

R Mac Setup

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Outline

- 1 Overview
- 2 Getting Started
 - Frequently Encountered Problems
- 3 Recommended Software
- 4 Install Editors (Optional)
- 5 Other Miscellaneous Installs
- 6 References

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Overview

- R (R Core Team, 2018) is a statistical computing framework that is offered for Windows, Macintosh, Linux, and other operating systems.
- The R package does not provide all of the components needed to use R fully.
- On our Mac systems, we install these programs that complement R.
 - `Xcode`: provides general programming tools that R packages might use
 - `XQuartz`: An X11 display layer that some graphics programs in R will use
 - `clang`: A C compiler that will be needed to install/run some packages (such as Rstan)
 - `gfortran`: A fortran compiler that will be needed to install some packages
- On Windows, the equivalent additions would be found in the R-Tools package and Mingw.

Overview ...

- R for Macintosh Operating System (macOS) includes an editor called R.app, which has many nice features.
- Other editors are also widely used, namely
 - 1 Rstudio
 - 2 Emacs

CRMDA Web References

- The R tool page for macOS describes these more fully:
<https://cran.r-project.org/bin/macosx/tools/>
- The CRMDA computer maintenance page,
<https://crmda.ku.edu/setup>
 - If there is an update for the guide you are reading now, it should be found at that address
- Guide index, <https://crmda.ku.edu/guides-index>

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Make sure your macOS is up to date

- R is generally designed to work with the most recent updates for the macOS. Bring your computer up to date before attempting to do the rest of this work.
- If your system is more than one update behind schedule, apply pending updates
 - `App Store...` then `Updates`
- As usual, while doing major updates,
 - plug in the computer's power supply, and
 - use a fast Ethernet connection (wired, if available)

The "Unidentified Developer" Problem

When you install software from 3rd party sites, as we do below, the macOS will try to prevent you from moving forward.

During the installation, it is likely you will receive a warning like this:

"The software can't be opened because it is from an unidentified developer".

When we installed clang (`clang-6.0.0.pkg`), for example, that warning appears.

It appears that the warning appears in slightly different ways when the user clicks on the `dmg` package to initiate the install.

To solve the warning about a `dmg` installer file, one easy fix is the following.

The "Unidentified Developer" Problem ...

Shortcut method to avoid the "unidentified developer" warning

- 1 Use the Finder to locate the `dmg` file.
- 2 Don't double click the `dmg` installer file.
- 3 Do hold down the `control` key and click on the `dmg` file.
- 4 Choose Open, and then choose Open again.

The "Unidentified Developer" Problem ...

There is another method that we have used while preparing these notes

Use Apple Menu to allow unidentified developer:

- 1 Open "System Preferences"
- 2 Open "Security & Privacy"
- 3 Click on the "Open Anyway" next to the warning message about the program under consideration
- 4 Follow (or "Continue") through the Installer steps to finish installing.

This solution applies to all the software installations illustrated in this document.

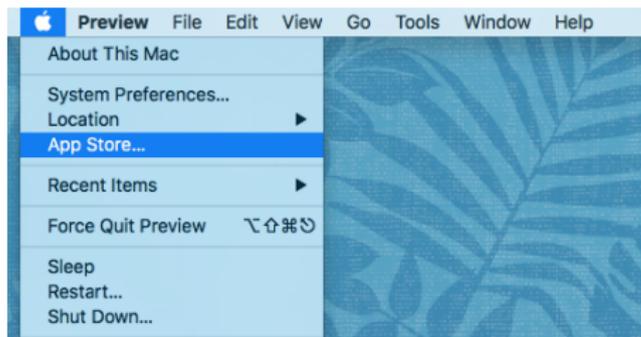
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Step 1 - Xcode

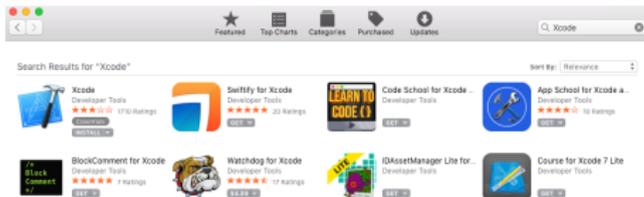
Xcode has general purpose tools that any hacker will need. It is the easiest to install because it is in the familiar Apple App Store.

