DISCRETE MATHEMATICS WITH APPLICATIONS, 3rd Edition
by Susanna S. Epp

Great effort was made to insure as error-free a product as possible. With approximately 3 million characters in the book, however, some mistakes are inevitable. I would be grateful to learn of any errors you find so that they can be listed on this page and corrected in subsequent printings. Please send them to me at sepp@condor.depaul.edu.

With thanks, Susanna S. Epp

Note: The printing number is located on the page on the opposite side from the title page. It is the smallest number listed underneath the words "Printed and bound in the United States of America."

ERRATA FOR THE 1st PRINTING

Ch. 1	Ch. 2	Ch. 3	Ch. 4	Ch. 5	Ch. 6	Ch. 7	Ch. 8	Ch. 9	Ch. 10	Ch. 11	Ch. 12

CHAPTER 1

Text

LOCATION	CORRECTION
9 – line 2	Change "Construct a truth table for *P* with" to "Construct a truth table with".
11 – Example 1.1.10, line 10	Add a small space between "2" and "(x ≠ 2)"
19 – Example 1.2.2, line 6	Change to "the rows in which *p* is true and *r* is false".
23 – Definition Example 1.2.7, line 3	Change the first word to "If". Change "break world's" to "break the world's ".
28 – Directions for exercises 32 and 33	Change the numbers in the directions to 32 and 33.
30 – Example 1.3.1	The truth values for the conclusion in rows 3, 5, and 6 should all be T.
32 – Line 4 from bottom	Change "exercise 11" to "exercise 12".
41 – Directions for exercises 6-10	Should be directions for exercises 6-11.
57 – Line 6 from bottom	Change "powers of the form" to "products of the form".

Exercises

LOCATION	CORRECTION
A-6 – **1.1 #39**	Change to "(*num_orders* ≤ 100 or *num_instock* > 500) and *num_instock* ≥ 200."
A-9 – **1.2 #40a**	In line 2, there is a missing left square bracket; the left-most six symbols should be "≡ [~(~*p*".
A-13 – **1.5 #13**	The final answer should be 10000_2.

CHAPTER 2

Text

LOCATION	CORRECTION
84 – Example 2.1.11, line 6	Change to "...among *Q*(*n*), *R*(*n*),and *S*(*n*)*".*
88 – Line 2 from bottom	Change "for the predicate variables" to "for the predicate symbols".
99 – Boxed text, line 3	Should be "∀ *x* in *D*, ∃ y in *E* such that *P*(*x*,*y*)".
99 – Bottom of page	Change "quanified" to "quantified".
103 – Line 3 Line 4 and line 2 of	Change to "We apply these laws to find". Change the second *"x"* to *"y":* The expression should be

boxed text	"~(∀ *x* in *D*, ∃ *y* in *E* such that *P*(*x*,*y*))".
104 – Lines 18-19	Change to "However, the first means that given any person, it is possible to find someone whom that person loves."
120 – Box at top of page	Change "∀*x* *P*(*x*) → *Q*(*x*)" and "∀*x* *Q*(*x*) → *R*(*x*)" and "∀*x* *P*(*x*) → *R*(*x*)" to "∀*x* (*P*(*x*) → *Q*(*x*))" "∀*x* (*Q*(*x*) → *R*(*x*))" and "∀*x* (*P*(*x*) → *R*(*x*))". Also in all three lines change "Anything that *x* makes" to "Any *x* that makes".
120 – Line 2 from bottom	Change "1 and 2" to "1 and 3."
121 – Top line	Change "4 together with 3" to "4 together with 2".
123 – Above #21	Change "Indicate whether the arguments in 21-26" to "Indicate whether the arguments in 21-27".

Exercises

LOCATION	CORRECTION
A-15 – **2.1 #7c**	Change "between –2 and –1 inclusive and between 1 and 2 inclusive" to "between –2 and –1 inclusive together with all those between 1 and 2 inclusive."
A-16 – **2.2 #27**, line 4	Change "*x* is to the left" to "*x* is not to the left".
A-16 – **2.2 #29**	The converse should be: "∀ real numbers *x*, if $x > 0$, then $x^2 \geq 1$".
109 – **2.3 #20a**	Change (1) to "For all circles *y* there is a triangle *x* such that *x* and *y* have different colors."
A-17 – **2.3 #33b**	Change "everyone has someone whom they love" to "everyone has someone whom they do not love."
110 – **2.3 #42**	Change "L" to "*f*(*a*)" three times. I.e., in line 2, change to "definition of $\lim_{x \to a} f(x) = f(a)$" and in line 5 change to "$f(a) - \varepsilon < f(x) < f(a) + \varepsilon$."
A-18 – **2.3 #51**	Change the answer for part (a) to "True. Circle *b* is the same color (black) as squares *h* and *j*."
111 – **2.3 #57**	The number 57 should be blue.
123 – **2.4 #30**	Sentence 1 should be "If an object is above all the triangles, then it is above all the blue objects".
124 – **2.4 #36**	Change to: "Derive the validity of the universal form of part (a) of the elimination rule from the validity of universal instantiation and the valid argument called elimination in Section 1.3".

