

Stat 5102 (Geyer) Spring 2016
Homework Assignment 10
Due Wednesday, November 30, 2016

Solve each problem. Explain your reasoning. No credit for answers with no explanation. If the problem is a proof, then you need words as well as formulas. Explain why your formulas follow one from another.

10-1. The URL

<http://www.stat.umn.edu/geyer/5102/data/prob10-1.txt>

contains six variables named x_1 , x_2 , x_3 , x_4 , x_5 , and y .

- (a) Perform a simple linear regression of y on x_1 .
- (b) Perform a hypothesis test of whether the regression coefficient for x_1 is significantly different from zero.
- (c) Perform a hypothesis test of whether the correlation coefficient of x_1 and y is significantly different from zero.
- (d) Calculate a 95% confidence interval for the true population regression coefficient for x_1 .

10-2. The URL

<http://www.stat.umn.edu/geyer/5102/data/prob10-1.txt>

contains six variables named x_1 , x_2 , x_3 , x_4 , x_5 , and y .

- (a) Perform a quadratic regression of y on x_1 , that is, the mean of y given x_1 is a quadratic function of x_1 .
- (b) Perform a hypothesis test of whether the regression coefficient for x_1^2 is significantly different from zero.
- (c) Calculate a 95% confidence interval for the true population regression coefficient for x_1^2 .

10-3. The URL

<http://www.stat.umn.edu/geyer/5102/data/prob10-1.txt>

contains six variables named x_1 , x_2 , x_3 , x_4 , x_5 , and y .

- (a) Perform a linear regression of y on x_1 and x_2 , that is, the mean of y given x_1 and x_2 is a linear function of these two variables.

- (b) Perform a hypothesis test of whether the regression coefficient for x_2 is significantly different from zero.
- (c) Calculate a 95% confidence interval for the true population regression coefficient for x_2 .

10-4. The URL

<http://www.stat.umn.edu/geyer/5102/data/prob10-1.txt>

contains six variables named x_1 , x_2 , x_3 , x_4 , x_5 , and y .

- (a) Perform a linear regression of y on x_1 and x_2 , that is, the mean of y given x_1 and x_2 is a linear function of these two variables.
- (b) Perform a quadratic regression of y on x_1 and x_2 , that is, the mean of y given x_1 and x_2 is a general quadratic function of these two variables containing terms x_1^2 , $x_1 * x_2$, and x_2^2 .
- (c) Perform a hypothesis test of whether the second model fits the data better than the first.

10-5. The URL

<http://www.stat.umn.edu/geyer/5102/data/prob10-5.txt>

contains two variables named x and y . This problem involves Fourier series. We will fit models of the form

$$E(Y) = \beta_1 + \sum_{i=1}^k (\beta_{2i} \sin(ix) + \beta_{2i+1} \cos(ix))$$

for various values of k . We call the model for k the Fourier series with terms up to frequency k .

- (a) Make a scatter plot of these two variables.
- (b) Fit the Fourier series with terms up to frequency 1.
- (c) Fit the Fourier series with terms up to frequency 2.
- (d) Fit the Fourier series with terms up to frequency 3.
- (e) Perform a hypothesis test of whether the second model fits the data better than the first.
- (f) Perform a hypothesis test of whether the third model fits the data better than the second.

- (g) Make a scatter plot of the data and add the regression functions for all three models to the plot.

10-6. The URL

<http://www.stat.umn.edu/geyer/5102/data/prob10-1.txt>

contains six variables named x_1 , x_2 , x_3 , x_4 , x_5 , and y .

- (a) Perform a simple linear regression of y on x_1 .
- (b) Perform a multiple linear regression of y on x_1 , x_2 , x_3 , x_4 , and x_5 .
- (c) Calculate a 95% confidence interval for the mean of the first individual using only x_1 .
- (d) Calculate a 95% confidence interval for the mean of the first individual using all five predictor variables.
- (e) Same as (c) except prediction interval.
- (f) Same as (d) except prediction interval.