G┐IT challenge (english)

G┐IT members

Sommario For the second time in the history of ArsTEXnica a G┐IT *challenge* is launched. The challenge was born in the Telegram group "G┐IT members". It consists in the elaboration, by LATEX, of a file containing a set of experimental data of a linear phenomenon. The goal is to draw the experimental points on a cartesian diagram together with the regression line, and to print the calculated parameters of the line. A rich prize for the winners!

1. Introduction

The physicist Mario Rossi is investigating a phenomenon, presumably linear, and he performs measurements in his laboratory to verify his hypothesis; he measures the quantity x which generates the phenomenon and he measures also one of the characteristics y showed by the phenomenon under the effect of the stimulation x. The measurement uncertainty on x is equal to the maximum error of the instrument used to measure it; the uncertainty on y is instead much larger than the instrumental one since the phenomenon is affected by other causes on which Mario Rossi has no control and therefore they are sources of random uncertainties. The relative uncertainty of x is much smaller than the relative uncertainty of y.

First of all, Mario reports the values of x and y in a table. For convenience he store these data in a file, freely downloadable at the URL https://github.com/GuITeX/ars-contest/tree/master/02-regression. In order to show the structure of the data, in Table 1 the first 25 lines of this file are reported. The data in the file are organized in the CSV (*comma separated values*) format, that is a ASCII text file composed by two columns of data, separated by a comma, in which the first column reports the values of x while the second column the values of y. The newline character is a *carriage return* and a *line feed*.

Subsequently Mario graphs the data of the table to judge if the points reasonably follow a linear trend or not; in this regard he computes the parameters of the regression line and he draws this line on the graph in order to judge the quality of the obtained results.

Unfortunately, the calculations to determine the parameters of the regression line are boring and repetitive. It would be appropriate to perform them automatically, by positioning, at the same time, the experimental data on the same graph.

Being a LATEX user, he thinks to kill two birds with one stone: using LATEX to draw the graph with the experimental data consisting in the x, y points and, at the same time, to compute the parameter a e b of the regression line $y = ax\ b$, and finally to draw also this line on the same graph.

But sadly, Mario Rossi is not so expert in LATEX and therefore he asked G┐IT a help.

Tabella 1. First 25 lines of the experimental data file. The first column reports the x's, the second column the y's. The full file (100 lines) is freely downloadable from the URL `https://github.com/GuITeX/ars-contest/tree/master/02-regression`.

```
0.104,0.243
0.237,0.052
0.331,0.201
0.401,0.592
0.537,0.638
0.603,0.617
0.725,0.885
0.807,0.943
0.950,0.782
1.020,0.905
1.139,1.162
1.232,1.192
1.343,1.413
1.439,1.486
1.539,1.506
1.608,1.437
1.746,1.884
1.819,1.807
1.928,1.729
2.029,2.098
2.142,2.135
2.249,2.033
2.320,2.313
2.423,2.305
2.509,2.512
 . . . . . .
```

2. The challenge

In order to help Mario Rossi a package must be prepared, having, at least, the following features:

- Once launched, it asks in the terminal the file name to be analyzed

- It must be able to process a file like the one reported at the URL `https://github.com/GuITeX/ars-contest/tree/master/02-regression` but with a generic numbero of experimental data, even not ordered in ascending or descending order.

- The output must consists in a pdf file containing the graph with the experimental data and the regression line. The parameters of the regression line must be printed too.

- It can only use the functionalities of the LaTeX core and the least possible number of packages managed by the LaTeX Team, therefore excluding the many packages provided by other users

- Interfaces with internal modules written in LaTeX3 can be used, if already present in the full and updated TeX distributions. Only packages contained in the LaTeX kernel can

be used or in the folders `/tex/latex/base/`, `/tex/latex/tools/`, `/tex/latex/graphics/` and `/tex/latex/etoolbox/`.

Additional functionalities from the graphical and interface point of view are welcome and they will contribute to the final judgement. Additional functionalities from the statistics point of view (uncertainty of the line parameters, determination coefficient to quantify the goodness of fit and the hyphothesis of linearity between x and y, etc. . .) can be obvioysly implemented, but they will only serve to settle the final judgementall other factors being equal.

3. Who can participate and how

Any LATEX user, italian or foreign, can participate to this contest. Current and previous ArsTEXnica editors are excluded.

In order to participate, the candidates must send their zipped package to the email address `arstexnica@guitex.org` **not later than 31 august 2021**.

The files contained in the `.zip` archive must be all anonymous, which means they must not contain any generality nor any other information useful to identify the participant. This is necessary because the package will be forwarded to the members of the selection board by the ArsTEXnica editor. The only person knowing the identity of all the participants will be the ArsTEXnica editor.

The `.zip` package must contain a single `.tex` file with the code. It must contain also a very short text file describing the strengths of the package, the strategy and the most important points of the code.

The file must be compiled by `pdflatex` or `xelatex`. Also `lualatex` can be used but in this case the participants will not compete with the others non Lua users, but they will be part of another separate competition of only Lua users.

The usage of ConTeXt is excluded, like any other typesetting program not using the LATEX language. Moreover, the usage of external software, for example by shell commands or `\write18` is forbidden.

4. Evaluation, results, prizes

The selection board will be composed by the ArsTEXnica editor and by three members of the ArsTEXnica Scientific Committee chosen by the editor. Clearly, only the Committee members who will not participate to the contest can be chosen.

One of the fundamental test adopted on the received packages will be running the code on an input data file, with the same format as the one described in this call, but with different values of the x's and the y's.

The final decision will be published in the ArsTEXnica volume of october 2021.

The prizes consist in copies of the book *TEX by topic* properly wrapped in the gift paper reporting the G_UIT logo.

G_UIT members
`arstexnica@guitex.org`