Installing an R Development Environment on Heterogenous Systems

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1 Introduction

This article explains how to set up an R deveploment enviroment (including LaTeX) on various operating systems. We provide a set of instructions for the three major desktop operating systems Windows, Mac OS X and Linux (Debian-based systems in particular) in Sections 2, 3, and 4, respectively. Section 6 includes references to related articles and further resources. For more information about R please visit the website of the R Project at `http://www.r-project.org/`. Additional informations about installation and administration of R is available in the manual at `http://cran.r-project.org/doc/manuals/R-admin.html`. Further questions not covered by this article and feedback may be sent to `statmath-qfin_AT_wu.ac.at`.

2 Windows

The instructions in this manual have been written to run/work under Windows 7. Nevertheless, it is possible to configure the R development enviroment on other Windows versions. To set up a basic R development environment under Windows, please follow the steps below:

1. Install the current version of R (available from `http://CRAN.R-project.org/bin/windows/base/`).

2. Install the R for Windows toolset (known as Rtools, available from `http://www.murdoch-sutherland.com/Rtools/`).

3. Set up a suitable LaTeX environment, preferably installing all available packages and updates (we recommend TeX Live `http://www.tug.org/texlive/` or another distribution like MiKTeX `http://miktex.org/`).

4. Update the `PATH`s and further environment variables.

Installing the R for Windows Toolset

Rtools includes various software packages needed for successfully building R and R packages (usually packages containing C or FORTRAN source code). It provides Windows with a set of compilers, libraries and various other tools.

LaTeX Environment

There are two popular options for installing a LaTeX environment under Windows. We are supporting the TeX Live distribution but MiKTeX can also be used. While it is possible to download and use the *net installer*, we recommend to download the ISO-Image from `http://mirror.ctan.org/systems/texlive/Images/`, mount it to a virtual drive (e.g., using the program DAEMON Tools Lite) and install TeX Live including all packages. In order to update the distribution use the TeX Live Manager *(Go to Start → All Programs → TeX Live <Version>→ TeX Live Manager → full installation)*, (<Version> has to be replaced with the installed TeX Live version). Note that the installation of

the LaTeX distribution and the corresponding update process could take several hours.

`PATH` and further environment variables

Presumably the most important step after the installation procedures is to update the `PATH` environment variable.

To do so go to: *Start → Control Panel → System → Advanced system settings → Advanced → Enviroment Variables.*
Search in the *System variable* list for the `PATH` variable. Click on *edit* and enter the corresponding `PATH`s into the *Variable value* field. The `PATH`s to the '`bin, x64`' or '`i386`' directories of the following programs have to be included (if they were not included automatically):

- R

- Rtools

- TeX Live

Note that the order of the entries is important. Separate them by semicolon. Do not delete other entries, Windows may need them. An example is given below, however there might be different `PATH`s on the system:

(*)	'`C:\Program Files\R\R-2.13\bin\x64;`'
(*)	'`C:\Program Files\Rtools\bin;`'
(*)	'`C:\Program Files\Rtools\perl\bin;`'
(*)	'`C:\Program Files\Rtools\MinGW\bin;`'
(*)	'`C:\Program Files\Rtools\MinGW64\bin;`'
(*)	'`C:\texlive\2010\bin\win32;`'
(**)	'`%SystemRoot%\system32;`'
(**)	'`%SystemRoot%;%SystemRoot%\System32\Wbem;`'
(**)	'`%SYSTEMROOT%\System32\WindowsPowerShell\v1.0\;`'

(*) are relevant `PATH` for the R development enviroment, (**) are relevant `PATH` for Windows (do not change them)

Text Editors

Links pointing to URLs where it is possible to download suitable text editors:

emacs	`http://vgoulet.act.ulaval.ca/en/emacs/windows/`
Rstudio	`http://www.rstudio.org/ide/download/`
Notepad++	`http://notepad-plus-plus.org/download`
TeXnicCenter	`http://www.texniccenter.org/resources/downloads/29/`
TeXworks	`http://www.tug.org/texworks/`
Tinn-R	`http://sourceforge.net/projects/tinn-r/`
vim	`http://www.vim.org/download.php`

3 MAC OS X

In order to successfully setup a basic development environment for R-related projects under MAC OS X it is necessary to follow these four steps:

1. Install the current version of R (available from `http://CRAN.R-project.org/bin/macosx/`).

2. Install a LaTeX environment (e.g., MacTeX).

3. Install XCode.

4. Install the GNU Fortran compiler (`gfortran`).

LaTeX environment

A readily usable environment for typesetting scientific articles with LaTeX is provided with the MacTeX distribution available from `http://www.tug.org/mactex/`. This distribution also includes a text editor named TeXShop.

