# Errata and updates for ASM Exam C/Exam 4 Manual (Tenth Edition) sorted by page

Note: Practice exam 10:21 is defective. The question should be fixed as indicated below. Also note the corrections to practice exam 2:19 (page 992), 3:2 and 7:33.

[8/12/2010] On page xv, there are errors in Table 1. Here is a corrected version:

| Topic | Lessons | May 2000 | Nov. 2000 | May 2001 | Nov. 2001 | Nov. 2002 | Nov. 2003 | Nov. 2004 | May 2005 | Nov. 2005 | Nov. 2006 | May 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Severity, Frequency, Aggregate Loss | 1–16 | 1 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 5 |
| Empirical Estimation | 17–24 | 4 | 2 | 2 | 4 | 4 | 5 | 4 | 6 | 5 | 9 | 7 |
| Parametric Fitting | 25–30 | 6 | 6 | 6 | 4 | 7 | 8 | 11 | 6 | 8 | 7 | 6 |
| Testing Fit | 31–35 | 2 | 0 | 3 | 2 | 2 | 2 | 3 | 4 | 4 | 1 | 3 |
| Limited Fluctuation Credibility | 36–38 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 0 |
| Bayesian Credibility | 39–44 | 4 | 5 | 5 | 4 | 3 | 5 | 3 | 3 | 3 | 5 | 3 |
| Bühlmann Credibility | 45–50 | 2 | 2 | 4 | 5 | 5 | 3 | 4 | 5 | 3 | 3 | 5 |
| Empirical Bayes | 51–52 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 |
| Simulation | 53–56 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 3 | 3 | 4 | 3 |
| Total | | 23 | 22 | 22 | 24 | 25 | 28 | 29 | 30 | 30 | 32 | 34 |

For the purpose of this table, F03:13 was classified as a probability-Lesson 1 question and F03:30 was classified as a parametric fit question, but neither question was based on the syllabus material then.

[11/7/2010] On page 8, in Theorem 2, change $\sum_i \Pr(B_i) = 1$ to $\Pr(\cup_i B_i) = 1$.

[11/29/2009] On page 20, in the solution to exercise 1.10, change "Generalized Pareto" to "Burr".

[11/29/2009] On page 22, in the solution to exercise 1.17, on the last line, $\ln 0.06$ should be $\ln 0.6$.

[11/29/2009] On page 24, on the last line of the solution to exercise 1.23, change 0.035764 to 0.035674.

[11/10/2010] On page 27, in the first displayed equation of Section 2.3, the $x_i$ in parenthesis should be $x$.

[11/30/2009] On page 30, in equation (*), the first exponent should be $-H(x \mid \Lambda)$.

[10/28/2010] On page 35, in exercise 2.14, on the last line, add the word "of" after "coefficient".

[1/24/2010] On page 36, in the solution to exercise 2.4, on the fourth line, change $\text{Var}(mn)$ to $\text{Var}(mN)$.

[12/3/2010] On page 40, in the solution to exercise 2.18, on the 4th line of the page, change the exponent $\alpha$ to $-\alpha$.

[11/30/2009] On page 46, in the solution to exercise 3.6, on the second line of the second paragraph, in the sentence beginning "The expected value . . . ", delete "by the Bernoulli shortcut".

[7/5/2010] On page 61, in the solution to exercise 4.18, add $d\lambda$ after $e^{-\lambda}$ on the two displayed lines.

[11/30/2009] On page 84, 3 lines below equation (6.2), change "$b$ is 0" to "$b$ is 1".

[5/1/2011] On page 86, one line above the end of formula (6.6), some parentheses are missing. The line should read

$$= \mathbf{E}[X] \left( \frac{1 - \Phi\left( \frac{\ln\left(\exp(\mu + z_p\sigma)\right) - \mu - \sigma^2}{\sigma} \right)}{1-p} \right)$$

put a second parenthesis after $\exp(\mu + z_p\sigma)$.

[11/30/2009] On page 90, on the last line of the solution to exercise 6.1, change "is" to "are".

[1/21/2010] On page 91, in the solution to exercise 6.5, on the second line, change the dummy integration variable from $x$ to $u$, so that the expression after the first equals sign is $\int_0^x \frac{2u\,\mathrm{d}u}{1000^2}$.

[11/30/2009] On page 96, Example 7B should ask for the reduction in the loss elimination ratio, not the excess. On the last line of the answer, interchange 135/256 and 5/9.

[11/13/2010] On page 109, in the solution to exercise 7.4, the left hand side of the displayed line is incorrect. Replace the displayed line with

$$\begin{aligned}
\mathbf{E}[X \wedge d] &= \mathbf{E}[X \wedge d \mid X < d] \Pr(X < d) + \mathbf{E}[X \wedge d \mid X \geq d] \Pr(X \geq d) \\
&= (\text{Average loss} < d) \Pr(X < d) + d \Pr(X \geq d) \\
&= 500(0.6) + d(0.4)
\end{aligned}$$

[11/30/2009] On page 113, in the solution to exercise 7.22, on the third line of the page, change $1.5147^2$ to $1.5174^2$.

[11/30/2009] On page 119, in the solution to exercise 7.48, on the fourth line, change "them" to "the". On the second displayed line, change the denominator $2000 + 5000$ to $2000 + 500$.

[9/6/2010] On page 122, 8 lines from the bottom of the page, change $Y$ to $Y^L$.

[9/6/2010] On page 123, on the second line of the page, replace $2d$ with $2d^*$.

[6/28/2010] On page 129, in exercise 8.23(D), change $5000 < X_i \leq 631{,}250$ to $6250 < X_i \leq 631{,}250$.

[11/30/2009] On page 135, in the solution to exercise 8.14, on the second line, put an $\mathbf{E}$ before $[X \wedge d]$.

[11/30/2009] On page 135, in the solution to exercise 8.15, change the second word to "question".

[11/30/2009] On page 145, in the solution to exercise 9.1, on the fourth line from the end, delete the extra 0 at the end of 440,0000.

[11/30/2009] On page 146, in the solution to exercise 9.6, on the second displayed line, insert an equal sign between 100 and $c$.

