Intermediate report for Projet long
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1 Introduction

To obtain a partial grade for "Projet Long" you have to write an intermediate report. The reason to use LaTeX for this is that it greatly simplifies technical writing, in that it forces authors to work on the *content* of the documents, while LaTeX itself takes care of the *appearance* of the documents.

This document shows LaTeX capabilities via a series of minimal examples (Section 2). Checkout the source file `report.tex` to see yourself how it works.

2 LaTeX examples

LaTeX supports automatic hyphenation for many different languages, and languages can be easily changed even within a single document, par exemple nous voici passés au Français. Le document pourrait continuer ainsi, mais comme nous avons commencé en Anglais, let us switch back to English.

An empty line in the source file is sufficient for LaTeX to recognise the beginning of a new paragraph (and this very paragraph is an example). If you like you can introduce explicitly a paragraph as follow.

Let's change topic. In this paragraph we discuss figures and images. LaTeX manages many different file formats for images. For example Figure 2 shows the network of European universities, and the image in contained in a `png` file. The original picture can be found on the GEANT web page [1]. The correct way to insert an image in a document is as it is done in this paragraph: define a figure environment together with a label, and a caption, and then use the macro `ref` and the label in the running text to discuss the image. The horizontal lines above and below the caption in Figure 2 are there just for readability.

Now we change topic again, so we begin a new paragraph. Indeed, each paragraph in a document should have one clear topic. Here we showcase a little

[1] In passing, observe that we just gave an example of hyperlink a LaTeXdocument, and also of how to define a footnote.

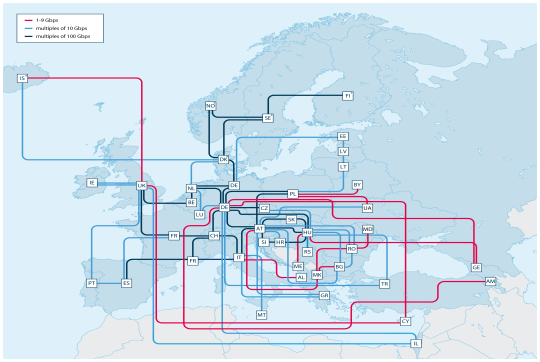

Figure 1: A picture of the GEANT network.

mathematics. LaTeX has macros to typeset formulas in the running text, for instance $((x_1 - x_2)^2 + (y_1 - y_2)^2)^{\frac{1}{2}}$ is the distance between two points (x_1, y_1) and (x_2, y_2). Formulas can also be separated from the running text, in particular to increase readability. For instance the convective form of the Navier–Stokes momentum equation is

$$\rho\frac{D\mathbf{u}}{Dt} = \rho\left(\frac{\delta\mathbf{u}}{\delta t} + \mathbf{u}\cdot\nabla\mathbf{u}\right) = -\nabla p + \nabla\cdot\left\{\mu(\nabla\mathbf{u} + (\nabla\mathbf{u})^T - \frac{2}{3}(\nabla\cdot\mathbf{u})\mathbf{I}) + \zeta(\nabla\cdot\mathbf{u})\mathbf{I}\right\} + \rho\mathbf{g}$$

The formula above does not fit into the margins of the document. To solve this problem we can use the `aligned` environment within an `equation` environment, and typeset the formula as follows,

$$\begin{aligned}\rho\frac{D\mathbf{u}}{Dt} &= \rho\left(\frac{\delta\mathbf{u}}{\delta t} + \mathbf{u}\cdot\nabla\mathbf{u}\right)\\ &= -\nabla p + \nabla\cdot\left\{\mu(\nabla\mathbf{u} + (\nabla\mathbf{u})^T - \frac{2}{3}(\nabla\cdot\mathbf{u})\mathbf{I}) + \zeta(\nabla\cdot\mathbf{u})\mathbf{I}\right\} + \rho\mathbf{g}\end{aligned}$$

What about listing things. LaTeX also provides useful environments to create lists. With no need of additional packages one have the `itemize` environment for unordered lists, whereas the `enumerate` environment allows you to create an ordered list. A list item within both of these environments has do be declared with the command `\item`. Needless to say, one can have a sub-list as a list item. In this case, LaTeX will automatically choose different bullet points for your nested items. The following example shows you how to nest properly your sub-lists inside your list.

1. First item

Listing 1: A naïve implementation of the Fibonacci series.

```
def fibo(n):
    if n < 0:
        print("Incorrect input")
    elif n == 0:
        return 0
    elif n == 1 or n == 2:
        return 1
    else:
        return fibo(n-1) + fibo(n-2)
```

2. Second item
    - Nested item a
    - Nested item b
        (a) Deeper level of nesting
3. Third item

LaTeX let us include very easily code and pseudo-code in our documents. For example Listing (1) shows a **wrong** implementation of the Fibonacci series. The code suffers a problem of overflow: for `n` >= 47 the value computed by the function `fibo` as nothing to do with the `n`th fibonacci number.

However, if you want to add some colors in your code and highlight it, feel free to use the `minted` environment. But in this case, you have to compile your document with the *option* `-shell-escape`. You can write your code in the LaTeX document but you can import it from a file as well. The following example is the same implementation of the Fibonacci series as in Listing (1) using `minted`.

```
def fibo(n):
    if n < 0:
        print("Incorrect input")
    elif n == 0:
        return 0
    elif n == 1 or n == 2:
        return 1
    else:
        return fibo(n-1) + fibo(n-2)
```