Errata and updates for ASM Exam 3L (Sixth Edition) sorted by page

Practice exam 1 question 9 is defective. See below for a corrected version of the question. Practice exam 6 question 17 is defective in that none of the answer choices are correct.

[1/20/2009] On page 15, in the solution to exercise 1.12, 3 lines from the end, change the denominator x to m.

[3/24/2008] On page 46, in the solution to exercise 3.19, on the second line, replace $\mu + \sigma^2$ with $\sigma^2 + \mu^2$.

[1/31/2009] On page 47, in the solution to exercise 3.22, on the last line, change 37,504.8 to 310.0782.

[1/23/2008] On page 49, in the solution to exercise 3.26, on the first line of the page, move the exponent 2 out of the parentheses: $(30 - \theta)^2$.

[10/22/2008] On page 64, the final answer to exercise 4.2 should be **13/60**.

[1/30/2008] On page 71, there are typos in each of the first three displayed lines of the solution to exercise 4.27. Replace them with

$$f(x;\theta,\tau) = \tau\left(\frac{x^{\tau-1}}{\theta^\tau}\right)e^{-(x/\theta)^\tau} \qquad x \geq 0$$

$$L(\theta) = \frac{1}{\theta^5}e^{-\sum(X_i/\theta)^{0.5}}$$

$$l(\theta) = -5\ln\theta - \left(\frac{\sum X_i^{0.5}}{\theta^{0.5}}\right)$$

[2/2/2008] On page 76, on the 5th displayed line of the page, change the integrand on the left hand side to $xf_Y(x)\mathrm{d}x$.

[3/16/2008] On page 84, in the solution to exercise 5.2, on the second to last line, replace $\mu'3$ and $\mu'2$ with μ'_3 and μ'_2 respectively.

[10/22/2008] On page 96, in exercise 6.8 choice A, delete an equal sign.

[3/16/2008] On page 117, in exercise 8.2, on the last line of the question, replace "text" with "test".

[3/16/2008] On page 132, on the second line of the answer to Example 9B, change $\Phi^{-1}(0.01)$ to $\Phi^{-1}(0.99)$.

[10/24/2008] On page 134, in the solution to exercise 9.4, on the second displayed line, change $\sqrt{50}n$ to $\sqrt{50/n}$.

[2/27/2008] On page 138, on the last line of the solution to Example 10B, the final answer should be **(8,803, 33,197)**.

[9/7/2008] On page 139, on the first line, replace $\frac{\bar{X}}{S}$ with $\frac{\bar{X}-\mu}{S/\sqrt{n}}$.

[10/22/2008] On page 140, in exercise 10.4, on the first line, replace "by" with "be".

[3/1/2008] On page 149, on the second line, insert the word "we" between "Suppose" and "have".

[3/1/2008] On page 150, on the first line, replace 0.001 with 0.01.

[1/28/2009] On page 151, in Example 11C, the table should have, for substandard classes B and C, 15 and 10 instead of 10 and 5 respectively. On the last displayed line of the answer, the sum of the last two fractions should be $\frac{(15-10)^2}{10} + \frac{(10-10)^2}{10}$.

[4/14/2008] On page 166, in the solution to exercise 12.8, change $\frac{1{,}282-11^2}{10}$ to $\frac{1{,}282}{10} - 11^2$.

[1/24/2009] On page 166, in the solution to exercise 12.9, on the fourth line, change "highest" to "lowest".

[3/19/2008] On page 170, on the 4th line from the bottom, put a hat on β^2.

[1/26/2009] On page 171, one line above Section 13.3, the numerator of the fraction on that line should be $(\sum x_i y_i)^2$.

[10/4/2008] On page 173, in the second line of the answer to Example 13F, change $\frac{10}{3}$ to $\frac{10}{6}$. The last 2 lines of the solution to Example 13F should read:

$$R^2 = \frac{F_{1,N-2}}{N-2+F_{1,N-2}}$$
$$= \frac{3.4596}{13+3.4596} = \boxed{\mathbf{0.2102}}$$

[2/21/2009] On page 177, in question 13.20, in the equation for s_Y^2, there should be a period, not a comma, between 3 and 5: 3.5.

[1/26/2009] On page 179, in exercise 13.28, there should be a summation sign before $(X_i - \bar{X})^2$.

