QMB 6315: Python for Business Analytics
College of Business
University of Central Florida
Spring 2025

Assignment 1

Due Friday, April 11, 2025 at 11:59 PM
in digital form in your GitHub repository.

Instructions:

Complete this assignment within the space on your *private* GitHub repo (not a fork of the course repo QMB6315S25) in a folder called `assignment_01`. In this folder, save your answers to Question 1 in a file called `my_functions.py`, following the sample script in the folder `assignment_01` in the course repository. When you are finished, submit it by uploading your files to your GitHub repo using the approach outlined in Question 2. You are free to discuss your approach to each question with your classmates but you must upload your own work.

Question 1:

Your assignment is to follow the function design recipe to define functions for all of the following calculations. For each function, create three examples to test your functions. Record the function definitions and examples in the sample script `my_functions.py`, which was already started by one of your coworkers. In some cases, the function definition is complete, while in others, all that remains is to create examples to test the function for accuracy.

a) Write a function `variance(x)` that calculates the sample variance of the variable in the list x. The formula for the variance is

$$Var(x) = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2,$$

where n is the number of items in the list x and $\bar{x}$ is the average of x.

b) Write a function `covariance(y, x)` that calculates the sample covariance of the variables in the lists y and x. The formula for the covariance is

$$Cov(x) = \frac{1}{n-1}\sum_{i=1}^{n}(y_i - \bar{y})(x_i - \bar{x}),$$

where the lists y and x both have length n.

c) Now write a function that calculates the slope coefficient for the linear regression model. Using calculus, you can show that the following function minimizes $SSR(y, x, \beta_0, \beta_1)$ for β_1:

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(y_i - \bar{y})(x_i - \bar{x})}{\sum_{i=1}^{n}(x_i - \bar{x})^2},$$

which is called the ordinary least squares (OLS) estimator. Write a function that performs this calculation called `ols_slope(y, x)`.

d) Now write a function `ols_intercept(y, x, beta_1_hat)` that calculates the intercept coefficient for the linear regression model. With the slope coefficient, the intercept can be calculated with

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}.$$

e) Write a function `ssr(y, x, beta_0, beta_1)` that calculates the sum of squared residuals for the linear regression model.

$$SSR(y, x, \beta_0, \beta_1) = \sum_{i=1}^{n} (y_i - \beta_0 - \beta_1 x_i)^2.$$

You can use the function `ssr_loops(y, x, beta_0, beta_1)` from Assignment 4 (including the solutions) as a template.

Question 2:

Upload your code to your GitHub repo using the interface in GitHub Desktop.

1. Save your file within the folder in your repository in GitHub Desktop.
2. When you see the changes in GitHub Desktop, add a description of the changes you are making in the bottom left panel.
3. Press the button "Commit to main" to commit those changes.
4. Press the button "Push origin" to push the changes to the online repository. After this step, the changes should be visible on a browser, after refreshing the page.