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

[5/11/2015] On page 5, in the paragraph under the 5-bullet list, on the last line, change “kurtosis of 0” to “skewness of 0”. On the last line of the next paragraph, change “skewness of 3” to “kurtosis of 3”.

[8/28/2016] On page 30, $F_X(x)$ is not a legitimate distribution function. Replace the example with

Claim sizes $X$ initially follow a distribution with distribution function:

$$F_X(x) = 1 - \frac{1}{e^{0.01x}(1+0.01x)} \qquad x > 0$$

Claim sizes are inflated by 50% uniformly.

Calculate the probability that a claim will be for 60 or less after inflation.

Replace the answer with

Let $Y$ be the increased claim size. Then $Y = 1.5X$, so $\Pr(Y \le 60) = \Pr(X \le 60/1.5) = F_X(40)$.

$$F_X(40) = 1 - \frac{1}{1.4e^{0.4}} = \boxed{\mathbf{0.5212}}$$

[9/30/2016] On page 94, in the solution to exercise 5.14, on the second line, change “between 21 and 25” to “between 20 and 25”.

[9/15/2015] On page 99, in the last paragraph, on the second line, change $\theta = d$ to $\theta - d$.

[10/30/2016] On page 114, in the solution to exercise 6.23, on the second line, replace disribution with distribution. On the last line, remove the extra equals sign before the final answer.

[8/28/2016] On page 157, on the last line, replace 21.2847 with 21.2848.

[10/26/2015] On page 171, in the solution to exercise 9.6, the first displayed line should be split into two, as follows:

$$\begin{aligned} 2500 &= 0.8e(1250) = 0.8(\theta + 1250) \\ 0.8\theta &= 1500 \end{aligned}$$

[6/10/2015] On page 207, in the solution to exercise 11.28, on the first line, change $\frac{u}{k}$ to $\frac{u^{k-1}}{k}$.

[11/1/2015] On page 231, in the solution to exercise 13.16, on the last line, change the denominator $e^{\lambda-1}$ to $e^{\lambda} - 1$.

[1/25/2016] On page 272, in the solution to exercise 15.19, on the second displayed line, change $\le 0.9$ to $\ge 0.9$.

[10/13/2015] On page 296, on the sixth and eighth lines, change Theorem 6.14 to Theorem 7.3.

[6/30/2015] On page 337, in the solution to exercise 19.10, six lines from the bottom of the page, replace the displayed line with

$$\mathbf{E}[X \wedge x] = \int_0^x S(t)\,\mathrm{d}t = \int_0^\theta 1\,\mathrm{d}t + \int_\theta^x \frac{\theta\,\mathrm{d}t}{t} = \theta\left(1 + \ln\frac{x}{\theta}\right)$$

[5/31/2015] On page 360, on the last line of the page, 18,860,942,085 should be 1,860.942,085.

[5/21/2015] On page 412, in the solution to exercise 24.10, on the third line, change the starting equation to $r_3 = 50 - 1 + 1 - 1 = 49$. (We must add 1 because of the new entrant at time 12.) Change the first 2 displayed lines to

$$\hat{H}(20) = \frac{1}{50} + \frac{1}{50} + \frac{1}{49} = 0.060408$$
$$\hat{S}(20) = e^{-\hat{H}(20)} = e^{-0.060408} = 0.941380$$

Change the last displayed line to

$$1 - \hat{S}(25) = 1 - 0.941380^{25/20} = 1 - 0.927270 = \boxed{\mathbf{0.072730}}$$

[7/10/2015] On page 506, in exercise 28.23, the headings on the table have the following meanings: $d_j$ means number of entrants, $u_j$ means number of withdrawals, $x_j$ means number of deaths.

[7/10/2015] On page 509, in the solution to exercise 28.6, three lines from the end, change "first group" to "second group".

[6/29/2016] On page 510, in the solution to exercise 28.9, two lines from the end, delete the extra right parenthesis from the numerator $e^{-3/12}$.

[11/10/2015] On page 511, in the solution to exercise 28.14, in the table, for Policy 3, change the entry under "End of" from 12-1-2012 to 12-31-2012.

[2/20/2016] On pages 573–574, in the solution to exercise 31.28, on the second-to-last line of the page, the exponent $\gamma$ should be $1/\gamma$. On the first line of page 574, there should be parentheses around the fraction $\frac{206}{0.8^{-1}-1}$.

