Errata and Updates for ASM Exam MLC (Fifteenth Edition Second Printing) Sorted by Page

[8/28/2016] On page xvi, in the table, change the entry for Fall 15 Interest rate models from 20 to 10.

[9/12/2016] On page xx, on the second line from the bottom, add "of" between "printing" and "the".

[1/6/2017] On page 49, in exercise 3.36, on the second line, change $0 \le x \le 1$ to $0 \le x < 1$.

[12/30/2016] On page 99, in the solution to exercise 5.2, on the second and fourth lines, in the integral in the exponent, change μ_u to μ_{25+u}.

[1/10/2017] On page 103, in the solution to exercise 5.21, on the sixth line, replace "$u = e^{-0.01t}$ and $v = \left(\frac{60-t}{50}\right)$." with "where $u = \left(\frac{60-t}{50}\right)$ and $\mathrm{d}v = e^{-0.01t}\,\mathrm{d}t$."

[7/25/2017] On page 194, in Example 10H, on the third line, change $A^{(2)}_{\overset{1}{x}:\overline{2}|}$ to $A^{(2)}_{\overset{1}{45}:\overline{2}|}$. Make the same correction on the third and seventh lines of the answer.

[8/6/2017] On page 256, on the fifth line of Subsection 12.2.1, add "this" before "section".

[1/23/2017] On page 285, 5 lines from the bottom of the page, replace the incomplete phrase "since there is a 40" with

since there is a 40% chance of surviving t years, so there is a 60% chance of not surviving that long. Then

[1/23/2017] On page 286, replace "highest 20" at the end of the second line to the answer to Example 13K with

highest 20% of its possible values. The 80th percentile of Z is then v^t. To compute t, we need to make $\Pr(20 \le T_{30} \le t) = 0.2$, or ${}_{20}p_{30} - {}_tp_{30} = 0.2$.

[1/23/2017] On page 290, in exercise 13.12, replace (i) with

principal and accumulated interest at 16% compounded annually at the end of 20 years if it does not default.

Replace the fourth line with

A risk-free investment will pay principal and accumulated interest at 10% compounded annually at the end of 20 years.

[1/23/2017] On page 295, in the solution to exercise 13.12, on the third line, the incomplete sentence "Just because the bonds pay 10" should be replaced with the following:

Just because the bonds pay 10% or 16% does not imply that we should use one of those as a valuation rate. The valuation rate doesn't matter!

[1/23/2017] On page 296, in the solution to exercise 13.17, replace the first two lines with

Z is highest when T_x is lowest. We want t such that the probability of living beyond t is 30%, or ${}_tp_x = 0.3$. For this beta distribution of mortality, ${}_tp_x = \left(\frac{40-t}{40}\right)^{0.3}$.

[1/23/2017] On page 297, in the solution to exercise 13.19, on the tenth line, replace "of time is 25" with

of time is 25%, or for which ${}_tp_{25} = 0.75$) correspond to the 75th percentile of the present value of the insurance.

[6/14/2016] On page 352, in Section 17.2, on the line below the timeline, change "annuity-due" to "annuity-immediate".

[3/6/2017] On page 426, in the solution to exercise 19.19, on the fourth line, put an exponent 2 on the last term in the numerator:

$$= \frac{1 - 2\delta({}^2\bar{a}_{x:\overline{n}|}) - (1 - \delta\,\bar{a}_{x:\overline{n}|})^2}{\delta^2}$$

[8/14/2017] On page 429, in the solution to exercise 19.26, on the first two lines, replace T_x with $K_x + 1$ four times.

[3/4/2017] On page 438, in the second paragraph of Section 20.2, on the fourth line, replace (14/5) with (14/6).

[1/3/2017] On page 540, in the answer to Example 26C, on the first line, delete “death”.

[8/24/2017] On page 582, on the first line of the answer to Example 29B, change $\bar{A}_x^2$ to A_x^2 (remove the bar).

[8/28/2016] On page 702, in exercise 36.6, change the last line to

Calculate the net premium reserve at the beginning of year 2, after the premium has been paid.