A) Open **App Store**



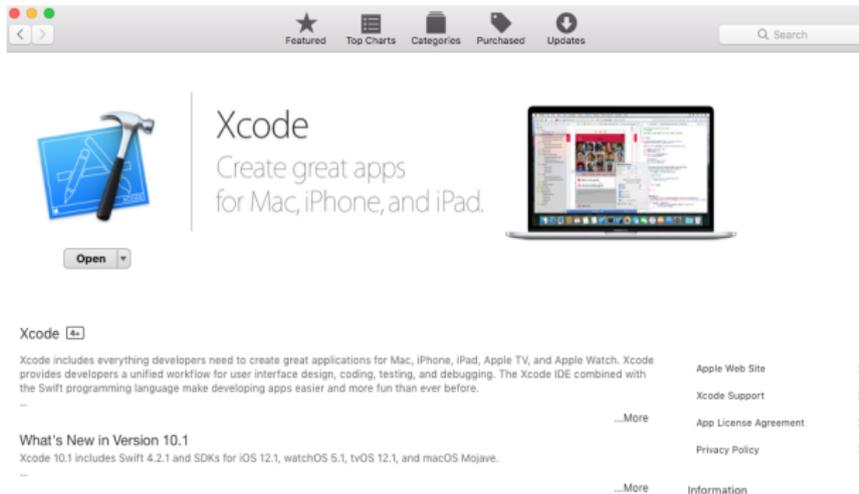
Step 1 - Xcode ...

B) The search bar, on the upper right corner, type in “Xcode”



Step 1 - Xcode ...

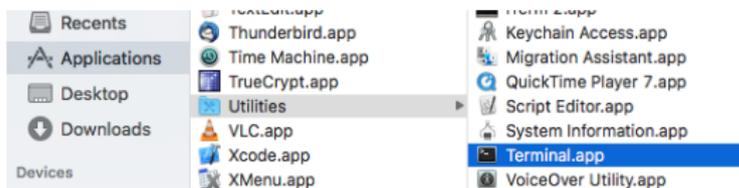
C) Click “Install” below the Xcode icon



Reminder: Use fast Ethernet connection if possible (it is a 6.07GB download)

Step 1 - Xcode ...

D) Accept the Xcode license. For a first-time installation, the Xcode package tools will not work correctly until the user accepts their legal restrictions. To do so, open a terminal (go to the “Utilities” under “Applications”, double click the “Terminal.app”)



and run the following command in the terminal window

```
$ sudo xcodebuild -license accept
```

The `sudo` command will require your user password; this will succeed only if the user has an Admin account on the computer.

Step 1 - Xcode ...

After running the above command, there should not be any feedback (or warning) messages. But, in case users do see any error messages, run the following command in the terminal to reset Xcode