[2/8/2016] On page 630, in the solution to exercise 33.3, on the first line, change "1, 2, and 4" to "1, 3, and 4".

[3/2/2016] On page 664, 12 lines from the bottom, replace the displayed line with

$$\sum_{i=1}^{n}(\bar{x} - \mu')(2x_i - \mu' - \bar{x}) = (\bar{x} - \mu')(2n\bar{x} - n\mu' - n\bar{x}) = n(\bar{x} - \mu')^2$$

[8/16/2015] On page 684, in the solution to exercise 34.41, 4 lines from the end, the summand of the first numerator should have a pair of parentheses around it:

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

[7/13/2015] On page 707, in the solution to exercise 35.15, in 2. of the numbered list, change $\Pr(N > m - k)$ to $\Pr(N \geq m - k)$.

[3/7/2016] On page 779, in exercise 39.23, in the table, the sum for interval (0, 2,000] should be 38,065.

[5/14/2015] On page 795, in the first sentence after the list of 5 score-based methods, change "higher scores" to "lower statistics".

[7/17/2015] On page 800, one paragraph above Section 40.2, on the second line of the paragraph, interchange the parenthesized numbers: (1) should be (2), (2) should be (1).

[7/30/2015] On page 922, in exercise 46.30, on the displayed line, change every $x$ on the right side of the equality (there are four) to $\theta$.

[8/3/2015] On page 959, at the end of the first paragraph of Section 49.1, there is an incomplete sentence. Replace the period at the end of the sentence with "will leave you more time for other exam questions!"

[4/11/2016] On page 1034, in the solution to exercise 52.37, on the third displayed line, replace EPV with VHM. On the fouth displayed line, replace VHM with EPV.

[4/15/2016] On page 1071, replace the first displayed line with

$$\bar{X} = \frac{c_1 + c_2 + c_3}{(6/12) + (8/12) + (3/12)}$$

[1/25/2016] On page 1071, on the line after the first displayed equation, delete the left parenthesis.

[2/13/2016] On page 1107, on the fourth line, remove the **E** and the left and right brackets in the numerator of the fraction.

[2/6/2016] On page 1121, in exercise 57.18, in the table's fourth column first row, change $\bar{x}_j$ to $\bar{x}_i$.

[6/15/2016] On page 1157, in exercise 59.16, ignore the answer choices. The correct answer is not one of the choices.

[6/15/2016] On pages 1162–1163, the solution to exercise 59.16 is incorrect. The correct solution is

Half of the policyholders, not half of the payments, come from a policy with deductible of 500. Therefore, the prior distribution of deductibles relates to policyholders. Since frequency of losses does not vary by deductible, the prior distribution of deductibles is equivalently related to losses. It is not related to payments; in fact, fewer than half the nonzero payments are made to policies with deductibles of 1000. Therefore, we must compute the likelihood of the losses, not the payments.

If the deductible is 500, the losses are 2000 and 4000 with likelihood

$$\left(\frac{3(4000^3)}{6000^4}\right)\left(\frac{3(4000^3)}{8000^4}\right) = 6.94444 \times 10^{-9}$$

If the deductible is 1000, the losses are 2500 and 4500 with likelihood

$$\left(\frac{3(4000^3)}{6500^4}\right)\left(\frac{3(4000^3)}{8500^4}\right) = 3.95616 \times 10^{-9}$$

so the posterior probability of a 500 deductible is $6.94444/(6.94444 + 3.95616) = 0.637070$. We will use the conditional variance formula, conditioning on the deductible, to calculate the variance of $X_3$, the next payment. The mean and variance of a payment given the deductible is

$$\mathbf{E}[X_3 \mid d = 500] = \frac{4500}{2} = 2250 \qquad \mathbf{E}[X_3 \mid d = 1000] = \frac{5000}{2} = 2500$$

$$\operatorname{Var}(X_3 \mid d = 500) = \frac{2(4500^2)}{2} - 2250^2 = 15{,}187{,}500 \qquad \operatorname{Var}(X_3 \mid d = 1000) = 5000^2 - 2500^2 = 18{,}750{,}000$$

Now we'll use the conditional variance formula.

$$\begin{aligned}\operatorname{Var}(X_3) &= \mathbf{E}[\operatorname{Var}(X_3 \mid I)] + \operatorname{Var}(\mathbf{E}[X_3 \mid I]) \\ &= 0.637070(15{,}187{,}500) + 0.362930(18{,}750{,}000) + (0.637070)(0.362930)(2500 - 2250)^2 \\ &= 16{,}494{,}889\end{aligned}$$

The standard deviation is **4061**.

