Errata and updates for ASM Exam 3L (Seventh Edition Second Printing) sorted by page

Note: Practice exam 1 question 9 is defective. See below for a corrected version of the question.

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

[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 15, in the solution to exercise 1.12, 3 lines from the end, change the denominator x to m.

[7/9/2009] On page 15, in the solution to exercise 1.14, on the 7th line, change $g(x)$ to $g(n)$.

[8/4/2009] On page 18, one line after Example 2A, add the word "independent": "...from n independent identically distributed ...".

[12/29/2008] On page 19, the second displayed line has 3 errors and should read

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

[1/24/2010] On page 27, in the solution to exercise 2.4, on the fourth line, change $\text{Var}(mn)$ to $\text{Var}(mN)$.

[8/31/2009] On page 30, in the solution to exercise 2.14, on the second line from the end, delete a plus sign between 0.0064 and 0.183125.

[1/31/2009] On page 47, in the solution to exercise 3.22, on the last line, change 37,504.8 to 310.0782.

[8/23/2009] On page 70, in the solution to question 4.22, on the second to last line, change 19.4470 to 19.4447.

[8/14/2009] On page 81, in exercise 5.13, statement 2, change "form" to "from".

[8/14/2009] On page 109, on the last line of the solution to exercise 7.17, change the exponent 0.5314 to 0.05314.

[8/24/2009] On page 126, in the solution to exercise 8.10, on the displayed line, replace 0.04540 with 0.00004540.

[8/24/2009] On page 128, in the solution to exercise 8.29, on the last line, change 0.01 level to 0.10 level.

[8/24/2009] On page 128, in the solution to exercise 8.30, replace the displayed line with

$$1 - \Phi\left(\frac{7-1}{\sqrt{12.5}}\right) = 1 - \Phi(1.697) = 0.045$$

[8/20/2009] On page 138, on the line above the second displayed equation, put a bar on the second X.

[8/24/2009] On page 144, in the solution to exercise 10.3, on the third line, change $N\sqrt{2}$ to $Z\sqrt{2}$.

[8/24/2008] On page 146, in the solution to exercise 10.16, on the third line, change 5th to 2.5th.

[8/24/2009] On page 146, in the solution to exercise 10.18, on the second displayed line, change the denominator 1.3586 to 1.1656.

[1/28/2009] On page 151, in Example 11C, the table should have, for substandard classes B and C, 15 and 10 instead of 10 and 5 respectively. On the last displayed line of the answer, the sum of the last two fractions should be $\frac{(15-10)^2}{10} + \frac{(10-10)^2}{10}$.

[8/24/2009] On page 157, in the solution to exercise 11.5, on the last line, change the last numerator to $(10-5)^2$.

[8/20/2009] On page 166, in the solution to exercise 12.8, while 3.33, 18.95, and 16.74 are not the exact percentiles of the $\chi^2(9)$ distribution, if you divide 72 by the exact percentiles and round it to one decimal place, you get the corresponding numbers 21.6, 3.8, and 4.3 respectively.

[8/25/2009] On page 166, in the solution to exercise 12.9, on the second displayed line, put a bar on X: $\sum(X_i - \bar{X})^2$.

[1/24/2009] On page 166, in the solution to exercise 12.9, on the fourth line, change "highest" to "lowest".

[8/25/2009] On page 170, on the 8th line of Section 13.2, change $\sum \hat{\varepsilon}_i y_i$ to $\sum 2\hat{\varepsilon}_i(\hat{Y}_i - \bar{Y})$.

[8/25/2009] On page 171, replace the displayed line one line above Section 13.3 with

$$R^2 = \frac{\sum(x_i y_i)^2}{(\sum x_i)^2 (\sum y_i)^2}$$

[2/21/2009] On page 177, in question 13.20, in the equation for s_Y^2, there should be a period, not a comma, between 3 and 5: 3.5.

[8/25/2009] On page 178, in exercise 13.21, on the first line, remove the hat in the subscript from $\sigma^2_{\hat{\varepsilon}}$.

[1/26/2009] On page 179, in exercise 13.28, there should be a summation sign before $(X_i - \bar{X})^2$.

[1/24/2009] On page 182, in the solution to exercise 13.14, change $\sum X_i$ to $\sum X_i^2$.