CHAPTER 3

Text

LOCATION	CORRECTION
135 – "Variations among Proofs"	Heading should be boldface.
142 – Solution to Example 3.2.1g	Change "7.4" to "7.3".
145 & 146 – Example 3.2.3	At the bottom of page 145 and the top of page 146, change to "*a* is any even integer and *b* is any odd integer".
150 – Caution Box, top of page, line 4	Change "$d \neq 0$" to "$a \neq 0$".
153 – Line 4	Change to "If $b \neq 0$, then you can cancel *b* from…."
156 – Line 4 from bottom	Change "more than 4" to "4 or more".
175 – Line 1	Change "*since a, b, c, and d are, and since*" to "*since a, b, c, and d are integers, and since*".
193 – Lemma 3.8.2, line 1	Change "nonnegative" to "any".

Exercises

LOCATION	CORRECTION

A19 – 3.1 #4	In line 2, change "$m > 0$ and $n > 0$" to "$m > 1$ and $n > 1$".
140 – 3.1 #26	Change "exericse" to "exercise".
141 – 3.1 #60b	Change $x^3 - 1253x + 255$ to $x^2 - 1253x + 255$
141 – 3.1 #61b	Change "$15x^3 + 7x^2 - 8x - 27$" to "$x^3 + 7x^2 - 8x - 27$".
155 – 3.3 #34b	Change "5377" to "5733".
A22 – 3.3 #35b	Change "5.880^2" to "5880^2".
A-22 – 3.4 #14, line 5	Change "*mod T*" to "*mod* 7".
A-23 – 3.4 #29	Change the last two lines to "$9q^2 + 12q + 4 = 3(3q^2 + 4q + 1) + 1$, and $3q^2 + 4q + 1$ is an integer because it is a sum of products of integers."
164 – 3.4 #48	Change to "If m, d, and k are nonnegative integers and $d \neq 0$, then…"
A-25 – 3.6 #19b	Should be "Suppose n is any integer such that n is not odd. Show that n^2 is not odd."
3.6 #12	Add: "An alternative solution uses Proposition 3.6.4."
A-26 – 3.6 #28a	In line 6, change "$\sqrt{ns} = \sqrt{n}\sqrt{n}$" to "$\sqrt{ns} > \sqrt{n}\sqrt{n}$".
A-26 – 3.6 #28b	Change "…n is divisible by any…" to "…n is divisible by a…"
A-26 – 3.6 #29ab and **#31ab**	Change "so the possible prime factors are 2, 3, 4, …" to "so the possible prime factors to be checked are 2, 3, 5, ..."
184 – 3.7 #9	Change "square root" to "positive square root" and change "an irrational" to "a positive irrational."
A-26 – 3.7 #9, line 2	Change "For all real numbers" to "For all positive real numbers".
A-26 – 3.7 #9, line 4	Change "any real number" to "any positive real number".
A-27 – 3.7 #20	Change "16(a)" to "16(b)."
A-27 – 3.7 #21a	Insert: "The answer is 2."
197 – 3.8 #21, line 2 line 4	Change "positive integers" to "integers with $b \neq 0$". Delete "and $0 \leq r < b$."
A-29 – 3.8 #26	Change "Partial proof" to "Proof."
198 – 3.8 #28&29	Change the number of exercise 28 to black and delete the *H* next to it. Change the number of exercise 29 to blue, and add an *H* next to it.
A-29 – 3.8 #28	This is actually the hint for 3.8, #29. Change the "28" to "29."

CHAPTER 4

Text

LOCATION	CORRECTION
204 – Example 4.1.9	(a) Change the summand from "$1/k^2$" to "$1/i^2$" (as in the solution). (b) Change the index of summation from "$i = 0$" to "$k = 0$".
231 – Line 11 from bottom	Change "$2n + 1 < n$" to "$2n + 1 < 2^n$".
232 – line 3 from bottom	Change "***for all integers n* ≥ 1" to "*for all integers k* ≥ 1".**
235 – line 4 from bottom	Change "if $P(k)$ is true then $P(k+1)$ is true" to "if $P(i)$ is true for all integers i with $a \leq i < k$, then $P(k)$ is true".
238 – line 15 from bottom	Change "the sum of the factors in the left-hand product plus those" to "the sum of the number of factors in the left-hand product plus the number".

Exercises

LOCATION	CORRECTION
213 – 4.1 #2	Change "k" to "j". It should be "$b_j = (5 - j)/(5 + j)$".
214 – 4.1 #15	The first number in the list should be 0, not 1.
A-30 – 4.1 #55	The top index for the final two summations should be $n - 1$.
A-30 – 4.2 #1	In lines 3, 5, 7, 14, and 20, change "15" to "14", and change line 4 to "Fourteen cents can be obtained by using one 8-cent coin and two 3-cent coins."