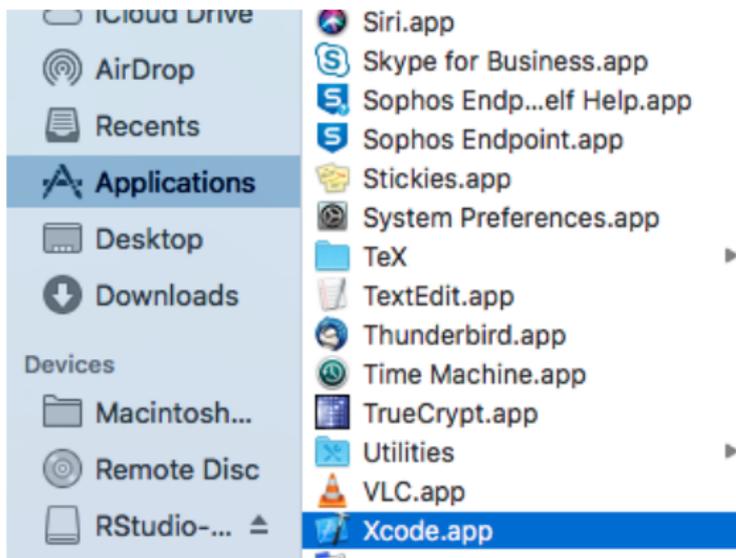
```
$ sudo xcode-select -r --reset
```

then, re-run

```
$ sudo xcodebuild -license accept
```

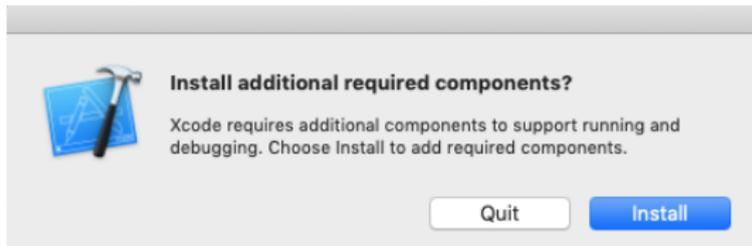
Step 1 - Xcode ...

E) Make sure Xcode does run. Go to “Applications” and double click the “Xcode.app”.



Step 1 - Xcode ...

If the following message comes up, choose “install” and get the additional required software.



Once the installation finished, double click the “Xcode.app” again to see if it is runnable.

Step 2 - XQuartz

A) Browse the XQuartz website <https://www.xquartz.org>

The XQuartz project is an open-source effort to develop a version of the [X.Org X Window System](#) that runs on OS X. Together with supporting libraries and applications, it forms the X11.app that Apple shipped with OS X versions 10.5 through 10.7.

Quick Download

Download	Version	Released	Info
XQuartz-2.7.11.dmg	2.7.11	2016-10-29	For OS X 10.6.3 or later

License Info

An XQuartz installation consists of many individual pieces of software which have various licenses. The X.Org software components' licenses are discussed on the [X.Org Foundation Licenses page](#). The [quartz-wm](#) window manager included with the XQuartz distribution uses the [Apple Public Source License Version 2](#).

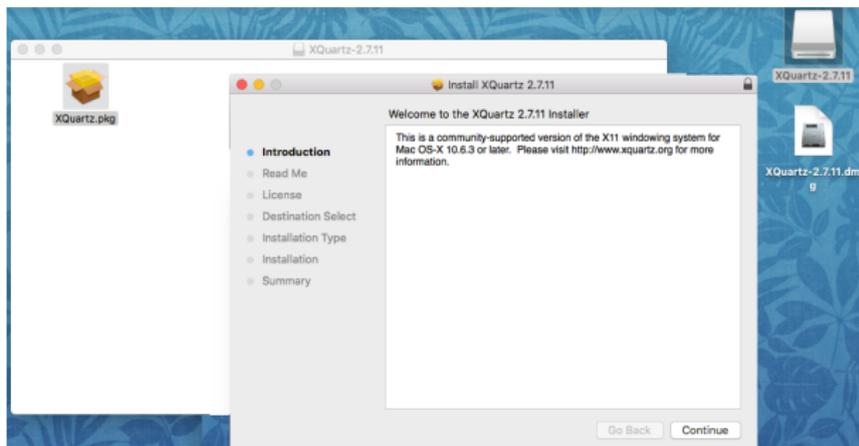
Step 2 - XQuartz ...

B) Download XQuartz-2.7.11.dmg (the current latest version is 2.7.11; this number may change)

The screenshot shows a web browser window at <https://www.xquartz.org>. The website has a navigation menu on the left with links for Home, Releases, Support, Contributing, Bug Reporting, and GitHub. The main content area includes a 'Quick Download' section with a 'Download' link and a green download icon for 'XQuartz-2.7.11.dmg'. Below this is a 'License Info' section. A macOS file dialog box is overlaid on the page, titled 'Opening XQuartz-2.7.11.dmg'. It shows the file 'XQuartz-2.7.11.dmg' (75.9 MB) from the URL 'https://d29vzk4ow07wi7.cloudfront.net'. The dialog asks 'What should Firefox do with this file?' and has three options: 'Open with DiskImageMounter (default)', 'Save File' (which is selected), and 'Do this automatically for files like this from now on.' There are 'Cancel' and 'OK' buttons at the bottom.

