

Introduction to Probability

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Corrections and clarifications to the 2018 Edition

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Chapter 1

Page 19, Example 1.24. In the 3-line display at the top of page 19, the binomial factors $\binom{6}{2}$ should be $\binom{60}{2}$.

Page 40, Exercise 1.59. The last sentence before the hint should be: Show that the probability that the needle intersects one of the parallel lines is $2\ell/\pi$.

Page 48. One instance of $\{B, M, H\}$ should be $\{F, M, H\}$.

Chapter 2

Page 52, Example 2.19. The second italicized subtitle, on line 5 from the bottom of the page, should be *Sampling without replacement*.

Page 56, Proof of Fact 2.28. On line 5 from the bottom of the page, indices x_1, \dots, x_n range over those *possible* values of the random variables X_1, \dots, X_n that satisfy the constraints $x_1 \in B_1, \dots, x_n \in B_n$.

Page 58, Example 2.30. Around the last displayed equation of the example, there are five instances where x_n and X_n should be replaced by x_k and X_k , respectively. In particular, the display and the text preceding it should be corrected to the following: If we take $x_1 = \dots = x_k = 1$, then the event $\{X_1 = 1, X_2 = 1, \dots, X_k = 1\}$ is empty. Consequently

$$P(X_1 = 1, X_2 = 1, \dots, X_k = 1) = 0 \neq \left(\frac{1}{n}\right)^k = \prod_{j=1}^k P(X_j = 1).$$

Next, change the sentence “Note that we could... their values.” to “Note that the inequality above could also have been justified simply by noting that each probability $P(X_j = 1)$ is positive, without calculating their values.”

Page 78, Exercise 2.38. The hint should be moved from part (c) to part (d).

Page 79, Exercise 2.46. *Urn* should be *box*.

Page 80, Exercise 2.50. The king has chosen one *of* the three ...

Page 81, Exercise 2.57. The second component has 4 independent elements that *each* work with probability 0.90.

Page 85, Exercise 2.77. The word *sequence* is misspelled.

Chapter 3

Page 91. The sentence “It follows that.... is not discrete.” found below Fact 3.2 should read “It follows that a random variable with a density function is not discrete.”

Page 136, Exercise 3.60. The problem should read: “Show that if all the expectations below are finite, then...”

Chapter 4

Page 163, Example 4.32. Replace the sentence “In part (b) we condition...” with “For part (b) we let X be the arrival of the next car in minutes, measured from the moment when the fox arrived. We condition on the information given by the fox, so the desired probability is $P(X > 5 + 10|X > 5)$.”

Page 172, Exercise 4.4. In the next-to-last sentence, n flips of the coin should be n rolls of the die.

Page 176, Exercise 4.38. The exercise in this form could be somewhat challenging. A slightly easier version would be to check Fact 4.20 with $n = 1$ for sets A of the form $\{k\}$.

Page 176, exercise 4.39. The example states that wheat cents were minted between 1909 and 1956. The year 1956 is incorrect. They were produced between 1909 and 1958.

Page 176, Exercises 4.40 and 4.41. The exact probability 0.000949681 is the correct one for Exercise 4.41 and not for Exercise 4.40. The exact probability for Exercise 4.40 is 0.00327556.

Chapter 5

Page 186, Above Def 5.12. Similarity is misspelled.

Chapter 6

Page 236, Section 6.5. Below equation (6.38), please change to: “In particular, if it is finite in a neighborhood of ...”

Page 237, Exercise 6.4. This problem should read as follows.

A sandwich shop offers 8 different sandwiches. Jamey likes them all equally. Each day for lunch he picks one randomly, independently of previous choices. Salami, falafel and veggie are three of the eight types of sandwiches. During a given week of 5 days, let X be the number of times he chooses salami, Y the number of times he chooses falafel, Z the number of times he chooses veggie, and W the number of times he chooses something else. Find the joint probability mass function of (X, Y, Z, W) . Identify the distribution of (X, Y, Z, W) by name.