[5/1/2016] On page 1167, on the third line of the third paragraph, replace "add $\frac{1}{2}$" with "subtract $\frac{1}{2}$".

[7/27/2015] On page 1241, in the solution to exercise 63.11, in the table, in the heading for claim time, change $x_i$ to $x_j$. In the heading for claim size, put subscript $i$ on the $t$: $10^{t_i}$. The heading for cumulative claims should be $\sum_{j=1}^{i} 10^{t_i}$. In the heading for the last column, put subscript $i$ on the $t$.

[9/25/2015] On pages 1244–1245, in the solution to exercise 63.22, on the last line of page 1244 change "Give" to "Given". On each of the second to fourth lines of page 1245, insert a negative sign after the right arrow.

[8/1/2015] On page 1259, in the solution to exercise 64.10, on the second displayed line, put bars on two $x$s in the last term: $2\,\mathbf{E}_{F_n}[(x_2-\bar{x})(x_3-\bar{x})]$.

[10/7/2015] On page 1335, in question 34, on the last two lines, change "losses" to "payments" once on each line.

[1/25/2016] On page 1350, question 11 is based on material in *Loss Models* that is not on the current syllabus. Replace the question with the following question:

You are given the following information for a group policyholder regarding actual aggregate losses and the variance of aggregate losses in each of 3 years:

| | Average Losses Per Member | Number of Members |
|---|---|---|
| Year 1 | 10 | 4 |
| Year 2 | 9 | 5 |
| Year 3 | 11 | 10 |

An exposure unit is defined as a member-year. The expected process variance per unit is 20 and the variance of the hypothetical means per unit is 1.

The prior value of expected losses per member-year is 15.

Calculate the Bühlmann-Straub estimate of aggregate losses per member-year.

(A) 12.4 (B) 12.5 (C) 12.6 (D) 12.7 (E) 12.8

[12/18/2015] On page 1419, in the solution to question 16, on the fourth line, remove the negative sign in front of $e^{-1000/\theta}$; change $u=-e^{-1000/\theta}$ to $u=e^{-1000/\theta}$.

[6/4/2015] On page 1424, in the solution to exercise 31, on the line for Employee H, under Censored, change "Yes" to "No".

[8/4/2015] On page 1474, in the solution to question 30, on the fifth line, change "or less" to "or greater".

[8/5/2015] On page 1490, the solution to question 3 is incorrect. The correct solution is

Since the average bonus in 2013 is 9.80, the average amount subject to bonus is 9.80/0.05 = 196.

$$\begin{aligned}\mathbf{E}[X\wedge 1500] &= \frac{\theta}{\alpha-1}\left(1-\frac{\theta}{\theta+1500}\right)=196\\ \frac{1500\theta}{\theta+1500} &= 196\\ 1500\theta &= 196\theta+294{,}000\\ \theta &= \frac{294{,}000}{1{,}304}=225.46\end{aligned}$$

In 2014, inflation increases $\theta$ to 225.46(1.05) = 236.73. Then, using $X^*$ for inflated spending on restaurants and gas,

$$0.05\,\mathbf{E}[X^*\wedge 1500]=\frac{0.05(1500)(236.73)}{1500+236.73}=\boxed{\mathbf{10.22}}\qquad\textbf{(E)}$$

[8/5/2015] On page 1503, in the solution to question 7, on the last line, replace the final answer 0.3612 with 0.1806.

[8/5/2015] On page 1492, in the solution to question 11, on the fifth line, replace the expression after Rural with

$$\frac{e^{-(2-1)^2/2(0.5)}}{\sqrt{0.5(2\pi)}} = 0.207554$$

Replace the final line with

$$\frac{0.2(0.207554)(1) + 0.8(0.398942)(2)}{0.2(0.207554) + 0.8(0.398942)} = \boxed{\mathbf{1.8849}} \qquad \textbf{(C)}$$

Since the average bonus in 2013 is 9.80, the average amount subject to bonus is 9.80/0.05 = 196.