[8/25/2009] On page 183, in the solution to exercise 13.17, replace the last displayed line with

$$\sigma_{\hat{\beta}} = \frac{0.000379}{4.4102} = 0.00008588$$

[8/25/2009] On page 184, in the solution to exercise 13.25, on the first line, change $\sum Y_i - \bar{Y}$ to $\sum(Y_i - \bar{Y})^2$.

[8/25/2009] On page 184, in the solution to exercise 13.29, on the last line, the denominator should be $216.680 + 91.321$; change the minus sign to a plus sign.

[2/21/2009] On page 187, in exercise 14.3, on the second line, replace $g(x)$ with $g(y)$.

[6/11/2009] On page 214, in the solution to exercise 17.6, on the third line, replace David with Dick.

[7/13/2009] On page 215, in the solution to exercise 17.8, on the displayed line, change the subscript $x + t$ to $x + 5$.

[7/13/2009] On page 216, in the solution to exercise 17.9, replace 0.948574 with 0.948514 on the third from last line and the last line.

[8/31/2009] On page 218, 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, ${}_tp_x = (65 + x)/(65 + x + t)$.

[8/31/2009] On page 225, in exercise 18.21, on the third line, change q_x to q_{30}.

[8/24/2009] On page 231, in the solution to exercise 18.14 part 2, put dx after the integrand $0.05(1.01)^x$.

[8/2/2009] On page 235, in the solution to exercise 18.34, put a negative sign before the integral in the first and second displayed lines.

[1/24/2010] On page 238, on the second line of the answer to Example 19A, change $\omega = 70$ to $\omega - x = 70$.

[12/27/2008] On page 245, in equation (20.2), a 2 is missing:

$$E\left[T(x)^2\right] = 2\int_0^\infty t\,{}_tp_x\,\mathrm{d}t$$

[1/28/2009] On page 259, the solution to exercise 20.12 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 $\mathring{e}_{60}$, 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:

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

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

The algebraic/geometric approach starts with the recursive formula, equation (21.1), to relate the given $\mathring{e}_x$'s.

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

$\mathring{e}_{20:\overline{40}|}$ is the integral of ${}_tp_{20}$ from $t = 0$ to 40, and ${}_tp_{20}$ 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,

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

[2/14/2009] On page 261, in the solution to exercise 20.24, on the last line of the page, change $\text{Var}\big(T(30 \wedge 30)\big)$ to $\text{Var}\big(T(30 \wedge 10)\big)$.

[2/7/2009] On page 267, on the fifth line, insert an n in the formula: ${}_nL_x = 0.5n(l_x + l_{x+n})$.

[2/21/2009] On page 268, on the first displayed line of the page, delete the 7 at the end of the line.

[7/14/2009] On page 280, in the solution to exercise 21.24, on the third line from the end, change $+\dfrac{0.6931}{2}$ to $-\dfrac{0.6931}{2}$.

[7/2/2009] On page 297, in the solution to exercise 22.12, on the second line from the end, change $1 - 0.5(0.6)$ to $1 - 0.5(0.06)$.

[9/3/2009] On page 298, in the solution to exercise 22.13, 4 lines from the end, delete one of the 1's after "are".

[9/3/2009] On page 298, in the solution to exercise 22.14, on the 6th line, the left hand side should be $\mathbf{E}[T^2 \wedge 2]$.

[7/14/2009] On page 298, in the solution to exercise 22.15, the page reference should be page 287, not page 22.7.

[7/14/2009] On page 299, in the solution to exercise 22.19, on the fourth displayed line, $\dfrac{5}{24}$ should be $-\dfrac{5}{24}$.

[7/7/2009] On page 300, in the graph for the solution to exercise 22.20, change l_x to ${}_{x-20}p_{20}$.

[7/2/2009] On pages 303–345, change "actuarial present value" to "present value" in:

- Section 23.1, third paragraph, third sentence.
- Example 23D, the sentence starting "Let Z be".
- Solution to exercise 24.22, first sentence.
- Solution to exercise 24.23, first sentence.