[1/12/2017] On page 735, in the solution to exercise 37.27, the notation is sloppy. The following solution cleans up the notational errors:

The retrospective reserve for our policy is the same as for a standard whole life insurance of 1000. Using the insurance-ratio formula, that is

$$1000\,{}_{20}V_{40} = 1000\left(\frac{0.4 - 0.2}{1 - 0.2}\right) = 250$$

Prospectively, the net premium reserve for our special policy can be expressed as $2000A_{60} - P\ddot{a}_{60} = 800 - P\ddot{a}_{60}$. Let’s calculate $\ddot{a}_{60}$. To do this, let’s back out d.

$$\begin{aligned}
0.0095 &= \frac{dA_{40}}{1 - A_{40}} \\
0.0095 &= \frac{0.2d}{0.8} \\
d &= \frac{0.0095(0.8)}{0.2} = 0.038 \\
\ddot{a}_{60} &= \frac{1 - A_{60}}{d} = \frac{1 - 0.4}{0.038} = 15.78947
\end{aligned}$$

Now we can back out P from the time-20 reserve.

$$\begin{aligned}
250 &= 800 - 15.78947P \\
P &= \frac{550}{15.78947} = \boxed{\mathbf{34.83}}
\end{aligned}$$

[1/10/2017] On page 757, on the last line of Example 39D, add “at time 14” between “future loss” and “increase”.

[6/18/2017] On page 799, in the solution to exercise 39.60(c), on the first displayed line, change $\ddot{a}_{\overline{\omega-x}|}$ to $\ddot{a}_{\overline{20}|}$. On the second displayed line, change $\ddot{a}_{\overline{20}|}$ to $\ddot{a}_{\overline{\omega-x}|}$.

[10/18/2016] On page 800, in the solution to exercise 39.63, on the second line, change $+d$ to $-d$.

[9/7/2017] On page 804, on the first line (below Table 40.1), change $\alpha - \beta$ to $\beta - \alpha$.

[1/10/2017] On page 815, in the solution to exercise 40.16, on the last line of the page, change ${}_{20}q_{55}$ to ${}_{20}p_{55}$.

[7/13/2016] On page 835, in exercise 41.38, on the first line, change “insurance of 1” to “insurance of 1000”.

[2/26/2017] On page 841, in the solution to exercise 41.16, replace the last four lines with

$$
\begin{aligned}
{}_{8.5}V &= \frac{(1122+175)_{8.25}V+P}{1.1^{0.25}} - \frac{10{,}000(0.010154/1.048809)}{1-0.010154} = 1208.88\\
{}_{8.7}V &= \frac{({}_{8.5}V+P)(1.1^{0.2}) - 10{,}000\,{}_{0.2}q_{78.5}/1.1^{0.3}}{1-{}_{0.2}q_{78.5}}\\
{}_{0.2}q_{78.5} &= 1-(1-0.04)^{0.2} = 0.008131\\
{}_{8.5}V &= \frac{(1122+175)_{8.5}V+P}{1.1^{0.2}} - \frac{10{,}000(0.008131)/1.0290006}{1-0.008131} = \boxed{\mathbf{1342.41}} \qquad \textbf{(E)}
\end{aligned}
$$

[9/8/2017] On page 882, formula (44.6) should be

$$\int_0^t {}_sp_x^{\overline{00}}\mu_{x+s}^{01}\,\mathrm{d}s\,t$$

[6/27/2016] On page 903, on the third displayed line of the answer to Example 45G, change the first subscript to $x+5$. Change $\bar{a}_{x+t}^{12}$ to $\bar{a}_{x+t}^{11}$. After these two changes, the line will read

$${}_5V^{(1)} = 10{,}000\bar{A}_{x+5}^{12} + 1000\bar{a}_{x+5}^{11} = \frac{10{,}000}{3} + \frac{100{,}000}{9} = \boxed{\mathbf{14{,}444.44}}$$

[10/15/2017] On page 904, replace the paragraph before equation (45.5) with

After replacing the left side of equation (**??**) with (*), multiply both sides of the resulting equation by h, and solve for ${}_{t-h}V^{(i)}$:

In equation (45.5), replace = with ≈.

[4/24/2017] On page 955, on the second line of Section 47.1, change "Markov chain" to "multiple decrement".

[9/24/2017] On page 969, in the solution to exercise 47.2, on the second and fourth lines, change ${}_1q^{()}x$ to $q_x^{(1)}$.