[3/19/2008] On page 180, on the second line of the solution to exercise 13.2, put a square root over $\frac{\sum y^2}{\sum x^2}$.

[3/19/2008] On page 182, in the solution to exercise 13.12, on the second line, replace RSS in the numerator and denominator with R^2. On the last line, replace *sqrt* with a square root sign over F.

[1/24/2009] On page 182, in the solution to exercise 13.14, change $\sum X_i$ to $\sum X_i^2$.

[2/21/2009] On page 187, in exercise 14.3, on the second line, replace $g(x)$ with $g(y)$.

[1/31/2008] On page 195, in the solution to exercise 15.2, replace the phrase "multiplying by -1" on the 3rd displayed line with "taking reciprocals and setting $\frac{1}{k}$ equal to a new constant which we call k".

[12/26/2007] On page 215, in the solution to exercise 17.6, the second denominator of the last line is incorrect. The last line should read

$$\left(\frac{9{,}471{,}591 - 9{,}455{,}522}{9{,}617{,}802}\right)\left(\frac{8{,}563{,}435}{9{,}607{,}896}\right) = \boxed{\mathbf{0.001489}} \qquad \textbf{(C)}$$

[7/25/2008] On page 215, in the solution to exercise 17.9, on the 4th displayed line, replace the denominator vw with uv.

[1/19/2008] On page 237, 3 lines before the exercises, put a right parenthesis after $\tau > 1$.

[1/19/2008] On page 244, on the second line after equation (20.5), replace $\omega/2$ with $\frac{\omega - x}{2}$.

[2/11/2008] On page 255, SOA M-F06:16,17 should not be in the list of released exam questions relevant to this lesson. Add SOA M-S05:21 to the list.

[2/14/2009] On page 259, in the solution to exercise 20.23, on the seventh displayed line, change $\text{Var}(T(30 \wedge 30)$ to $\text{Var}(T(30 \wedge 10)$.

[12/26/2007] On page 274, in the solution to exercise 21.6, on the 3rd and last lines, replace 10.192 with 10.1933. 4 lines from the end, p'_x should be p'_{25}. On the last line, the final answer is 0.8047 instead of 0.8034.

[7/13/2008] On page 275, in the solution to exercise 21.11, on the 4th displayed line, e_x should be e'_x.

[1/31/2008] On page 292, in the solution to exercise 22.5, on the second displayed line, replace 4,630,360 with 4,530,360.

[9/7/2008] On page 306, in exercise 23.9, replace all 7 λ's with δ's.

[2/4/2008] On page 323, on the last line of subsubsection 24.3.2, delete "in the passage labeled 53".

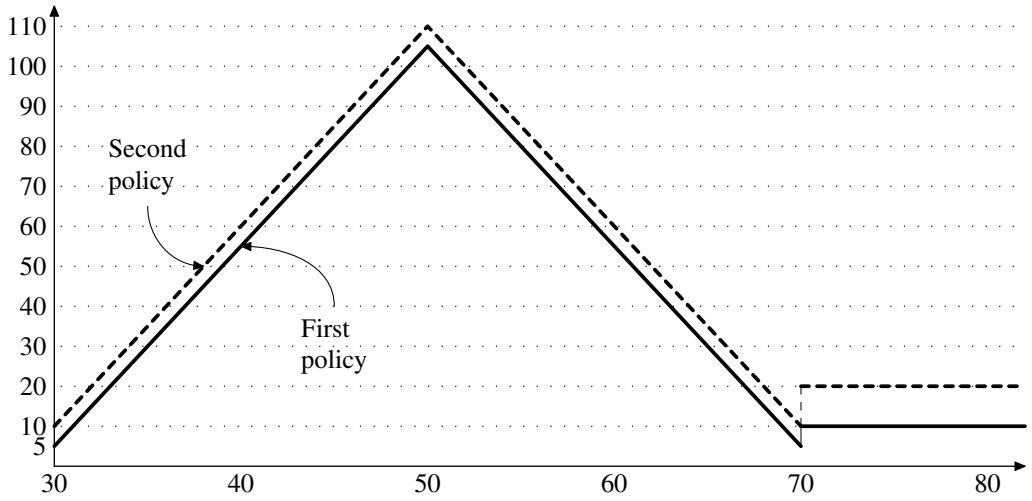
[3/24/2009] On page 335, in the solution to exercise 24.7, on the 3rd line of the page, there should be a negative sign before the expression:

$$= -\left(\frac{0.02}{0.1}\right)\left(\frac{1}{1+0.1t}\right)\Bigg|_0^{50}$$

[1/21/2008] On page 342, in the solution to exercise 24.28, on the second line, replace the first ${}_np_x$ with ${}_nq_x$.