[5/22/2010] On page 151, on the second line of Section 10.2, delete the right parenthesis after 2007. The sentence containing this error is ambiguous; here's a rewritten sentence:

When they moved severity, frequency, and aggregate loss material to Exam C/4 in 2007, they added material on the $(a,b,1)$ class back to the syllabus.

[1/15/2010] On page 153, in the equation for $r$ (the 8th displayed line of the page), change the right hand side to $1 + \frac{-0.9}{0.75} = -0.2$

[12/1/2009] On page 173, in the solution to exercise 11.11, change "if" to "it".

[11/16/2009] On page 176, on the fifth line of the answer to Example 12B, the part of the line starting with "Revised $\beta$ to the end should be moved to a separate line.

[11/30/2009] On page 208, in the solution to exercise 13.14, on the 5th line, replace "variance" with "second moment".

[12/1/2009] On page 209, in the solution to exercise 13.16, on the third displayed line, change 0.596 to 0.6.

[12/2/2009] On pages 211–212, the solution to exercise 13.22 is too complicated, and has some typos. Here is a better solution:

This exercise is harder than the previous one, since the deductible now affects claim frequency. There are two ways we can do the exercise:

1. We can let $N^P$ be the number of payments and $Y^P$ the payment per payment.
2. We can let $N$ be the number of losses and $Y^L$ the payment per loss, or

Both methods require work. I think the first method is easier, but will demonstrate both ways.

**First method** The negative binomial has $r\beta = 0.3$ and $r\beta(1+\beta) = 0.6$, so $\beta = 1$, $r = 0.3$. The probability of a loss above 3000 is

$$\Pr(X > 3000) = \left(\frac{\theta}{3000}\right)^{\alpha} = \left(\frac{2000}{3000}\right)^{3} = \frac{8}{27}$$

The modified negative binomial has $r = 0.3$, $\beta = 8/27$, so its moments are

$$\mathbf{E}[N^P] = \frac{2.4}{27} = 0.088889 \qquad \text{Var}(N^P) = \frac{0.3(8)(35)}{27^2} = 0.115226$$

$Y^P$ is a two-parameter Pareto with modified parameters with parameters $\theta = 3000$ and $\alpha = 3$. Using the tables to calculate its mean and variance:

$$\mathbf{E}[(Y^P)] = \frac{\theta}{\alpha - 1} = \frac{3000}{3-1} = 1500$$
$$\mathbf{E}\left[(Y^P)^2\right] = \frac{2\theta^2}{(\alpha-1)(\alpha-2)} = \frac{2(3000^2)}{2} = 3000^2$$
$$\text{Var}(Y^P) = 3000^2 - 1500^2 = 6{,}750{,}000$$

The variance of aggregate payments is

$$\text{Var}(S) = \mathbf{E}[N^P]\,\text{Var}(Y^P) + \text{Var}(N^P)\,\mathbf{E}[Y^P]^2 = (0.088889)(6{,}750{,}000) + (0.115226)(1500^2) = \boxed{\mathbf{859{,}259}}$$

**Second method** We computed the mean and variance of $Y^P$ in the first method. Therefore,

$$\mathbf{E}[Y^L] = \mathbf{E}[Y^P]\Pr(X > 3000) = \left(\frac{8}{27}\right)(1500) = 444.444$$

The variance is computed by treating $Y^L$ as a compound distribution. The primary distribution is Bernoulli with $q = \Pr(X > 3000)$ and the secondary is $Y^P$.

$$\text{Var}(Y^L) = \left(\frac{8}{27}\right)(6{,}750{,}000) + \left(\frac{8}{27}\right)\left(\frac{19}{27}\right)(1500^2) = 2{,}469{,}136$$

The variance of aggregate payments is

$$\text{Var}(S) = 0.3(2{,}469{,}136) + 0.6(444.444^2) = \boxed{\textbf{859,259}}$$

[12/1/2009] On page 216, in the solution to exercise 13.36, on the last line, change the 79,875 in the denominator to 79,375.

[12/2/2009] On page 237, on the third line, add the word "and" between "empty" and "the".

[12/2/2009] On page 248, in the solution to exercise 15.12, on the fifth line, change 0.1 to 0.01.

[11/8/2010] On page 251, in the solution to exercise 15.24, at the end of the first line, add (after "than" and before "500") "or equal to".

[2/14/2010] On page 254, on the displayed line, change $F_X(s)$ to $F_X(x)$.

[2/6/2010] On page 257, the last 5 lines of the solution to Example 16G are incorrect. Replace them with

Let $u = e^{-x/10{,}000}$, and multiply through by 4.

$$\begin{aligned} 3u^2 + u - 2 &= 0 \\ u = \frac{-1+\sqrt{25}}{6} &= \frac{2}{3} \\ e^{-x/10{,}000} &= \frac{2}{3} \\ x = -10{,}000 \ln 2/3 &= \boxed{\textbf{4055}} \end{aligned}$$

[2/15/2011] On page 258, on the second line of the answer to Example 16I, change $m_0^1$ to $m_1^0$.

[12/2/2009] On page 259, on the line above equations (16.1), change $m_k^0$ and $m_k^1$ to $m_0^k$ and $m_1^k$.

[1/21/2010] On page 263, replace the last line of the solution to exercise 16.3 with

$$\text{Var}(S) = (0.72)(192) + 0.6624(24^2) = \boxed{\textbf{519.7824}}$$

[1/31/2010] On page 263, the solution to exercise 16.4 is incorrect. The correct solution is

Frequency is not in the $(a,b,i)$ family $(i = 0,1)$, so it cannot be modified. So we will use a compound model with number of losses and payment per loss.