[7/19/2016] On page 977, in the solution to exercise 47.28, on the second line, change ${}_{40}p_{40}^{(\tau)}$ to ${}_{20}p_{40}^{(\tau)}$.

[10/6/2016] On page 1060, in the solution to exercise 52.4, on the third displayed line of the page, change ${}_{30|}q_{40}^{(W)}$ to ${}_{30|10}q_{40}^{(W)}$.

[2/26/2017] On page 1090, in the solution to exercise 54.2, on the third line, change ${}_tp_{xy}$ to ${}_tp_{\overline{xy}}$.

[7/29/2016] On page 1109, in the solution to exercise 55.13, on the second displayed line, change $\mathring{e}_{65:65}$ to $\mathring{e}_{65:55}$.

[3/5/2017] On page 1166, in exercise 58.45, on the first line, change 8ill to Bill and 1ives to lives.

[9/12/2016] On page 1180, in the solution to exercise 58.46(a)(ii), a v^t is missing. The correct solution is

$$\int_0^\infty v^t\,{}_tp_x\,{}_tp_y\,\mu_{y+t}\,\mathrm{d}t$$

[9/27/2017] On page 1222, on the fourth line, change "should be" to "should we".

[8/28/2016] On page 1224, in the table, change the retirement probability for age 62 from 0.02892 to 0.02692.

[8/17/2016] On page 1228, on the third line before the end of the answer to Example 61J, change age 59 to age 61 and age 60 to age 62.

[9/23/2016] On page 1247, in the solution to exercise 61.25, on the second line, change 47,500 to 47,300.

[9/18/2016] On page 1247, in the solution to exercise 61.28, change the final answer to 10,136.84.

[3/5/2017] On page 1294, in equation (65.4), the lower limit of the sum should be $j=0$ instead of $j=1$.

[3/5/2017] On page 1300, in equations (65.3) and (65.4), the lower limit of the sum should be $j=0$ instead of $j=1$.

[9/23/2016] On page 1312, in the solution to exercise 65.17, on the third through fifth lines, every subscript 50 should be replaced with subscript $50+t$, so they look like this:

$$\sum_{k=0}^{\infty} v^{k+1}\,{}_kp_{50+t}\big(10{,}000q_{50+t+k}+10{,}000(0.001)\big)=10{,}000(A_{50+t}+0.001\,v\,\ddot{a}_{50+t})$$

$$=10{,}000A_{50+t}+10v\left(\frac{1-A_{50+t}}{d}\right)=250+9750A_{50+t}$$

where we've used that at $i=0.04$, $v/d=(1/1.04)(1.04/0.04)=25$, as well as $\ddot{a}_{50+t}=(1-A_{50+t})/d$. Thus the

[9/21/2016] On page 1323, in the solution to exercise 66.3, on the displayed line, change ${}_{10}E_{64}$ to ${}_{10}E_{54}$.

[10/21/2016] On page 1342, in exercise 67.9(i), add "at time 10" between "value" and "is".

[10/15/2017] On page 1357, in the solution to Quiz 67-2, change the final answer 0.168 to 0.0168.

[9/14/2016] On page 1368, in the solution to exercise 68.2, on the fourth line, change "the actual profit was 5" to "the actual profit was −5."

[10/6/2016] On page 1413, in the solution to exercise 70.46, it is not true that $p_{13}=p_{02}$ since the probability of (x) dying in a year is $p_{02}+p_{03}$; similarly $p_{23}\neq p_{01}$. All three statements are false.

[8/28/2016] On page 1446, in question 6(a), on the second line, change 400,000 to 399,000.

[4/19/2017] On page 1451, in question 17(i), add "based on" after "is".

[8/26/2016] On page 1457, in question 6(c), on the first line, change 109,700 to 100,300.

[4/23/2017] On page 1522, in question 7, in statement (iii), change "9.80, 10.50, 11.30, and 12.40" to "980, 1050, 1130, and 1240".

[4/23/2017] On page 1542, in question 6(c), change ${}_{10}p_{40}^{01}$ to ${}_{10}p_{35}^{01}$.