226 – **4.2 #5**	Change "n" to "n^2".
A-30 – **4.1 #66**	In the first row of the table, change "g" to "q".
A-32 – **4.2 #13**, last line	Change "$n \geq 0$" to "$n \geq 2$".
227 – **4.2 #23**	Change "k is a positive integer" to "k is an integer and $k \geq 2$."
227 – **4.2** #**33**	Change "m is any odd integer and n is any integer" to "m and n are any positive integers and m is odd."
233 – **4.3** #**2**	This exercise number should be blue.
233 – **4.3** #**6c**	Change to "Write $P(k + 1)$."
234 – 4.3 #33	The arrow from C to E should go in the opposite direction.
A-33 & A-34 –**4.3 #8** line 7; **#11** line 7, and **#16** line 7	Change "$n \geq 0$" to "$k \geq 0$."
242 – **4.4** #**4**, line 4	Change "$d_n \leq 1$" to "$0 < d_n \leq 1$."
A-35 – **4.4 #7**	In the bottom line, after "must show that" insert "$g_k =$".
A-37 – **4.4 #20**,line 9	Change "1 < b by 2a to obtain 2a < 2ab = nb. Thus a < 2a < nb" to "1 ≤ b by 2a to obtain 2a ≤ 2ab = nb. Thus a < 2a ≤ nb".
243 – **4.4** #**21**	Add *H* next to the exercise number.
A-37 – **4.4** #**21**, lines 3 & 4	Delete the words "represent r as a quotient of integers".
243 – **4.4** #**22**	Delete the *H* next to the exercise number. A full solution is given.
A-37 – **4.4** #**22**, line 2	Change "for some integer i" to "for some nonnegative integer i".
254 – **4.5** #**11**, line 12	Insert the following after line 12: "$y_{new} = y_{old} - 1$."

CHAPTER 5

Text

LOCATION	CORRECTION
264 – Example 5.1.13, line 2	Change the second sentence of the solution to "In Section 5.2 we will show that Ø is a subset of every set, and so Ø $\in \mathcal{P}(\{x, y\})$."
275 – Line 6	Change "definition of union" to "definition of intersection".
285 – Proof of Theorem 5.3.1, line7	Change "$k \geq 1$" to "$k \geq 0$".

Exercises

LOCATION	CORRECTION
268 – **5.1 #18b**	Change "$A \cap C = \emptyset$" to "$B \cap C = \emptyset$".
292 – **5.3 #46&47**	Change "Theorem 5.2.2(1)-(5)" to "Theorem 5.2.2(1)-(9)" .
292 – **5.3 #50**	Change the second (d) to (e), (e) to (f), and (f) to (g).
A-44 – **5.3 #59**	Hint (2): Change "$x(x + (y + z)$" to "$(x + (y + z) \cdot x$" and change "$x((x + y) + z)$" to "$((x + y) + z) \cdot x$". Hint (3): Change "$((a + b) + c)(a + (b + c))$" to "$((a + b) + c) \cdot (a + (b + c))$".

CHAPTER 6

Text

LOCATION	CORRECTION
316 – line 12	Change "direct use of the first version" to "direct use of the second version".
324 – Example 6.3.4, line 2	Change "hyphen (-)" to "underscore (_)".
351 – Example 6.5.2, part c	Change to "If root beer is one of the types of soft drink, how many different selections of 15 cans contain fewer than six cans of root beer?"
352 – Example 6.5.2, solution for part c	Change to "According to the difference rule, the number of selections of 15 cans that contain fewer than six cans of root

	beer equals the total number of selections of 15 cans minus the number that contain at least six cans of root beer. Therefore, by parts (a) and (b), the answer is 3876 715 = 3,161."
364 – line below the definition	Change the second sentence to "Defining it to be 1, as is done here, makes it possible to consider expressions such as $(a+b)^n$ without having to exclude values of the variables that result in the expression 0^0."
368 – Example 6.7.3, lines 1 and 10	Change "Theorem 5.3.5" to "Theorem 5.3.1".
379 – Box	Change the first sentence to "Suppose that a sample space S is a union of mutually disjoint events $B_1,B_2,B_3,\ldots,B_n$, suppose A is an event in S, and suppose A and all the B_i have nonzero probabilities."
384 –Sentence following Example 6.9.8	Change the reference from "Example 6.9.6" to "Example 6.9.8".

Exercises

LOCATION	CORRECTION
305 – **6.1 #20b**	Change to "If you switch to another door, what can you say about your chance of winning the prize?"
A-46 – **6.2 #11b**	Change to: "Imagine that there are three 0's in the three left-most positions, and imagine filling in the remaining 5 positions as a 5-step process, where step i is to fill in the $(i + 3)$rd position. Since there are 2 ways to perform each of the 5 steps, there are 2^5 ways to perform the entire operation. So there are 2^5, or 32, 8-bit strings that begin with three 0's."
A-46 – **6.2 #12a**, line 3	In line 3, change "8" to "9".
A-46 – **6.2 #14**	Steps 1-3 should be steps 1-4, and steps 4-6 should be steps 5-7. The answer for part *a* should be $26^4 \cdot 10^3 = 456{,}976{,}000$, for part *b* it should be $26^3 \cdot 10^2 = 1{,}757{,}600$, and for part *d* it should be $26 \cdot 25 \cdot 24 \cdot 23 \cdot 10 \cdot 9 \cdot 8 = 258{,}336{,}000$.
A-50 – **6.3 #26d**	Change "$N((T \cap N) - N(T \cap N \cap U))$" to "$N(T \cap N) - N(T \cap N \cap U)$".
347 – 6.4 #11i	Change to: "Neither a repeated denomination, nor five adjacent denominations, nor five of the same suit"
355 – **6.5 #3d**	Change to "If the different kinds of selections of 20 pastries are equally likely, what is the probability that a selection contains exactly three eclairs?"
A-52 – **6.5 #3d**, line 5	Delete the word "random".
355 – **6.5 #4c**	Change to "If the different kinds of inventories of 30 batteries are equally likely, what is the probability that an inventory contains at least four A76 batteries?"
355 – **6.5 #4d**	Change to "If the different kinds of inventories of 30 batteries are equally likely, what is the probability that an inventory contains exactly four A76 batteries?"
355 – **6.5 #15b**	Change to "If each different type of combination of 50 balloons is equally likely, what is the probability that a combination contains at least one balloon of each kind?"
355 – **6.5 #16b**	Change to "If the different kinds of collections of 30 coins are equally likely, what is the probability that a collection contains at least four coins of each type?"
A-52 – **6.5 #18**	An alternative solution for this exercise is given at the end of these errata. (With thanks to David Little and Stephen Weissenhofer.)
A-54 – **6.7 #15**	Change "$\binom{15}{8}$" to "$\binom{15}{7}$" in each of the three places where it occurs.