Frequency of losses has mean $0.25 + 2(0.2) + 3(0.1) = 0.95$ and second moment $0.25 + 4(0.2) + 9(0.1) = 1.95$, hence variance $1.95 - 0.95^2 = 1.0475$. The modified distribution for payment per payment is a Pareto with $\alpha = 4$, $\theta = 100 + 80 = 180$. Its mean is $180/3 = 60$ and its variance is $2(180^2)/(3)(2) - 60^2 = 7200$. The payment per loss is a two-component mixture with probability $(100/180)^4$ of a payment and probability $1 - (100/180)^4$ of 0. Let's calculate the mean and variance of this two-component mixture random variable $Y^L$, with $I$ being the component of the mixture.

$$\begin{aligned} \mathbf{E}[Y^L] &= 60\left(\frac{100}{180}\right)^4 = 5.715592 \\ \text{Var}(Y^L) &= \mathbf{E}[\text{Var}(Y^L \mid I)] + \text{Var}(\mathbf{E}[Y^L \mid I]) \\ &= \left(\frac{100}{180}\right)^4 (7200) + \left(\frac{100}{180}\right)^4 \left(1 - \left(\frac{100}{180}\right)^4\right)(60^2) \\ &= 996.1386 \end{aligned}$$

Using the compound variance formula on our compound model,

$$\text{Var}(S) = (0.95)(996.1386) + (1.0475)(5.715592^2) = \boxed{\textbf{980.55}}$$

[12/2/2009] On page 263, in the solution to exercise 16.5, change "payment per payment" to "payment per loss".

[4/24/2011] On page 275, in equation (19.3), remove the hat on $v(\theta)$.

[1/16/2010] On page 275, three lines from the bottom, change 98% to 95%.

[12/3/2009] On page 276, on the last line of the answer to Example 17I, change $(0, 0.55208)$ to $(0.55208, 1)$.

[6/30/2010] On page 282, on the first line of the solution to exercise 17.7, add "unbiased" between "variance" and "estimator", and also between "an" and "estimator".

[2/9/2010] On page 284, on the first line of the solution to exercise 17.16, move the first left parenthesis into the sum, and put a bar on the $X$: $\frac{\sum(X_i-\bar{X})^2}{n-1}$.

[7/2/2010] On page 286, in the solution to exercise 17.22, replace the fifth line from the end (beginning $\text{bias}_{\hat{\theta}}(\theta)$) with

$$\left(\text{bias}_{\hat{\theta}}(\theta)\right)^2 = \text{Var}(\hat{\theta})$$

[8/20/2010] On page 290, one line below equation (18.1), change $(c_{j=1}, c_j)$ to $[c_{j-1}, c_j)$. The textbook arbitrarily makes the histogram right continuous.

[1/26/2010] On page 296, 4 lines below formula (19.3), change $\text{Var}\left(F_n(x)\right)$ to $\text{Var}\left(f_n(x)\right)$.

[11/11/2010] On page 307, on the last line of the last bullet, change "amount" to "time".

[1/16/2010] On page 307, 6 lines from the bottom, change the italicized "censored from below" to "censored from above".

[11/27/2010] On page 310, in the first table, in the heading, replace $y_j \le t \le y_{j+1}$ with $y_j \le t < y_{j+1}$.

[3/4/2011] On page 322, in the solution to exercise'20.8, on the first displayed line, change $n-t+1$ to $n-i+1$.

[8/10/2010] On page 345, in formula (22.1), delete the upper bound $j$ on the sum.

[11/26/2010] On page 347.2, in the answer to Example 22C, 3 line from the end, change 0.004618 to 0.0004618.

[2/5/2010] On page 347.6, in Example 22C's final answer, delete the extra "0." after the comma. On the last line of Example 22D, delete the comma after "interval" and add a right parenthesis before the "=".

[7/9/2010] On page 359, in the solution to exercise 22.25, on the second to last line, change both 0.8's to $\ln 0.8$.

[2/5/2010] On page 359, in the solution to exercise 22.26, change $z_{0.975}$ to $z_{0.95}$ and $z_{0.95}$ to $z_{0.975}$ in two places.

[12/4/2009] On page 362, on the fifth line, change $fx_i$ to $f(x_i)$.

[2/27/2011] On page 367, five lines above Figure 23.5, change $\hat{f}(11.6)$ to $\hat{k}(11.6)$.

[2/4/2010] On page 382, the solution to exercise 23.1 is incorrect. The correct solution is

The kernel density is $1/(2b) = 1/8$, and the five points 37, 39, 42, 42, and 44 are within 4 of 40 (since points on the boundaries count), so the estimate is $\hat{f}(40) = (1/8)(5)(1/8) = \boxed{\textbf{0.078125}}$.

[9/14/2010] On page 385, in the solution to exercise 23.19, on the fourth and fifth lines, change $X$ and $X^2$ to $Y$ and $Y^2$.

[4/12/2011] On page 387, in the third paragraph's first line, change "starting at $c_{j-1}$ and ending at $c_j$]] to"'starting at $c_j$ and ending at $c_{j+1}$".

[4/12/2011] On pages 388–390 and page 396–397, the indexing on $P_j$ is incorrect:

1. On page 388, on the first line of the answer to Example 24A, change $P_j = P_{j-1} \ldots$ to $P_{j+1} = P_j \ldots$.
2. On page 390, on the line before Example 24C, change $P_{j-1}$ to $P_j$.
3. On page 390, on the first line of the answer to Example 24C, change $P_j = P_{j-1} \ldots$ to $P_{j+1} = P_j \ldots$. Also change $P_{j-1}$ at the end of the line to $P_j$.
4. On page 396, in the solution to exercise 24.1, on the second line, change $P_{j-1}$ to $P_j$.
5. On page 397, in the solution to exercise 24.2, on the first line, change $P_{j-1}$ to $P_j$.

[12/1/2010] On page 388, on the first line, change "an including" to "and including".

[2/10/2010] On page 388, in the last table of the page, change the heading $\hat{q}'_j$ to either $\hat{p}'_j$ or $1-\hat{q}'_j$.

[4/12/2011] On page 390, in the solution to exercise 24.6, in the table's header, change $c_{j-1}$ to $c_j$ and $P_{j-1}$ to $P_j$.

[2/10/2010] On page 391, in the second table of the page, change the heading $\hat{q}'_j$ to either $\hat{p}'_j$ or $1-\hat{q}'_j$.

[1/23/2010] On page 402, in formula (25.1), replace $m^2+t^2$ with $t-m^2$ in two places:

$$\hat{\theta} = \frac{\hat{\sigma}^2}{\bar{x}} = \frac{t-m^2}{m} \qquad \hat{\alpha} = \frac{\bar{x}^2}{\hat{\sigma}^2} = \frac{m^2}{t-m^2} \tag{1}$$

[12/4/2009] On page 404, on the last line of Subsection 25.2.4, change the first formula to

$$\hat{\mu} = 2\ln m - 0.5\ln t$$

[1/23/2010] On page 407, in Table 25.1, change the formulas for Gamma to $\hat{\alpha} = \dfrac{m^2}{t-m^2}$ and $\hat{\theta} = \dfrac{t-m^2}{m}$. Change the first formula for Lognormal to

$$\hat{\mu} = 2\ln m - 0.5\ln t$$

[12/6/2009] On page 428, in footnote 1, change $f(1000^-)$ and $f(1000)$ to $F(1000^-)$ and $F(1000)$.