[7/20/2008] On page 343, in the boldfaced line, replace $1 - 100p^{\text{th}}$ with $100(1-p)^{\text{th}}$.

[3/4/2009] On page 371, Figure 26.1 is incorrect. The correct figure is



[3/10/2009] On page 388, the solution to exercise 27.2 is incorrect. The correct solution is

The benefit premium is

$$10{,}000A_{63} = \frac{5233}{1.12} = 4672.32,$$

so $A_{63} = 0.467232$. We use the equation

$$A_{63} = vq_{63} + v^2 p_{63}\, q_{64} + v^2\, {}_2p_{63}\, A_{65}$$

and the values of $q_{63} = 0.01788$, $q_{64} = 0.01952$, $l_{63} = 7{,}823{,}879$, $l_{65} = 7{,}533{,}984$ to obtain:

$$\begin{aligned}
{}_2p_{63} &= \frac{l_{65}}{l_{63}} = \frac{7{,}533{,}984}{7{,}823{,}879} = 0.962947 \\
0.467232 &= \frac{0.01788}{1.05} + \frac{(1-0.01788)(0.01952)}{1.05^2} + \frac{0.962947}{1.05^2}A_{65} \\
0.467232 &= 0.017029 + 0.017389 + 0.873422A_{65} \\
A_{65} &= \frac{0.467232 - 0.017029 - 0.017389}{0.873422} = 0.49554
\end{aligned}$$

The contract premium at 65 is $1.12(10{,}000)(0.49554) = 5550$. The earnings rate needed is $\left(\frac{5550}{5233}\right)^{1/2} - 1 =$ **0.030**. **(A)**

[2/23/2009] On page 395, on the second line of the third paragraph, change "present variable" to "present value".

[7/13/2008] On page 405, on the last line, SOA MLC-S07:24 belongs to lesson 29.

[1/15/2009] On page 412, on the last line of the solution to Example 29B, replace ${}_{30|}\ddot{a}_{35}$ with $\ddot{a}_{35:\overline{30}|}$.

[1/19/2008] On page 439, in the solution to exercise 29.44, on the third line, change "begin" to "being".

[10/22/2008] On page 441, in the paragraph before Example 30A, it is stated that all the formulas can be used for annuities-due by replacing δ with d. Actually, in the last formula, ${}^2\bar{A}_x = 1 - (2\delta)\,{}^2\bar{a}_x$, 2δ should be replaced with d at twice the force of interest, which is $2d - d^2$.

[2/18/2008] On page 457, in the solution to exercise 30.23, on the first displayed line, replace $Ap2_{40}$ with ${}^2A_{40}$.

[7/14/2008] On page 470, in exercise 31.31, on the fifth line, change "the" to "then".

[3/31/2009] On page 478, in the solution to exercise 31.31, on lines 5, 4, and 3 from the end of the solution, change ${}_{9|}\ddot{a}_x$ to ${}_{9|}\ddot{a}_{x+1}$.

[3/3/2009] On page 495, in the solution to exercise 30.2, on the first line, there should be a bar over the A.

[1/24/2009] On page 503, the information in the box at the top should be used for questions 33.20–33.23 (not just for 33.20 and 33.21).

[1/26/2008] On page 505, in exercise 33.29(vi), change "live" to "life".

[1/24/2008] On page 513, in the solution to exercise 33.2, 6 lines from the end, an annuity symbol is missing; it should read

$$\ddot{a}_{35:\overline{15|}} = \ddot{a}_{35} - {}_{15}E_{35}\,\ddot{a}_{50}$$

[4/3/2009] On page 528, in the solution to exercise 33.53, move the right parenthesis of the second line past d:

$${}_{15}E_{30}\left(d + \frac{1}{\ddot{a}_{30:\overline{15|}}} - d\right) = \frac{1}{\ddot{s}_{30:\overline{15|}}}$$

[10/29/2008] On page 529, on the first line of the answer to Example 34A, change "25th" to "75th".

