paragraph, delete the word "benefit".

[9/23/2009] On page 453, in the answer to Example 27C part 2 two lines from the end, change ${}_{15}^{20}V_x$ to ${}_{15}^{20}V_{40}$.

[3/24/2009] On page 461, in the solution to exercise 27.9, on the second to last line, change "end of the third year" to "end of the second year".

[8/3/2009] On page 470, in the solution to exercise 27.12, on the 4th displayed line, change 0.46587 to 0.046587.

- [4/12/2009] On page 475, in the solution to exercise 28.3, on the third line, change “present value of future benefits” to “present value of future premiums”.
- [3/1/2009] On page 477, in the solution to exercise 28.7, on the third line, replace ${}_{15}\ddot{a}_{10:\overline{30}|}$ with ${}_{15}\ddot{a}_{10:\overline{30}|}$.
- [3/1/2009] On page 477, in the solution to exercise 28.8, “the insurance formula” refers to the insurance-ratio formula, equation (29.2).
- [2/10/2010] On page 477, in the solution to exercise 28.9, on the third displayed line, change B to $\frac{B}{1000}$.
- [8/3/2009] On page 479, in the solution to exercise 28.17, on the 4th line, change $v^{(2)}$ to ${}_iV^{(2)}$.
- [2/10/2010] On page 481, in the solution to exercise 28.23, on the second to last line, change $\bar{a}_{50:\overline{10}|}$ to $\bar{a}_{50:\overline{7}|}$.
- [8/4/2009] On page 494, in the solution to exercise 29.1, on the third displayed line, change ${}_{10}V_{50:\overline{20}|}^1$ to ${}_{10}V_{50:\overline{20}|}^1$.
- [8/4/2009] On page 495, in the solution to exercise 29.6, on the displayed line, change the ${}_i\bar{V}(\bar{A}_{x+t})$ to ${}_i\bar{V}(\bar{A}_x)$.
- [8/4/2009] On page 497, in the solution to exercise 29.17, on the last line, change ${}_{20}V_{35}$ to ${}_{20}V_{25}$.
- [8/4/2009] On page 497, in the solution to exercise 29.18, on the second line from the end, change $1 - 0.1(0.4)$ to $1 - 0.1(4)$.
- [9/23/2009] On page 499, in the solution to exercise 29.24, on the first displayed line, change P_x to P_{36} .
- [10/27/2009] On page 501, in the first displayed formula, replace $\text{Var}({}_tL \mid T(x) \geq t)$ with $\text{Var}({}_tL \mid T(x) > t)$.
- [3/24/2010] On page 618, in exercise 30.5, while this question is the one that appeared on the old exam, the intended question was “Calculate $\frac{\text{Var}({}_tL \mid T(x) > t)}{\text{Var}({}_{t+1}L \mid T(x) > t + 1)}$ ” instead of what is on the last line.
- [3/3/2009] On page 507, in the solution to exercise 30.2, on the first line, there should be a bar over the A .
- [4/26/2010] On page 510, in the solution to exercise 30.16, put bars on the A_{25} and A_{50} on the first two lines of the page.
- [4/12/2010] On page 513, in exercise 31.2(iii), change ${}_{10}E_x$ to ${}_{10}E_{50}$.
- [8/5/2009] On page 526, in the solution to exercise 31.15, on the third line from the end, 1.05^{16} should be in the numerator, so that the right hand side is
- $$\frac{107.1389(1.05^{16})}{0.044135}$$
- [8/5/2009] On page 527, in the solution to exercise 31.17, on the first displayed line, change A_{x+20} to $1000A_{x+20}$.
- [9/23/2009] On page 533, two lines from the bottom of the page, delete one of the two consecutive “the”s
- [9/23/2009] On page 535, on the second line of the answer to Example 32C, replace q_{x-1} with q_{x+t-1} .
- [2/10/2010] On page 417, in equation (24.2), delete one of the two equals signs.
- [8/9/2009] On page 545, in exercise 32.24, on the last line, change “understates” to “overstates”.
- [2/13/2010] On page 550, in the solution to exercise 32.8, on the sixth line, change the left-hand side to $v^{t-1}\pi - v^t$.
- [11/18/2009] On page 552, in the solution to exercise 32.17, on the first line, change ${}_2V(\bar{A}_{40:\overline{10}|}^1)$ to ${}_2V(\bar{A}_{40:\overline{10}|})$ — the term insurance should be an endowment insurance.
- [2/15/2009] On page 559, in the answer to Example 33D, on the first displayed line, replace ${}_{60}q_{0:0}$ with ${}_{60}p_{0:0}$.
- [11/18/2009] On page 570, in the solution to Example 34A, on the third and fifth lines, the values of ${}_tP_{80}$ and ${}_tP_{82}$ should be interchanged for $t = 2$ and $t = 3$.