[12/2/2009] On page 457, in question 27.15, the denominator of (B) should be $f(100;\theta)^3$ and the denominator of (E) should be $\left(1-F(100;\theta)\right)^3$.

[2/8/2010] On page 468, 3 lines from the bottom, replace the first $\theta$ with $1/\theta$.

[2/8/2010] On page 469, on the last line of the answer to Example 28C, change the final equation to $F(5000) = e^{-2442.75/5000} =$ **0.6135**.

[12/6/2009] On page 471, on the second line of Section 28.5, change "are fixed" to "is fixed".

[4/7/2010] On page 473, in Table 28.1, the formula for $\hat{\sigma}$ of lognormal is incorrect, and should be $\hat{\sigma} = \sqrt{\dfrac{\sum_{i=1}^n \ln^2 x_i}{n} - \hat{\mu}^2}$. For both two-parameter and single-parameter Pareto, change $\hat{\theta} = -n/K$ to $\hat{\alpha} = -n/K$. For a single-parameter Pareto, replace the = between "Single" and "parameter" with -. In the formula for $K$ of a two-parameter Pareto, remove the subscript $i$ from $d$. Alternatively (to allow for varying deductibles), replace the numerator with $\prod_{i=1}^{n+c}(\theta + d_i)$. In the formula for $K$ of a single-parameter Pareto, remove $\theta +$ in the denominator, so that it is $K = \ln \dfrac{\prod_{i=1}^{n+c} \max(\theta, d_i)}{\prod_{i=1}^{n+c} x_i}$. In the last two formulas, remove the negative signs at the beginning of the two formulas for $K$.

[11/19/2010] On page 482, in exercise 28.19(iii), add "follow a" after "to".

[1/12/2011] On page 494, in the solution to exercise 28.23, on the fifth line, remove the negative sign in front of $\frac{2}{\theta^3}$.

[8/17/2010] On page 499, in the solution to exercise 28.37, on the fourth displayed line, add "$x_i$" after the product sign before the equals sign.

[1/27/2010] On page 504, in the solution to exercise 28.52, on the last line, the answer choice should be **(D)**, not (E).

[8/8/2010] On page 506, one line under formula (29.2), put a prime on $\left(\frac{\partial g}{\partial x_1}, \ldots, \frac{\partial g}{\partial x_k}\right)$.

[2/11/2010] On page 508, 8th line of sidebar, change $a_{2-i,2-j}$ to $a_{3-i,3-j}$.

[8/8/2010] On page 508, 5 lines from the end of the page, delete the sentence beginning "If so", which goes to the end of that paragraph.

[2/16/2010] On page 515, on the second line of the third paragraph, change $p$th to $100p$th.

[8/9/2010] On page 516, once apiece on each of the three displayed lines of the answer to Example 29K, change $x$ to $\theta$.

[2/11/2010] On page 528, in the solution to exercise 29.13, on the last displayed line, in the matrix in the numerator, on the second line, change 12 to $-12$ and $-104$ to 104.

[2/11/2010] On page 529, in the solution to exercise 29.25, on the first line, $g(x)$ should be $g(\mu,\sigma)$. On the last line, $g(X,y)$ should be $g(\mu,\sigma)$.

[2/11/2010] On page 530, in the solution to exercise 29.26, 6 lines from the end, $L$ should be $l$.

[2/14/2010] On page 533, in the solution to exercise 29.36, 5 lines from the end, reverse the order of the summands in the numerator of the first expression:

$$\frac{\sum(\ln x_i - \mu')^2 - (\ln x_i - 5)^2}{4}$$

[2/14/2010] On page 541, on the third and fourth lines, change 5(1) to 1(5) and $5(1^2)$ to $1(5^2)$.

[2/14/2010] On page 552, in the solution to exercise 30.17, on the second line, change $e-\lambda$ to $e^{-\lambda}$.

[2/14/2010] On page 562, in the solution to exercise 31.2, change the fourth word from "if" to "is".

[1/30/2010] On page 571, in exercise 32.10, on the third line, change "payments of 10,000" to "payments of 9,500".

[6/28/2010] On page 577, in the solution to exercise 32.6, on the first line of the table, in columns 3 and 4, $F^-(x_j)$ should be $F_5^-(x_j)$ and $F(x_j)$ should be $F_5(x_j)$.

[1/30/2010] On page 577, in the solution to exercise 32.8, on the last line of the table, change 0.0057 to 0.0053.

[12/7/2009] On page 581, on the second line, add "of" after "exception".

[8/18/2010] On page 584, in the solution to exercise 33.4, on the last line of the table, change 50 to 60.

[2/15/2011] On page 586, in the solution to exercise 33.8, on the last line, change 0.9048 to 0.9046 and change the final answer to 4.1976.

[12/7/2009] On page 587, on the first line of the third paragraph, add "is" after "it".

[8/12/2010] On page 587, replace the sentence after equation (34.1) with:

You know that to calculate (biased) sample variance, you can use the definition, $\sum(x_i-\bar{x})^2/n$, or you can use an alternative formula, $\sum x_i^2/n-\bar{x}^2$.

[12/7/2009] On page 594, in the table for the answer to Example 34J, add 10 to each year in the first column.

[8/11/2010] On page 610, in exercises 34.30 and 34.32, on the first lines of both, change 1995–1998 to 2005–2008.

[4/8/2010] On page 619, 2 lines above Section 35.1, delete "there are".

[12/11/2010] On page 635, one line after the numbered list at the top of the page, delete the words "of number".

[12/7/2009] On page 651, in the answer to Example 37C, replace 41 with 11.

[12/7/2009] On page 669, in the solution to exercise 38.15, on the fifth line, replace 41 with 11.

[2/4/2010] On page 691, on the second line from the end of the page, after **53,409**, add **(C)**.

