EEE933 - Case Study 01

Performance of a new software version

The experiment

The **current** version of a software used for simulating certain electromagnetic characteristics of a patch antenna is known, based on extensive past experience, to have a mean simulation time of $\mu = 55s$ seconds and a variance $\sigma^2 = 100s^2$.

A **new** version of this software is developed, and we wish to investigate whether it results in *performance gains* when compared to the currently available version. To investigate this particular question, 16 simulations of small variations of the patch antenna geometry are executed, and their times are recorded as:

```
##    run.time
## 1  45.05054
## 2  55.44200
## 3  61.09109
## 4  37.08012
## 5  56.50387
## 6  57.04239
## 7  49.47682
## 8  49.67358
## 9  49.54884
## 10 47.26974
## 11 50.15965
## 12 46.51129
## 13 48.06622
## 14 53.95121
```

For this experiment in particular, we are interested in investigating possible gains both in terms of *mean run time* and of the *variance of run times*.

Activities

For the test on the mean runtime:

For this test, assume a desired significance level $\alpha = 0.01$. The teams must perform the following activities:

- Define the statistical hypotheses to be tested (null/alternative).
- Discuss and define the other experimental parameters of the test (smallest effect of practical relevance, desired power, *etc.*). This is specific for each team, but must be determined based on discussions, related to the topic of the experiment.
- Test the hypotheses and decide for rejecting (or not) the null hypothesis.
- Calculate the confidence interval on the mean runtime.
- Validate and discuss the assumptions of the test.
- Discuss the power of the test (if needed), and the adequacy of the available sample size for this particular test.

For the test on the standard deviation:

For this test, assume a desired significance level $\alpha = 0.05$. The teams must perform the following activities:

- Define the statistical hypotheses to be tested (null/alternative).
- Test the hypotheses and decide for rejecting (or not) the null hypothesis.
- Calculate the confidence interval on the variance of the runtime.
- Validate and discuss the assumptions of the test.

After performing the activities related to each test individually, the team must:

- Draw conclusions and provide recommendations regarding the adoption (or not) of the new software version.
- Discuss possible ways to improve this experiment.

Report

Each team must prepare a short report detailing the experiment and the analysis performed. The report will be evaluated according to the following criteria:

- Use of the predefined format (see below);
- Reproducibility of the analyses;
- Technical quality;
- Logical structure;
- Correct use of language (grammar, orthography, *etc.*);

The report must **necessarily** be prepared using R Markdown, and must contain the full code needed to reproduce the analysis performed by the team, embedded in the form of *code blocks*. Each team must deliver the following files:

- The report file, compiled in **.pdf** .
- The original (source) of the report, in **.Rmd**.

the **.Rmd** file must be able to be recompiled, if needed (tip: save your **.Rmd** file using UTF-8 encoding, to prevent compilation problems in other operational systems.

Report templates are available on https://git.io/vHk0F, and an example of report structure can be consulted on https://git.io/vHk0j.

Important: Please include in the report the roles of each team member (Coordinator, Recorder, Checker and, for 4-member teams, Monitor)

Important: Reports can be prepared in either Portuguese or English.

Deadline

The report files (pdf + rmd) must be compressed into a single file and uploaded to the activity **Case Study 01** on Moodle, until **Monday, April 30th 2018, 11:59p.m.**. After that deadline the system will be closed.

Important: Reports will NOT be received by e-mail or in printed form.