[3/24/2009] On page 569, in the solution to exercise 37.9, on the second to last line, change "end of the third year" to "end of the second year".

[5/7/2008] On page 570, in the solution to exercise 37.14, on the fourth line, change $\frac{1000}{0.06}$ to $\frac{1000}{1/0.06}$.

[2/2/2008] On page 583, in the solution to exercise 38.1, put bars on $A^1_{30:\overline{10|}}$ on the first and second lines, and ${}_{10}k_{30}$ on the last line.

[4/12/2009] On page 583, in the solution to exercise 38.3, on the third line, change "present value of future benefits" to "present value of future premiums".

[3/1/2009] On page 585, in the solution to exercise 38.7, on the third line, replace ${}_{15}\ddot{a}_{10:\overline{30|}}$ with ${}_{15|}\ddot{a}_{10:\overline{30|}}$.

[3/1/2009] On page 585, in the solution to exercise 38.8, "the insurance formula" refers to the insurance-ratio formula, equation (29.2).

[3/19/2008] On page 589, in the solution to exercise 38.24, on the third line, change $\frac{1}{0.8}$ to $\frac{1}{0.08}$.

[3/3/2009] On page 615, in the solution to exercise 40.2, on the first line, there should be a bar over the A.

[4/2/2008] On page 617, in the solution to exercise 40.13, on the last line, replace 0.961530 with 0.956320.

[1/28/2008] On page 667, add SOA M-F06:17 to the list of released exam questions.

[2/14/2009] On page 672, in the solution to exercise 44.15, on the first displayed line of the page, put negative signs in both numerators so it reads

$$= \frac{1}{5250}\left(\frac{-(75-x)^3}{3}\bigg|_0^{70} - \frac{-5(75-x)^2}{2}\bigg|_0^{70}\right)$$

[3/27/1980] On page 683, on the last line of the solution to exercise 45.20, put a bar over $A_{55:55}$: $\bar{A}_{55:55}$.

[7/20/2008] On page 689, on the 2nd and 4th lines of the page, change 7.142957 to 7.142857.

[3/16/2008] On page 694, in the solution to exercise 46.7, on the third line, replace $\ddot{a}_x$ with $\ddot{a}_z$. z refers to an arbitrary life with constant force of mortality μ. On the next line, put a t in the exponent in the sum: $e^{(-0.08-\mu)t}$.

[5/11/2008] On page 698, in the solution to exercise 46.15, there are v's missing from the second and third displayed lines. They should read

$$\begin{aligned}
&= \ddot{a}_{x:\overline{10|}} + v^{10}{}_{10}p_x \sum_{t=0}^{9} v^t {}_tp_y \, {}_tp_y \\
&= \ddot{a}_{x:\overline{10|}} + {}_{10}E_x \ddot{a}_{yy:\overline{10|}}
\end{aligned}$$

[4/7/2008] On page 704, in the table of exercise 47.7, change both subscripts $x + t - 1$ to x.

[4/19/2009] On page 722, in the solution to exercise 48.2, on the second line, change $0.2k^{-0.8t}$ to $0.2ke^{-0.8t}$.

[3/31/2008] On page 723, in the solution to exercise 48.3, on the first, second, and fourth displayed lines, the right subscript of p should be 40 instead of 0.

[5/7/2009] On page 724, in the solution to exercise 48.15, on the third displayed line, move the subscript x on the (τ) in the exponent to p: ${}_tp_x^{(\tau)}$.

[5/7/2009] On page 726, in the solution to exercise 48.21, on the last line, move the exponent outside the parentheses into the denominator and remove the parentheses:

$$\frac{6{,}616{,}155^2 - 6{,}396{,}609^2}{8{,}188{,}073^2}$$

[9/13/2008] On page 750, in the solution to exercise 50.16, on the fifth line, change "is 0.1, for a product of 0.05" to "is 0.2, for a product of 0.1".

[5/11/2008] On page 752, the discussion starting in the 3rd paragraph calculates value only of the one-time benefits of the prototype example, namely the death benefit and the 100 paid upon disability.

[4/7/2008] On page 753, on the last line, put a subscript 1 on ${}_3Q^{(1,4)}$.