369 – **6.7 #21**	Change "positive" to "nonnegative."
A-54 – **6.7 #22**	Change to $a = 1$ and $b = -(1/2)$.
369 – **6.7 #33**	Remove the factor of $(-1)^k$.
386 – **6.9 #3b**, line 2 **6.9 #3b**, line 5	Change "negative" to "positive". Change "positive" to "negative".
386 – **6.9 #9**	Change the color of the exercise number to black, eliminate the symbol *H* next to the number, and change the text to: "Prove the full version of Bayes' theorem."
A-56 – **6.9 #10**	Insert "*a*." at the beginning of the answer, and in line 7 change "$A \cap U_2$" to "$B \cap U_2$". Add the following to the end of the answer: *b*. Given that the chosen ball is blue, the probability that it came from the first urn is $P(U_1 \mid B)$. By Bayes' theorem and the computations in part (a), $P(U_1 \mid B) = \frac{P(B\mid U_1)P(U_1)}{P(B\mid U_1)P(U_1)+P(B\mid U_2)P(U_2)} = \frac{(12/19)(0.5)}{(12/19)(0.5)+(8/27)(0.5)} \cong 68.1\%.$
386 – **6.9 #13**	Change 97% to 98% and change 98% to 97%.
A-56 – **6.9 #13**	Change $P(A \mid B_1)$ to 0.98 and $P(A^c \mid B_2)$ to 0.97. The answer to part (a) becomes 57.6%. The answer to part (b) is correct as given.
387 – **6.9 #20**	Delete the word "both" at the end of line 1.
A-56 – **6.9 #21**	In line 4, change "definiiton" to "definition".
387 – **6.9 #28**	The letter a should be blue. (This part of the exercise has an answer.)
A57 – 6.9 #29a	Change "$(0.3)^0$" to "$(0.03)^0$".
387 – **6.9 #30d**	Assume that the probability that a randomly chosen woman has breast cancer is 0.0002.

CHAPTER 7

Text

LOCATION	CORRECTION
394 – Example 7.1.6	In line 1 of the solution, change "-1^{n+1}" to "$(-1)^{n+1}$".
395 – Example 7.1.7 Example 7.1.9	In line 1, change "Section 5.3" to "Section 5.1". Add "with $b \neq 1$" to the end of the first sentence in the example.
412 – Top box, line 1	Change "positive real number *b*," to "positive real number *b* with $b \neq 1$,"
Example 7.2.6, line 3	Change "with $c \neq 1$" to "with $b \neq 1$ and $c \neq 1$".
416 – Example 7.2.12, line 6	Change "that unique real number *y*" to "that unique real number *x*".
448 – Sentences below Figure 7.5.3	Change to "To be specific: Set F(1) = 1/1, F(2) = 1/2, F(3) = 2/1, and F(4) = 3/1. Then skip 2/2 because 2/2 = 1/1, which was counted first. After that, set F(5) = 1/3, ..."

Exercises

LOCATION	CORRECTION
400 – **7.1 #11d**	Change "U_{kj} to "u_{kj} ".
400 – **7.1 #15b**	Add an equal sign. It should be "$\log_2(1/25) = -2$".
400 – **7.1 #19**, line 1	Change "*b* is any positive real number" to "*b* is any positive real number with $b \neq 1$".
A-59 – **7.2 #11d**	Change the first two sentences of the last paragraph to the following: "Every onto function from *X* to *Y* either sends at least two elements of *X* to *f*(*d*) or it does not. If it sends at least two

	elements of X to $f(d)$, then it is in the second category."
419 – **7.2 #52**. last line	Change "Theorem 5.3.5" to "Theorem 5.3.1".
454 – **7.5 #1**	In line 2, change "*A* are *B*" to "*A* and *B*".
A-65 – **7.5 #23a**	Change the last three lines to " $G(3) = (2,0)$, $G(4) = (1,1)$, $G(5) = (0,2)$, $G(6) = (3,0)$, $G(7) = (2,1)$, $G(8) = (1,2)$, and so forth."
455 – **7.5 #28**	Change "any two countably infinite" to "any two disjoint countably infinite".
455 – **7.5 #30**	Change "a union" to "a disjoint union".
455 – **7.5 #31**	This exercise number should be black, not blue.
455 – **7.5 #33**	Change "exercises 27, 30, and 32" to "exercises 27, 31, and 32"

