

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

Note: Practice exam 10:21 is defective. The question should be fixed as indicated below. Also note the correction to practice exam 3:2.

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

Topic	Lessons	May	Nov.	May	Nov.	Nov.	Nov.	Nov.	May	Nov.	Nov.	May
		2000	2000	2001	2001	2002	2003	2004	2005	2005	2006	2007
Severity, Frequency, Aggregate Loss	1–18	1	2	1	2	1	1	0	0	0	0	5
Empirical Estimation	19–26	4	2	2	4	4	5	4	6	5	9	7
Parametric Fitting	27–32	6	6	6	4	7	8	11	6	8	7	6
Testing Fit	33–37	2	0	3	2	2	2	3	4	4	1	3
Limited Fluctuation Credibility	38–40	1	1	0	1	1	2	1	1	1	1	0
Bayesian Credibility	41–46	4	5	5	4	3	5	3	3	3	5	3
Bühlmann Credibility	47–52	2	2	4	5	5	3	4	5	3	3	5
Empirical Bayes	53–54	2	3	1	1	1	1	2	2	3	2	2
Simulation	55–58	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.

- [6/8/2010] On page 13, in the fourth bullet of the second column of Table 1.1, replace $\Pr(X = x)$ with $\Pr(X = n)$.
- [6/2/2010] On page 29, on the 4th displayed line from the end of the page, replace $F_X(1/y)$ with $S_X(1/y)$ and $1 - e^{-1/(y^\theta)}$ with $e^{-1/(y^\theta)}$. On the 2nd to last line of the page, delete 1–.
- [5/29/2010] On page 33, in the second sentence of Subsection 2.3.6, change the single-quote after “parameter” to a double-quote.
- [6/2/2010] On page 34, in the first displayed line of Subsection 2.3.7, replace the exponent $\alpha - 1$ with $\alpha + 1$.
- [5/21/2010] On page 36, in Table 2.1, for the Single-parameter Pareto, replace the denominator $\theta^{\alpha+1}$ with $x^{\alpha+1}$.
- [7/5/2010] On page 68, in the solution to exercise 4.8, add $d\lambda$ after $e^{-\lambda}$ on the two displayed lines.
- [6/6/2010] On page 80, in exercise 5.12, on the second line, delete the word “expected”.
- [8/22/2010] On page 82, in the solution to exercise 5.9, on the first displayed line, add a standard-sized right parenthesis after 4000.
- [5/5/2010] On page 86, in the solution to Example 6B, replace the third line with
 To this, we add $500S(500) = 500(0.3) = 150$ for a total expected payment per loss of 400.
 Replace the last line with
 Once again we would add $500S(500)$ to this to get the final answer of 400.
- [5/29/2010] On page 116, in exercise 7.19, replace 1999 with 2009 in three places—4 lines from the end, 3 lines from the end (subscript), and 1 line from the end.

[5/29/2010] On pages 122–123, replace the subscript 1998 with 2008 (4 lines from bottom of page 122) and the subscript 1999 with 2009 (5th line of page 123).

[6/30/2010] On page 128, 6 lines from the bottom, the first word “loss” should be “let”.

[5/17/2010] On page 136, on the 6th line of Section 8.4, delete the first “are”.

[5/26/2010] On page 149, first displayed line, change the first – to =.

[6/28/2010] On page 156, in exercise 9.19(D), change $5000 < X_i \leq 631,250$ to $6250 < X_i \leq 631,250$.

[5/22/2010] On page 180, on the second line of Section 11.2, 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.

[5/18/2010] On page 180, the line above Example 11B should be

$$p_n^M = (1 - p_0^M)p_n^T \quad n > 0$$

[6/28/2010] On page 205, add a period on the first line after the word “syllabus”.

[6/30/2010] On page 207, at the end of the fifth line, replace p_0^M with p_0^{M*} .

[6/28/2010] On page 226, in the solution to exercise 14.1, on the last line, change $\left(\frac{1}{2}\right)^2$ to $\left(\frac{1}{2}\right)^4$.