[2/21/2009] On page 307, in the answer to Example 23B:

- 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:

$$\text{Var}(Z') = 0.111344 - 0.218359^2 = 0.063663$$
$$\text{Var}(Z) = 1{,}000{,}000(0.063663) = \boxed{\mathbf{63{,}663}}$$

[9/25/2009] On page 308, in the answer to Example 23C, on the second displayed line, change the first exponent to $-[0.01 + 2(0.03)](10)$

[1/3/2009] On page 308, in the answer to Example 23C, 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 308, in the answer to Example 23D, 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

$$E[Z^2] = \frac{0.01}{0.01 + 2(0.03)}\left(1 - e^{-0.01+2(0.03)}\right) = \frac{1 - e^{-0.7}}{7} = 0.071916$$
$$\text{Var}(Z) = 0.071916 - 0.082420^2 = \boxed{\mathbf{0.065123}}$$

[8/8/2009] On page 317, in the solution to exercise 23.7, 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 $\bar{a}_x = \int_0^\infty v^t \, {}_tp_x \, \mathrm{d}t$, and adding a constant to μ lowers ${}_tp_x$. However, $\bar{A}_x = 1 - \delta\bar{a}_x$, so making $\bar{a}_x$ higher results in making $\bar{A}_x$ lower.

[7/16/2009] On page 318, in the solution to exercise 23.5, on the first line, change $\bar{A}_{x+t}$ to $\bar{A}_{x+3}$.

[7/16/2009] On page 318, in the solution to exercise 23.8, on the second line, change $e^{-1.6}$ to $100{,}000e^{-1.6}$.

[9/9/2009] On pages 319–320, the solution to exercise 23.13 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

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

[2/7/2009] On page 320, in the solution to exercise 23.14, 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 322, in the solution to exercise 23.27, 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 338, in the solution to exercise 24.5, on the second line, delete $\int_0^{60} e^{-0.06t}\mathrm{d}t$. On the fourth line, change "interest rate" to "force of interest".

[3/24/2009] On page 339, in the solution to exercise 24.7, on the 4th line of the page, there should be a negative sign before the expression:

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

[1/21/2010] On page 339, in the solution to exercise 24.9, replace $\bar{a}_{\overline{75|}}$ with $\bar{a}_{\overline{25|}}$ on the first and fourth displayed lines.

[7/17/2009] On page 341, in the solution to exercise 24.15, on the 5th displayed line, change $\frac{4}{15}$ to $\frac{4}{14}$.

[7/17/2009] On page 354 in the solution to exercise 25.3, on the 6th line, replace the second sentence with

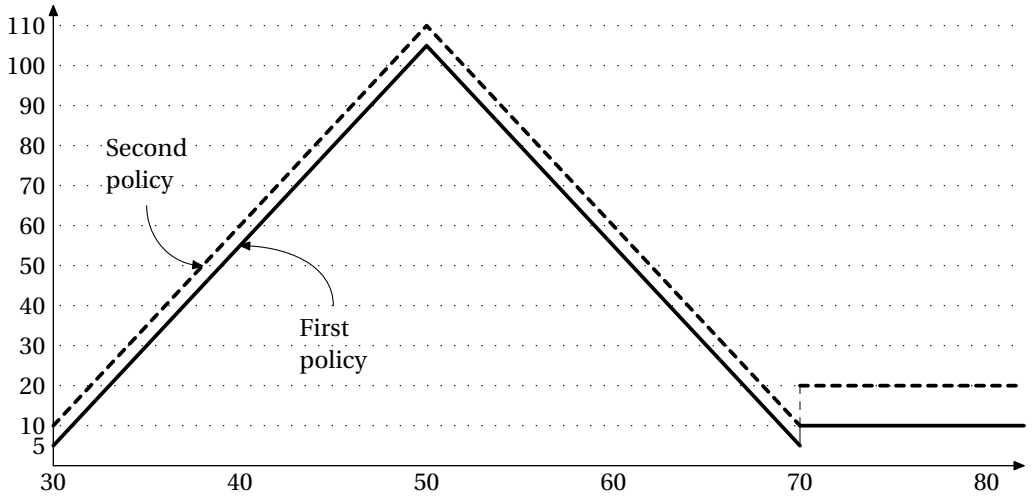
We want $\Pr\left(1.864707e^{-0.06T} > 0.5\right)$, or $\Pr\left(e^{-0.06T} > 0.5/1.864707\right)$ and $0.5/1.864707 = 0.268139$, or $\Pr(T < -\ln 0.268139/0.06)$, and $-\ln 0.268139/.06 = 21.9375$.

