

**Research Methods**

---

**STAT 480      ASSIGNMENT 2      DUE: Thursday 28/01/2016      15 points 3/3**

---

For the second assignment you are required to conduct and analyze results from a simulation study. You have the choice of any of the following

- the simulation study briefly introduced in class.
- any other simulation study which you might be using in your research project.

You should write three functions following the instructions below.

1. [gen.data](#): a function generating data according to a linear model with slope and intercept and fixed covariate

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon},$$
$$\boldsymbol{\varepsilon} \sim N(\mathbf{0}, \mathbf{V})$$

Here,

- $\mathbf{X}$  is the design matrix having only 1s on the first column.
  - $\boldsymbol{\beta}$  is the parameter vector containing the slope and intercept.
  - $\mathbf{V}$  is a diagonal matrix.
2. [fit.data](#): a function fitting the model by two methods: ordinary least squares and generalized least squares. Output: two (vector) estimators.
  3. [MC.simul](#): a function which performs the Monte Carlo simulation. It should contain a loop, where at each step the two functions [gen.data](#) and [fit.data](#) are called.

You should perform the analysis and discuss the results obtained. Make sure that your report is able to answer the following questions

- Are the two estimators behaving similarly?
- Are there cases in which they do and cases in which they don't?
- In the case when they don't behave the same which estimator is better and why?

Justify your answers with numeric results and use the *caption* command to add captions to your tables and figures. *Note that in the case when you chose to work on a different simulation study, to create your report you should follow similar guidelines.*

**Submit by email to [laura.dumitrescu@vuw.ac.nz](mailto:laura.dumitrescu@vuw.ac.nz):**

1. A simulation study report in the form of a standard **.pdf file** (**not** a presentation!). Its length should be of **no more than three pages** and the report should have a structure similar to what we saw in class.
2. A **.txt** file with the R code containing the three function above. You are *not* required to document it.