[2/9/2008] On page 778, the solution to Example 53B is incorrect. Replace the part of the solution on page 778 (from the top) with the following. In the following, for convenience, the last 2 lines of page 789 (which are unchanged) are also given

$$\begin{aligned}
E[T] &= \int_0^\infty e^{-\int_0^u 0.1t\,\mathrm{d}t} \mathrm{d}u \\
&= \int_0^\infty e^{-0.1u^2/2} \\
&= \int_0^\infty e^{-u^2/(2\sqrt{10}^2)} \mathrm{d}u
\end{aligned}$$

This is the integrand of a normal distribution function with $\mu = 0$, $\sigma = \sqrt{10}$, except that it is missing the constant $\frac{1}{\sigma\sqrt{2\pi}}$. Therefore, it is equal to $\sigma\sqrt{2\pi}[1 - \Phi(0)]$, and we have

$$E[T] = \sigma\sqrt{2\pi}[1 - \Phi(0)] = \sqrt{10}\sqrt{2\pi}\,(0.5) = \boxed{\mathbf{3.963}}$$

[4/26/2009] On page 778, in the sentence after the boldfaced sentence, and the word "know" between "not" and "how". Also, Quiz 53-1 is the same as Example 53D.

[2/9/2008] On page 779, on the first line of the solution to Example 53F, replace "fifth" with "ninth".

[2/13/2008] On page 785, in the answer to Example 54F, replace the displayed line with

$$\int_2^{10} 50\left(0.8 - 0.1e^{-t}\right)\mathrm{d}t = 40(10-2) + 5e^{-t}\Big|_2^{10} = 320 + 5\left(e^{-10} - e^{-2}\right) = \boxed{\mathbf{319.3236}}$$

[2/13/2008] On page 785, on the line after Example 54F, delete the word "this".

[11/2/2008] On page 789, in exercise 54.20, on the first line after "guests arrive", add the words "in a Poisson process". Change the displayed line to

$$F(t) = t^2 \qquad 0 \le t \le 1$$

[4/27/2009] On page 790, in the solution to exercise 54.5, on the sixth displayed line, delete $\frac{1}{2}$ in front of $e^{-1/2}$.

[11/2/2008] On page 792, replace the solution to exercise 54.20 with

We must determine the mean value for guests arriving and not being greeted.

Guests arriving from times $t = 0$ to 1 are always greeted. For guests arriving at time $t > 1$, the probability of not being greeted by time 2, since there is $2 - t$ minutes from time t to time 2, is the complement of $F(2-t)$, or $1 - (2-t)^2$. We must integrate 2 guests per minute times this function from 1 to 2. To make the integral easier, we'll change the variable $u = t - 1$ and integrate 2 guests per minutes times $1 - (1-u)^2$ from 0 to 1 to obtain the mean value:

$$\int_0^1 2\left[1 - (1-u)^2\right]\mathrm{d}u = 2 + \frac{2}{3}(1-u)^3\Big|_0^1 = \frac{4}{3}$$

The probability that at least 1 guest is ungreeted is $1 - e^{-4/3} = \boxed{\mathbf{0.736403}}$.

[4/3/2008] On page 793, the solution to Quiz 54-2 is incorrect. The correct solution is

For the process with 1's, there is no variance since we are told the exact value. For the other two processes, the variance equals the mean. All processes are independent. If N_5 is the number of 5's and N_{10} the number of 10's, then the variance of the value of the coins is

$$\mathrm{Var}(5N_5 + 10N_{10}) = 5^2\,\mathrm{Var}(N_5) + 10^2\,\mathrm{Var}(N_{10}) = 3(25) + 3(100) = \boxed{\mathbf{375}}$$

[2/13/2008] On page 795, in Example 55A, on the last line delete the word "no" and on the second line of the answer delete the word "no". Also on the last line, change "events" to "event".

[2/13/2008] On pages 796–797, in the answer to Example 55C, change all 8 ">"s to "≥".

[4/23/2008] On page 797, in property 2 of the negative binomial, switch the exponents k and r:

$$\Pr(N = k) = \binom{r+k-1}{k}\left(\frac{1}{1+\beta}\right)^r\left(\frac{\beta}{1+\beta}\right)^k$$

[4/7/2008] On page 799, replace Quiz 55-2 with:

For policyholders under dental policies:

2/3 of them submit claims in a Poisson process at a rate of 2 per year.