XCode

Compilers are needed for installing R packages containing source code typically written in C or FORTRAN. A set of C compilers for Mac OS X is provided in XCode, the basic development tools for Mac OS X. Installable either from the DVD containing the operating system that came with the Mac or, after downloading the latest version from the Apple Developer website at `http://developer.apple.com/technology/xcode.html`.

GNU FORTRAN compiler

Unfortunately, the compiler `gfortran` is not included in XCode. Luckily, since R version 2.5.0 the compiler is installed with the R Mac OS X installer (see Step 1: Installing the current version of R). Nevertheless, it is possible to install it manually using the packages provided at `http://r.research.att.com/tools/`, in case any problems are encountered when setting up the compiler.

Text Editors
Links pointing to URLs where it is possible to download suitable text editors:

emacs	`http://vgoulet.act.ulaval.ca/en/emacs/mac/`
Rstudio	`http://www.rstudio.org/ide/download/`
LyX	`http://www.lyx.org/Download/`
TeXworks	`http://www.tug.org/texworks/#Getting_TeXworks`
vim	`http://www.vim.org/download.php`

4 Linux

In this article we focus on Debian-based distributions, as it is hardly possible to provide a complete set of instructions for every Linux distribution. The most prominent of such Debian-based Linux distributions is called Ubuntu (`http://www.ubuntu.com`). Nevertheless, the instructions mentioned in this section should usually work on any Debian-based system.

In order to successfully setup a basic R development environment under Ubuntu follow these three steps:

1. Install the current version of R (**r-base** and **r-recommended** packages).

2. Install a LaTeX environment (e.g., TeX Live available by installing the **texlive-full**).

3. Install compilers and other development packages (**r-base-dev** packages).

Installing R

R is provided in form of a binary Debian package called **r-base**. It can be installed either by using the *Synaptic Package Manager* or by issuing the following command on the command prompt:

```
sudo aptitude install r-base r-recommended
```

To install a more recent version of R follow the steps provided on the website. For Debian at `http://cran.r-project.org/bin/linux/debian` or for Ubuntu at `http://cran.r-project.org/bin/linux/ubuntu`.

LaTeX environment

A readily usable environment for typesetting scientific articles with LaTeX is provided with the TeX Live distribution available from `www.tug.org/textlive/`. Luckily, one can install the complete distribution with the **texlive-full** package very easily. It can be installed either using the *Synaptic Package Manager* or by issuing the following command:

```
sudo aptitude install texlive-full texlive-xetex
```

In order to use the wu-beamerstyle one additionally needs to install the ttf-mscorefonts-installer.

```
sudo aptitude install ttf-mscorefonts-installer
```

Compilers and Other Tools

Typically, compilers and other development tools are needed in a reasonable development environment. Those tools are made available on Debian-based systems simply by installing the **r-base-dev** package. It can be installed either using the *Synaptic Package Manager* or by issuing the following command:

```
sudo aptitude install r-base-dev
```

Text Editors

Please feel free to install the editors you need as mentioned above via Synaptic

Package Manager or via commandline:

`sudo aptitude install` i.e. emacs, rstudio and so on.

5 Official Presentation Format

As your lecturer may want you to use the wubeamer style for your presentation within the scope of our department's courses, please feel free to download it via svn from the WU's svn Repository `http://www.wu.ac.at/it/instructions/latex_template`. Please note that according to our departments understanding the use of the template is permitted exclusively for courses at the WU. In order to use the wu-beamerstyle (official presentation format, https://svn.wu-wien.ac.at/wu/ login with the WU SVN Repository Login i.e. h+matriculation number + powernet password) one additionally needs to install the ttf-mscorefonts-installer.

6 Further Information

More information about the topic can be retrieved from the following references.

