

Computer Tools for Economics (CTE)

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Who

- Paolo Pellizzari (paolop@unive.it),
<http://www.dma.unive.it/~paolop>
- Courses: Mathematics (under and postgrads),
Computer Science, Computational Economics.
- Research: agent-based artificial markets (fat tails,
crashes and bubbles) and market design; Monte Carlo
option pricing (exotic options, variance reduction).
- Student time: Thursday, from 10.00 to 12.00, Ca'
Dolfin (close to Ca' Foscari) or, if time and boats
permit, after or before the lectures.

Who (2)

- Who are you?
- 10 weeks, one meeting per weeks, check timetable at www.dma.unive.it/~paolop/ctedeo.html
- Examination: no final test (events of null probability do exist!)

Content

- Broadly speaking: advanced suggestions to improve your computer productivity.
- Review of methods and programs largely used in economic studies and research (typesetting and web publishing, spreadsheets, computer algebra systems, statistical packages, network connectivity and file-sharing).

Schedule

The classes will be held usually on Tuesday at 15.45.

Today (September 25-th)

- Network connectivity (Telnet, SSH, FTP, SFTP)
- **Definition.** A protocol is
 1. A formal description of message formats and the rules two computers must follow to exchange those messages...
 2. A standardized means of communication among machines across a network.
 3. A set of formal rules describing how to transmit data, especially across a network.

[Google]

- Telnet (probably: TELecommunication on a NETwork) is a protocol to access a remote computer called server.

TelNet

- For simplicity we confuse the definition with the program implementing it (do you confuse a function with its defining expression?): both are called TelNet.



- In order to connect and use the server resources you need a LOGIN (USER) and a PASSWORD to authenticate.
- Try Maple to compute the 97-th digit of π .

SSH, Secure SHell

- Pitfall: with TelNet information travel in clear, this is extremely dangerous for passwords.
- Solution: SSH, a protocol and a program for encrypted communication.



- Everything is the same: LOGIN (USER) and a PASSWORD to authenticate.
- Using a SHELL, connect to `sunshine.dma.unive.it`, user `cte`, password `deo_gratia`.
- Try `bc -l` to compute the 97-th digit of π .
- At `unive` only SSH is now allowed (no more TelNet for security reasons)

FTP

- File Transfer Protocol (FTP): a protocol and a program for files bidirectional exchange.



- LOGIN (USER) and a PASSWORD to authenticate, then a set of commands to get and put files on the SERVER or CLIENT
- get: takes a file from the SERVER and downloads it to the CLIENT
- put: takes a file from the CLIENT and uploads it to the server

FTP

- There are other commands (`ls`, `cd`, `lls`, `lcd`, `hash`, `help...`)
- There are easy-to-use graphical applications where no command is explicitly seen.
- There are servers offering general interest downloads to everyone: Anonymous FTP. User `anonymous`, password `email@xxx.yyy`
- Use `quit` or `bye` to exit.

SFTP, Secure FTP

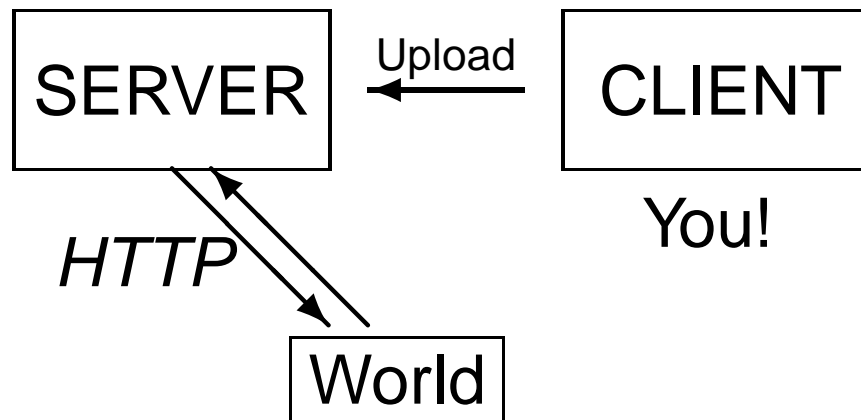
- Pitfall: with FTP information travel in clear, this is extremely dangerous for passwords.
- Solution: SFTP, a protocol and a program for encrypted files exchange.
- Not much to add wrt FTP...
- Many servers do not offer FTP any more, only SFTP is allowed for security reasons.
- Download this presentation by SFTP from `sunshine.dma.unive.it`
- GUI applications (Cyberduck)

Tagged typesetting and web publishing

- HTTP, a protocol to publish online material. Client-server architecture.
- Tagged typesetting: content is tagged for two main reasons
 1. Emphasize hierarchically the importance of content;
 2. Give proper typographic instructions;
 3. This distinction is of huge importance
- Markup language (think to the content, don't care about appearance, you are a PhD student, ya?) and HTML
- Some useful (and basic) HTML tags. Textual or visually aided composition.

