

## Errata and Updates for ASM Exam MAS-I (First Edition) Sorted by Page

Practice Exam 5 Question 6 is defective. See the correction to the question below. In Practice Exam 6 Question 11, the answer ranges are suitable for an annuity of 1 per year rather than 50,000 per year.

[8/31/2018] On page 164, in the solution to exercise 13.30, on the first displayed line, change  $10 + 7e^{-(10-x)/7}$  to  $10 - 7e^{-(10-x)/7}$ .

[10/28/2018] On page 169, in the solution to exercise 14.9, on the first and second lines, change “with mean 1” to “on  $[0, 1]$ ”.

[10/28/2018] On page 216, two lines after formula (18.2), change  $1 - 10(0.9^9) = 0.964844$  to  $1 - 10(0.5^9) = 0.980469$ .

[2/19/2018] On page 295, in the solution to exercise 23.9, on the second line, replace 2.51 with 2.52. Replace the sixth line with

$$x_2 = e^{0.75(2.52)+5.6} = 1790.05$$

Replace the last line with

$$\frac{241.21 + 1690.05 + 526.41 + 0}{4} = \boxed{614.42} \quad (\mathbf{A})$$

[12/27/2017] On page 302, in exercises 24.4 (line 3) and 24.5 (line 4), change  $U_1 < cq(x)$  to  $U_2 < cg(x)$ .

[10/28/2018] On page 292, in the box before exercises 24.8 and 24.9, on the third line, change “geometric” to “gamma”.

[12/27/2017] On page 302, in exercise 24.9, delete the second sentence.

[7/20/2018] On page 303, in the solution to exercise 24.1, change the answer key from **(C)** to **(B)**.

[12/27/2017] On page 303, in the solution to exercise 24.2, replace the last two sentences with

The first and second numbers are accepted. The other two are rejected because  $0.44 > 0.4224$  and  $0.34 > 0.2944$ . The average of the accepted numbers is  $(1.28 + 0.76)/2 = \boxed{1.02}$ .

[7/1/2018] On page 304, in the solution to exercise 24.3, on the second line of the page (the one with  $u \rightarrow$ ), change  $\sqrt{(1-u)/2}$  to  $1 - \sqrt{(1-u)/2}$ . Replace the last two lines of the solution with

Comparing that fraction to the second number in each pair, we have  $0.55 \leq 1 - 0.3 = 0.7$ ,  $0.37 \leq 1 - 0.4 = 0.6$ ,  $0.62 \geq 0.6$ , and  $0.77 \leq 0.8$ . We accept when the second number is less than or equal to the fraction, so we accept all except the third number. The average is  $(0.3 + 0.4 + 0.8)/3 = \boxed{0.5}$ .

[10/28/2018] On page 305, change the first two lines of the solution to exercise 24.7 to

$$c = \max \left( \frac{f(x)}{g(x)} \right)$$

$$\frac{f(x)}{g(x)} = \frac{xe^{-x}}{1/(1+x)^2}$$

[10/28/2018] On page 326, in the solution to exercise 25.24, on the third line, change “by  $\theta$ ” to “be  $\theta$ ”.

[11/6/2018] On page 343, on lines 2 through 5, add a factor  $b$  before each  $k$ :

$$bk_5(16) = \frac{e^{-((16-5)^2)/2(8^2)}}{\sqrt{2\pi}} = 0.155012$$

$$bk_{12}(16) = \frac{e^{-((16-12)^2)/2(8^2)}}{\sqrt{2\pi}} = 0.352065$$

$$bk_{15}(16) = \frac{e^{-((16-15)^2)/2(8^2)}}{\sqrt{2\pi}} = 0.395838$$

$$bk_{20}(16) = \frac{e^{-((16-20)^2)/2(8^2)}}{\sqrt{2\pi}} = 0.352065$$

[5/10/2018] On page 359, in the solution to exercise 26.18, on the second line, change  $-1.33$  to  $-0.67$ . On the third line, change  $0.0159$  to  $0.1587$ . On the last line, change  $0.1067$  to  $0.1047$ .