[2/16/2009] On page 355, in the solution to exercise 25.5, delete the last line of the solution.

[9/9/2009] On page 356, in the solution to exercise 25.9, on the first line, replace λ with δ.

[9/9/2009] On page 374, in exercise 26.36, on the second line after the table, add "age 49" at the end of the sentence after "100 lives".

[3/4/2009] On page 379, Figure 26.1 is incorrect. The correct figure is



[7/19/2009] On page 383, in the solution to exercise 26.34, on the second line from the end, change 0.21546 to 0.021546.

[7/20/2009] On page 386, change the third sentence of Section 27.2 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 396, the solution to exercise 27.2 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

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

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 $\left(\frac{5550}{5233}\right)^{1/2} - 1 =$ $\boxed{\mathbf{0.030}}$. **(A)**

[7/27/2009] On page 400, in the solution to exercise 27.22, on the first line, change vq_{50} to $1000vq_{50}$.

[2/23/2009] On page 403, on the second line of the third paragraph, change "present variable" to "present value".

[2/21/2010] On page 405, on the first line, replace $a_{\overline{T}|}$ with $\bar{a}_{\overline{T}|}$.

[9/15/2009] On page 415, in the solution to exercise 28.7, on the 6th line, replace $0.09 + 0.3 = 0.09$ with $0.09 + 0.03 = 0.12$.

[1/15/2009] On page 420, on the last line of the solution to Example 29B, replace ${}_{30|}\ddot{a}_{35}$ with $\ddot{a}_{35:\overline{30}|}$.

[9/9/2009] On page 441, in the solution to exercise 29.14, the last line should read

$$ia_{x:\overline{n}|} + (1+i)A_{x:\overline{n}|} - 1 = 1 + i - i + i\,{}_nE_x - 1 = \boxed{\boldsymbol{i\,{}_nE_x}} \qquad \textbf{(B)}$$

[7/24/2009] On page 449, in equation (30.6), replace $\ddot{a}_{\overline{T(x)}|}$ with $\ddot{a}_{\overline{K(x)+1}|}$.

[7/26/2009] On page 450, on the 12th line under "Variance of a deferred annuity", replace $\mathrm{Var}(Y \mid I)$ with $\mathrm{Var}_I(\mathbf{E}[Y \mid I])$.

[8/6/2009] On page 452, on the last line of the page, (-1266.67^2) should be $(-1266.67)^2$.

[7/24/2009] On page 455, in exercise 30.6, change "continous" to "continuous whole"

[11/18/2009] On page 460, in the solution to exercise 30.1, in the second bullet, change $E[T(x)]^2$ to $E[T(x)^2]$.

[9/9/2009] On page 460, in the solution to exercise 30.2, on the second displayed line, move the double-dot off the E to $a_{x:\overline{30}|}$.

[9/9/2009] On page 462, in the solution to exercise 30.9, on the fourth line, change ${}_tq_{30}$ to ${}_{t|}q_{30}$.

[8/6/2009] On page 482, in the solution to exercise 31.6, on the last line, remove the minus sign from the exponent.

[12/5/2009] On page 484, in the solution to exercise 31.14, on the 6th displayed line, change t to T.

[7/26/2009] On page 485, in the solution to exercise 31.16, 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 $\dfrac{e^{-1.2}}{0.08}$.

[3/31/2009] On page 488, in the solution to exercise 31.31, 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 489, in the solution to exercise 31.32, on the last line, replace $u(65)$ with $u(64)$.

[9/23/2009] On page 507, in exercise 33.3, on the first line, change fullY to fully.

[1/24/2009] On page 513, the information in the box at the top should be used for questions 33.20–33.23 (not just for 33.20 and 33.21).

[7/28/2009] On page 522, in the solution to exercise 33.1, 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.

[7/28/2009] On page 523, in the solution to exercise 33.3, on the first displayed line, change the t's to k's:

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

In the fourth displayed equation, change px to p_x.

[7/28/2009] On page 525, in the solution to exercise 33.7, on the last line, the denominator should be 14, not 13.236242.