[11/18/2009] On page 570, two lines below the first enumerated list, change “to age $x + t$ ” to “to ages $x + t$ and $y + t$ ”.

[3/8/2010] On page 578, in the solution to exercise 34.17, change 256 in all four denominators to 64. Replace 0.105469 with 0.421875, and remove the shaded box around it. On the second displayed line, change the upper bound of the integral from 2 to 3. Add the following line at the end:

Therefore, the probability of at least one surviving for 3 years is $1 - 0.421875 = \boxed{0.578125}$.

[9/23/2009] On pages 584–585, in the solution to exercise 35.11, change all eleven x 's to t 's.

[2/14/2009] On page 590, in the solution to exercise 35.15, on the fourth displayed line of the page, put negative signs in both numerators so it reads

$$= \frac{1}{5250} \left(\frac{-(75 - x)^3}{3} \Big|_0^{70} - \frac{-5(75 - x)^2}{2} \Big|_0^{70} \right)$$

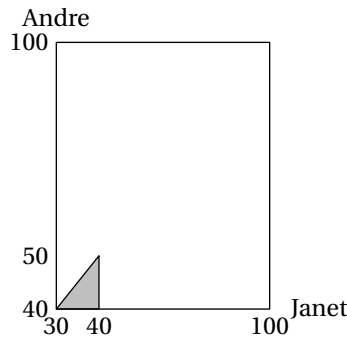
[3/8/2010] On page 603, in the solution to exercise 36.19, on the second displayed line, delete “1 - ” on the right hand side.

[10/6/2009] On page 618, in the solution to exercise 37.15, three lines from the end, replace the subscript $\overline{y : \overline{y} : \overline{n}}$ with $\overline{y : \overline{y} : \overline{10}}$.

[9/25/2009] On page 620, in the solution to exercise 37.22, on the seventh line, ${}_{30}E_{20}$ should be ${}_{30}E_{20}$.

[2/23/2009] On page 635, in the solution to exercise 38.15, the final answer should be $\boxed{0.23}$.

[2/28/2009] On page 636, the graph for the solution to exercise 38.22, which “fell off” page 635, is:



[3/1/2010] On page 652, exercise 40.13, change (iii) to

The probability that an entering student fails in the first year is twice the probability that a student who completed the first year fails in the second year.

[10/6/2009] On page 658, in the solution to exercise 40.13, on the first line, replace “voluntarily” with “leaving voluntarily in the second year”.

[4/19/2009] On page 668, in the solution to exercise 41.2, on the second line, change $0.2k^{-0.8t}$ to $0.2ke^{-0.8t}$.

[3/8/2010] On page 669, in the solution to exercise 41.3, on the first and fourth displayed lines, replace $\mu_{(2)}^{(20)}$ with $\mu_{40}^{(2)}(20)$.

[3/8/2010] On page 669, in the solution to exercise 41.4, replace $\mu_{20}^{(\tau)}$ with $\mu_{40}^{(\tau)}(20)$ and $\mu^{(2)}$ with $\mu_{40}^{(2)}(20)$.

[5/7/2009] On page 670, in the solution to exercise 41.15, on the third displayed line, move the subscript x on the (τ) in the exponent to p : ${}_t p_x^{(\tau)}$.

[5/7/2009] On page 672, in the solution to exercise 41.21, on the second displayed line, delete the second =. On the last line, move the exponent outside the parentheses into the denominator and remove the parentheses:

$$\frac{6,616,155^2 - 6,396,609^2}{8,188,073^2}$$

[11/18/2009] On page 679, 2 lines from the bottom of the page, change “live remaining” to “lives remaining”.

[10/6/2009] On page 687, in the solution to exercise 42.21, on the second to last line, the numerator should be $q_{60}^{(1)}$.

[5/10/2009] On page 687, in exercise 42.31, add the word “calendar” before “year” in (i), (ii), and (iii).

[10/6/2009] On page 695, in the solution to exercise 42.21, on the second to last line, the numerator should be $q_{60}^{(1)}$.