1/3 of them submit claims in a Poisson process at a rate of 0.5 per year.

A group has 100 policyholders selected at random.

Calculate x for which the probability that the total number of claims from this group over the course of 1 month is less than x is at least 95%, using a normal approximation.

[2/27/2008] On page 802, the last two lines of the solution to exercise 55.4 are incorrect, because the second moment of an exponential is twice the square of the mean. The correct lines are

$$E[X^2] = 0.75(2(5^2)) + 0.25(2(15^2)) = 150$$
$$\text{Var}(X) = 150 - 7.5^2 = \boxed{\mathbf{93.75}}$$

[2/10/2008] On page 802, the solution to exercise 55.9 is incorrect. The correct solution is

For 10 days, the Poisson rate is 10λ, which has mean $10(0.2) = 2$ and variance $10^2(0.1) = 10$. A gamma distribution with this mean and variance has $\alpha\theta = 2$ and $\alpha\theta^2 = 10$, making $\theta = 5$ and $\alpha = 0.4$. The corresponding negative binomial distribution has $r = 0.4$ and $\beta = 5$. The probability of at least 2 applications is

$$1 - p_0 - p_1 = 1 - \left(\frac{1}{6}\right)^{0.4} - 0.4\left(\frac{1}{6}\right)^{0.4}\left(\frac{5}{6}\right) = 1 - 0.488359 - 0.162786 = \boxed{\mathbf{0.3489}}$$

[4/23/2008] On page 803, the solution to exercise 55.11 is incorrect starting with "The probability of 1 cod". The correct solution from that point on is:

The probability of 1 cod is

$$\int_{0.5}^{1.5} 2.8\lambda e^{-2.8\lambda} \mathrm{d}\lambda$$

Let's use our technique for evaluating an incomplete gamma integral. The integrand is for a gamma distribution with $\alpha = 2$, $\theta = 1/2.8$, and should have the constant 2.8^2 instead of 2.8. It represents the probability of at least 2 arrivals by time 1.5 minus the probability of at least 2 arrivals by time 0.5 with a Poisson parameter of 2.8. This is

$$\left[1 - e^{-4.2}(1 + 4.2)\right] - \left[1 - e^{-1.4}(1 + 1.4)\right] = 0.922023 - 0.408167 = 0.513856$$

Divide by the missing constant: $0.513856/2.8 = 0.183520$.

The probability of 2 or more cod is $1 - 0.082715 - 0.183520 = \boxed{\mathbf{0.73377}}$.

[4/27/2009] On page 803, in the solution to exercise 55.12, on the second line, change $2(1 + 1) = 2$ to $2(1 + 1) = 4$.

[4/7/2008] On page 804, replace the solution to Quiz 55-2 (note that the quiz itself is also replaced; see the above) with

Since policyholders are selected at random, the number of claims from each policyholder is a *mixture of Poisson distributions*. The mean number of claims (N) in a month for a policyholder is

$$E[N] = \left(\frac{2}{3}\right)\left(\frac{2}{12}\right) + \left(\frac{1}{3}\right)\left(\frac{0.5}{12}\right) = 0.125$$

The second moment of the number of claims is

$$E[N^2] = \left(\frac{2}{3}\right)\left[\left(\frac{2}{12}\right)^2 + \frac{2}{12}\right] + \left(\frac{1}{3}\right)\left[\left(\frac{0.5}{12}\right)^2 + \frac{0.5}{12}\right] = 0.144097$$

So the variance is

$$\text{Var}(N) = 0.144097 - 0.125^2 = 0.128472$$

As expected, the variance is greater than the mean for a mixture. Using the normal approximation for 100 policyholders, we have

$$100E[N] + 1.645\sqrt{100\,\mathrm{Var}(N)} = 12.5 + 16.45\sqrt{0.128472} = 18.3962$$

Since we need at least 95% probability of having *less than x* claims, we set $x =$ **19**.

[4/23/2008] On page 818, the solution to exercise 56.29 is incorrect. The correct solution is

Severity is a mixture distribution with weights 0.527332 (as calculated in the previous exercise) and the complement, 0.472668. Let X be the damage in millions. Since an exponential is memoryless, the distribution of the excess damage amount over 3,000,000 given that the damage is greater than 3,000,000, or $X-3|X>3$, is the same as the unconditional distribution. So the moments are the same. Moreover, the standard deviation of $X|X>3$ (which is what we want to calculate) is the same as the standard deviation of $X-3|X>3$, since subtracting a constant from a random variable does not affect the standard deviation. So we'll compute $\mathrm{Var}(X-3|X>3)$.