[4/19/2017] On page 1589, replace the solutions to questions 6(d) and 6(e) with the following:

(a) Salary increases 3% per year, and we account for that in the following formula:

$$3(100{,}000)\left(\frac{14}{1.05^{0.5}}+\frac{15(1.03)}{1.05^{1.5}}+\frac{15(1.03^2)}{1.05^{2.5}}\right)\Big/978=\boxed{\mathbf{12{,}917}}$$

(a) Salaries discounted to age 62 are

$$100{,}000\left(978+\frac{964(1.03)}{1.05}+\frac{879(1.03^2)}{1.05^2}\right)\Big/978=283{,}177$$

The percentage of salary needed to fund 12,917 is $100(12{,}917)/283{,}177=\boxed{\mathbf{4.5614}}$.

[10/21/2016] On page 1635, in the solution to question B1(c), change the final answer 5,213.21 to 5,110.99.

[7/27/2017] On page 1649, in the solution to question 2(c), on the second line from the end, change $Ep20_{45}$ to ${}_{20}E_{45}$.

[4/20/2017] On page 1652, in the solution to question 5(d), on the fourth line, replace the sentence starting with "Interest" with

Interest is $0.05(6321.6395+3500-175)=482.332$.

Replace the last sentence with

Profit is $6321.6395+3500-175+482.332-71.5855-10{,}105.27=\boxed{\mathbf{-47.884}}$.

[10/26/2016] On page 1674, in the solution to question B2(d), on the last line, change $\left(1-\left(\frac{18}{20}\right)\right)^{0.5}$ to $\left(1-\left(\frac{18}{20}\right)^{0.5}\right)$.

[10/26/2016] On page 1677, replace the solution to question B6(c) with the following:

The net premium would be lower but is not payable once the system is in state 1. The net premium reserve is the expected present value of future benefits, and in state 1 this is unchanged, so the net premium reserve would be the same.

[4/23/2017] On page 1677, replace the solution to question B7 with the following:

(a)

$$\frac{980}{A_{47}}=\frac{980}{0.21936}=4468$$
$$\frac{1050}{A_{48}}=\frac{1050}{0.22892}=4587$$

The rate in year 2 is $4468/100{,}000=\boxed{\mathbf{4.468\%}}$. The total face amount after the reversionary bonus is 104,468. The rate in year 3 is $4587/104{,}468=\boxed{\mathbf{4.391\%}}$.

(b) At time 3, original face amount is 100,000 and bonus amount is 4468, as computed in part (a). Let x be the rate on the original amount. The cost of the dividend is then $100{,}000xA_{48}+4468(2x)A_{48}$. Set this equal to 1050 and solve.

$$22{,}892x+4468(2)(0.22892)x=1050$$
$$x=\frac{1050}{24{,}937.63}=\boxed{\mathbf{4.211\%}}$$

(c) The reserve on the original face amount is

$$100{,}000\left(1-\frac{\ddot{a}_{48}}{\ddot{a}_{46}}\right)=100{,}000\left(1-\frac{13.6224}{13.9546}\right)=2380.58$$

The cumulative bonus, as computed in part (a), is $4468+4587=9055$; the split of the rate between the original face amount and the bonus in part (b) does not affect the total bonus. The reserve on the bonus is the single net premium, or $9055A_{48}=9055(0.22892)=2072.87$. Total reserve is $2380.58+2072.87=\boxed{\mathbf{4453.45}}$.

[4/23/2017] On page 1695, in the solution to question 19, on the second-to-last line, replace "the variance of the expected values" with "the expected value of the variances".

[4/23/2017] On page 1700, replace the solution to question B6 parts (c) and (d) with:

(c) Use formula (44.7)