HTTP, SHTTP

- The mother of all protocols, most used in the world
- HTTP stands for HyperTextProtocol (Secure, if needed)



- Hence, you have to upload material on the server (typically, using [S]FTP) in order to be seen by the world.

WYSIWYG and tags

- What You See Is What You Get. Quick and dirty, you have to take care of typographical issues (PhD student, ya?), not portable, does not deliver what it promises.
- However WYSIWYG is the most used way to write in the world, MSWord, Corel WordPerfect. . .
- Alternative: use tags to provide emphasis (about content) and typographical details (about printing).
- Focus mainly (exclusively!) on content and structure
Forget about printing tags.
- Forget about appearance and provide the right structural and logical information . . . and no more.
- `<H1>This is important !!!</H1>`
`<H2>Better than nothing</H2>`

Markup languages

- Force (or strongly help) the user to focus on structure and not on visual layout.
- Hence, no WYSIWYG here! You provide contents, other will do the typographical job (strict markup).
- The distinction structure vs layout is important. Where do you want to stay?
- HTML: Hyper Text Markup Language.
- Portable, reusable, simple, logical. . . no fonts, no char sizes, no styles, no frills. . .
- Caveat: if you really want, even Markup Languages can be messed up by a sick user.
- Basic example (Alpha).

Some HTML tags

- Header tag: `<H1> First order important </H1>`, `<H2> Second order important</H2>`,...
- Ordered and unordered lists (OL and UL)

```
<OL>
<LI> First item
<LI> Second item
<LI> ...
</OL>
```

The tag ` ... ` produces Unordered lists.

- Links: `Unive website`
- Images: ``, note that there is not a closing tag.

More HTML tags

- Tables: use `<TR> ... </TR>` to produce Table Rows and `<TD> Data </TD>` to insert Table Data in the rows.
- Emphasis: ` Material to be emphasized `.
- Centering: `<CENTER> Centered material </CENTER>`.
- Forgetting `<CENTER>` ``, all the tags provide structure but not typesetting instructions.

Typographical markup and stylesheets

- What if I want my own typographical style?
- Well, you can mess up everything or...
- ... use stylesheets!
- Visually aided composition.

[Example]

R: cran.r-project.org

- A language and environment for statistical computing and graphics.
- *Statistical*: linear and nonlinear modelling, statistical tests, time series analysis, classification, clustering.
- *Graphics*: high and low level commands, 2D, 3D and much more.
- *Computing*: powerful vectorial programming language (MATLAB like), literally hundreds of accurate and optimized functions (STATA like).

R: outline

- The official R sample session.
- Sequences, vectors, matrices, vectorialization and recycling components.
- Libraries and a few graphic commands (`scatterplot3d`, `persp`, `contour`).
- Numerical routines (`uniroot`, `integrate`, `optim`)

R and Sweave

- Flexible framework for mixing text and R code for automatic document generation.
- The text is made of
 1. Documentation chunks: start with an at character (@);
 2. Code chunks: start with `<<name>>=` at the beginning of the line.
- Invaluable for automatic report generation and exact replication of papers (useful in the refereeing process).
- Let's go for an example...

STATA

- STATA: statistics, graphics, data management.
- Stata is, at its heart, a command-driven program (born in a command-line UNIX environment).
- You can type commands by hand (advanced) or using menus, mouse and dialog boxes.
- Information is organized in windows: results, variables, history, command, graphics, review ...
- Help yourself! `help`, `help scatter`, `help window`, `db regress`.

Inputting / importing data

- Copy and paste (from a spreadsheet).
- Import data saved in txt and other formats: menu `File`
- `Import`.
- `insheet`, `INput from SHEET`.
- You can also save in STATA format for easy future use.

Some tricks

- Click on a command on the review window to copy the command. Double-click to execute command.
- Commands can be abbreviated:
`reg(ress) y x`
`h uniform`
- <TAB> can be used to complete the name of variables (auto completion).
- The show must go on...

