

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

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

[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.

[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.

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

[8/31/2010] On page 1344, change the entry for Spring 2007 question 36 from 46 to 48.

[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.

[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%.

[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.

[8/18/2010] On page 644, in the solution to exercise 35.4, on the last line of the table, change 50 to 60.

[8/17/2010] 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.

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

[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	1–18	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.

[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, $\sum x_i^2/n - \bar{x}^2$.

[8/12/2010] On page 1029, 6lines 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.”

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

[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).

[8/12/2010] 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.

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

[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.

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

[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.

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

[8/10/2010] 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.
- [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 .
- [8/9/2010] On page 1066, on the last line, the final answer should be $49/27$ instead of $56/27$.
- [8/9/2010] On page 1171, in the solution to question 11, on the fourth line of the page, change $(1 - x)^2$ to $(1 - x^2)$.
- [8/8/2010] On page 567, one line under formula (31.5), put a prime on $\left(\frac{\partial g}{\partial x_1}, \dots, \frac{\partial g}{\partial x_k}\right)$.
- [8/5/2010] On page 493, in the solution to Quiz 28-1, change the equation at the end to $0.2(20) + 0.8(70) = \boxed{60}$.
- [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

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

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

- [7/26/2010] On page 1326, in the solution to question 9, on the second to last line, replace $\frac{\theta a}{b}$ with $\frac{\theta a}{a+b}$.
- [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”.
- [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”.
- [7/25/2010] On page 1028, on the fifth line of the subsection headed “Probabilities”, add the word “the” before “estimator”.
- [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:

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

- [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 $3\lambda e^{-3\lambda}$.
- [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:

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

- [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 $\sum \ln(x_i + 7) - \sum \ln(x_i + 3.1)$
- [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

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

- [7/13/2010] On page 716, in Example 39A, on the fifth line, replace 10% with 5%.
- [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 $\ln 0.8$.
- [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).
- [7/5/2010] On page 68, in the solution to exercise 4.8, add $d\lambda$ after $e^{-\lambda}$ on the two displayed lines.
- [7/2/2010] On page 314, on the first line of Table 19.1, the formula for bias should be $\text{bias}_{\hat{\theta}}(\theta) = \mathbf{E}[\hat{\theta} | \theta] - \theta$.
- [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

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

- [6/30/2010] On page 128, 6 lines from the bottom, the first word “loss” should be “let”.
- [6/30/2010] On page 207, at the end of the fifth line, replace p_0^M with p_0^{M*} .

- [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”.
- [6/30/2010] 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”.
- [6/30/2010] On page 376, at the end of the first line of Quiz 23-2, delete the word “are”.
- [6/30/2010] On page 407, in the fifth bullet, change $F(11) = 0.375$ to $F(11) = 0.25$.
- [6/28/2010] On page 156, in exercise 9.19(D), change $5000 < X_i \leq 631,250$ to $6250 < X_i \leq 631,250$.
- [6/28/2010] On page 205, add a period on the first line after the word “syllabus”.
- [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.

$$\begin{aligned} \mathbf{E}[S] &= 0.7e^{5+0.5(1.2^2)} = 213.4334 \\ \text{Var}(S) &= 0.7e^{10+2(1.2^2)} = 274,669.8 \\ \mathbf{E}[S^2] &= 274,669.8 + 213.4334^2 = 320,223.7 \end{aligned}$$

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

$$\begin{aligned} \mu + 0.5\sigma^2 &= \ln 213.4334 \\ 2\mu + 2\sigma^2 &= \ln 320,223.7 \\ \sigma^2 &= \ln 320,223.7 - 2 \ln 213.4334 = 1.9501 \\ \sigma &= 1.3965 \\ \mu &= \ln 213.4334 - 0.5(1.3965)^2 = 4.3883 \end{aligned}$$

Now apply the lognormal approximation.

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

- [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 $F_5(x_j)$.
- [6/28/2010] On page 769, on the table’s fourth line, change 0.022619 to 0.22619.
- [6/14/2010] On page 981, the last three lines of the solution to Quiz 53-1 are incorrect, and should be

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

- [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 $\mathbf{E}[Y^P]^2$.

- [6/8/2010] On page 13, in the fourth bullet of the second column of Table 1.1, replace $\Pr(X = x)$ with $\Pr(X = n)$.
- [6/8/2010] On page 426, the answer to exercise 25.1 should be 0.0625 instead of 0.00625.
- [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 .
- [6/6/2010] On page 80, in exercise 5.12, on the second line, delete the word “expected”.
- [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 $1 -$.
- [6/2/2010] On page 34, in the first displayed line of Subsection 2.3.7, replace the exponent $\alpha - 1$ with $\alpha + 1$.
- [6/2/2010] On page 476, three lines above Example 28B, change $-\theta(1 - p)$ to $-\theta \ln(1 - p)$.
- [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.
- [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).
- [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

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

- [5/26/2010] On page 149, first displayed line, change the first $-$ to $=$.
- [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.
- [5/21/2010] On page 36, in Table 2.1, for the Single-parameter Pareto, replace the denominator $\theta^{\alpha+1}$ with $x^{\alpha+1}$.
- [5/18/2010] On page 180, the line above Example 11B should be

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

- [5/17/2010] On page 136, on the 6th line of Section 8.4, delete the first “are”.
- [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.
- [5/3/2010] 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

[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.

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

[5/2/2010] On page 1180, in the solution to question 6, 2 lines from the bottom of the page, change 50^8 to $50^{8\alpha}$.

[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 .

- [4/27/2010] On page 1335, in the solution to question 10, on the second displayed line, change $\theta \ln 0.5$ to $-\theta \ln 0.5$.
- [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 $\frac{6}{8}(9)\theta$ with $(8/9)\theta$.