[7/28/2009] On page 525, in the solution to exercise 33.9, on the third displayed line, the denominator should be 40(0.05) instead of 40.

[9/23/2009] On page 530, in the solution to exercise 33.25, on the 6th and 8th lines, put double-dots on the three a's that don't have them.

[11/18/2009] On page 536, in the solution to exercise 33.47, on the first line of the page, change $\dfrac{1}{\ddot{a}_2 0}$ to $\ddot{a}_{20}$.

[7/28/2009] On page 536, replace the last line of the solution to exercise 33.49 with

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

[4/3/2009] On page 538, in the solution to exercise 33.53, 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 539, on the last line of Example 34A, delete the word "benefit".

[8/2/2009] On page 543, the solution to exercise 34.7 should read

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

[2/10/2010] On page 545, in equation (35.2), delete one of the two equals signs.

[8/2/2009] On page 555, in the solution to exercise 35.16, on the fifth line from the end, change "v^T otherwise" to "v^n otherwise".

[7/29/2009] On page 564, in the solution to exercise 36.7, on the fourth displayed line, the line should end with 1.7763, and $\dfrac{P}{d} = 0.7763$ should be placed a separate line.

[9/23/2009] On page 565, in the solution to exercise 36.11, replace the third displayed line with

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

[8/3/2009] On page 569, on the fourth line of the second paragraph, delete the word "benefit".

[9/23/2009] On page 571, in the answer to Example 37C part 2 two lines from the end, change ${}^{20}_{15}V_x$ to ${}^{20}_{15}V_{40}$.

[3/24/2009] On page 579, in the solution to exercise 37.9, on the second to last line, change "end of the third year" to "end of the second year".

[8/3/2009] On page 580, in the solution to exercise 37.12, on the 4th displayed line, change 0.46587 to 0.046587.

[4/12/2009] On page 593, in the solution to exercise 38.3, on the third line, change "present value of future benefits" to "present value of future premiums".

[3/1/2009] On page 595, in the solution to exercise 38.7, on the third line, replace ${}_{15}\ddot{a}_{10:\overline{30}|}$ with ${}_{15|}\ddot{a}_{10:\overline{30}|}$.

[3/1/2009] On page 595, in the solution to exercise 38.8, "the insurance formula" refers to the insurance-ratio formula, equation (39.2).

[2/10/2010] On page 595, in the solution to exercise 38.9, on the third displayed line, change B to $\dfrac{B}{1000}$.

[8/3/2009] On page 597, in the solution to exercise 38.17, on the 4th line, change ${}^{(2)}_{V}$ to ${}_tV^{(2)}$.

[2/10/2010] On page 599, in the solution to exercise 38.23, on the second to last line, change $\bar{a}_{50:\overline{10}|}$ to $\bar{a}_{50:\overline{7}|}$.

[8/4/2009] On page 612, in the solution to exercise 39.1, on the third displayed line, change ${}_{10}V_{50:\overline{20}|}$ to ${}_{10}V^{1}_{50:\overline{20}|}$.

[8/4/2009] On page 613, in the solution to exercise 39.6, on the displayed line, change the ${}_t\bar{V}(\bar{A}_{x+t})$ to ${}_t\bar{V}(\bar{A}_x)$

[8/4/2009] On page 615, in the solution to exercise 39.17, on the last line, change ${}_{20}V_{35}$ to ${}_{20}V_{25}$.

[8/4/2009] On page 615, in the solution to exercise 39.18, on the second line from the end, change $1 - 0.1(0.4)$ to $1 - 0.1(4)$.

[9/23/2009] On page 617, in the solution to exercise 39.24, on the first displayed line, change P_x to P_{36}.

[10/27/2009] On page 619, in the first displayed formula, replace $\text{Var}({}_tL \mid T(x) \geq t)$ with $\text{Var}({}_tL \mid T(x) > t)$.

[3/3/2009] On page 625, in the solution to exercise 40.2, on the first line, there should be a bar over the A.

[8/5/2009] On page 644, in the solution to exercise 41.15, 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 644, in the solution to exercise 41.17, on the first displayed line, change A_{x+20} to $1000A_{x+20}$.