$$
\begin{aligned}
{}_{10}p_{35}^{01} &= \int_0^{10} {}_tp_{35}^{00}\,\mu_{35+t}^{01}\,{}_{10-t}p_{35+t}^{11}\,\mathrm{d}t \\
{}_tp_{35}^{00} &= \exp\left(-\int_0^t \big(0.02u + 0.005u\big)\mathrm{d}u\right) \\
&= \exp\big(-0.0125t^2\big) \\
{}_{10-t}p_{35+t}^{11} &= \exp\left(-\int_t^{10} 0.01u\,\mathrm{d}u\right) \\
&= \exp\big(-0.005(10^2 - t^2)\big) \\
{}_{10}p_{35}^{01} &= \int_0^{10} 0.02t\,e^{-0.0125t^2 - 0.005(10^2) + 0.005t^2}\mathrm{d}t \\
&= 0.02e^{-0.5}\int_0^{10} t\,e^{-0.012t^2}\,\mathrm{d}t \\
&= -\frac{0.02e^{-0.5}}{0.024}\;e^{-0.012t^2}\Big|_0^{10} \\
&= -\frac{0.02e^{-0.5}}{0.024}(e^{-1.2} - 1) = \boxed{\mathbf{0.353206}}
\end{aligned}
$$

(d) Let's calculate ${}_{10}p_{35}^{00}$, and then the probability of death, of being in state 2, is the complement of the probabilities of the other two states.

$$
\begin{aligned}
{}_{10}p_{35}^{00} &= \exp\left(-\int_0^{10} (0.02t + 0.005t)\mathrm{d}t\right) \\
&= e^{-0.0125(10^2)} = 0.286505
\end{aligned}
$$

The probability of death in 10 years is $1 - 0.286505 - 0.353206 = \boxed{\mathbf{0.360289}}$.

[10/26/2016] On page 1708, in the solution to question B4(a), on the last line, change 266.0965 to 265.3224.

[10/26/2016] On page 1721, in the solution to question B4(b), additional precision is needed on the second-to-last line, or else the answers to (b) and (c) are the same. Change 13.5873 on that line and on the last line to 13.58728, and change the final answer to 15.35257. In (c), change the final answer to 15.35254.

[10/26/2016] On page 1721, in the solution to question B4(b), additional precision is needed on the second-to-last line, or else the answers to (b) and (c) are the same. Change 13.5873 on that line and on the last line to 13.58728, and change the final answer to 15.35257. In (c), change the final answer to 15.35254.

[10/26/2016] On page 1722, in the solution to question B6(c), two lines from the end, change 0.28324 to 0.28422. On the last line, change the final answer from 283.24 to 284.22. In part (d), on the last line, change 283.24 to 284.22 and change −3.8164 to −2.8327.

[9/24/2016] On page 1727, in the solution to question 37, on the line for age 30 in the table, exchange 8,950,901 and 9,501,381.

[2/27/2017] On page 1781, in the solution to question 5, change lines 2–6 to

$$
{}_{4|}q_{\overline{80:90}} = {}_5q_{\overline{80:90}} - {}_4q_{\overline{80:90}} = {}_5q_{80}\,{}_5q_{90} - {}_4q_{80}\,{}_4q_{90}
$$

$$\begin{aligned}
{}_4q_{80} &= 1-\frac{l_{84}}{l_{80}} = 1-\frac{2{,}660{,}734}{3{,}914{,}365} = 0.320264\\
{}_5q_{80} &= 1-\frac{l_{85}}{l_{80}} = 1-\frac{2{,}358{,}246}{3{,}914{,}365} = 0.397541\\
{}_4q_{90} &= 1-\frac{l_{94}}{l_{90}} = 1-\frac{403{,}072}{1{,}058{,}491} = 0.619201\\
{}_5q_{90} &= 1-\frac{l_{95}}{l_{90}} = 1-\frac{297{,}981}{1{,}058{,}491} = 0.718485\\
{}_{4|}q_{\overline{80:90}} &= (0.397541)(0.718485)-(0.320264)(0.619201) = 0.087319
\end{aligned}$$

[7/20/2017] On page 1838, in the solution to question 14, on the fifth line, replace ${}_{0.5}q_{15.6}$ with ${}_{0.4}q_{15.6}$.

[8/28/2016] On page 1870, in the solution to question 16, replace the last two lines with

$$\frac{({}_9V+P)(1+i)-q_{64}(10P)}{1-q_{64}} = {}_{10}V = 9896.9$$

$${}_9V = \frac{9896.9(1-0.01952)+(0.01952)(10)(693.7643)}{1.06} - 693.7643 = \boxed{\mathbf{8588.44}} \qquad \textbf{(D)}$$

[7/27/2017] On page 1874, in the solution to question 3(c)(i), on the first line, change Pi_t to Π_t.