[6/28/2010] On page 255, the solution to exercise 15.27 is incorrect. The correct solution is

We calculate aggregate mean and variance.

$$\mathbf{E}[S] = 0.7e^{5+0.5(1.2^2)} = 213.4334$$

$$\text{Var}(S) = 0.7e^{10+2(1.2^2)} = 274,669.8$$

$$\mathbf{E}[S^2] = 274,669.8 + 213.4334^2 = 320,223.7$$

We solve for the μ and σ parameters of the lognormal having this mean and second moment.

$$\mu + 0.5\sigma^2 = \ln 213.4334$$

$$2\mu + 2\sigma^2 = \ln 320,223.7$$

$$\sigma^2 = \ln 320,223.7 - 2\ln 213.4334 = 1.9501$$

$$\sigma = 1.3965$$

$$\mu = \ln 213.4334 - 0.5(1.3965)^2 = 4.3883$$

Now apply the lognormal approximation.

$$\Pr(S > 300) = 1 - \Phi\left(\frac{\ln 300 - 4.3883}{1.3965}\right) = 1 - \Phi(0.94) = \boxed{0.1736}$$

[6/30/2010] On page 256, on the second to last line of the solution to exercise 15.29, replace “the 90th percentile of aggregate losses” with “TVaR at the 90% security level”.

[6/12/2010] On page 301, in the solution to exercise 18.15, one line above “**Second method**”, change $\mathbf{E}[(Y^P)^2]^2$ to $\mathbf{E}[Y^P]^2$.

[7/2/2010] On page 314, on the first line of Table 19.1, the formula for bias should be $\text{bias}_{\hat{\theta}}(\theta) = \mathbf{E}[\hat{\theta} | \theta] - \theta$.

[5/29/2010] On page 314, on the last line of Table 19.1, there should be expected value around $(\hat{\theta} - \theta)^2$ and $\text{bias}_{\hat{\theta}}(\theta)$ should be squared, so the formula should read

$$\text{MSE}_{\hat{\theta}}(\theta) = \mathbb{E}[(\hat{\theta} - \theta)^2 | \theta] = \text{bias}_{\hat{\theta}}^2(\theta) + \text{Var}(\hat{\theta})$$

[6/30/2010] On page 323, on the first line of the solution to exercise 19.7, add “unbiased” between “variance” and “estimator”, and also between “an” and “estimator”.

[7/2/2010] On page 326, in the solution to exercise 19.22, replace the fifth line from the end (beginning $\text{bias}_{\hat{\theta}}(\theta)$) with

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

[8/20/2010] On page 330, one line below equation (20.1), change $(c_{j=1}, c_j)$ to $[c_{j-1}, c_j]$. The textbook arbitrarily makes the histogram right continuous.

[6/30/2010] On page 376, at the end of the first line of Quiz 23-2, delete the word “are”.

[8/10/2010] On page 387, in formula (24.1), delete the upper bound j on the sum.

[8/10/2010] On page 390, in formula (24.1), delete the upper bound j on the sum.

[7/9/2010] On page 401, in the solution to exercise 24.25, on the second to last line, change both 0.8's to $\ln 0.8$.

[6/30/2010] On page 407, in the fifth bullet, change $F(11) = 0.375$ to $F(11) = 0.25$.

[6/8/2010] On page 426, the answer to exercise 25.1 should be 0.0625 instead of 0.00625.

[6/2/2010] On page 476, three lines above Example 28B, change $-\theta(1-p)$ to $-\theta \ln(1-p)$.

[8/5/2010] On page 493, in the solution to Quiz 28-1, change the equation at the end to $0.2(20) + 0.8(70) = \boxed{60}$.

[8/15/2010] On page 516, in the solution to Quiz 29-1, on the first displayed line, add θ^5 to the right-hand side: $\theta^5 \exp(-0.051304\theta)$.

[7/28/2010] On page 524, in the heading of the table for Example 30H, interchange “Policyholders” and “Claims”.

[7/28/2010] On page 526, the last four lines of the answer to Example 30H are incorrect. Replace them with:

$$= (1-p)^{258} p^{113}$$

and therefore $\hat{p} = 113/(113 + 258) = 0.30458$. Then

$$\frac{\beta}{1+\beta} = 0.30458$$

$$\hat{\beta} = \frac{0.30458}{0.69542} = \boxed{0.4380}$$

[8/17/2010] On page 551, in the solution to exercise 30.37, on the fourth displayed line, add “ x_i ” after the product sign before the equals sign.

[8/8/2010] On page 567, one line under formula (31.5), put a prime on $\left(\frac{\partial g}{\partial x_1}, \dots, \frac{\partial g}{\partial x_k}\right)$.

[8/9/2010] On page 570, once apiece on each of the three displayed lines of the answer to Example 31K, change x to θ .

[6/28/2010] On page 636, in the solution to exercise 34.6, 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 $F_5(x_j)$.