Step 2 - XQuartz ...

C) Double click the .dmg file to expose the contents within, which include a .pkg file. Then double click the .pkg file to begin installation.



Once the installation is completed, you can delete the .dmg file.

Step 3 - clang

The next 3 steps start with downloads from the R worldwide network.

To reduce the *wear and tear* on the internet, it is suggested that you should:

Find a CRAN Mirror server that is close to you.

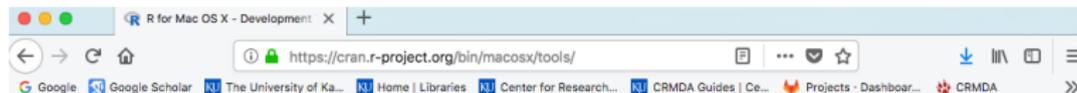
- The KU Mirror is <https://rweb.crmda.ku.edu/cran>.
- A full list of Mirrors is available <http://r-project.org/mirrors.html>.

The **clang** package includes C libraries and a compiler needed for use of packages such as Rcpp and Rstan.

While not strictly necessary for basic R use, it is necessary for most interesting uses of R

Step 3 - clang ...

A) Browse nearby mirror of the CRAN macosx tools page



R for Mac OS X

Development Tools and Libraries

This directory contains tools and libraries that are part of the base distribution of R for Mac OS X.

Note: CRAN does not have Mac OS X systems and cannot check these binaries for viruses. Although we take precautions when assembling binaries, please use the normal precautions with downloaded executables.

Important note: R 3.5.0 El Capitan binaries are using Clang 6.0.0 and GNU Fortran 6.1 to provide OpenMP parallelization support and C++17 standard features. If you want to compile R packages from sources, please download GNU Fortran binary from the official [GNU Fortran Binaries](#) page - in particular OS X 10.11 [gfortran 6.1](#). Alternatively, we are providing a copy here as well as Clang 6.0.0 binaries for OS X 10.11 and higher - see below for the download links. You can also try to use clang from Xcode, but it will be missing required features so your mileage may vary and it is not recommended.

Files:

[clang-6.0.0.pkg](#) (OS X 10.11+, signed, 64-bit) MD5-hash: c29700c4e7b2914073ef7e741eb105bc (ca. 418Mb) Clang 6.0.0 for OS X 10.11 and higher, static build for x86_64, signed package, installs into `/usr/local/clang6`. To be used with El Capitan builds of R (typically R 3.4.0 and higher).

[gfortran-6.1.pkg](#) (OS X 10.11+, signed, 64-bit) MD5-hash: 201026216e8b373d9ca2efc0cc474b86 (ca. 73Mb) GNU Fortran 6.1 for OS X 10.11 and higher - a copy from [GFortranBinaries pages](#) for x86_64, signed package, installs into `/usr/local/gfortran` (identical content, re-packaged to a flat Installer package and signed). To be used with El Capitan builds of R.

The following binaries are obsolete and only provided for historical reasons

[gfortran-4.2.3.pkg](#) (OS X 10.5+, signed, 64-bit driver) MD5-hash: 8783f903038bbe65487a262a5f8995ea (ca. 27Mb) Universal GNU Fortran 4.2.3 for Mac OS X 10.4 and higher. It is necessary in order to build R packages from sources that contain Fortran code.

[gfortran-4.2.3.dmg](#) (OS X 10.4, 32-bit driver) MD5-hash: 95516a6d55537d41db581154da727ef (ca. 27Mb) Unlike many other builds, this is a fully universal build of GNU Fortran that uses Apple's driver and supports all target architectures (i386, ppc, x86_64 and ppc64). As such it fully supports compilation into fat files like `gfortran -arch i386 -arch ppc -arch x86_64 -arch ppc64 t.f -o t.o` on both Intel Macs and PowerPC Macs (32- and 64-bit). Dependent libraries are fat as well, avoiding

Step 3 - clang ...