[12/7/2009] On page 695, in the solution to exercise 39.21, on the line after "We are given that the weighted posterior sum ...", change $\frac{1}{12}(3)$ to $\frac{2}{12}(3)$.

[12/7/2009] On page 696, in the solution to exercise 39.24, on the fourth line, change 0.2(60,000) to 0.1(60,000).

[2/12/2011] On page 697, in the solution to exercise 39.25, change the final answer 0.7312 to 0.7311 in two places, and change 0.2688 on the last line of the table to 0.2689.

[12/8/2009] On page 703, in the Reading paragraph at the top, there should be an "or" after *Loss Models* Third Edition 20.3.1–20.3.3; SN C-21-01 4 is a distinct option.

[12/8/2009] On page 703, on the last line of the page, change 12.28 to 15.17.

[12/8/2009] On page 708, on the first line of Section 40.5, change 12.4.3 to 15.5.3.

[8/26/2010] On page 708, in the last displayed equation, the denominator of the exponent should be $2\sigma^2$. Three lines lower, change $\theta^2$ to $\sigma^2$.

[7/20/2010] On page 718, in the solution to exercise 40.5, in the paragraph starting "As an alternative" on the second line, replace $3\lambda 3^{-3\lambda}$ with $3\lambda e^{-3\lambda}$.

[2/14/2011] On page 718, in the solution to exercise 40.6, on the third line, add a 4 to the first exponent in the numerator: $-\lambda e^{-4\lambda}$.

[12/8/2009] On page 725, in the solution to exercise 40.25, on the fourth line of the page, replace "and 4" with "$\alpha = 2$ and $y = 4$".

[12/8/2009] On page 725, in the solution to exercise 40.28, replace the second displayed line with

$$= -\frac{e^{-2\theta}}{2(1-e^{-k})}\Bigg|_0^k$$

[12/8/2009] On page 726, on the last line of the solution to exercise 40.29, replace the fraction with $\frac{0.021845-0.014006}{0.021845-0.007776}$.

[12/8/2009] On page 736, exercise 41.19 is the same as exercise 11.5.

[12/8/2009] On page 740, in the solution to exercise 41.21, on the second line, change both $y$'s to $n$'s.

[12/8/2009] On page 752, 2 lines from the bottom of the page, change $4(0.6)^4$ to $3(0.6)^4$.

[5/1/2010] On page 780, in the solution to question 45.12, replace $\lambda$ (once on the second line and twice apiece on the first four displayed lines) with $\theta$.

[8/31/2010] On page 805, on the first line of the page, delete "C-S07:36" and the preceding comma. This question is a Bühlmann- Straub question

[12/9/2009] On page 837, in the solution to exercise 47.18, three lines from the end, change 0.375 to 0.0375.

[12/9/2009] On page 842, in the solution to exercise 47.35, on the second line, add the words "the square of" before "the length".

[8/31/2010] On page 853, on the line before "Solutions", add ",36" at the end of the line.

[7/20/2010] On page 859, on the third line of the second paragraph, delete the first appearance of the word "a".

[8/31/2010] On page 865, on the line below the first displayed line (equation for $\bar{Y}_i$), change "in such as way" to "in such a way".

[12/10/2009] On page 866, in Section 50.2, on the first line of 1, change "expected observations" to "predictive expected value". On the second line of Example 50B, change "expected number of observations" to "expected number of claims".

[12/10/2009] On page 879, 6 and 5 lines from the bottom, change page 599 to page 629 and example 16.36 to example 20.34.

[12/10/2009] On page 880, on the second line, change example 16.37 to example 20.35.

[10/26/2010] On page 885, in exercise 51.14, two lines under the table, change $m_j$ to $m_i$.

[12/10/2009] On page 888, in the solution to exercise 51.3, on the 7th line, change 80,000 in the numerator to 180,000.

[7/8/2010] On page 897, starting with the first displayed formula and through the ensuing paragraph, all $n$'s (there are six of them) should be changed to $r$'s, where $r$ is the number of policyholders (consistent with the meaning of $r$ in the previous lesson).

[4/7/2010] On page 897, in formula (52.3), $v$ should be $\hat{v}$.

[7/25/2010] On page 900, on the second line of the answer to Example 52D, change "twice the mean" to "1.4 times the mean".

[12/10/2009] On page 901, on the 4th line after the table at the top of the page, change 16.5.2 to 20.4.2 and 16.39 to 20.37.

[3/16/2010] On page 914, in the solution to exercise 52.12, the last paragraph is incorrect. 3 exposures, not 30, should be used. However, the simpler formula for $\hat{\mu}$ and $\hat{v}$ also considers each cell as 1 exposure rather than as 10, so that $\hat{v}$ is 10 times as high. Here is the correct paragraph:

Notice that since there were the same number of exposures for both policyholders, the uniform exposures formula for $\hat{a}$, equation (51.3) could also have also been used. But then, each cell would be treated as one exposure. The mean and expected process variance would be estimated as 2.

$$\hat{a} = (3-2)^2 + (1-2)^2 - \frac{4}{3}$$

Then the credibility factor is $\hat{Z} = \dfrac{3\hat{a}}{3\hat{a}+\hat{v}} = \dfrac{3(4/3)}{3(4/3)+2} = \boxed{\mathbf{\frac{2}{3}}}$.

[12/10/2009] On page 919, delete ", plus *Derivatives Markets* 19.2–19.3" from the first line.

[12/14/2009] On page 921, on the last line of the answer to Example 53B, change 17.1 to 21.1.

[3/17/2010] On page 921, two lines above Example 53C, change $x_i$ to $x_j$.

[10/31/2010] On page 922, on the line between the two tables, delete "would" after "rule".

[2/20/2010] On page 923, delete the second line "-12pt". On the second line of Table 53.1, equation (53.2), insert a minus sign in the radical: $\theta\sqrt[\tau]{-\ln(1-u)}$.

There is no need to memorize this table. The tables you get at the exam list $\text{VaR}_p(X)$. Each entry in the table is the $u^{\text{th}}$ percentile of the distribution, and $\text{VaR}_p(X)$ is the $p^{\text{th}}$ percentile of the distribution, so set $p = u$ and you will have the required formula for the inversion method.