- [8/18/2010] On page 644, in the solution to exercise 35.4, on the last line of the table, change 50 to 60.
- [8/12/2010] On page 647, replace the sentence after equation (36.1) 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, $\sum x_i^2/n - \bar{x}^2$.
- [8/11/2010] On page 670, in exercises 36.30 and 36.32, on the first lines of both, change 1995–1998 to 2005–2008.
- [7/13/2010] On page 680, on the fifth line, replace “two=parameter” with “2-parameter”. On the top line of the table for Quiz 37-1, replace “Negative” with “Maximal”.
- [7/13/2010] On page 716, on the first displayed line and denominator of the third displayed line, replace σ_f with μ_s ; on the second displayed line and numerator of the third displayed line, replace σ_s with σ_s^2 and σ_f with σ_f^2 . The three displayed lines will then be

$$\begin{aligned} E[S] &= \mu_f \mu_s \\ \text{Var}(S) &= \mu_f \sigma_s^2 + \sigma_f^2 \mu_s^2 \\ n_F &= \mu_f n_0 \frac{\mu_f \sigma_s^2 + \sigma_f^2 \mu_s^2}{\mu_f^2 \mu_s^2} \end{aligned}$$

- [7/13/2010] On page 716, in Example 39A, on the fifth line, replace 10% with 5%.
- [8/22/2010] On page 739, change the first paragraph of Quiz 41-1 to:
For a certain insurance coverage, only one claim per year can be submitted. There are two types of group. In a good group, the expected annual number of claims from each risk is 0.1. In a bad group, the expected annual number of claims from each risk is 0.2. The probability that a group is good is 70%.
- [6/28/2010] On page 769, on the table's fourth line, change 0.022619 to 0.22619.
- [6/8/2010] On page 772, 3 lines from the end of the answer to Example 42A, the numerator of the fraction should be $e^{-3\lambda}$; delete λ .
- [7/20/2010] On page 774, on the first displayed line, change the lower bound of the integral from 5 to 3.
- [7/20/2010] On page 786, in the solution to exercise 42.2, in the paragraph starting “As an alternative” on the second line, replace $3\lambda 3^{-3\lambda}$ with $3\lambda e^{-3\lambda}$.
- [9/2/2010] On page 829, the solution to exercise 45.12 is incorrect. The correct solution is
The model is negative binomial with $r = 2$. The prior distribution is beta with $a = 1$, $b = 1$. The posterior is $a + * = a + nr = 1 + 1(2) = 3$, $b_* = b + n\bar{x} = 1 + 1(0) = 1$. The predictive mean is $rb/(a - 1) = 2(1)/(3 - 1) = \boxed{1}$. Notice that the original mean is infinite.
- [5/1/2010] On page 853, in the solution to question 47.12, replace λ (once on the second line and twice apiece on the first four displayed lines) with θ .
- [8/31/2010] On page 878, on the line before “Solutions”, delete “C-S07:36” and the preceding comma. This question is a Bühlmann- Straub question
- [8/31/2010] On page 930, on the line before “Solutions”, add “,36” at the end of the line.
- [7/20/2010] On page 931, in the solution to exercise 50.3, on the second displayed line, replace *lambda* with λ .
- [7/20/2010] On page 937, on the third line of the second paragraph, delete the first appearance of the word “a”.

[7/20/2010] On page 943, in the solution to exercise 51.11, on the first line, $Z = 9/(9 + 3a)$, not $9/(9 + 2a)$. Also, the tables do not list the mode of a beta. The proof that the mode of the distribution is $(a - 1)/(a + b - 2)$ for the given f is:

$$\begin{aligned}\ln f(\theta) &= \ln \Gamma(a + b) - \ln \Gamma(a) - \ln \Gamma(b) + (a - 1)\ln \theta + (b - 1)\ln(1 - \theta) \\ \frac{d \ln f(\theta)}{d \theta} &= \frac{a - 1}{\theta} - \frac{b - 1}{1 - \theta} = 0 \\ (a - 1)(1 - \theta) - (b - 1)\theta &= 0 \\ \theta(a + b - 2) &= a - 1 \\ \theta &= \frac{a - 1}{a + b - 2}\end{aligned}$$

[8/31/2010] On page 945, on the line below the first displayed line (equation for \tilde{Y}_i), change “in such as way” to “in such a way”.

[7/25/2010] On page 945, 5 lines from the bottom, replace b with β .

[7/25/2010] On pages 953–954, change $\mathbf{E}[X^2]$ to $\text{Var}(X)$ in the following places:

- Third and fourth displayed lines of solution to exercise 52.1.
- First and third lines of solution to exercise 52.4.
- Second and fourth lines of solution to exercise 52.5.

[7/25/2010] On page 962, on the first line, change “Group A” to “Policyholder 1”.