B) Download **clang** (Here we have “clang-6.0.0.pkg”)

The screenshot shows a web browser window at <https://cran.r-project.org/bin/macosx/tools/>. The page title is "R for Mac OS X Development Tools and Libraries". The main content area contains the following text:

This directory contains tools and libraries that are part of the base distribution of R for Mac OS X.

Note: CRAN does not have Mac OS X systems and cannot check the normal precautions with downloaded executables.

Important note: R 3.5.0 El Capitan binaries are using Clang 6.0 features. If you want to compile R packages from sources, please X 10.11 gfortran 6.1. Alternatively, we are providing a copy here You can also try to use clang from Xcode, but it will be missing t

Below this text, there are two links:

- [clang-6.0.0.pkg](#) (OS X 10.11+, signed, 64-bit) MD5-hash: 23700a4c7b2914073c7c741e1010bc (ca. 418MB)
- [gfortran-6.1.pkg](#) (OS X 10.11+, signed, 64-bit) MD5-hash: 2010216e8937389a2c6fc474088 (ca. 733Mb)

Overlaid on the page is a dialog box titled "Opening clang-6.0.0.pkg". The dialog contains the following text:

You have chosen to open:

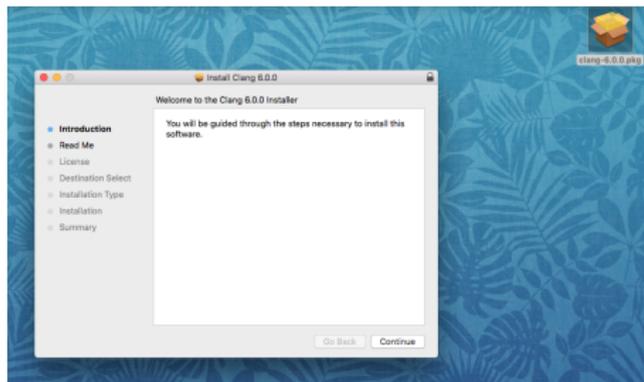
- clang-6.0.0.pkg which is: PKG file (418 MB) from: <https://cran.r-project.org>

Would you like to save this file?

Buttons: Cancel, Save File

Step 3 - clang ...

C) Double click the .pkg file to begin installing clang.

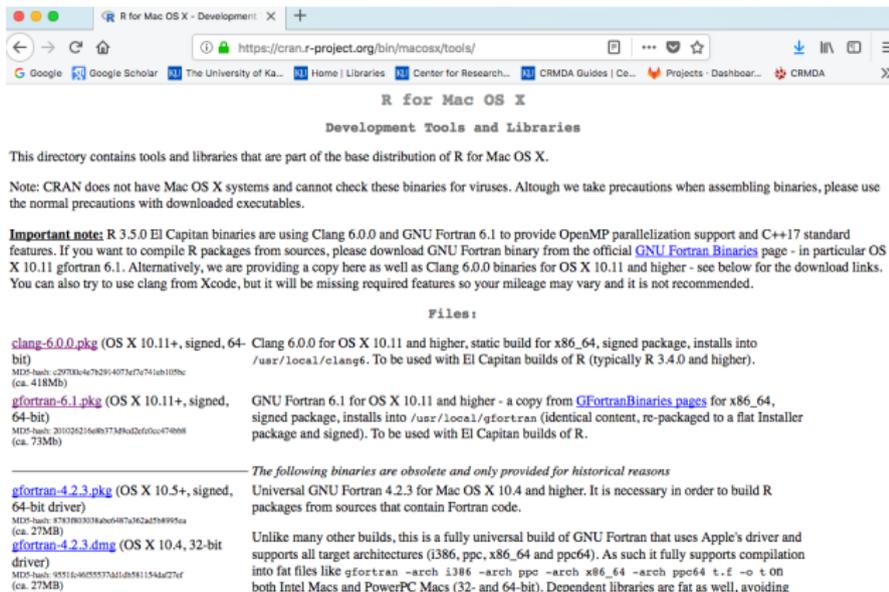


This will provoke the “unidentified developer” security feature mentioned in Slide number 9.