[3/25/2009] On page 697, the solution to exercise 42.27 is incorrect. The correct solution is

$p_{50}^{(\tau)} = 29,360/29,919$. Also,

$$\frac{q_{50}^{(w)}}{q_{50}^{(\tau)}} = \frac{d_{50}^{(w)}}{d_{50}^{(\tau)}} = \frac{299}{168 + 299 + 102}$$

Using formula (42.1),

$$\begin{aligned} p_{50}^{(w)} &= \left(p_{50}^{(\tau)}\right)^{q_{50}^{(w)}/q_{50}^{(\tau)}} \\ &= \left(\frac{29,360}{29,919}\right)^{299/(168+299+102)} = 0.989961 \end{aligned}$$

Therefore, $q_{50}^{(w)} = 1 - 0.989961 = \boxed{0.010039}$.

[10/6/2009] In the solution to exercise 42.28, in the third displayed formula, $\mu_{64}(t)$ should be $\mu_{64}^{(1)}(t)$.

[5/10/2009] On pages 698–699, the solution to exercise 42.31 is incorrect. While the calculation of $0.25q_{x+0.25}^{(2)}$ is correct, the calculation of $0.25q_{x+0.5}^{(2)}$ incorrectly divides by $0.5p_x^{(\tau)}$ instead of by $0.25p_{x+0.25}^{(\tau)}$. In any case, the solution is too complicated. A simpler solution is:

Number the decrements with the question’s item numbers, (1), (2), and (3). We need $0.5q_{x+0.25}^{(2)}$, since the decrements are uniform by calendar year but we’re starting with a resident who is alive on April 1. Let’s first compute $0.25|0.5q_x^{(2)}$, and then divide it by $0.25p_x^{(\tau)}$.

The probability of dying in a time interval not crossing June 30 is the rate of death, 0.3, times the period of time, times the average, or midpoint, of survivors from the other two decrements, 1 and 3. For the period April 1–June 30, the midpoint of the period is May 15, or $3/8$ of the way into the calendar year, and decrement 3 has not occurred yet, so

$$0.25|0.25q_x^{(2)} = 0.3(0.25)\left(1 - \frac{3}{8}(0.25)\right) = 0.0679688$$

For the period July 1–September 30, decrement 3 has occurred with survivorship rate 0.9, and the midpoint of the period is August 15, or $5/8$ of the way into the calendar year, so

$$0.5|0.25q_x^{(2)} = 0.3(0.25)\left(1 - \frac{5}{8}(0.25)\right)(0.9) = 0.0569531$$

To compute $0.25p_x^{(\tau)}$, we decrement (1) and (2) for 0.25 years:

$$0.25p_x^{(\tau)} = \left(1 - 0.25(0.3)\right)\left(1 - 0.25(0.25)\right) = 0.8671875$$

The probability of dying between April 1 and September 30 is

$${}_{0.5}q_{x+0.25}^{(2)} = \frac{0.0679688 + 0.0569531}{0.8671875} = \boxed{0.14405}$$

- [10/6/2009] On page 699, in the solution to exercise 42.33, on the second line, $q^{(1)}$ should be $q_{20}^{(1)}$.
- [10/6/2009] On page 706, on the third line of the answer to Example 44B, in the last integral, ${}_tP_x$ should be ${}_tP_{45}^{(\tau)}$.
- [4/23/2009] On page 736, in the solution to exercise 45.10, on the first displayed line, add “+ 14” after $\frac{1000A_{35}}{\ddot{a}_{35}}$.
- [8/11/2009] On page 737, in the solution to exercise 45.13, on the 9th displayed line, replace $\frac{11.24}{0.897}$ with $\frac{11.24}{(11.925)(0.9897)}$.
- [5/10/2009] On page 755, in the solution to Example 47C, on the second and fourth lines, change e_5 to e_4 .
- [10/6/2009] On page 769, on the second line from the end of the first paragraph, change ${}_kQ^{(i,i)}$ to ${}_kQ^{(i,j)}$.
- [8/14/2009] On page 795, in the solution to exercise 49.9, change 0.04608 to 0.4608 on the line “No payment” and on the first white line of the table.
- [11/18/2009] On page 797, 9 lines from the bottom of the page, change “variables” to “variable”.
- [11/18/2009] On page 798, on the fourth line of the answer to Example 50B, change “number” to “numbers”.
- [4/21/2010] On page 800, on the first line of Example 50H, add after “answering center”: “in a nonhomogeneous Poisson process”.
- [11/18/2009] On page 801, the caption of Figure 50.1 should refer to Example 50H instead of 50G.
- [8/16/2009] On page 809, in the first sentence, change the phrase between dashes to “the time from when $N(t) = 0$ until $N(t) = n$ ”.
- [10/12/2009] On page 809, on the first line of the answer to Example 51A, change $t \geq 4$ to $T \geq 4$.
- [11/18/2009] On page 809, on the second line from the bottom of the page, add “du” at the end.
- [4/26/2009] On page 810, in the sentence after the boldfaced sentence, and the word “know” between “not” and “how”.
- [5/4/2010] On page 814, in the solution to Quiz 51-2, on the first line, change the exponent on e from $e^{-0.06}$ to $e^{-0.06t}$.
On the first displayed line, change 0.0108 to $\frac{1}{0.0108}$.
- [8/16/2009] On page 815, in the solution to Example 52A, change the final answer from 0.04656 to 0.04653.
- [4/27/2009] On page 823, in the solution to exercise 52.5, on the sixth displayed line, delete $\frac{1}{2}$ in front of $e^{-1/2}$.
- [8/16/2009] On page 826, in the solution to exercise 52.23, on the first displayed line, change 30 to 3.
- [3/4/2009] On page 826, the solution to exercise 52.24 is incorrect. The correct solution is:

For deaths uniformly distributed between integral ages, the probability of death before age 71 for someone buying a policy at age $70 + t$ is ${}_{1-t}q_{70+t} = (1-t)q_{70}/(1-tq_{70})$. With $q_{70} = 0.03$, this is $0.03(1-t)/(1-0.03t)$. The Poisson process of deaths is the Poisson process of contracts sold thinned by the proportion who die or by the probability of death. The mean value λ for the Poisson process of deaths is therefore the integral of 100 times the probability of death.

$$\lambda = 100 \int_0^1 \frac{0.03(1-t)dt}{1-0.03t}$$

$$\begin{aligned}
&= 100 \int_0^1 \frac{(1 - 0.03t - 0.97)dt}{1 - 0.03t} \\
&= 100 \int_0^1 \left(1 - \frac{0.97}{1 - 0.03t}\right) dt \\
&= 100 \left(1 + \left(\frac{0.97}{0.03}\right) \ln(1 - 0.03t)\right) \Big|_0^1 \\
&= 100 \left(1 + \left(\frac{97}{3}\right) \ln 0.97\right) = 1.5152
\end{aligned}$$

- [4/6/2010] On page 829, in the second sentence of the paragraph before Example 53B, change “If X if” to “If X is”. Also, change $X - Y$ to $\mathbf{E}[X] - \mathbf{E}[Y]$ and change $X + Y$ to $\text{Var}(X) + \text{Var}(Y)$.
- [11/18/2009] On page 832, in the answer to Example 53E part 2, in the second sentence of the first bullet, change r to θ .
- [9/29/2009] On page 836, in the solution to exercise 53.4, on the fourth line, delete the word “twice”.
- [1/27/2009] On pages 837–839, beginning with the solution to exercise 53.7, every solution number should be incremented by 1. The solution to exercise 53.7 starts with the paragraph “Let X be the process” of the solution to exercise 53.6.
- [8/17/2009] On page 838, in the solution to exercise 53.14 (numbered 53.13), on the third line, change 0.7λ to 0.7 (delete λ).
- [4/27/2009] On page 838, in the solution to exercise 53.15 (numbered 53.14), on the second line, change $2(1 + 1) = 2$ to $2(1 + 1) = 4$.
- [10/12/2009] On page 845, in question 54.12, on the first line, change X_n to X_N .
- [10/12/2009] On page 850, in the solution to question 54.8, on the displayed line, change $\mathbf{E}[X | I]$ to $\mathbf{E}[S | I]$.
- [8/17/2009] On page 851, in the solution to exercise 54.10, on the last line, change 07422 to 0.7422.
- [9/6/2009] On page 866, in question 5, on the last line of the question, delete “actuarial”.
- [4/29/2009] On page 871, in question 26(i), delete the words “variance of”.
- [4/26/2009] On page 926, in the solution to question 21, on the sixth line, replace 0.5 in the exponent with 5.
- [11/5/2009] On page 930, in the answer key, 23 should be B.
- [11/5/2009] On page 935, in the solution to question 18, on the first line of the table, q_{x+t} should be q_{x+t-1} .
- [11/5/2009] On page 937, in the solution to question 25, on the sixth displayed line, change the = in the exponent to a -.
- [11/18/2009] On page 946, in the solution to question 21, on the third line, change “Waiting time for 4 services” to “Waiting time for 5 services”.
- [11/5/2009] On page 954, in the solution to question 14, on the sixth displayed line, add dy at the end.
- [5/9/2010] On page 956, in the solution to question 20, the last two lines should read