[3/2/2019] On pages 367–368, in Example 27C,  $e(20)$  is the expected value of the random variable given that it is greater than 20. The parenthetical remark on page 368 starting with “Actually” is true, but not derived anywhere in the manual, so you may ignore it.

[5/15/2018] On page 412, in the solution to exercise 28.18, on the second to last line,  $\left(\frac{6}{9}\right)^\tau = \frac{\ln 0.75}{\ln 0.25} = 0.20752$  should be moved to a separate line.

[5/15/2018] On page 412, in the solution to exercise 28.19, on the last line of the page, change  $\ln 0.2$  to  $\ln 0.4$ .

[5/17/2018] On page 416, in the solution to exercise 29, replace the fifth and sixth lines with

$$\left(\frac{\theta}{1.82}\right)^\tau = -\ln 0.4$$

$$\left(\frac{\theta}{12.66}\right)^\tau = -\ln 0.8$$

[5/17/2018] On page 418, replace the solution to Quiz 28-2 with the following:

$$e^{-(\theta/20)^\tau} = 0.2$$

$$e^{-(\theta/560)^\tau} = 0.7$$

$$\left(\frac{\theta}{20}\right)^\tau = -\ln 0.2$$

$$\left(\frac{\theta}{560}\right)^\tau = -\ln 0.7$$

$$28^\tau = \frac{\ln 0.2}{\ln 0.7}$$

$$\tau \ln 28 = \ln \left(\frac{\ln 0.2}{\ln 0.7}\right)$$

$$\hat{\tau} = \frac{\ln((\ln 0.2)/(\ln 0.7))}{\ln 28} = \frac{1.506815}{\ln 28} = 0.452198$$

$$\hat{\theta} = \frac{20}{(-\ln 0.2)^{-1/0.452198}} = \boxed{57.289}$$

[7/29/2018] On page 434, in exercise 29.25, on the second line, the square symbol should be on the denominator:

$$S_X(x) = \frac{\theta^4}{(\theta^2 + x^2)^2}$$

[2/7/2019] On page 561, in equation (36.1), change  $F(u)$  to  $F(d)$ .

[3/7/2019] On pages 562–563, change Example 36B and its solution to

**EXAMPLE 36B** A sample of 5 points is fitted to an exponential distribution with mean 6. Let  $F_e(x)$  be the empirical distribution of the data and  $F^*(x)$  the fitted exponential distribution.

Figure 36.2 is a graph of  $F_e(x) - F^*(x)$ .

Determine the Kolmogorov-Smirnov statistic for this fit.

**ANSWER** The largest absolute difference from 0 occurs right before  $x = 9$ . At that point,  $F_e(9^-) = 3/5 = 0.6$  and  $F^*(9^-) = 1 - e^{-9/6}$ . The absolute difference is  $|0.6 - (1 - e^{-9/6})| = \boxed{0.17687}$ .

[10/28/2018] On page 571, in exercise 36.22, in the third bullet, change all 4 denominators from  $n$  to  $\sqrt{n}$ .

[10/28/2018] On page 622, in the solution to exercise 40.3, on the fifth line, change  $\lambda^{-n\bar{x}}$  to  $\lambda^{n\bar{x}}$ .

[10/28/2018] On page 624, in the solution to exercise 40.9, on the second-to-last line, change the  $-2$  at the beginning of the line and the  $-2$  after “or” to  $2$ ; remove the minus signs.

[10/28/2018] On page 625, on the third line of the third paragraph, change “20<sup>th</sup> percentile” to “15<sup>th</sup> percentile”.

[10/28/2018] On page 628, in the solution to exercise 41.4, on the first line, change  $(3, 8)$  to  $(5, 8)$ .

[7/6/2018] On page 659, in the fourth displayed line, on the right side in the exponent, change  $\sum_{i=1}^p$  to  $\sum_{i=2}^p$ .

[3/6/2019] On page 641, on the second line of the answer to Example 43D, change the second and third lines to

$$f(x) = \frac{\tau x^{\tau-1}}{\theta^\tau} e^{-(x/\theta)^\tau}$$

$$\ln f(x) = \ln \tau + (\tau - 1) \ln x - \tau \ln \theta - \left(\frac{x}{\theta}\right)^\tau$$

$\ln \tau$  may be added to either  $c(\theta)$  or  $d(x)$  on the next two lines.