CHAPTER 8

Text

LOCATION	CORRECTION
471 – Figure 8.1.5	To the right of the drawing, change "$S_{n-1,r-1} + S_{n-1,r}$" to "$S_{n-1,r-1} + rS_{n-1,r}$". Beneath the drawing, on the right side, change "$S_{n-1,r}$" to "$rS_{n-1,r}$".
472 – line 3	Change "$1 \le r \le n$" to "$1 < r < n$".
477 – Example 8.2.2	Change the statement to: "Under the force of gravity, an object falling in a vacuum falls about 9.8 meters per second (m/sec) faster each second than it fell the second before. Thus, neglecting air resistance, a skydiver's speed upon leaving an airplane is approximately 9.8 m/sec one second after departure, 9.8+9.8=19.6m/sec 2 seconds after departure, and so forth. If air resistance is neglected, how fast would the skydiver be falling 60 seconds after leaving the airplane?"
478 – Example 8.2.2	Change the solution to: "Let s_n be the skydiver's speed in m/sec n seconds after exiting the airplane if there were no air resistance. Thus s_0 is the initial speed, and since the diver would travel 9.8 m/sec faster each second than the second before, $s_k = s_{k-1} + 9.8$ m/sec for all integers k. It follows that $s_0, s_1, s_2, \ldots$ is an arithmetic sequence with a constant adder of 9.8, and thus $s_n = s_0 + (9.8)n$ for each integer n. Hence sixty seconds after exiting and neglecting air resistance, the skydiver would travel at a speed of $s_{60} = 0+(9.8)(60)=588$ m/sec."
480 – Box, line 4	Change "10^{30}" to "10^{9}".
491 – Box title	Change "Distincts-Roots" to "Distinct-Roots".
502 – Box, item 2	Change to "Show that for each rule in the RECURSION, if the rule is applied to objects in S that satisfy the property, then the objects defined by the rule also satisfy the property."

Exercises

LOCATION	CORRECTION
A-67 – **8.1 #13**	In line 9, add a right parenthesis, i.e., change the expression to $2(2 + (k - 1)) - (2 + (k - 2))$.
474 – **8.1 #38**	Change "$a_k = a_{k-1} + a_{k-3} + \cdots + a_0 + 2$ " to "$a_k = a_{k-1} + a_{k-3} + a_{k-4} + \cdots + a_0 + 2$ ".
474 – **8.1 #49**	Change the lower limit of the summation from "$k = 1$" to "$k = 2$".
485 – **8.2 #11**, line 1	Change to "$p_k = p_{k-1} + 2 \cdot 3^k$"
A-71 – **8.2 #26b**	In line 3, change "$(1.0025)^{n-1}$" to "$(1.0025)^{n-2}$".

A-71 – **8.2 #26d**	Should be "$A_{480} \cong \$188{,}527.05$".
486 – **8.2 #27**	There should be *H*'s in the margin next to parts a and c of this exercise.
A-73 – **8.2 #50**, line 3	Should be "$a_2 = 2 \cdot 0 + (2 - 1) = 1$".
499 – **8.3 #20**, line 4	Change "*K*" to "*k*".
A-75 – **8.4 #15, II**	Should be "If *s* and *t* are in *S*, then **a**. $st \in S$ **b**. $0s1 \in S$ **c**. $1s0 \in S$."
509 – **8.4 #32**, line 4	Change "$2G(3n - 2)$" to "$2 + G(3n - 5)$".

CHAPTER 9

Text

LOCATION	CORRECTION
519 –**Figure 9.2.1**	Change the captions to "$f(x)$ is $\Omega(g(x))$", "$f(x)$ is $O(g(x))$", and "$f(x)$) is $\Theta(g(x))$", respectively
519 – Box, line 4 Box, line 7 Box, line 10	Change to "a positive real number *A* and a nonnegative real number *a* such that". Change to "a positive real number *B* and a nonnegative real number *b* such that". Change to "numbers *A* and *B* and a nonnegative real number *k* such that".
520-21 – Example 9.2.2	In line 1 of part (b) of the solution, change to "$A = 15$ and $B = 45$". Three lines from the bottom of page 520 and in the top line of page 521, change "x_0 to "*k*".
523 – Example 9.2.4, line 10	Change "Let $M_1 = 2$ and $x_1 = 0$" to "Let $A = 2$ and $a = 0$".
524 – Example 9.2.5, line 11	Delete the absolute value signs on the right-hand side of the inequality that follows the arrow.
525-6 – Example 9.2.6	The polynomial in this example should be written consistently as $3x^3 - 1000x - 200$. Thus, in the following places the number 100 should be changed to 200: On page 525, lines 1, 5, 9, 23, 24, and 31, and on page 526, line 1.
526 – Example 9.2.8, line 5	Change the inequality to "$\lvert x^2 \rvert \le B \lvert x \rvert$".
528 – Box	The *x*'s are missing in the three rational algebraic expressions. Each should be $\dfrac{a_n x^{r_n} + a_{n-1} x^{r_{n-1}} + \cdots + a_1 x^{r_1} + a_0 x^{r_0}}{b_m x^{s_m} + b_{m-1} x^{s_{m-1}} + \cdots + b_1 x^{s_1} + b_0 x^{s_0}}$.
533 – Table 9.3.1	In column 5, row 4 of the body of the table, change "27.8 min" to "27.8 hr".
537 – Algorithm 9.3.1	Change the statements inside the **for-next** loop to the following: $x := a[k]$ $j := k - 1$ **while** ($j \neq 0$) **if** ($a[j] > x$) **then do** $a[j + 1] := a[j]$ $j := j - 1$ $a[j + 1] := x$ **end do** **else** $j := j - 1$ **end while**
538 – Example 9.3.5	Change the 2nd and 3rd sentences of the solution to: "Because $j \neq 0$, the **while** loop is entered and the condition for the **if-then-else** statement is tested. Because $a[1] > x$, then $a[2]$ is assigned the value of $a[1]$, which is 6, *j* is