[2/15/2009] On page 653, in the answer to Example 42D, on the first displayed line, replace ${}_{60}q_{0:0}$ with ${}_{60}p_{0:0}$.

[11/18/2009] On page 664, in the solution to Example 43A, 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 664, 2 lines after the first enumerated list, change "to age $x + t$" to "to ages $x + t$ and $y + t$".

[3/8/2010] On page 672, in the solution to exercise 43.17, 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 $1 - 0.421875 =$ **0.578125**.

[9/23/2009] On pages 682–683, in the solution to exercise 44.11, change all eleven x's to t's.

[2/14/2009] On page 684, in the solution to exercise 44.15, on the fourth displayed line of the page, put negative signs in both numerators so it reads

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

[3/8/2010] On page 697, in the solution to exercise 45.19, on the second displayed line, delete "1 − " on the right hand side.

[10/6/2009] On page 712, in the solution to exercise 46.15, three lines from the end, replace the subscript $\overline{y:y} : \overline{n}|$ with $\overline{y:y} : \overline{10}|$.

[9/25/2009] On page 714, in the solution to exercise 46.22, on the seventh line, $30E_{20}$ should be ${}_{30}E_{20}$.

[3/1/2010] On page 720, exercise 47.13, 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 726, in the solution to exercise 47.13, on the first line, replace "voluntarily" with "leaving voluntarily in the second year".

[4/19/2009] On page 736, in the solution to exercise 48.2, on the second line, change $0.2k^{-0.8t}$ to $0.2ke^{-0.8t}$.

[3/8/2010] On page 737, in the solution to exercise 48.3, on the first and fourth displayed lines, replace $\mu^{(2)}_(20)$ with $\mu^{(2)}_{40}(20)$.

[3/8/2010] On page 737, in the solution to exercise 48.4, replace $\mu^{(\tau)}_{20}$ with $\mu^{(\tau)}_{40}(20)$ and $\mu^{(2)}$ with $\mu^{(2)}_{40}(20)$.

[5/7/2009] On page 738, in the solution to exercise 48.15, on the third displayed line, move the subscript x on the (τ) in the exponent to p: ${}_tp^{(\tau)}_x$.

[3/8/2010] On page 740, in the solution to exercise 48.21, 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:

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

[10/6/2009] On page 751, on the second line from the end of the first paragraph, change ${}_kQ^{(i,i)}$ to ${}_kQ^{(i,j)}$.

[8/14/2009] On page 777, in the solution to exercise 51.9, 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 779, 9 lines from the bottom of the page, change "variables" to "variable".

[11/18/2009] On page 780, on the fourth line of the answer to Example 52B, change "number" to "numbers".

[11/18/2009] On page 783, the caption of Figure 52.1 should refer to Example 52H instead of 52G.

[8/16/2009] On page 791, 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 791, on the first line of the answer to Example 53A, change $t \geq 4$ to $T \geq 4$.

[11/18/2009] On page 791, on the second line from the bottom of the page, add "du" at the end.

[4/26/2009] On page 792, in the sentence after the boldfaced sentence, and the word "know" between "not" and "how".

[8/16/2009] On page 796, in the solution to Quiz 53-2, on the first displayed line, change 0.0108 to $\frac{1}{0.0108}$.

[8/16/2009] On page 797, in the solution to Example 54A, change the final answer from 0.04656 to 0.04653.

[4/27/2009] On page 805, in the solution to exercise 54.5, on the fifth line of the page, delete $\frac{1}{2}$ in front of $e^{-1/2}$.

[3/4/2009] On page 807, the solution to exercise 54.23 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.

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

The probability of exactly one death claim is $e^{-1.5152}(1.5152) = \boxed{\mathbf{0.3330}}$.

[10/12/2009] On page 809, in the second sentence of the paragraph before Example 55B, change "If X if" to "If X is".

[11/18/2009] On page 812, in the answer to Example 55E part 2, in the second sentence of the first bullet, change r to θ.

[9/29/2009] On page 816, in the solution to exercise 55.4, on the fourth line, delete the word "twice".

[1/27/2009] On pages 817–819, beginning with the solution to exercise 55.7, every solution number should be incremented by 1. The solution to exercise 55.7 starts with the paragraph "Let X be the process" of the solution to exercise 55.6.