$$\begin{aligned}
\Lambda_4 &= -P_{50} + \frac{5V_{50} - 4V_{50}}{1.05} \\
&= -0.027386 + \frac{0.047034 - 0.037139}{1.05} = \boxed{-0.01796}
\end{aligned}$$

[5/13/2009] On page 958, in the solution to question 26, the v 's on lines 2–4 should be changed to $1 + i$:

$$0 = (1 + i)_h V - {}_{h+1}V \quad h = 7, 8, 9$$

Multiplying by $(1 + i)^{9-h}$ and adding up results in

$$0 = (1 + i)^3 {}_7V - {}_{10}V$$

[4/29/2009] On page 964, in the solution to question 13, on the first line, change L_x to l_x .

[11/5/2009] On page 966, in the solution to question 21, on the first line, change μ_{x+t} to μ_t .

[9/7/2009] On page 971, in the solution to question 1, on the fifth line, delete the presubscript t from ${}_t p_{64}$.

[9/7/2009] On page 972, in the solution to question 4, on the first line, add “is” after $f(x)$.

[9/7/2009] On page 974, in the solution to question 10, on the second displayed line, the first exponent should be $-(0.01 + 0.03)t$; change the second minus to plus.

[5/13/2009] On page 984, in the solution to question 7, on the third and fourth displayed lines, the bounds on the second integral should be 0 to 1, not 1 and 2.

[4/29/2010] On page 985, in the solution to question 8, change the second and third lines to

$$\begin{aligned} \pi_h &= vq_{45+h} + v {}_{h+1}V - {}_hV \\ (h + 1)\pi_0 &= 0.01v + v {}_{h+1}V - {}_hV \end{aligned}$$

On the fourth line, change v^{h-1} to v^h .

[9/7/2009] On page 986, in the solution to question 10, on the last line, put a bar on P .

[9/7/2009] On page 994, in the solution to question 6, on the second line from the end, there should be a double-dot on ${}_5\bar{s}$.

[11/5/2009] On page 996, in the solution to question 11, on the third displayed line, change the 1 after the left parenthesis to t .

[11/5/2009] On page 998, in the solution to question 17, on the first displayed line, change m_{85+t} to m_{85} .

[11/5/2009] On page 1002, in the solution to question 25, $a_{\overline{10}|}$ (5th line of page) should be $\ddot{a}_{\overline{10}|}$ and $a_{\overline{60}|}$ (6th line of page) should be $\ddot{a}_{\overline{60}|}$.

[11/5/2009] On page 1002, in the solution to question 27, on the last line of the page, change $t < 60$ and $t > 60$ to $t < 20$ and $t > 20$.

[8/19/2009] On page 1005, in the solution to question 1, in the table, interchange the column headings ${}_t p_x$ and q_{x+t} .

[8/19/2009] On page 1006, the solutions to questions 13 and 14 are misnumbered 12 and 13 respectively.

[8/19/2009] On page 1007, in the solution to question 26:

- On the third line, change 2,358,256 in the numerator to 2,358,246.
- On the displayed line and the line after it, change 14,681,400,000 to 146,814,000.

[8/19/2009] On page 1008, in the solution to question 37, in the table, interchange l_{x+20} and l_x at the heads of the third and fourth columns.

- [5/13/2009] On page 1010, in the solution to question 8, on the 7th line, change $v_{1/2} p_{30}$ to $v^{1/2} {}_{1/2} p_{30}$.
- [5/13/2009] On page 1013, in the solution to question 21, on the fourth line, put parentheses around $\omega - 30$.
- [8/18/2009] On page 1013, in the solution to question 23, on the first line, change ${}_k p_{xy}$ to ${}_k p_{\overline{xy}}$.
- [4/29/2009] On page 1014, the solution to question 27 is incorrect after the second sentence. The correct solution, starting with the third sentence, is

Conveniently, $\mu_{50}^{(\tau)}(t) = 0.05$ for all t , so ${}_t p_{50}^{(\tau)} = e^{-0.05t}$.