This .pkg file can be removed/deleted following the installation

Step 4 - gfortran

A) Begin (again) at the [CRAN macosx tools](https://cran.r-project.org/bin/macosx/tools/) page, or the [CRMDA mirror](#).



R for Mac OS X

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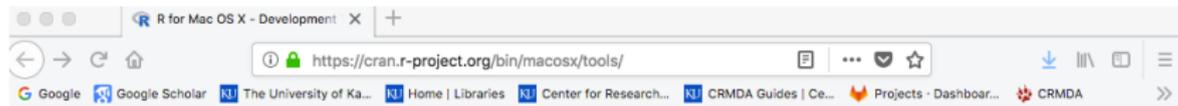
Important note: R 3.5.0 El Capitan binaries are using Clang 6.0.0 and GNU Fortran 6.1 to provide OpenMP parallelization support and C++17 standard features. If you want to compile R packages from the official [GNU Fortran Binaries](#) page - in particular OS X 10.11 gfortran 6.1. Alternatively, we are providing a copy here as well as Clang 6.0.0 binaries for OS X 10.11 and higher - see below for the download links. You can also try to use clang from Xcode, but it will be missing required features so your mileage may vary and it is not recommended.

Files:

<p>clang-6.0.0.pkg (OS X 10.11+, signed, 64-bit) MD5-hash: c207f3b24e792914073e7c76716b10b6 (ca. 418Mb)</p> <p>gfortran-6.1.pkg (OS X 10.11+, signed, 64-bit) MD5-hash: 20102621646b734f8a3d2ef0c474868 (ca. 73Mb)</p> <hr/> <p>gfortran-4.2.3.pkg (OS X 10.5+, signed, 64-bit driver) MD5-hash: 8763f80303ba6c6087a3c2a5f88995a (ca. 27Mb)</p> <p>gfortran-4.2.3.dmg (OS X 10.4, 32-bit driver) MD5-hash: 9551164605557811d8511544c27cf (ca. 27Mb)</p>	<p>Clang 6.0.0 for OS X 10.11 and higher, static build for x86_64, signed package, installs into <code>/usr/local/clang6</code>. To be used with El Capitan builds of R (typically R 3.4.0 and higher).</p> <p>GNU Fortran 6.1 for OS X 10.11 and higher - a copy from GFortranBinaries pages for x86_64, signed package, installs into <code>/usr/local/gfortran</code> (identical content, re-packaged to a flat Installer package and signed). To be used with El Capitan builds of R.</p> <p><i>The following binaries are obsolete and only provided for historical reasons</i></p> <p>Universal GNU Fortran 4.2.3 for Mac OS X 10.4 and higher. It is necessary in order to build R packages from sources that contain Fortran code.</p> <p>Unlike many other builds, this is a fully universal build of GNU Fortran that uses Apple's driver and supports all target architectures (i386, ppc, x86_64 and ppc64). As such it fully supports compilation into fat files like <code>gfortran -arch i386 -arch ppc -arch x86_64 -arch ppc64 t.f -o t.o</code> on both Intel Macs and PowerPC Macs (32- and 64-bit). Dependent libraries are fat as well, avoiding</p>
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Step 4 - gfortran ...

B) Download **gfortran-6.1.pkg** (the current latest version is 6.1; this number may change)



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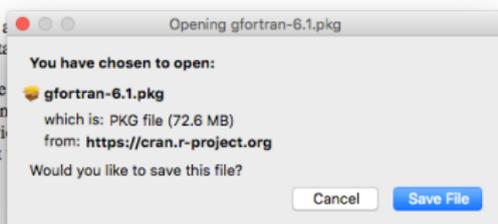
Important note: R 3.5.0 El Capitan binaries are not available. If you want to compile R packages from source, you need to use a higher version of R (10.11 or higher). You can also try to use clang from Xcode, but it is not recommended.

