



# STAT448 - Assignment 1

Due by 11:55 pm of March 22, 2020

Assignment should be submitted on Learn as a pdf file for the part non involving R and a and html Rmarkdown file for the R code and results, properly commented.

Assignments can be done in pairs: both names and student id's should be on the assignment and both students should submit.

1. **(14 marks)** Three observations for a response random variable  $\mathbf{Y}$  are  $\{5, 9, 13\}$ ; the corresponding values observed for the explanatory variable  $\mathbf{X}$  are  $\{3, 4, 5\}$ . Assume a linear model:

$$Y = \beta_0 + \beta_1 X + \epsilon$$

- (a) Compute ordinary least squares estimates of the coefficients  $\hat{\beta}_0$  and  $\hat{\beta}_1$  using linear algebra calculations by hand and with explanatory comments.
  - (b) Calculate by hand the estimates of the residuals  $\hat{\epsilon}$ .
  - (c) Perform the same matrix algebra calculations of part (a) and (b) using R.
  - (d) Estimate the coefficients using the function `lm` in R.
2. **(6 marks)** In the context of exercise 1, consider the case where the values observed for the explanatory variable  $\mathbf{X}$  are  $\{2, 2, 2\}$ .
    - (a) What happens to the coefficient estimates?
    - (b) Please give both a statistical and geometric explanation of this situation.