Page 239, Exercise 6.17. There is a typo in the formula for $f_V(v)$. It should be $f_V(v) = \lambda^2 v e^{-\lambda v}$ for $v > 0$.

Page 241, Exercise 6.30. It should be $P(X = Y + 1)$ instead of $P(X + 1 = Y)$.

Chapter 7

Page 267, Exercise 7.20. The first sentence should be: Let X have density $f_X(x) = 2x$ for $0 < x < 1$ and 0 outside of $(0, 1)$, and let Y be uniform on the interval $(1, 2)$.

Chapter 8

Page 285. Before Example 8.26. The sentence should read: “We illustrate the computation of covariance with one more example before continuing with the general properties.”

Page 288. To match the summation indices, the covariance in the middle member of equation (8.23) should be $\text{Cov}(I_i, I_j)$ instead of $\text{Cov}(I_j, I_k)$.

Page 295. In equation (8.32), σ_x should be σ_X . (That is, the lower case x should be a capital X .)

Page 300, Exercise 8.18. Change “normal” to “normals” in the first sentence. Add the following sentence at the end of the problem: “You can take for granted that (U, V) has bivariate normal distribution.”

Page 302, Exercise 8.32. In part (a) replace $I_A I_A$ with $I_A I_B$.

Chapter 9

Page 312, Example 9.6. In the last displayed equation $\sum_{k=60}^{100} \binom{100}{k} 2^{-k}$ should be $\sum_{k=60}^{100} \binom{100}{k} 2^{-100}$.

Page 324, Exercise 9.11. Replace the first sentence (and the displayed equation) with: Suppose the random variable X is positive and has moment generating function $M_X(t) = (1 - 2t)^{-3/2}$ for $t < \frac{1}{2}$ and $M_X(t) = \infty$ for $t \geq \frac{1}{2}$.

Page 325, Exercise 9.14. The second sentence should be: Let X be a positive random variable with $E[X] = 2$ and $\text{Var}(X) = 9$. The next sentence should start as: “Find the values $t > 2$ where ...”

Page 327, Exercise 9.26. The probability to be estimated in part (a) should be $P(T_n > (1 + \varepsilon)n \ln(n))$, and in part (b) it should be $P(|T_n - E[T_n]| > \varepsilon n \ln(n))$.

Chapter 10

Page 369, Exercise 10.15. The last sentence should be changed to: Suppose further that each claim comes from policy A with probability 1/4, independently of other claims.

Page 369, Exercise 10.16. Change the first sentence to: Continuing Problem 10.15, suppose that each claim from policy A is greater than \$100,000 with probability 4/5, each claim from policy B is greater than \$100,000 with probability 1/5, and these happen independently for each claim.

Page 369, Exercise 10.18. Change r to $r \geq 3$. In part (b) change “have probabilities” to “have positive probabilities”.

Page 370, Exercise 10.20. In part (b) assume that $0 < k < n$. Thus, it should read “Show that, given $S_n = k$ with $0 < k < n$, the random variables X_1, \dots, X_n are exchangeable but not independent.”

Page 374, Exercise 10.44. The reference should be to (10.29) instead of (10.15).

Appendix D

Page 404, Example D.5. It should be $\sum_{n=1}^{\infty} \frac{1}{n^\gamma}$ instead of $\sum_{k=1}^{\infty} \frac{1}{n^\gamma}$ (this appears three times).

Appendix F

Page 408. The range of the variable n in the negative binomial probability mass function should be $n \geq k$ instead of $n \leq k$.

Page 409. The probability density function of the gamma distribution should be $f_X(t) = \frac{\lambda^r t^{r-1}}{\Gamma(r)} e^{-\lambda t}$ (in other words, replace x^{r-1} with t^{r-1}).

Answers to selected exercises

Page 420. Answer to 9.7: replace \$1055.44 with \$1055.80.

Page 422. Answer to 10.35(b): replace s with S . Thus, the answer should read: $E[X|S] = \frac{S}{2}$ and $E[X^2|S] = \frac{1}{2} + \frac{S^2}{4}$.