[1/19/2011] On page 934, in the solution to exercise 53.8, on the first line, change "and 4" to "and 1".

[8/11/2010] On page 941, on the second line under the heading "**Mean**", change $s^2$ to $s_n^2$.

[7/25/2010] On page 942, on the fifth line of the subsubsection headed "Probabilities", add the word "the" before "estimator".

[1/12/2011] On page 942, 9 lines from the bottom, change $100p$th to $100\pi$th.

[2/23/2010] On page 942, 6 lines from the bottom, an $n^2$ is missing from the denominator:

$$n \geq \frac{z_\pi^2 P_n/n\left(1-P_n/n\right)}{k^2 P_n^2/n^2}$$

[8/12/2010] On page 943, 7 lines above Example 54C, replace $\lfloor np \rfloor$ with $\lfloor nq \rfloor$.

[8/12/2010] On page 944, replace the fourth bullet in Table 54.1 with "$s_n$ is the square root of the unbiased sample variance after $n$ runs."

[6/10/2011] On page 945, in exercise 54.3, the last column of the table is obviously inconsistent with the previous column, and the $S_i^2$ column is inconsistent with the previous column. This question was adapted from the sample exam, but the $t$ column had to be changed due to a change in the Ross textbook when it was on the syllabus, and the result was an inconsistent table. To fix the question, replace the table and the paragraph preceding the table with:

You want to be 95% certain that your estimate will not differ from the true value by more than 0.01 units. Your estimates of profitability, $X_i$, for the first 120 policies reviewed, together with the indicated statistics, are shown below.

| $i$ | $X_i$ | $\bar{X}_i$ | $S_i^2$ | $S_i$ | $S_i/\sqrt{i}$ |
|---|---|---|---|---|---|
| 1 | 1.0795 | 1.0795 | | | |
| 2 | 1.0559 | 1.0677 | 0.00027908 | 0.0167 | 0.011813 |
| 3 | 1.1062 | 1.0806 | 0.00063266 | 0.0252 | 0.014522 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 100 | 1.0066 | 1.0787 | 0.00269721 | 0.0519 | 0.005193 |
| 101 | 1.1691 | 1.0796 | 0.00275115 | 0.0525 | 0.005219 |
| 102 | 1.0834 | 1.0796 | 0.00272405 | 0.0522 | 0.005168 |
| 103 | 1.1272 | 1.0801 | 0.00271931 | 0.0521 | 0.005138 |
| 104 | 1.0722 | 1.0800 | 0.00269351 | 0.0519 | 0.005089 |
| 105 | 1.1373 | 1.0806 | 0.00269886 | 0.0520 | 0.005070 |
| 106 | 1.0428 | 1.0802 | 0.00268661 | 0.0518 | 0.005034 |
| 107 | 1.0759 | 1.0802 | 0.00266144 | 0.0516 | 0.004987 |
| 108 | 1.1418 | 1.0807 | 0.00267174 | 0.0517 | 0.004974 |
| 109 | 1.1249 | 1.0811 | 0.00266489 | 0.0516 | 0.004945 |
| 110 | 1.2350 | 1.0825 | 0.00285565 | 0.0534 | 0.005095 |
| 111 | 1.0478 | 1.0822 | 0.00284056 | 0.0533 | 0.005059 |
| 112 | 1.0875 | 1.0823 | 0.00281522 | 0.0531 | 0.005014 |
| 113 | 1.1149 | 1.0826 | 0.00279950 | 0.0529 | 0.004977 |
| 114 | 1.1591 | 1.0832 | 0.00282611 | 0.0532 | 0.004979 |
| 115 | 1.0226 | 1.0827 | 0.00283329 | 0.0532 | 0.004964 |
| 116 | 0.9668 | 1.0817 | 0.00292447 | 0.0541 | 0.005021 |
| 117 | 1.1487 | 1.0823 | 0.00293761 | 0.0542 | 0.005011 |
| 118 | 1.1887 | 1.0832 | 0.00300848 | 0.0548 | 0.005049 |
| 119 | 1.1303 | 1.0836 | 0.00300164 | 0.0548 | 0.005022 |
| 120 | 1.0484 | 1.0833 | 0.00298673 | 0.0547 | 0.004989 |

[6/10/2011] On page 947, consistent with the change to the exercise, change the solution to exercise 54.3 to

Your objective is met when the 1.96 times the standard deviation (estimated by the last column, $S_i/\sqrt{i}$) is less

than or equal to 0.01, or

$$\frac{S_i}{\sqrt{i}} \le \frac{0.01}{1.96} = 0.005102$$

(Technically speaking we need a $t$ coefficient rather than 1.96, but the difference is small for large $i$.) $i =$ **104** is the first time that this happens.

On page 951, two lines from the bottom, add the following sentence before "However":

Since $TVaR_q(X)$ is the *mean* of the upper tail of the distribution, we might think that all we need to do is divide $s_q^2$ by $n$, the same way we estimate the variance of the sample mean.

On the last line, replace $s_q^2$ with $s_q^2/n$.

[2/23/2010] On page 952, second paragraph of answer to Example 55C, first two lines, change $\text{TVaR}_{0.95}$ to $\text{TVaR}_{0.99}$ and change $\widehat{\text{TVaR}}_{0.95}$ to $\widehat{\text{TVaR}}_{0.99}$.

[3/17/2010] On page 968, in the final answer to exercise'55.27, replace 82.24 with 76.52.

[3/18/2010] On page 971, in exercise 56.3, on the second line, change $x^2$ to $s^2$.

[11/26/2010] On page 982, in question 14, on the fourth line, delete the first "numbers".

[5/10/2011] On page 984, in question 21, on the first and third lines (once apiece), change "psuedorandom" to "pseudorandom".

[6/16/2011] On page 992, in question 19, on the second line, change "varies by exposure" to "varies by group".

[5/10/2011] On page 993, in question 20, on the second line, change "psuedorandom" to "pseudorandom".

[11/27/2010] On page 996, in question 34:

1. On the second line, delete the words "per claim".
2. Change the last line to "Calculate the square root of the simulated unbiased sample variance of the annual reimbursement".

[8/12/2010] On page 999, in question 2, interchange "'policies" and "claims" in the head of the table.