Let X_1 and X_2 be the damage of windstorms and floods in millions respectively; X is still the damage of the mixture in millions. The second moment of an exponential is twice the mean squared. So

$$\begin{aligned}
E[X-3|X>3] &= 0.527332E[X_1-3|X_1>3] + 0.472668E[X_2-3|X_2>3] \\
&= 0.527332(1) + 0.472668(2) = 1.472668 \\
E[(X-3)^2|X>3] &= 0.527332[2(1^2)] + 0.472668[2(2^2)] = 4.836007 \\
\mathrm{Var}(X-3|X>3) &= 4.836007 - 1.472668^2 = 2.667526
\end{aligned}$$

The standard deviation is $1{,}000{,}000\sqrt{2.667256} =$ **1,633,174**.

[4/23/2009] On page 823, question 9 is defective. Replace it with the following:

A Normal random variable is known to have mean 5. For a sample of five observations from the variable, $\sum_{i=1}^{5}(x_i-5)^2 = 175$.

Construct a 95% confidence interval of the form (a,∞) for the variance.

Determine a.

(A) Less than 12
(B) At least 12, but less than 14
(C) At least 14, but less than 16
(D) At least 16, but less than 18
(E) At least 18

[3/25/2009] On page 825, in question 15, divide all the answer choices by 10:

(A) Less than 0.0045
(B) At least 0.0045, but less than 0.0055
(C) At least 0.0055, but less than 0.0065
(D) At least 0.0065, but less than 0.0075
(E) At least 0.0075

[4/23/2009] On page 881, replace the solution to question 9 with the following:

Let σ^2 be the true variance. Let $W = \sum_{i=1}^{5}(x_i - 5)^2/\sigma^2$. Then by the definition of the chi-square distribution, W is a chi-square random variable with 5 degrees of freedom. So

$$\sigma^2 \sim \frac{175}{W}$$

To find the lower bound a of a 95% confidence interval, we use the 95th percentile of W, or 11.070:

$$a = \frac{175}{11.070} = \boxed{\textbf{15.808}} \qquad \textbf{(C)}$$

[4/2/2008] On page 884, the solution to question 22 is incorrect. The correct solution is

We have a homogeneous Markov chain with three states: preferred, standard, and gone (not renewed). The transition matrix, with the three states in this order, is

$$\begin{pmatrix} 0.7 & 0.2 & 0.1 \\ 0.4 & 0.5 & 0.1 \\ 0 & 0 & 1 \end{pmatrix}$$

Since we have to condition the expectation on renewing 3 times, we consider all 8 possible paths for a driver who renews 3 times, calculate the probability of each path and the number of transitions in each path. Since the probability of renewal is 0.9 each year, the probability of renewing 3 times, which will be the sum of the 8 probabilities of the paths, is $0.9^3 = 0.729$. In the following table, the path PSS (for example) means being in the preferred state after the first renewal and the standard state after the second and third renewals. The probability of each path is the product of the probabilities of the 3 transitions. All probabilities in this table are unconditional; they are not conditioned on renewing.

Path	Probability of Year 1	Probability of Year 2	Probability of Year 3	Probability of Path	Number of Transitions
PPP	0.7	0.7	0.7	0.343	0
PPS	0.7	0.7	0.2	0.098	1
PSP	0.7	0.2	0.4	0.056	2
PSS	0.7	0.2	0.5	0.070	1
SPP	0.2	0.4	0.7	0.056	2
SPS	0.2	0.4	0.2	0.016	3
SSP	0.2	0.5	0.4	0.040	2
SSS	0.2	0.5	0.5	0.050	1
Total				0.729	0.570

0.570 is the weighted average of the probabilities:

$$0.343(0) + 0.098(1) + 0.056(2) + 0.070(1) + 0.056(2) + 0.016(3) + 0.040(2) + 0.050(1) = 0.570$$

The conditional expected value is 0.0570 divided by 0.729: $0.570/0.729 = \boxed{\textbf{0.78189}}$. **(C)**

[5/3/2009] On page 891, in the solution to question 20, there are a few minor errors on the first displayed line. It should read

$$\frac{\alpha_0^n 100^{n\alpha_0} / \prod(100 + x_i)^{\alpha_0+1}}{\alpha^n 100^{n\alpha} / \prod(100 + x_i)^{\alpha+1}} = \left(\frac{\alpha_0}{\alpha}\right)^n 100^{n(\alpha_0-\alpha)} \prod(100 + x_i)^{\alpha-\alpha_0}$$

[5/3/2008] On page 902, in the solution to question 4, on the third displayed line, delete the fraction $\frac{2}{3}$ on the right hand side.

