

# Design and Analysis of Experiments

## 00 - Course Intro

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*“The combination of some data and an aching desire for an answer does not ensure that a reasonable answer can be extracted from a given body of data.”*

John W. Tukey (1915 – 2000)  
American mathematician



# Course Overview

## Objectives

- To develop advanced skills in designing experiments, defining and testing hypotheses, and performing statistical data analyses within one's field of interest;
- By the end of this course, the student should be able to:
  - Plan experiments related to his/her work;
  - Perform appropriate statistical analyses of the data obtained from the experiment;
  - Develop sound conclusions based on the available data;
  - Identify the problems and limitations of his/her own experiments, and suggest improvements;
  - Perform critical interpretations of other experimental methodologies and results reported in the literature.

# Course Overview

## Course Structure

- Lectures (10-11 weeks): discussions about several aspects and techniques for design and analyses of experiments. Theory, application examples and *computational case studies*;
- Final project presentations;
- Written exams;
- Tutoring;

# Course Overview

## Course Structure

### Evaluation criteria

Item	Type	Value
Case studies	Classroom activity	35
Written exams	Written exam	40
Final Project	Report and presentation	25

### Other relevant Information

- Lectures slides, example R files, data, etc. available at <http://git.io/v3Kh8>
- Office hours: depends on the week. Please drop me a message to check availability.
- Software/services used: R (<http://cran.r-project.org/>), GitHub (<http://github.com/>).

# Course Overview

## Course Bibliography

### Main:

- Felipe Campelo (2015), *Lecture Notes on Design and Analysis of Experiments*. Online: <http://git.io/v3Kh8> Version 2.11; Creative Commons BY-NC-SA 4.0.
- D.C. Montgomery, G.C. Runger (2010), *Applied Statistics and Probability for Engineers*, John Wiley & Sons.
- Michael J. Crawley (2007), *The R Book*, Wiley.

### Additional:

- D.C. Montgomery (2012), *Design and Analysis of Experiments*, John Wiley & Sons.
- B. Caffo (2015), *Statistical inference for data science*, LeanPub - <https://leanpub.com/LittleInferenceBook/>
- J.J. Faraway (2002), *Practical Regression and Anova using R* - <http://goo.gl/ewMWL>
- D. Wiens (2005), *Introduction to Design and Analysis of Experiments* - <http://goo.gl/hZXg1>

# Course Overview

Required / Desired background

This is a course on *applied* experimental design and analysis. As such, a large portion of the course is dedicated to case studies in which the student will design experiments, collect (simulated) data, perform inference and report his or her analysis.

It is **strongly recommended** that the student should complete the free online course *R Programming*<sup>b</sup> **before the end of the second week** of the semester (except if the student is already fluent with R).

It is also **strongly recommended** that the student should complete the free online course *Reproducible Research*<sup>c</sup> **before the end of the first month** of the semester (except if the student is already fluent with writing reports using R Markdown).

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<sup>b</sup><https://www.coursera.org/course/rprog>

<sup>c</sup><https://www.coursera.org/course/repdata>

# About this material

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Please reference this work as:

Felipe Campelo (2015), *Lecture Notes on Design and Analysis of Experiments*.

Online: <https://github.com/fcampelo/Design-and-Analysis-of-Experiments>

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@Misc{Campelo2015-00,  
  title={Lecture Notes on Design and Analysis of Experiments},  
  author={Felipe Campelo},  
  howPublished={\url{https://github.com/fcampelo/Design-and-Analysis-of-Experiments}},  
  year={2015},  
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}
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# About this material

## Acknowledgments

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