[5/10/2011] On page 1008, in question 6, on the second line, change "psuedorandom" to "pseudorandom".

[11/28/2010] On page 1014, on the second line of question 30, change "not less be" to "not be less".

[11/29/2010] On page 1019, in question 15, change the last four lines to:

Two different assumptions are used to estimate S(60):

(i) $\hat{S}(60)$ is the estimate if all new entries and withdrawals occur at interval boundaries.
(ii) $\tilde{S}(60)$ is the estimate if all new entries and withdrawals occur uniformly throughout the interval.

[11/30/2010] On page 1042, in question 33, on the line below the table, change "average payment per loss" to "average payment per payment".

[12/1/2010] On page 1047, in question 9, add the word "Annual" before the first sentence: "Annual claim counts…", and delete "Annual" from the second sentence.

[5/10/2011] On page 1058, in question 12, on the first line, change "psuedorandom" to "pseudorandom".

[5/10/2011] On page 1070, in question 11, on the second line, change "psuedorandom" to "pseudorandom".

[5/3/2010] On page 1072, in question 21(ii), add 0.75 to $P(z)$:

$$P_X(z) = 0.75 + \frac{\left(1-3(z-1)\right)^{-1} - 0.25}{3}$$

Change the answer choices to

(A) 1/27 (B) 2/27 (C) 4/27 (D) 8/27 (E) 16/27

[5/10/2011] On page 1074, in question 21, on the first and third lines (once apiece), change "psuedorandom" to "pseudorandom".

[8/9/2010] On page 1083, in the solution to question 11, on the fourth line of the page, change $(1-x)^2$ to $(1-x^2)$.

[5/2/2010] On page 1092, in the solution to question 6, 4 lines from the end of the page, change $50^8$ to $50^{8\alpha}$.

[8/11/2010] On page 1093, in the solution to question 7, 2 lines from the end, change 1.775123 in the denominator to 1.775173.

[8/11/2010] On page 1093, in the solution to question 9, one line below the first displayed equation, change the comma after "point" to a period.

[8/11/2010] On page 1095, in the solution to question 15, on the last line, change $p_0^M = 0.2$ to $p_0^M = 0.25$.

[2/27/2010] On page 1096, in the solution to question 18, change $\max[0, X-0.6(7500)]$ to $\max[0, 0.6(7500)-X]$

[8/11/2010] On page 1097, in the solution to question 20, on the second and fourth displayed lines, change 101.25 to 100.25. On the second to last line, add the word "is" before $531-517$.

[5/17/2010] On page 1097, for the solution to question 21, change the reference from Section 2.3 to Section 2.4.

[8/12/2010] On page 1099, in the solution to question 29, on the last line of the page, add $x$ after 2(0.035625).

[1/15/2011] On page 1100, in the solution to question 32, on the fourth displayed line, change $F_{Y_1}(y_1)$ to $S_{Y_1}(y_1)$. Two lines lower, change $\mathbf{E}[Y_1+Y_2]$ to $\mathbf{E}[Y_2]$.

[11/27/2010] On page 1101, in the solution to question 34, change "The unbiased standard deviation" to "The square root of the unbiased sample variance".

[8/12/2010] On page 1106, in the solution to question 16, on the last displayed line, change 0.5478 to 0.5517 and 0.4522 to 0.4483.

[8/12/2010] On page 1113, add "[**Lesson 47**]" after "34." at the beginning of the solution to question 34.

[11/26/2010] On page 1122, in question 14, on the fourth line, delete the first "numbers".

[4/26/2010] On page 1128, in the solution to question 3, on the second line, change $(1+e^{-x})$ to $(x+e^{-x})$.

[11/29/2010] On page 1131, in the solution to question 15, 2 lines from the end, change $\hat{S}(60)$ to $\tilde{S}(60)$.

[2/22/2011] On page 1134, in the solution to question 28, change $1-q'^{10}$ to $(1-q')^{10}$.

[11/29/2010] On page 1137, in the solution to question 35, on the third line from the end, change $CV_s$ to $CV_s^2$.

[11/29/2010] On page 1139, in the solution to question 3, the final answer should be 0.3348.

[11/30/2010] On page 1160, the solution to question 33 should indicate that all survival functions and probabilities are conditional on $X > 500$. A revised solution follows:

It is a little confusing that payment amounts rather than loss amounts are given.

Let $X$ be the loss random variable. Considering payments from all three coverages, we have

| $y_i$ | $r_i$ | $s_i$ | $\hat{S}_X(y_i \mid X>500)$ | $\Pr(X=y_i \mid X>500)$ |
|---|---|---|---|---|
| 1500 | 10 | 1 | 0.9 | 0.1 |
| 3000 | 9 | 2 | 0.7 | 0.2 |
| 3500 | 7 | 1 | 0.6 | 0.1 |
| 5000 | 6 | 3 | 0.3 | 0.3 |

The last column, $\Pr(X=y_i)$, is computed as differences of the survival functions. For example,

$$\Pr(X=3000)=\Pr(X\geq 3000)-\Pr(X>3000)=S_X(3000^- \mid X>500)-S_X(3000 \mid X>500)=0.9-0.7=0.2$$

Notice that the survival function can only be computed conditional on the loss being greater than 500, since there is no data for losses below 500.

Let $Y^P$ be the average payment on the first coverage, which has a deductible of 500 and a maximum covered loss of 5000. The average payment is the sum of the probabilities times the amounts of the payments, taking into account that the payment is 4500 for any loss above 3500 (since such a loss is always 5000 or higher):

$$\begin{aligned}\mathbf{E}[Y^P] &= \sum_{x<3500}(x-500)\Pr(X=x \mid X>500)+4500S(3500 \mid X>500)\\ &= 0.1(1000)+0.2(2500)+0.1(3000)+0.6(4500)=\boxed{\mathbf{3600}}\end{aligned}$$ **(D)**

Alternatively, you can integrate the survival function from 500 to 5000:

$$\begin{aligned}\mathbf{E}[Y^P] &= \int_{500}^{5000} S_X(x \mid X>500)\mathrm{d}x\\ &= \int_{500}^{1500} 1\,\mathrm{d}x+\int_{1500}^{3000} 0.9\,\mathrm{d}x+\int_{3000}^{3500} 0.7\,\mathrm{d}x+\int_{3500}^{5000} 0.6\,\mathrm{d}x\\ &= 1000+0.9(1500)+0.7(500)+0.6(1500)=\boxed{\mathbf{3600}}\end{aligned}$$

[2/15/2011] On page 1162, in the solution to question 5, $K$ is defined as negative what is shown in the solution, or $-6.7709$. Then $\hat{\alpha}=-n/K$, so it would still have the same value as shown in the solution.