$$\begin{aligned}
\mathbf{E}[X \wedge 1500] &= \frac{\theta}{\alpha - 1}\left(1 - \frac{\theta}{\theta + 1500}\right) = 196 \\
\frac{1500\theta}{\theta + 1500} &= 196 \\
1500\theta &= 196\theta + 294{,}000 \\
\theta &= \frac{294{,}000}{1{,}304} = 225.46
\end{aligned}$$

In 2014, inflation increases $\theta$ to 225.46(1.05) = 236.73. Then, using $X^*$ for inflated spending on restaurants and gas,

$$0.05\,\mathbf{E}[X^* \wedge 1500] = \frac{0.05(1500)(236.73)}{1500 + 236.73} = \boxed{\mathbf{10.22}}\,(\mathbf{E})$$

[1/20/2016] On pages 1499–1500, while the solution to question 33 is correct, the following solution may be clearer:

The likelihood of no deaths is $(1-q)^2$. The prior distribution is normal with density $f(q)$. The posterior density function is the likelihood times the prior density, divided by the integral of the likelihood times the prior density. In other words, the posterior density function is

$$\pi(q \mid N_1) = \frac{(1-q)^2 f(q)}{\int_{-\infty}^{\infty}(1-q)^2 f(q)\,\mathrm{d}q} = \frac{(1-q)^2 f(q)}{\mathbf{E}_Q[(1-Q)^2]}$$

where $N_1$ is the observed number of deaths in the first year. The mean of the posterior distribution is

$$\begin{aligned}
\mathbf{E}[Q \mid N_1] &= \frac{\int_{-\infty}^{\infty} q(1-q)^2 f(q)\,\mathrm{d}q}{\mathbf{E}(1-Q)^2} \\
&= \frac{\mathbf{E}[Q(1-Q)^2]}{\mathbf{E}[(1-Q)^2]} \\
&= \frac{\mathbf{E}[(1-(1-Q))(1-Q)^2]}{\mathbf{E}[(1-Q)^2]} \\
&= \frac{\mathbf{E}[(1-Q)^2] - \mathbf{E}[(1-Q)^3]}{\mathbf{E}[(1-Q)^2]}
\end{aligned}$$

$1-Q$ is normal with mean 0.995 and variance 0.000001. So

$$\begin{aligned}
\mathbf{E}[1-Q] &= \mu = 0.995 \\
\mathbf{E}[(1-Q)^2] &= \mu^2 + \sigma^2 = 0.995^2 + 0.000001 = 0.990026
\end{aligned}$$

To obtain $\mathbf{E}[(1-Q)^3]$, we'll use the fact that a normal distribution is symmetric, so that its third central moment is 0.

$$\mathbf{E}[((1-Q)-0.995)^3]=0$$
$$\mathbf{E}[(1-Q)^3]-3\,\mathbf{E}[(1-Q)^2](0.995)+2(0.995)^3=0$$
$$\mathbf{E}[(1-Q)^3]=3\,\mathbf{E}[(1-Q)^2](0.995)-2(0.995)^3=3(0.990026)(0.995)-2(0.995)^3=0.985078$$

The posterior expected value is

$$\frac{0.990026-0.985078}{0.990026}=\boxed{\mathbf{0.004998}}\qquad\textbf{(E)}$$

[1/25/2016] On page 1504, replace the solution to question 11 with the following solution to the revised question:

The total number of exposures is $4+5+10=19$. The weighted observed mean is

$$\bar{X}=\frac{4(10)+5(9)+10(11)}{19}=10.26316$$

The credibility factor is

$$Z=\frac{19}{19+20/1}=\frac{19}{39}$$

The Bühlmann-Straub estimate is

$$\frac{19}{39}(10.26316)+\frac{20}{39}(15)=\boxed{\mathbf{12.6923}}\qquad\textbf{(D)}$$

[1/26/2016] On page 1526, in the solution to question 34, change $m$ to $\hat{m}$ in the three places it appears in the solution.

[5/29/2015] On page 1560, in the solution to question 19, on the fifth line, change $e^{-\ln 4}$ to $e^{\ln 4}$.

[8/3/2015] On page 1591, in the solution to question 6, on the thirds line of the page, change $-\dfrac{1}{11\theta}$ to $-\dfrac{\theta}{11}$.

[8/4/2015] On page 1610, in the solution to question 32, on the first line, change $\frac{1000}{2000}$ to $\frac{2000}{1000}$.