[6/14/2010] On page 981, the last three lines of the solution to Quiz 53-1 are incorrect, and should be

$$\begin{aligned}\hat{a} &= (0.25 - 0.75)^2 + (1.25 - 0.75)^2 - \frac{7/12}{4} = 0.354167 \\ \hat{Z} &= \frac{4\hat{a}}{4\hat{a} + \hat{v}} = \frac{1.41667}{1.41667 + 7/12} = 0.708333 \\ P_C &= 0.708333(0.25) + (1 - 0.708333)(0.75) = \mathbf{0.395833}\end{aligned}$$

[7/8/2010] On page 983, starting with the last 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).

[7/25/2010] On page 985, on the second to last line, after (53.3), change the comma to a period. On the last line, change 280 to 250.

[7/25/2010] On page 987, on the second line of the answer to Example 54D, change “twice the mean” to “1.4 times the mean”.

[8/11/2010] On page 1027, on the second line under the heading “**Mean**”, change s^2 to s_n^2 .

[7/25/2010] On page 1028, on the fifth line of the subsection headed “Probabilities”, add the word “the” before “estimator”.

[8/12/2010] On page 1029, 6 lines above Example 54C, replace $\lfloor np \rfloor$ with $\lfloor nq \rfloor$.

[8/12/2010] On page 1030, replace the fifth bullet in Table 56.1 with “ s_n is the square root of the unbiased sample variance after n runs.”

[7/25/2010] On page 1058, on the last line of the answer to Example 58B, insert a small left parenthesis before 11.56 and a large right parenthesis after $(158.76 - 341.04)^2$.

[7/25/2010] On page 1064, in the solution to exercise 58.9, on the second displayed line, the expression inside the brackets on the left should be squared:

$$\mathbf{E}_{F_x} \left[\left(\frac{1}{2} ((x_2 - \bar{x}) + (x_3 - \bar{x})) \right)^2 \right]$$

[8/9/2010] On page 1066, on the last line, the final answer should be 49/27 instead of 56/27.

[8/12/2010] On page 1089, in question 2, interchange “policies” and “claims” in the head of the table.

[5/3/2010] On page 1160, in question 21(ii), add 0.75 to $P(z)$:

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

Change the answer choices to

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

[8/9/2010] On page 1171, 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 1180, in the solution to question 6, 2 lines from the bottom of the page, change 50^8 to $50^{8\alpha}$.

[8/11/2010] On page 1181, 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 1181, in the solution to question 9, 3 lines from the bottom of the page, change the comma after “point” to a period.

[8/11/2010] On page 1183, in the solution to question 15, on the last line, change $p_0^M = 0.2$ to $p_0^M = 0.25$.

[8/11/2010] On page 1185, 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 $531 - 517$.

[8/12/2010] On page 1187, in the solution to question 29, on the last line of the page, add x after $2(0.035625)$.

[8/11/2010] On page 1188, in the solution to question 32, on the 11th line, change $\mathbf{E}[Y_1 + Y_2]$ to $\mathbf{E}[Y_2]$.

[8/12/2010] On page 1194, 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 1201, add “[**Lesson 49**]” after “34.” at the beginning of the solution to question 34.

[4/26/2010] On page 1216, in the solution to question 3, on the second line, change $(1 + e^{-x})$ to $(x + e^{-x})$.

[4/26/2010] On page 1218, in the solution to question 13, on the last line, replace $(\frac{1}{8}/9)\theta$ with $(8/9)\theta$.

[5/3/2010] On pages 1282–1283, 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 β 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

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

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.

$$\begin{aligned} P_N(z) &= (1 - 2(z - 1))^{-3} \\ P'_N(z) &= (2 \cdot 3)(1 - 2(z - 1))^{-4} \\ P_X(z) &= 0.75 + \frac{(4 - 3z)^{-1} - 0.25}{3} \\ P_X(0) &= 0.75 \\ P'_X(z) &= \frac{1}{(4 - 3z)^2} \\ P'_S(0) &= \left(\frac{6}{(1 - 2P_X(0))^4} \right) \left(\frac{1}{(4 - 3(0))^2} \right) \\ &= \left(\frac{6}{1.5^4} \right) \left(\frac{1}{4^2} \right) = \left(\frac{32}{27} \right) \left(\frac{1}{16} \right) = \boxed{\frac{2}{27}} \quad \text{(B)} \end{aligned}$$

[7/26/2010] On page 1326, in the solution to question 9, on the second to last line, replace $\frac{\theta a}{b}$ with $\frac{\theta a}{a+b}$.

[4/27/2010] On page 1335, 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 1336, 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 1344, change the entry for Spring 2007 question 36 from 46 to 48.

[8/12/2010] On page 1346, Practice Exam 3:34's lesson should be 49, not 48.