	assigned the value of $j - 1$, which is 0, and $a[1]$ is assigned the value of x, which is 3." Add columns to the table for values of j descending to 0.
551 – Example 9.4.5	In line 1 of the solution, change "$\Omega(x)$" to "$\Omega(x \log_2 x)$", and in line 9, change "$O(x)$" to "$O(x \log_2 x)$". In lines 10 and 13, change "x_2" to "b". Also change line 16 of the solution to "$x \log_2 x = \lvert x \log_2 x \rvert$".
552 – Example 9.4.5	In line 5, change "$\Omega(x)$" to "$\Omega(x \log_2 x)$" and "$O(x)$" to "$O(x \log_2 x)$". In line 6, change "$\Theta(x)$" to "$\Theta(x \log_2 x)$".
559 – line 3	Change the square brackets to floor symbols.
564 – The 3 lines above the "Merge Sort" heading	Change "0.000017 second" to "0.000000027 second", "0.000027 second" to "0.000000037 second", "2.78 hours" to "27.78 hours", and "0.000037 second" to "0.000000047 second".
568 – line 2	Change inequality to "$(1/2)n\log_2 n \le m_n \le 2n\log_2 n$".

Exercises

LOCATION	CORRECTION
A-79 – **9.1 #20**, line 1	Change "u_1" to "u".
529 – **9.2 #21b**, line 2	Change "x" to "$\sqrt{x}$ ".
530 – **9.2 #27**, line 4	Change "x_1" to "a".
Directions for **9.2** #28-30, line 8	Change "the highest-order term" to "x^n where n is the degree".
530 – **9.2 #49a**, line 2	Change "$g(x)$ is $O(f(x))$" to "$g(x)$ is $O(h(x))$".
531 – **9.2 #55**	Change "$(x - 1)$" in the denominator of the fraction to "$(x + 1)$".
A-82 – **9.3 #1c**	Change "81,121.5" to "81.1215".
541 – **9.3 #16**, lines 2 and 8	Change "k" to "i".
A-84 – **9.3 #22**	Add columns with values of j descending to 0.
A-84 – **9.3 #24**	*Solution 1:* Change to "The answer is 14, twice the number of nonzero values of j (counting repetitions)." *Solution 2:* Change to "The answer is 14: 2 comparisons in step 1, 2 in step 2, 6 in step 3, and 4 in step 4."
A-87 bottom & **A-88** top – **9.4 #30**, line 3	Change "Observe that….$\log_2 x \le x$" to "It is clear from the graphs of $y = \log_2 x$ and $y = x$ that for all $x > 0$, $\log_2 x \le x$."
556 – **9.4 #38**	Change "$Q((4/5)^n)$" to "$Q(1)$".
556 – **9.4 #50**	Change the beginning of the first sentence to "For all positive real numbers u,…".
A-89 – **9.4 #49c**, lines 3&4	The inequality should be: "$rn - r^2 + r \ge n$".
556 – **9.4 #50**	Change the beginning of the first sentence to "For all positive real numbers u,…".
570 – **9.5 #25**	Change part (a) to "$(1/2)n\log_2 n \le m_n$"
A-89 – **9.4 #54b**	In the last two lines, change "x_0" to "b".

CHAPTER 10

Text

LOCATION	CORRECTION
572 – line 3	Delete this line. (0 is not in *B.*)
581 – line 8 from the bottom	Change "exercise 20" to "exercise 23".
595 – Boxed definition	Change the last part to "there is a subset A_i of the partition such that both x and y are in A_i".