[12/1/2010] On page 1165, in the solution to question 12, on the first displayed line, move the first 0 into the upper limit of the integral:

$$\int_0^{10} x\left(\frac{x-6}{16}\right)$$

[2/23/2011] On page 1170, in the solution to question 29, on the first displayed line, $2\sigma^2$ should be in the exponent as follows:

$$\frac{1}{\sigma x\sqrt{2\pi}}e^{-(\ln x-\mu)^2/2\sigma^2}$$

Four lines from the end, a summation sign is missing under the radical: $\sqrt{\sum(\ln x_i-2)^2/5}$.

[5/3/2010] On pages 1195–1196, the solution to question 21 is incorrect. The correct solution is

You may either do this by recognizing the distributions or by calculating $P_S'(0)$.

By looking at the tables, you can recognize $P_N(z)$ as from a negative binomial with $r=3$, $\beta=2$. $P_X(z)$ looks like a zero-truncated negative binomial with $r=1$, $\beta=3$, except that the denominator is 3 instead of 0.75, and 0.75 is

added. So the probabilities for this distribution are 1/4 of the corresponding probabilities for a zero-truncated distribution, and the probability of 0 is 0.75, which means that it is zero-modified with $p_0^M = 0.75$. We can handle the aggregate distribution by modifying the frequency distribution to be the frequency of non-zero losses and modifying the severity distribution to condition it on non-zero losses. The negative binomial frequency is modified by multiplying $\beta$ by the probability that a loss is greater than 0, which is 0.25. The resulting negative binomial has $r = 1$, $\beta = 0.5$. The severity is modified by truncating 0, turning it into a zero-truncated geometric.

The probability that the modified frequency is 1 equals:

$$p_1 = \Pr(N=1) = 3\left(\frac{1}{1+\beta}\right)^r\left(\frac{\beta}{1+\beta}\right) = 3\left(\frac{1}{1+0.5}\right)^3\left(\frac{0.5}{1.5}\right) = \frac{8}{27}$$

$\Pr(X=1)$ for a zero-truncated geometric is the same as $\Pr(X=0)$ for the corresponding untruncated geometric. Our geometric has $\beta = 3$.

$$f_1 = \Pr(X=1) = \left(\frac{1}{1+\beta}\right) = \frac{1}{4}$$

The probability of aggregate losses of 1 is therefore

$$\Pr(S=1) = \Pr(N=1)\Pr(X=1) = \left(\frac{8}{27}\right)\left(\frac{1}{4}\right) = \boxed{\frac{\mathbf{2}}{\mathbf{27}}} \qquad \textbf{(B)}$$

Alternatively, we can calculate $P_S'(0)$. To calculate $P_S'(0)$, use $P_S = P_N(P_X)$. To differentiate, use the chain rule.

$$\begin{aligned}
P_N(z) &= \big(1-2(z-1)\big)^{-3} \\
P_N'(z) &= (2\cdot 3)\big(1-2(z-1)\big)^{-4} \\
P_X(z) &= 0.75 + \frac{(4-3z)^{-1} - 0.25}{3} \\
P_X(0) &= 0.75 \\
P_X'(z) &= \frac{1}{(4-3z)^2} \\
P_S'(0) &= \left(\frac{6}{\big(1-2P_X(0)\big)^4}\right)\left(\frac{1}{\big(4-3(0)\big)^2}\right) \\
&= \left(\frac{6}{1.5^4}\right)\left(\frac{1}{4^2}\right) = \left(\frac{32}{27}\right)\left(\frac{1}{16}\right) = \boxed{\frac{\mathbf{2}}{\mathbf{27}}} \qquad \textbf{(B)}
\end{aligned}$$

[9/21/2010] On page 1205, the solutions to questions 20 and 21 should be interchanged.

[11/4/2010] On page 1211, on the 3rd line of the page, the bias is $-1/11\theta$, not $-1/\theta$.

[12/1/2009] On page 1213, in the solution to question 18, on the second line from the end, change ruls to rule.

[3/4/2011] On page 1130, in the solution to question 13, on the last line, replace $\frac{(}{8}/9)\theta$ with $(8/9)\theta$. Also, change the two $M$'s to $\hat{\theta}$'s.

[10/10/2010] On page 1223, in the solution to question 16, on the last line of the page, add a factor $n_0$ before $\dfrac{N-P}{P}$.

[7/26/2010] On page 1238, in the solution to question 9, on the second to last line, replace $\frac{\theta a}{b}$ with $\frac{\theta a}{a+b}$.

[6/23/2011] On page 1243, in the solution to question 33, two lines after the itemized list, replace "$a = 10, \ldots 10\big(\frac{9}{9+11}\big) = \boxed{\mathbf{5.50}}$ with "$a = 12$, $b = 10$, and mode $10\big(\frac{11}{11+9}\big) = \boxed{\mathbf{5.50}}$".

[4/27/2010] On page 1247, in the solution to question 10, on the second displayed line, change $\theta \ln 0.5$ to $-\theta \ln 0.5$.

[7/18/2010] On page 1248, in the solution to question 14, on the first displayed line, remove the product symbol in the denominator. On the third displayed line, change the $\sum \ln(x_i+7)+\sum \ln(x_i+3.1)$ to $\sum \ln(x_i+7)-\sum \ln(x_i+3.1)$

[8/31/2010] On page 1256, change the entry for Spring 2007 question 36 from 46 to 48.

[8/12/2010] On page 1258, Practice Exam 3:34's lesson should be 47, not 46.

[6/20/2011] On page 1260, the table omits the correspondence of questions 283–289. They correspond to questions M-F06: 22,29,30,31,32,39, and 40 respectively, whose solutions are found on pages 1234–1235.

[3/4/2011] On page 1343, in the solution to question 34, on the second line, after "distribution mean", add "squared".