Known errata/items to fix in *Exploring Modeling with Data and Differential Equations Using R* by Zobitz

Textbook page [Github issue]	Description

Page 82 [#2]	Code chunk should read:
	# Define the windows where we make the plots
	t_window <- c(0, 3)
	x_window <- c(0, 5)
	
	# Define the differential equation
	system_eq <- c(
	  dt ~ 1,
	  dx ~ -0.7 * x * (3 - x) / (1 + x)
	)
	
	phaseplane(system_eq,
	  x_var = "t",
	  y_var = "x",
	  x_window = t_window,
	  y_window = x_window
	)

Page 60 [#3]	Differential equation in Exercise 4.2 should read: dp/dt = 0.023p*(1-p)
Page 92 [#4]	Equation 7.8 should be dI/dt + .023I = 312.8
Page 146 [#5]	Revise part a: "... has a minimum value at *b = 1.865*"
Page 156 [#7] Date closed: 10/23/23	Revise question to ask for the mean, not the median: "Display the bootstrap histogram of 1000 bootstrap samples for the standard deviation of the `snowfall` dataset. From this bootstrap distribution (for the standard deviation) what is the median and 95% confidence interval?"
Page 36 [#8]	I think that in the last paragraph of section 3.1, page 36 (just above section 3.2), the current sentence *"For Equation (3.1), this means that we are solving dE/dt = ..."* should read instead: *"For Equation (3.1), this means that we are solving dN/dt = ..."*
Page 70 [#9] Date closed: 12/19/23	Revise last sentence of page 70: "Next we apply local linearization to construct a locally linear approximation L(y) for f(y) at y=*y:"

Page 311 [#11]
Date closed:
12/19/23
	D_log is not defined - here is some revised code:
	
	# Many solutions
	n_sims <- 100 # The number of simulations
	
	# Identify the standard deviation of the stochastic noise
	D_logistic <- 1
	
	# Compute solutions
	logistic_run_r <- rerun(n_sims) %>%
	  set_names(paste0("sim", 1:n_sims)) %>%
	  map(~ euler_stochastic(deterministic_rate = deterministic_logistic_r,
	                         stochastic_rate = stochastic_logistic_r,
	                         initial_condition = init_logistic,
	                         parameters = logistic_parameters,
	                         deltaT = deltaT_logistic,
	                         n_steps = timesteps_logistic,
	                         D = D_logistic)
	) %>%
	  map_dfr(~ .x, .id = "simulation")
	
	# Plot these all together
	  ggplot(data = logistic_run_r) +
	  geom_line(aes(x=t, y=x, color = simulation)) +
	  ggtitle("Spaghetti plot for the logistic SDE") +
	  guides(color="none")

Page 330 [#12] Date closed: 12/19/23	Section 26.1.2, the SDE is dX = 2 dt + dW(t) (not dX = 0.2 dt + dW(t))
Page 67 [#13] Date closed: 8/12/25	Adjust the wording on the definition of equilibrium solution to avoid any confusion in reading (perhaps expound more). Revisions in 2025 quarto edition: The **stability** of an equilibrium solution describes the long-term behavior of the family of solutions to a differential equation. Some solutions may converge to the equilibrium in the long run, while others may not. More formally stated: > The constant function $y=y_{*}$ is considered an asymptotically *stable* solution to a differential equation $\displaystyle \frac{dy}{dt} = f(y)$ if there exists a solution $y_{S}(t)$, such that $\displaystyle \lim_{t \rightarrow \infty} y_{S}(t) = y_{*}$. In other words, as time increases, the the family of solutions to the differential equation is approximated by the constant function $y=y_{*}$. You may note that the definition of stability relies on determining the solution $y_{S}(t)$. However we can circumvent determining this solution by using ideas from calculus and the rate of change:
Page XXX [#25] Date closed: 7/11/25	Equation 4.8 should read: dI/dt = kSI - beta*I

Exercise 19.5, page 248 [#10] Date closed: 8/12/25	This equation has an eq. soln at (0,0), but y' is mathematically not defined there. Revise this question. Revised in the 2025 update to: a. There are three equilibrium solutions for this differential equation. What are they? *Hint:* first determine where $y'=0$ and then substitute your solutions into $x'=0$. b. For what values of x and y is the function $g(x,y)=0.5y \cdot (1-yx)$ not defined? How might that affect interpretation of the trivial ($(x,y)=(0,0)$) equilibrium solution? c. Visualize the phase plane for this system of differential equations. d. Compute the Jacobian matrix for all of the non-trivial equilibrium solutions (i.e. not $(x,y)=(0,0)$). e. Use the trace-determinant relationships to evaluate the stability of the non-trivial equilibrium solutions. Is the trace-determinant analysis consistent with your phase plane?
Better scaffolding Exercise 10.4 [#6] Date closed: 8/12/25	10.4 - ask for more specificity in how to do this and each part - students mashed this problem up! Revised in the 2025 update to: 1. Researchers believe that . One way to do this is to include an a. Researchers believe that $\theta \approx 7$. One way to do this is to include an additional term of $(\theta-7)^{2}$ in the cost function. Re-write your formula from [@exr-phos-09]b $S(1.737,\theta)$ to account for this additional (prior) information. Call this revised function $S_{b}(1.737,\theta)$ 2. b. Make a graph of $S_{b}(1.737,\theta)$ and determine where the global optimum value occurs. 3. c. How does the inclusion of this additional information change the shape of the cost function and the location of the global minimum, compared to $S(1.737,\theta)$? 4. d. Finally, reconsider the fact that $\theta \approx 7 \pm .5$ (as prior information). To account for this in your cost function, the additional term in $S_{b}(1.737,\theta)$ could be modified to $\displaystyle \frac{(\theta-7)^{2}}{0.5^{2}}$. How does that additional modification change $S_{b}(1.737,\theta)$ further and the location of the global minimum? 5. e. Let's say researchers believe $\theta \approx \mu \pm \sigma$. What would be a general expression to include in the original cost function $S(1.737,\theta)$ to account for this information? Your final expression will have μ and σ in it. 6. f. Use [desmos](https://www.desmos.com/calculator) or other graphic software to investigate what would happen in your general expression as μ and σ. First set $\sigma=0.5$ and let $\mu=7$ be a slider. Investigate values of μ between 3 and 10 and report what happens. Next set $\mu=7$ and let $\sigma = 0.5$ be a slider. Investigate values of σ between 0.1 and 1 and report what happens.