[12/31/2018] On page 641, on the fourth line of the answer to Example 43D, change  $b(\theta) = \theta^\tau$  to  $b(\theta) = \theta^{-\tau}$ .

[1/27/2018] On page 649, in the solution to exercise 43.2, on the last line, remove the negative signs before the two  $\ln x$ s:  $a(x) = \ln x$  and  $a(x) = (\ln x)/\sigma^2$ .

[1/27/2018] On page 650, replace the solution to exercise 43.5 with

The linear component is  $22 + 15 + 0 = 37$ . Inverting the link,  $\mu = 37^2 = \boxed{1369}$ .

[8/12/2018] On page 667, change the first two lines of exercise 44.15 to

In a cumulative proportional odds model for an ordinal variable, the fitted model is

$$\ln \frac{\sum_{i=1}^j \hat{\pi}_i}{1 - \sum_{i=1}^j \hat{\pi}_i} = b_{0j} + b_1 x_1$$

[8/12/2018] On page 674, in the solution to exercise 44.23, two lines from the end, change  $\Phi(1.01)$  to  $\Phi(1.32)$ .

[3/12/2019] On page 682, delete the first sentence of footnote 2. The delta method is not discussed in this course. The footnote may be helpful for remembering the components of the **W** matrix, but if you do not know the delta method, ignore the footnote.

[7/10/2018] On page 708, on the third line of Quiz 46-4, change “loglikelihood” to “loglikelihood”.

[6/28/2018] On page 730, in exercise 47.20, in the first bullet, change the two subscripts on the right to  $i_2$  and  $i_3$ :

$$\hat{y}_i = 20.0 - 1.5x_{i_2} - 2.0x_{i_3}$$

[6/28/2018] On page 733, in the solution to exercise 47.12, on the third line, change  $b_2$  to  $b_3$ .

[6/28/2018] On page 738, on the first line of Example 48B, change  $\beta_5x_6$  to  $\beta_5x_5$ .

[6/28/2018] On page 741, in exercise 48.2, on the second line, replace  $x_{i_7}$  with  $x_{i_6}$ .

[7/17/2018] On page 745, in exercise 48.15, on the second line, replace  $\beta_4x_{i_1}x_{i_2}$  with  $\beta_4x_{i_2}x_{i_3}$ .

[8/8/2018] On page 745, exercise 48.16 is a duplicate of exercise 48.13.

[8/8/2018] On page 746, in exercise 48.17, on the second line of the second bullet, put a period after 0.940. The statement beginning "A second regression equation" should be moved to a third bullet.

[1/27/2018] On page 747, in exercise 48.20, in the table, change II on the last line to III. On the line below the table, change  $\beta_1 + \beta_2 = 1$  to  $\beta_2 + \beta_3 = 1$ .

[6/28/2018] On page 747, in exercise 48.21, on the last line, change  $\beta_3 = 0$  to  $\beta_4 = 0$ .

[8/8/2018] On page 753, in the solutions to exercises 48.10 and 48.11, on the displayed line in each solution,  $SSE_R$  and  $SSE_{UR}$  should be interchanged so that the numerator is  $(SSE_R - SSE_{UR})/q$ . In addition, in the solution to exercise 48.11, put parentheses around  $n - p$  in the denominator.

[8/8/2018] On page 753, in the solution to exercise 48.13, on the first and second lines, delete the sentence fragment "The unrestricted model with 8 variables."

[8/8/2018] On page 753, in the solution to exercise 48.14, on the displayed line, change  $n - k$  to  $n - p$ .

[4/22/2019] On page 755, in the solution to exercise 48.20, on the first line, change " $\beta_1 + \beta_2 = 1$ " to " $\beta_2 + \beta_3 = 1$ ".

[8/8/2018] On page 764, in exercise 49.2, in the first bullet, change  $\hat{y}$  to  $\hat{y}_i$ .