$$\begin{aligned} {}_{10}q_{50}^{(1)} &= \int_5^{10} {}_t p_{50}^{(\tau)} \mu_{50}^{(1)}(t) dt \\ &= 0.02 \int_5^{10} e^{-0.05t} dt \\ &= 0.02 \left(\frac{e^{-0.25} - e^{-0.5}}{0.05} \right) = \boxed{0.06891} \quad (\text{A}) \end{aligned}$$

- [8/18/2009] On page 1025, in the solution to question 15, delete A_x on the first displayed line.
- [8/18/2009] On page 1041, in the solution to question 2, on the 4th displayed line, there should be a dt before the equal sign.
- [5/13/2009] On pages 1042–1043, in the solution to question 10, the second expression for $m(t)$ is incorrect. Replace all displayed lines with:

$$m(t) = \begin{cases} t/30 & t \leq 45 \\ 45/30 + (t - 45)/15 & t \geq 45 \end{cases}$$

$m(t)$ for $t > 45$ can be rearranged as follows:

$$m(t) = \frac{45}{30} + \frac{t - 45}{15} = -\frac{3}{2} + \frac{t}{15}$$

Now we integrate the survival function.

$$\begin{aligned} \int_0^{\infty} s(x) dx &= \int_0^{45} s(x) dx + \int_{45}^{\infty} s(x) dx \\ &= \int_0^{45} e^{-x/30} dx + \int_{45}^{\infty} e^{3/2 - t/15} dx \\ &= 30(1 - e^{-3/2}) + 15e^{3/2} e^{-3} \\ &= 30 - 15e^{-3/2} = \boxed{26.653} \quad (\text{D}) \end{aligned}$$

- [2/21/2010] On page 1046, in the solution to question 24, on the first displayed line change $p_{61}^{(\tau)}$ to $p_{60}^{(\tau)}$. On the second displayed line, change $p_{62}^{(\tau)}$ to $p_{61}^{(\tau)}$.
- [5/13/2009] On page 1047, in the solution to question 34, on the third displayed line, change $A_{51:\overline{9}}$ to $A_{50:\overline{10}}$.
- [8/18/2009] On page 1047, in the solution to question 35, on the first displayed line, the 1000 should be outside the parentheses, so that the right hand side is

$$1000v(q_{80} + p_{80} A_{81})$$

- [8/18/2009] On page 1048, in the solution to question 36, on the second line, change the denominator 796 to 776.
- [8/20/2009] On page 1049, in the solution to question 6, on the second displayed line, change $\frac{x^2}{100}$ to $\frac{x^2}{10,000}$.
- [8/20/2009] On page 1051, in the solution to question 27, the heading of the fifth column of the table should be ${}_tP_{65}^{(\tau)} = {}_{t-1}P_{65}^{(\tau)}(1 - q_{65+t-1}^{(\tau)})$.
- [8/19/2009] On page 1054, in the solution to question 4, the last denominator on the first displayed line is missing a pair of parentheses and should be $(1 - 0.0653)^2$.
- [8/19/2009] On page 1055, the second sentence is incorrect, since the premiums are paid at different times, resulting in different accumulated values. The correct solution to question 7 is:
- From a retrospective viewpoint, the accumulated benefit is the same, so the higher the accumulated premium, the higher the reserve. In all cases, the premiums have a total of 10, so the earlier highest accumulated benefit will be from the premiums paid earliest, which accumulate more interest. (E) clearly has the earliest premiums, since all patterns have 6 in the first 3 years but only (E) collect 3 in the first year. (E)
- [8/19/2009] On page 1056, in footnote 1, delete one of the double vertical lines after 893.
- [8/19/2009] On page 1057, in the solution to question 13, delete one of the double vertical lines in $\text{Var}({}_1L \mid |K(x) \geq 1)$.
- [8/20/2009] On page 1066, in the solution to question 40, on the third line, “change” should be “chance”.
- [8/20/2009] On page 1067, in the solution to question 12, on the second line, change $2(10^7)$ to $2(10^{14})$ in two places.
- [4/17/2009] On page 1069, in the solution to question 24, on the displayed line, $\ddot{a}_{35:\overline{1}}$ should be $\ddot{a}_{39:\overline{1}}$.
- [8/9/2009] On page 1076, in Table C.1, the entry for Spring 2007:29 should be 17 instead of 32.