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

Note: Practice Exam 10 question 21 is defective. The question should be fixed as indicated below.

[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.

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

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

[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 $\mathrm{d}\lambda$ 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".

[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 $\displaystyle\int_0^x \frac{2u\,\mathrm{d}u}{1000^2}$.

[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.

[11/30/2009] 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 $2000+500$.

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

[11/30/2009] On page 135, in the solution to exercise 8.14, on the second line, put an **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 $1+\dfrac{-0.9}{0.75} = -0.2$

[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 β 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

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

[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.

[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.

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

[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

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

[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.

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

Using the compound variance formula on our compound model,

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

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

[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

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

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

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

[2/5/2010] On page 347, 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 $f(x_i)$.

[2/4/2010] 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 $\hat{f}(40) = (1/8)(5)(1/8) = \boxed{\mathbf{0.078125}}$.

[1/22/2010] 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 $P_{j+1} = P_j\ldots$.
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.

[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 $1-\hat{q}'_j$.

[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 $\hat{\alpha} = \frac{m^2}{t-m^2}$ and $\hat{\theta} = \frac{t-m^2}{m}$. 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 $\Big(1-F(100;\theta)\Big)^3$.

[2/8/2010] On page 468, 3 lines from the bottom, replace the first θ 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 $\hat{\sigma} = \sqrt{\frac{\sum_{i=1}^{n} \ln^2 x_i}{n} - \hat{\mu}^2}$. 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 $K = \ln \frac{\prod_{i=1}^{n+c} \max(\theta, d_i)}{\prod_{i=1}^{n+c} x_i}$. In the last two formulas, remove the negative signs at the beginning of the two formulas for K.

[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).

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

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

[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".

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

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

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

[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).

[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.

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

[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 λ (once on the second line and twice apiece on the first four displayed lines) with θ.

[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".

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

[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.

[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.

[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: $\theta\sqrt{-\ln(1-u)}$.

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^{th} percentile of the distribution, and $\text{VaR}_p(X)$ is the p^{th} percentile of the distribution, so set $p = u$ and you will have the required formula for the inversion method.

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

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

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

[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.

[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

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

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

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

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

[4/26/2010] On page 1130, in the solution to question 13, on the last line, replace $\frac{(}{8}/9)\theta$ with $(8/9)\theta$.

[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 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

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

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.

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

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

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

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