[8/8/2018] On page 766, in the solution to exercise 49.2, on the second line, change  $\hat{y}$  to  $\hat{y}_i$ . Replace the last line with

$$r_3 = \frac{\hat{\varepsilon}_3}{s\sqrt{1 - h_{33}}} = \frac{1.2}{2\sqrt{1 - 0.6}} = \boxed{0.948683}$$

[6/28/2018] On page 769, two lines above equation (50.1), change  $\beta_0 + \beta_1x^*$  to  $\beta_1 + \beta_2x^*$ .

[1/28/2018] On page 771, in the solution to exercise 50.3, change the first displayed line to

$$s = \sqrt{\frac{SSE}{n - 2}} = \sqrt{\frac{5245}{23}} = 15.101$$

Change the third displayed line to

$$15.101\sqrt{1 + \frac{1}{25} + \frac{(100 - 223)^2}{958,356.8}} = 15.517$$

Change the last line to  $547.26 + 2.069(15.517) = \boxed{579.4}$ .

[2/19/2018] On page 780 in the table at the top of the page, and in the corresponding table on page 786, change the second column of the  $D_A$  and  $D_B$  lines to match the following table:

Model	Sum of Squares	Deviance
$Y = \mu + \varepsilon_{ij}$	SST	$D_M$
$Y = \mu + \alpha_i + \varepsilon_{ij}$	SST – SSTR	$D_A$
$Y = \mu + \beta_j + \varepsilon_{ij}$	SST – SSB	$D_B$
$Y = \mu + \alpha_i + \beta_j + \varepsilon_{ij}$	SSE	$D_I$

Interchange formulas (51.9) and (51.10) on pages 780 and 786; in other words, change  $D_B$  to  $D_A$  in formula (51.9) and  $D_A$  to  $D_B$  in formula (51.10)

- [3/13/2018] On page 780, 2–3 lines from the bottom of the page, change “at 1% significance but not at 2% significance” to “at 2% significance but not at 1% significance”.
- [2/19/2018] On page 805, in the solution to exercise 51.26, change  $D_A$  to  $D_B$  all three times it appears, and change  $D_B$  to  $D_A$  all two times it appears.
- [2/19/2018] On page 806, in the solution to exercise 51.29, on the second and last lines, replace 2.361 with 3.056. Replace the final answer with 2970.43.
- [7/10/2018] On page 820, in the solution to exercise 52.5, on the first line, delete “a” before “Poisson”.
- [4/22/2019] On page 829, in exercise 53.5, change “mean square error” to “standard error” twice, once on the third line and once on the last line.
- [7/2/2018] On page 834, one line below formula (54.1), change “variance of the residual  $\varepsilon$ ” to “residual variance of the regression”.
- [7/2/2018] On page 835, in the first paragraph of Example 54A, change “The variance of the residual” to “The residual variance of the regression”.
- [7/2/2018] On page 838, in exercises 54.8 and 54.9, change “estimated variance of the residuals” to “estimated residual variance of the regression”.
- [7/2/2018] On page 838, in exercise 54.10, 2–3 lines from the end, delete the sentence beginning “For each model”.
- [7/2/2018] On page 838, in exercise 54.11, on the first line, change 28 to 29. In the table, delete the  $\hat{\sigma}^2$  column.
- [3/4/2018] On page 841, replace the solution to exercise 54.2 with
- We need 4 variables for AGE, 1 for SEX, 1 for BLOOD PRESSURE, and 1 for CHILDREN, a total of 7 variables. We start with 1 model with just the intercept, then consider 7 models for the first variable to add, 6 for the second, and so on. Total number of models considered is

$$1 + \sum_{k=0}^6 (7 - k) = 1 + \frac{(7)(8)}{2} = \boxed{29}$$

- [8/8/2018] On page 842, replace the solution to exercise 54.10 with

The mean squared error of the full model is  $284/(60 - 5) = 5.163636$ . Then

$$\begin{aligned} C_p(0) &= \frac{326}{60} = 5.4333 \\ C_p(1) &= \frac{314 + 2(5.163636)}{60} = 5.4055 \\ C_p(2) &= \frac{303 + 2(2)(5.163636)}{60} = 5.3942 \\ C_p(3) &= \frac{293 + 2(3)(5.163636)}{60} = 5.4000 \\ C_p(4) &= \frac{284 + 2(4)(5.163636)}{60} = 5.4218 \end{aligned}$$

The **2-variable** model is selected.