[8/17/2009] On page 818, in the solution to exercise 55.14 (numbered 55.13), on the third line, change 0.7λ to 0.7 (delete λ).

[4/27/2009] On page 818, in the solution to exercise 55.15 (numbered 55.14), on the second line, change $2(1+1) = 2$ to $2(1+1) = 4$.

[10/12/2009] On page 825, in question 56.12, on the first line, change X_n to X_N.

[10/12/2009] On page 830, in the solution to question 56.8, on the displayed line, change $\mathbf{E}[X \mid I]$ to $\mathbf{E}[S \mid I]$.

[8/17/2009] On page 831, in the solution to exercise 56.10, on the last line, change 07422 to 0.7422.

[4/23/2009] On page 839, question 9 is defective. Replace it with the following:

A Normal random variable is known to have mean 5. For a sample of five observations from the variable, $\sum_{i=1}^{5}(x_i-5)^2 = 175$.

Construct a 95% confidence interval of the form (a, ∞) for the variance.

Determine a.

(A) Less than 12
(B) At least 12, but less than 14
(C) At least 14, but less than 16
(D) At least 16, but less than 18
(E) At least 18

[3/25/2009] On page 841, in question 15, divide all the answer choices by 10:

(A) Less than 0.0045
(B) At least 0.0045, but less than 0.0055
(C) At least 0.0055, but less than 0.0065
(D) At least 0.0065, but less than 0.0075
(E) At least 0.0075

[10/20/2009] On page 874, in question 21, replace the second line with

$$\mathbf{Q}_0 = \begin{pmatrix} 0.8 & 0.2 \\ 0.4 & 0.6 \end{pmatrix} \qquad {}_2\mathbf{Q}_0 = \begin{pmatrix} 0.38 & 0.62 \\ 0.44 & 0.56 \end{pmatrix}$$

[4/23/2009] On page 897, replace the solution to question 9 with the following:

Let σ^2 be the true variance. Let $W = \sum_{i=1}^{5}(x_i - 5)^2/\sigma^2$. Then by the definition of the chi-square distribution, W is a chi-square random variable with 5 degrees of freedom. So

$$\sigma^2 \sim \frac{175}{W}$$

To find the lower bound a of a 95% confidence interval, we use the 95th percentile of W, or 11.070:

$$a = \frac{175}{11.070} = \boxed{\mathbf{15.808}} \qquad \textbf{(C)}$$

[11/5/2009] On page 903, in the solution to question 3, on the first line, change μ_{x+t} to μ_t.

[11/5/2009] On page 904, in the solution to question 10, on the first line of the table, q_{x+t} should be q_{x+t-1}.

[5/3/2009] On page 907, in the solution to question 20, there are a few minor errors on the first displayed line. It should read

$$\frac{\alpha_0^n 100^{n\alpha_0} / \prod(100 + x_i)^{\alpha_0+1}}{\alpha^n 100^{n\alpha} / \prod(100 + x_i)^{\alpha+1}} = \left(\frac{\alpha_0}{\alpha}\right)^n 100^{n(\alpha_0-\alpha)} \prod (100 + x_i)^{\alpha-\alpha_0}$$

[10/20/2009] On page 924, in the solution to question 22, on the fourth line, replace $\sqrt{3{,}335{,}337}\left(\frac{1}{130} + \frac{1}{80}\right)$ with $\sqrt{3{,}335{,}337\left(\frac{1}{130} + \frac{1}{80}\right)}$.

[10/20/2009] On page 932, the solution to question 21 is incorrect. The correct solution is

Let $\mathbf{Q}_1 = \begin{pmatrix} x & 1-x \\ y & 1-y \end{pmatrix}$. Since $\mathbf{Q}_0\,\mathbf{Q}_1 = {}_2\mathbf{Q}_0$,

$$\begin{pmatrix} 0.8 & 0.2 \\ 0.4 & 0.6 \end{pmatrix}\begin{pmatrix} x & 1-x \\ y & 1-y \end{pmatrix} = \begin{pmatrix} 0.38 & 0.62 \\ 0.44 & 0.56 \end{pmatrix}$$

Equating the left column vectors of both sides, we have

$$0.8x + 0.2y = 0.38$$
$$0.4x + 0.6y = 0.44$$

Doubling the second equation and subtracting the first from it, we get $y = 0.5$, $x = 0.35$. From ${}_2\mathbf{Q}_0$, we see that the state vector after two transitions for someone in state 1 is $(0.38, 0.62)$. Then the probability of being in state 2 after another transition is $0.38(1 - x) + 0.62(1 - y) = 0.38(0.65) + 0.62(0.5) = \boxed{\mathbf{0.557}}$. **(E)**

[11/5/2009] On page 937, in the solution to question 10, on the sixth displayed line, add dy at the end.