Excel

- Most used and abused program in the world. The development of the Personal Computer (PC) was historically due to the spreadsheet invention.
- Drag or Loop?
 - Newton Iteration and quadratic convergence
 - Newton in higher dimension
- Optimization wizard

$$\max x + 2y,$$

on the set $\{(x, y) : x \geq 0, y \geq 0, x^2 + y^2 = 1\}$

- Programmable features

LaTeX

- TeX: a powerful text formatting program initially written by Donald Knuth.
- LaTeX: structured text formatting and typesetting macro package, La(mport) TeX.
- The LaTeX macros encourage writers to think about the content of their documents, rather than the form. It contains all the capabilities of TeX.
- Very close in spirit to tagged typesetting and HTML.

Why is LaTeX fundamental?

- You should find your own way to deal with three basic tasks:
 1. papers
 2. presentations (`Prosper`)
 3. web pages (`HTML`)
- You need a *consistent* way to work to achieve 1 source - 3 purposes goal.
- You are probably spending most of your time working on this stuff + studying/reading and living.

LaTeX

- Some examples (essentially to recall a tagged language).
- Prosper and `tex2html`.
- How to insert graphics using `.eps` and `.pdf`
- How many cut-and-pastes? Bibfiles and references management.

Examples

- ```
\documentclass[a4paper,11pt]{article}
\usepackage[italian]{babel}
\usepackage{graphicx}
```

```
\begin{document}
```

```
<here you place the material>
```

```
\end{document}
```

- ```
\begin{abstract}
```

```
This papers studies an agent-based model of an
order-driven stock market.
```

```
\end{abstract}
```

Examples (2)

- ```
\begin{equation}
\frac{v}{p} \geq 1+r(h_{i}-t)
\end{equation}
```

produces

$$\frac{v}{p} \geq 1 + r(h_i - t)$$

- ```
\begin{table}
\centering
\begin{tabular}{1|1|1}
Param. & Value & Meaning\\
\end{tabular}
\end{table}
```

Examples (3)

• `\begin{eqnarray*}\label{eq:bidprice}`
`\beta_i(t) & = & \frac{v_i}{1+(r+\pi_i)(h_i-t)} \\`
`\label{eq:askprice}`
`\alpha_i(t) & = & \frac{v_i}{1+r(h_i-t)}`
`\end{eqnarray*}`
produces

$$\beta_i(t) = \frac{v_i}{1 + (r + \pi_i)(h_i - t)}$$
$$\alpha_i(t) = \frac{v_i}{1 + r(h_i - t)}$$

Presentations

- Use a LaTeX package called Prosper:

```
\begin{slide}{Why is LaTeX fundamental?}
  \begin{itemize}
    \item You should find your own way to deal w
      \begin{enumerate}
        \item papers
      \end{enumerate}
    \item You need a \emph{consistent} way to wo
  \end{itemize}
\end{slide}
```

- Did you get the point? Formulas are the same, you just have to fit a few things in each slide...

Presentations (2)

- Use a LaTeX package called `Prosper`: this is a standard slide.

```
\begin{slide}{Title of the slide}
  \begin{itemstep}
    \item First thing to say
    \item Second thing to say\ldots
  \end{itemstep}
\end{slide}
```

- You can easily get something nicer but KISS, in the spirit of tagged typesetting!

Use of punctuation



- This is a tiger!
- Are you a zebra?
- Don't worry :-), be happy ;-)

Not sure this is *really* useful, but catching attention can be of paramount importance.

How to insert figures?

- The insertion of figures is not straightforward in LaTeX.
- The most portable and easy way to do it is to use .eps files:

```
\begin{figure}[tbp]
  \centerline{
    \includegraphics[scale=0.5]{file.eps}
  }
  \caption{This is a caption}
  \label{fig:label}
\end{figure}
```

- Recent (and advanced) clients let you import .pdf.

BibTeX and references

- Compiling references can be a very time-consuming task, that is likely to be repeated many times.
- BibTeX: a tool to create reference lists by searching for them in .bib archives.
- A typical entry of a bibfile is:

```
@book{batten00,  
  author = {Batten, D.},  
  title = {Discovering artificial  
economics},  
  publisher = {Westview Press},  
  year = 2000  
}
```

BibTeX and references (2)

- Then you have to cite Batten using

```
\cite{batten00}
```

in text.

- Your references are listed in an .aux file (auxiliary file) that is going to be processed by a BibTeX application that produces the reference list (.bbl file) in the desired style.

- Then you include the references in the paper using:

```
\bibliography{2004}
```

```
\bibliographystyle{apalike}
```

- Here is an example...

Tex and HTML

- Quite often you want to get an HTML from a Tex source.
- One solution is T_tH : TeX to HTML.
- Finally, you can get papers, high quality presentations and HTML pages from the very same source with (little?) effort and portability.