[8/8/2018] On page 843, replace the solution to exercise 54.11 with

The estimated value of the mean square error of the model with 4 explanatory variables is

$$\hat{\sigma}^2 = \frac{\text{RSS}}{n - p} = \frac{132}{29 - 5} = 5.5$$

We calculate Mallows's  $C_p$  for each model.

$$\begin{aligned} C_p(0) &= \frac{162}{29} = 5.586 \\ C_p(1) &= \frac{145 + 2(1)(5.5)}{29} = 5.379 \\ C_p(2) &= \frac{140 + 2(2)(5.5)}{29} = 5.586 \\ C_p(3) &= \frac{136 + 2(3)(5.5)}{29} = 5.828 \\ C_p(4) &= \frac{132 + 2(4)(5.5)}{29} = 6.069 \end{aligned}$$

The model with **1 explanatory variable** has the lowest  $C_p$  and is therefore the best.

[8/8/2018] On page 843, in the solution to exercise 54.14, on the fourth line, delete the first  $\frac{15}{12}$ , the one without parentheses.

[7/31/2018] On page 850, in the displayed formula in Subsection 55.2.1, change  $\bar{X}$  to  $\bar{X}_j$ .

[8/8/2018] On page 851, on the second line of Section 55.3, change "test data" to "training data".

[8/8/2018] On page 856, in the solution to exercise 55.11, on the second line, but a negative sign before  $\frac{1}{2} \frac{\partial f}{\partial \beta_0}$ .

[10/28/2018] On page 857, in the solution to exercise 55.14, item 2, change "latter takes the response into account" to "former takes the response into account".

[12/25/2018] On page 868, on the second line of the second paragraph, replace the first url with [www.maths.adelaide.edu.au/andrew.metcalfe/Data](http://www.maths.adelaide.edu.au/andrew.metcalfe/Data).

- [10/25/2018] On page 872, in the box for exercises 57.2 and 57.3, in the table for centered moving averages, change the entry for 2011Q3 from 127.65 to 127.625.
- [7/24/2018] On page 884, in the solution to exercise 58.13, change the final answer to  $-1.25$ .
- [3/21/2019] On page 894, replace the last line with  
If you are given the nonzero mean of a stationary  $AR(p)$  process, it must be subtracted from every  $x_{t-k}$  term.
- [3/21/2019] In Example 60C on the first line, change “intercept” to “mean”.
- [4/4/2019] On page 900, in the solution to exercise 60.9, on the last line, change  $z_{103|100}$  to  $x_{103|100}$ .
- [4/22/2019] On page 907, in exercise 61.2, on the last line, change  $\hat{z}_{22|20}$  to  $\hat{x}_{22|20}$ .
- [7/26/2018] On page 910, in the solution to exercise 61.1, change the final answer to 5.83614.
- [7/26/2018] On page 912, in the solution to exercise 61.14, on the first line, change 0.7 to 70 and  $+ 0.3$  to  $- 30$ .
- [10/28/2018] On page 939, in the solution to exercise 64.5, on the second to last line, delete the “is derived” that is before “by”.
- [3/12/2019] On page 977, in question 10, on the first line, delete the word “bridge”.
- [10/12/2018] On page 1006, in question 6, in the two bullets, change “payment per loss” to “payment per payment”. Change the last line of the question to  
Calculate the percentage increase in the variance of payment per loss in 2016 over 2015.
- [7/26/2018] On page 1029, in question 27, on the second line, change  $\beta_2$  to  $x_2$ .
- [7/26/2018] On page 1030, in question 29, on the first bulleted line, insert a comma between 0.3111 and 0.5584.
- [4/4/2019] On page 1047, in the solution to question 27, in the first denominator, change  $(N - (p + 1))$  to  $n = p$  to be consistent with formula (48.3).
- [10/28/2018] On page 1048, in the solution to question 34, on the first displayed line, change the denominator  $2\pi x^2$  to  $2\pi x^3$ .
- [10/28/2018] On page 1052, in the solution to question 11, on the last line, change  $\frac{l_{52}}{l_{51}}$  to  $\frac{l_{53}}{l_{52}}$ .