591 – bottom line	Change "For all $m,n \in \mathbf{Z}$" to "For all $m,n,p \in \mathbf{Z}$".
592 – line 2	Change "For all $m,n \in \mathbf{Z}$" to "For all $m,n,p \in \mathbf{Z}$".
595 – Figure 10.3.1	Change "$A_i \cap A_i = \varnothing$" to "$A_i \cap A_j = \varnothing$".
606 – lines 4-6	Change the first sentence to "In exercise 36 at the end of this section, you are asked to show that if *a* is any element of an equivalence class [*b*], then [*a*] = [*b*]."
614 – line 9	Change "divided by an integer" to "divided by a positive integer".
615 – Theorem 10.4.3, part 4	Change "for all integers" to "for all positive integers".
617 – lines 14-16	Change "≡" to "=".
619 – line 12 of the proof	Change "$d \mid c$" to "$d \le c$".
620 – line 1 line 8	Change the first line to: "Thus *r* is a linear combination of *a* and *b*. If $r > 0$, then *r* would be in *S* and so *r* would" Change "Hence it is less than" to "Hence it is less than or equal to"
623 – line 13	Change "27-(-13) = -40 = (-1)40" to "27-(-13) = 40".
624 – Example 10.4.10, line 5	Change "Example 10.4.4(b)" to "Example 10.4.8(b)".
625 – line 2	Add at end: "= 17".
626 – line 4 in the paragraph below the theorem box	Change "$(ac)d \equiv (bd)d$" to "$(ac)d \equiv (bc)d$".
629 – lines 20 and 26	Insert directly below line 20: "If *M* is not relatively prime to *pq*, then either $p \mid M$ or $q \mid M$. Without loss of generality, assume $p \mid M$. It follows that $M^{ed} \equiv 0 \equiv M \pmod{p}$. Moreover, because $pq < M$, $q \nmid M$, and thus, as above, $M^{ed} \equiv M \pmod{q}$. Therefore, in this case also, $M^{ed} \equiv M \pmod{p}$ and $M^{ed} \equiv M \pmod{q}$." Change the last paragraph in the subsection to: "This proof has shown that the RSA cipher gives the correct result provided $M < pq$, which ensures that the solution is unique."
631 – Algorithm 10.4.1	Delete the lines "**if** ($b \neq 0$) **then do**" and "**end do**". Change the post-condition to "$\gcd(A,B) = a = sA + tB$.
638 – Top diagram	Add an arrow from Ø to {*b*}.

Exercises

LOCATION	CORRECTION
A-91 – **10.1 #4**	Replace the last two lines by "*m* and *n* are both odd."
593 – **10.2 #18**	Change **"Z"** to "$\mathbf{Z}^+$" and "all integers" to "all positive integers".
A-94 – **10.2 #38**	Delete the symbol *R* at the beginning of the second line of the algorithm description, and insert the following text between the first and second lines: "*R defined on a set A, which is represented as the one-dimensional array* a[1]*,* a[2]*,…,*a[*n*]*,. To test whether R is reflexive, the*".
A-95 – **10.3 #17a(2)**	Change "major" to "major (or double major)".
630 – **10.4 #8e**	Change "2^2" to "3^2".
10.4 #11	Add "for all integers $m \ge 1$."
630 – **10.4 #12a**	Change to "Prove that for all integers $n \ge 1$, $10^n \equiv 1 \pmod 9$."
A-97 – **10.4 #12a**	Add: "*Alternative proof*: By definition of congruence, $10 \equiv 1 \pmod 9$ because $10 - 1 = 9$ and $9 = 9 \cdot 1$. Thus, by Theorem 10.4.3(4), for all positive integers *n*, $10^n \equiv 1^n = 1 \pmod 9$."
A-97 – **10.4 #13a**	Change to "Prove that for all integers $n \ge 1$, $10^n \equiv (-1)^n \pmod{11}$."
A-97 – **10.4 #22**, line 10	Change "$25^2 \equiv 20 \pmod{55}$" to "$5^2 \equiv 20 \pmod{55}$"
631 – Directions for exercises **10.4 #28-29**	Change "$sa + tb$" to "*s*, *t*, and $sA + tB$".
A-98 – **10.4 #28**	Change the entries in the bottom row to "s$A + tB$, 330, 156 18,

	12, 6”. Change the entries in the right-most column to “6, 0, 0, 2, 9, –19, –26, 55, –26, 55, 6” (reading from top to bottom).
631 – **10.4 #31**	Change “partial congruence” to “positive solution”.
A-98 – **10.4 #31c**, line 9	Change “9 (mod 13” to “8 (mod 13)”.
631 – **10.4 #41b**	Change the second-to-last sentence to: “But, by part (a), $p_1 = q_i$ for some integer i with $1 \le i \le s$.”
A-99 – **10.4 #46**, line 2	Change “6 (mod 5)” to “5 (mod 6)”.
A-101 – **10.5 #41**, line 12	Change “and so x_i” to “and so x_j”.

CHAPTER 11

Text

LOCATION	CORRECTION
655 – Example 11.1.6, line -7	Change “*vvcBc*” to “*vvc*/*Bc*”.
657 – Definition of subgraph	Change “every edge in *H* has the same endpoints as in *G*” to “the endpoints of the edges in *H* are in *V*(*H*)”.
676 – Example 11.2.7: Floor plan diagram Diagram in the solution	Rooms *A* and *B* should be completely separated. Extend the line between them accordingly. Delete the edge between *I* and *K*.
678 – last line before Example 11.2.8	Change “where *C* contains” to “where *G* contains”.
690 – line 9	Change “= 2” to “= –2”.
691 – line 13	The second term after the equal sign should be “$a_{i2}b_{21}c_{1j}$”.
691 – line 5 from bottom	Add an equal sign between the second and third matrices.
692 – Example 11.3.9	In line 5, change “A_{ij}” to “a_{ij}”. In line 10, change “by definition of 1” to “by definition of **I**”.
693 – lines 2, 16, and 17	In line 1, change “*A*” to “**A**”; in line 16, change “Your” to “You”; and in line 17 change “From v_1” to “From v_2”.
702 – line 18	Change “the ones that are images under *g*” to “the ones that are images under *h*”.
703 – Example 11.4.5	In the first line of the solution, change “*f*” to “*g*”.
730 – line 6 from bottom	Change “first” to “last”.
730 – line 4 from bottom	Change “*T*” to “*W*”.
730 – line 2 from bottom	Change “an edge *e’* joining” to “an edge *e’* that is not in *T* and joins”.