[4/16/2008] On page 908, the solution to question 22 is incorrect. The correct solution is

We are testing the difference of means, $\mu_1 - \mu_2$. We calculate the pooled variance

$$s^2 = \frac{129(2000^2) + 79(1500^2)}{130 + 80 - 2} = 3{,}335{,}337$$

and the standard deviation for the combined sample is then $\sqrt{3{,}335{,}337}\left(\frac{1}{130} + \frac{1}{80}\right) = 259.52$. The means are $\frac{100{,}000}{130} = 769.23$ and $\frac{20{,}000}{80} = 250$. Thus we need

$$1 - \Phi\left(\frac{769.23 - 250}{259.52}\right) = 1 - \Phi(2.00) = 0.0228.$$

Since it is a two-sided test, we double 0.0228 and get 0.0456, so the answer is **(C)**.

[4/23/2008] On page 911, the correct answer choice for question 5 is **(C)** instead of **(D)**. Also correct the table on page 909.

[5/7/2008] On page 918, in the answer key, the answer to 23 should be E.

[5/3/2008] On pages 920–921, in the solution to question 9, all 4 A's and 2 a's on the left sides of the equations are continuous functions and should have bars.

[5/7/2008] On pages 923–924, the solution to question 17 is incorrect. The correct solution is

Let Y_1, Y_2, Y_3 be the order statistics. Then $\frac{Y_1+Y_3}{2}$ is the midrange. We compute the expected value of Y_1 and Y_3. It is helpful to know that $\int_0^\infty xe^{-nx}\mathrm{d}x = 1/n^2$, which follows from the fact that for an exponential X with mean $1/n$,

$$\frac{1}{n} = E[X] = \int_0^\infty nxe^{-nx}\mathrm{d}x$$

$$\begin{aligned}
f(y_1) &= \frac{3!}{1!2!} f(x)\Big(1 - F(x)\Big)^2 \\
&= 3e^{-3x} \\
E[Y_1] &= \int_0^\infty 3xe^{-3x}\mathrm{d}x = \frac{1}{3} \\
f(y_3) &= \frac{3!}{1!2!} F(x)^2 f(x) \\
&= 3\left(1 - e^{-x}\right)^2 e^{-x} \\
E[Y_3] &= \int_0^\infty \left(3xe^{-x} - 6xe^{-2x} + 3xe^{-3x}\right)\mathrm{d}x \\
&= 3 - \frac{6}{4} + \frac{3}{9} = \frac{11}{6}
\end{aligned}$$

Therefore, the expected value of the midrange is $\left(\frac{1}{3} + \frac{11}{6}\right)/2 = \frac{13}{12}$.

The median m satisfies:

$$\begin{aligned}
e^{-m} &= 0.5 \\
m &= \ln 2
\end{aligned}$$

The bias is $\frac{13}{12} - \ln 2 = 0.3902$.

[4/24/2008] On pages 945–948, the solutions for questions 14–25 are misnumbered as 13–24. The solution to question 13, which is based on lesson 22, is

$$
\begin{aligned}
{}_{0.5}q_{90.25} &= \frac{0.5q_{90}}{1-0.25q_{90}} = \frac{0.5(0.1587)}{1-0.25(0.1587)} = 0.08263 \\
{}_{0.5}p_{90.25} &= 1 - 0.08263 = \boxed{\mathbf{0.91737}} \qquad \mathbf{(A)}
\end{aligned}
$$

[1/19/2008] On page 969, in the solution to question 40, on the 4th line, change "begin" to "being".

[1/28/2008] On page 971, SOA Fall 2006 question 16 is NS and question 17 is 44.

[5/3/2008] On page 972, the columns for practice exams 6 and 7 are interchanged.