- [9/30/2018] On page 1069, replace the solution to question 41 with

The variance of the terms in the series, by formula (62.3), is

$$\sigma^2 = 4(1 + 0.8^2 + 0.6^2) = 8$$

The nonzero autocorrelations for the MA(2) series are at lags 1 and 2, based on formula (62.5).

$$\rho_1 = \frac{0.8 + (0.8)(0.6)}{1 + 0.8^2 + 0.6^2} = 0.64$$

$$\rho_2 = \frac{0.6}{1 + 0.8^2 + 0.6^2} = 0.3$$

Using formula (61.1), the variance of the sample mean is

$$\begin{aligned} \text{Var}(\bar{x}_t) &= \frac{\sigma^2}{n} (1 + 2(1 - 1/n)(\rho_1) + 2(1 - 2/n)(\rho_2)) \\ &= \frac{8}{10} (1 + 2(0.9)(0.64) + 2(0.8)(0.3)) = \boxed{2.1056} \quad (\text{E}) \end{aligned}$$

- [7/26/2018] On page 1078, in the solution to question 30, on the displayed line, change 1.4 in the exponent to 0.4.
- [10/28/2018] On page 1097, in the solution to question 11, on the last line, 13.883 should be multiplied by 50,000 to obtain a final answer of **694,150**.
- [10/28/2018] On page 1104, in the solution to question 45, on the second and fourth lines (once apiece), change  $\text{Cov}(x_t, x_{t+1})$  to  $\text{Cov}(x_t, x_{t+2})$ .
- [8/12/2018] On page 1183, in the solution to question 33, on the second line, put “ln” before  $\frac{\mu}{1 - \mu}$ .
- [7/5/2018] On page 1210, in the solution to question 38, on the first line, change “gamma” to “Gaussian”. On the fourth line, change “ $a(x) = \theta, \underline{(\theta)} = -(x - 1)^2/2x$ ” to “ $a(x) = -(x - 1)^2/2x, b(\theta) = \theta$ ”.
- [4/11/2019] On page 1217, in the solution to question 36, 3 lines from the end, the 5141.2 in the denominator should not be squared. The line should read

$$\sqrt{6.993} \sqrt{1 + \frac{1}{30} + \frac{(50 - 66.6)^2}{5141.2}} = 2.7570$$

- [9/13/2018] On page 1223, replace the solution to question 19 with  
 Since  $n/(n + 4) \rightarrow 1$  as  $n \rightarrow \infty$ , the limit of  $\mathbf{E}[\hat{\alpha}_n]$  is 7, making statement I true.  
 The mean square error of  $\hat{\alpha}_8$  is the square of the bias plus the variance:

$$\begin{aligned} \text{bias}_{\hat{\alpha}_8}(\alpha) &= \frac{7(8)}{8 + 4} - 7 = 2\frac{1}{3} \\ \text{Var}(\hat{\alpha}_8) &= \frac{140(7)}{15} = 65\frac{1}{3} \\ \text{MSE}(\hat{\alpha}_8) &= (2\frac{1}{3})^2 + 65\frac{1}{3} = 70\frac{7}{9} \end{aligned}$$

The variance approaches 70 from below as  $n \rightarrow \infty$ , since

$$\lim_{n \rightarrow \infty} \frac{n - 1}{2n - 1} = \frac{1}{2}$$

and

$$\frac{n - 1}{2n - 1} < \frac{n - 1}{2n - 2} = \frac{1}{2}$$

Since  $70\frac{7}{9} > 70$ , statement II is true.

Since the variance does not go to 0, we cannot be sure that  $\hat{\alpha}_n$  is consistent, so statement III is false.

**(B)**