

**Introduction to Data Science**  
**Homework 9: Due Friday November 2 at 2:00pm**

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## Exercises:

1. Do Conceptual Exercise 2 from Chapter 3 of *An Introduction to Statistical Learning*. **Hint:** Read section 3.5 first.
2. Do Conceptual Exercise 3 from Chapter 3 of *An Introduction to Statistical Learning*.
3. Do Conceptual Exercise 5 from Chapter 3 of *An Introduction to Statistical Learning*.
4. Do Applied Exercise 8 from Chapter 3 of *An Introduction to Statistical Learning*.
5. Do Applied Exercise 9 from Chapter 3 of *An Introduction to Statistical Learning*.
6. In this problem you are asked to write R code to do simple quadratic regression “by hand.” Recall that in the lecture R notebook for simple linear regression, we computed simple linear regression “by hand” by carrying out the following steps:
  - (a) We wrote a function to represent the linear expression  $ax + b$ , where  $x$  is the predictor variable and  $a$  and  $b$  are the parameters.
  - (b) We wrote a function to compute the MSE for the predictor values  $x$  and for input values of the parameters  $a$  and  $b$ . This will be a function of the parameters which we made sure was vectorized.
  - (c) We used the `optim()` function to minimize the MSE function as a function of the parameter values.

Your task is to carry out the same steps now using a quadratic expression  $ax^2 + bx + c$  instead of a linear expression. In order to test your code, simulate some data (make sure to add a small amount of noise) that is well-approximated by a quadratic function. Then, simulate some data that should not be well-approximated by a quadratic function.

7. Try using both simple linear regression and multiple linear regression on your project dataset. Describe what you do and assess the results. Specifically, what if anything does (either simple or multiple) linear regression tell you about (some or all of) the variables in your data? Do you have any evidence that linear regression helps to accurately explain at least part of your dataset?