- R Installation and Administration:

    - Windows
      `http://cran.r-project.org/doc/manuals/R-admin.html#Installing-R-under-Windows`

    - Mac Os X
      `http://cran.r-project.org/doc/manuals/R-admin.html#Installing-R-under-Mac-OS-X`

    - Unix/Linux
      `http://cran.r-project.org/doc/manuals/R-admin.html#Installing-R-under-Unix_002dalikes`

- Writing R Extensions (R-Project):
  `http://cran.r-project.org/doc/manuals/R-exts.html`

- Making R packages for the Mac:
  `http://www.personality-project.org/R/makingpackages.html`

- Making R packages under Windows:
  `http://cran.r-project.org/doc/contrib/Graves+DoraiRaj-RPackageDevelopment.pdf` and `http://www.math.ncu.edu.tw/~chenwc/R_note/reference/package/packages.pdf`

- TEX Formula Quick Reference (Wikipedia):
  `http://en.wikipedia.org/wiki/Help:Displaying_a_formula`

- LaTeX unter Windows (German):
  `http://schlosser.info/latexsystem.html`

7 Frequently Asked Questions

1. TeX Live (Windows):

   (a) How to make TeX Live recognize '`Sweave.sty`'?

   Answer:

   Go to the R installation directory, i.e., the directory where R has been installed to. We call this directory '`RHOME`'. Search for the LaTeX style sheet called '`Sweave.sty`'. Typically it is located in the folder '`<RHOME>\share\texmf\`'. Next, one needs to copy the corresponding files to the "personal" LaTeX libary. We will call the directory where TeX Live has been installed '`TEXHOME`'. The "personal" LaTeX library is located in the directory '`<TEXHOME>\texmf\tex\latex\`' and '`<TEXHOME>\texmf-local\tex\latex\`'. Copy the contents of the '`<RHOME>\share\texmf\`' latex folder to the '`Sweave`' folder in the "personal" LaTeX library. If the '`Sweave`' folder is not found in the latex library, create it and copy the contents into this folder.

   Eventually the package database needs to be updated.

   Go to *Start* and open the command line interface by entering *cmd*. Once the command line interface starts and update the database by entering *texhash* (use the command texhash.exe).

   (b) How to install further LaTeX packages?

   Answer: Go to *Start → All Programs → TeX Live <Version>→ TeX Live Manager*. (<Version> has to be replaced with the installed TeX Live version)

   Search for the packages needed, then select the package and click on *Install*. (It is also possible to select all packages, but this will include many language packs which are probably not needed).

   (c) Note that the installation and the update process of TeX Live can take a very long time. Sometimes this can lead to the sytem becoming unresponsive, in that case simply restart the corresponding process.

2. MiKTeX(Windows):

   (a) How to make MiKTeX recognize '`Sweave.sty`'?

   Answer: Go to the R Installation directory, i.e., the directory where R has been installed to. We call this directory '`RHOME`'. Search for the LaTeX style sheet called '`Sweave.sty`'. Typically, it is located in the folder '`<RHOME>\share\texmf\`'. Copy the contents of this folder to the '`Sweave`' folder in the "personal" LaTeX library. The location of the LaTeX library can be seen by going to *Start → All Programs → MiKTeX <Version>[1] → Maintenance → Settings*.

Go to the *Roots* tab, and mark the "Show MiKTeX-maintained root directories" box. Look at the *Description* where it says "UserInstall,UserConfig". The coresponding *PATH* points to the location. Usually it is in '`<RHOME>\Application Data\MiKTeX\<Version>\tex\latex\`'; (<Version>has to be replaced with the installed MiKTeX version). If there is no '`latex`' and/or '`Sweave`' folder, create it and copy the contents into this folder.

(b) How to install further LaTeX packages?

Answer: Go to *Start → All Programs → MiKTeX<Version>[1] → Maintenance(Admin) → Package Manager(Admin)*; (<Version>has to be replaced with the installed MiKTeX version).

Search for the package needed, then right click on the package name and click on *Install*.

(c) MikTeX offers downloading missing packages but fails.

Answer: Note that it is required to be able to write to the system library of MiKTeX. Typically this can only be achieved through logging in with *Administrator* privileges.

8   Acknowledgment

An earlier version of this manual was written by Ksenia Fraczek.