Exercises

LOCATION	CORRECTION
683 – **11.2 #50**	Change to “Show that if a graph is bipartite then every circuit in the graph has an even number of edges.”
A-108 – **11.5 #18**	Change to “There are 20.”
A-111 – **11.6 #9**	In the diagram for adding edges using Prim's algorithm, change {*a*,*f*} to {*e*,*f*}.

CHAPTER 12

Text

LOCATION	CORRECTION
737 – Example 12.1.3	Change the solution to the following: “L = {41+,41–,44+,44–,11+,11–,14+,14–}. 41+ = 4+1 = 5, 41– = 4–1 = 3, 44+ = 4+4 = 8, 44– = 4–4 = 0, 11+ = 1+1 = 2,

	11– = 1–1 = 0, 14+ = 1+4 = 5, 14– = 1–4 = –3.”
738 – Top Definition Box, bottom line	Change “∈” (the element-of symbol) to “ϵ” (the null-string symbol).
739 – line 1	Change “{*a*,*b*}” to “{*a*,*b*,*c*}”.
739 – Definition Box, line 4	Change “ϵ” (the null-string symbol) to “∈” (the element-of symbol).
740 – line 2	On the left of the equal sign, change “(*L*(*a* | *b*))*” to “*L*((*a* | *b*)*)”.
741 – Example 12.1.9	Change the end of first sentence to “…that define the following languages.” *a*. Change to “The language consisting of all strings of 0’s and 1’s that have even length and in which the 0’s and 1’s alternate.” c. Change to “The language consisting of all strings of 0’s and 1’s that do not contain two consecutive 1’s.” Solution for *a*. Delete the first sentence and change the second sentence to “If a string in the language starts with a 1, the pattern 10 must continue for the length of the string.” Solution for *c*. Change to “Note that a string may end in a 1, but any other 1 must be followed immediately by a 0. Thus, it is enough to enforce the rule that a 1 must be followed by a 0, unless the 1 is at the end of the string. A regular expression satisfying these conditions is (0 | 10)*(ϵ | 1).”
743 – line 7	Change “Account Number” to “AccountNumber”.
744 – line 3	Change “second of February” to “fifth of February”.
760 – line 1	Change “$a^q b^p$” to “$s = a^q b^p$”.
772 – line 9	Change “10.4.2” to “12.3.2”.

Exercises

LOCATION	**CORRECTION**
A-112 – **12.1 #19**	Add to the end of the sentence: “and end in an *a*.”
762 – **12.2 #48a**	Change to: “A string of seven digits in which neither of the first two digits is a 0 or a 1 (*a local call string*).”
773 – **12.3 #3**	Change “10.4.1” to “12.3.1”

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Alternative Solutions for Exercise 6.5 #18 (with thanks to David Little and Stephen Weissenhofer.)

6.5 #18(a): Let P be the set containing all selections of 20 pastries chosen from the six kinds. From exercise 3(a) we know that $N(P) = 53,130$. Let E be the set of all the selections that contain at least 11 eclairs. For these selections, 9 additional pastries are chosen from the 20 kinds, and so $N(E) = \binom{9+6-1}{9} = \binom{14}{9} = 2,002$. But $P-E$ is the set of all the selections that contain at most 10 eclairs, and, by the difference rule, $N(P-E) = N(P)-N(E) = 53,130-2,002 = 51,128$. Thus there are 51,128 selections of pastries that contain at most 10 eclairs.

6.5 #18(b): Let S be the set of all the selections of 20 pastries that contain at least 9 napolean slices. For these selections, 11 additional pastries are chosen from the 20 kinds. So $N(S) = \binom{11+6-1}{11} = \binom{16}{9} = 4,368$. Now $E \cap S$ is the set of all the selections that contain at least 11 eclairs and at least 9 napolean slices. Since $11+9 = 20$, there is only one such selection, and so $N(E \cap S) = 1$. By the inclusion/exclusion principle,

$$N(E \cup S) = N(E) + N(S) - N(E \cap S) = 2,002 + 4,368 - 1 = 6,369.$$

But $E \cup S$ is the set of all the selections that contain at least 11 eclairs or at least 9 napolean slices, and so $P - E \cup S = (P - E) \cap (P - S)$ is the set of all the selections that contain at most 10 eclairs and at most 8 napolean slices. By the difference rule,

$$N(P - E \cup S) = N(P) - N(E \cup S) = 53,130 - 6,369 = 46,761.$$

Thus there are $46,761$ selections of pastries that contain at most 10 eclairs and at most 8 napolean slices.