[11/5/2009] On page 948, in the solution to question 19, on the sixth displayed line, change the = in the exponent to a $-$.

[9/7/2009] On page 949, in the solution to question 23, on the last line, put a bar on P.

[8/19/2009] On page 951, in the solution to question 1, in the table, interchange the column headings ${}_tp_x$ and q_{x+t}.

[8/19/2009] On page 952, the solutions to questions 13 and 14 are misnumbered 12 and 13 respectively.

[8/19/2009] On page 953, 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 954, 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 958, in the solution to question 21, on the second line of the page, put parentheses around $\omega - 30$.

[8/18/2009] On page 958, in the solution to question 23, on the first line, change ${}_kp_{xy}$ to ${}_kp_{\overline{xy}}$.

[4/29/2009] On page 959, 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 ${}_tp_{50}^{(\tau)} = e^{-0.05t}$.

$$\begin{aligned} {}_{10}q_{50}^{(1)} &= \int_5^{10} {}_tp_{50}^{(\tau)}\,\mu_{50}^{(1)}(t)\mathrm{d}t \\ &= 0.02\int_5^{10} e^{-0.05t}\mathrm{d}t \\ &= 0.02\left(\frac{e^{-0.25} - e^{-0.5}}{0.05}\right) = \boxed{\mathbf{0.06891}} \qquad \textbf{(A)} \end{aligned}$$

[8/19/2009] On page 979, in the solution to question 2, on the last line, remove the minus sign in front of $\dfrac{5}{1.7406}$.

[8/18/2009] On page 987, 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 988–989, in the solution to question 10, the second expression for $m(t)$ is incorrect. Replace all displayed lines with:

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

$m(t)$ 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.

$$\begin{aligned}\int_0^\infty s(x)\,\mathrm{d}x &= \int_0^{45} s(x)\,\mathrm{d}x + \int_{45}^\infty s(x)\,\mathrm{d}x \\ &= \int_0^{45} e^{-x/30}\,\mathrm{d}x + \int_{45}^\infty e^{3/2-t/15}\,\mathrm{d}x \\ &= 30\left(1-e^{-3/2}\right) + 15e^{3/2}e^{-3} \\ &= 30 - 15e^{-3/2} = \boxed{\mathbf{26.653}} \qquad \textbf{(D)}\end{aligned}$$

[5/13/2009] On page 992, 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 992, in the solution to question 36, on the second line, change the denominator 796 to 776.

[8/20/2009] On page 994, 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 997, 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 1000, 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 1001, 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 1002, in footnote 1, delete one of the double vertical lines after 893.

[8/20/2009] On page 1007, in the solution to question 11, on the second line, $\frac{S_2^2}{S_2^1}$ should be $\frac{S_2^2}{S_1^2}$. Also, $F(12,11)$ should be $kF(12,11)$.

[8/20/2009] On page 1010, in the solution to question 40, on the third line, "change" should be "chance".

[8/20/2009] On page 1012, 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 1015, in the solution to question 24, on the displayed line, $\ddot{a}_{35:\overline{1}|}$ should be $\ddot{a}_{39:\overline{1}|}$.

[4/23/2009] On page 1017, in the solution to question 7, on the displayed line, change the exponent in the denominator $-47/9.5$ to $-47/9.4$.

[5/7/2009] On page 1018, in the solution to question 11, replace the last line with the following:

Since this is a one-sided test, the significance levels in the table need to be halved, so that for example 0.1 in both tails corresponds to 0.05 in one tail. Anyway, the statistic 0.5725 is less than the critical value at 22 degrees of freedom shown in the 10% column, 1.717, so the answer is **(E)**.

[1/24/2010] On page 1024, the columns for practice exam 6 and 7 are interchanged.