[clang-6.0.0.pkg](#) (OS X 10.11+, signed, 64-bit) Clang 6.0.0 for OS X 10.11 and higher, native build for x86_64, signed package, installs into `/usr/local/clang6`. To be used with El Capitan builds of R (typically R 3.4.0 and higher).

MDS-hash: c29700c0e7b2914073ef7e741eb105bc (ca. 418Mb)

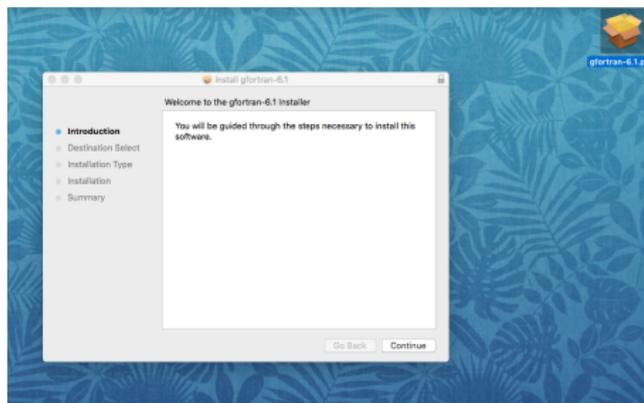
[gfortran-6.1.pkg](#) (OS X 10.11+, signed, 64-bit) GNU Fortran 6.1 for OS X 10.11 and higher - a copy from [GFortranBinaries](#) pages for x86_64, signed package, installs into `/usr/local/gfortran` (identical content, re-packaged to a flat Installer package and signed). To be used with El Capitan builds of R.

MDS-hash: 201026216e8b373d9cd2ef0cc474bb8 (ca. 73Mb)



Step 4 - gfortran ...

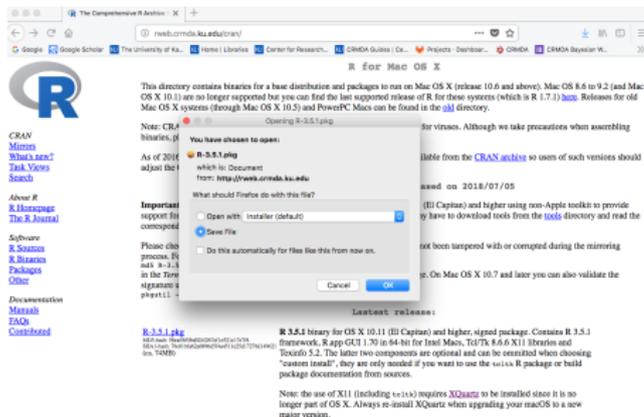
C) Double click the .pkg file to begin installing gfortran.



This .pkg file can be removed/deleted following the installation

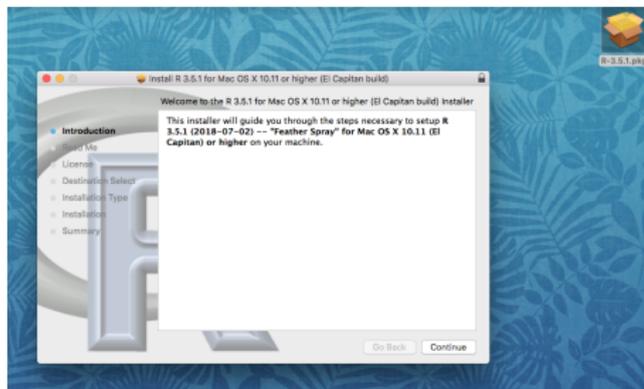
Step 5 - R

- Browse a **CRAN** mirror near you
- Click **Download R for (Mac) OS X**
- Versions of R will be displayed, from newest to oldest. Choose the newest R package and download it (version **R-3.5.1.pkg** shown here).



Step 5 - R ...

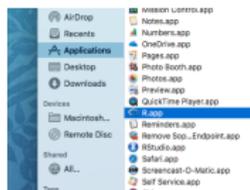
- Double click the .pkg file to begin installing R.



This .pkg file can be deleted following the installation

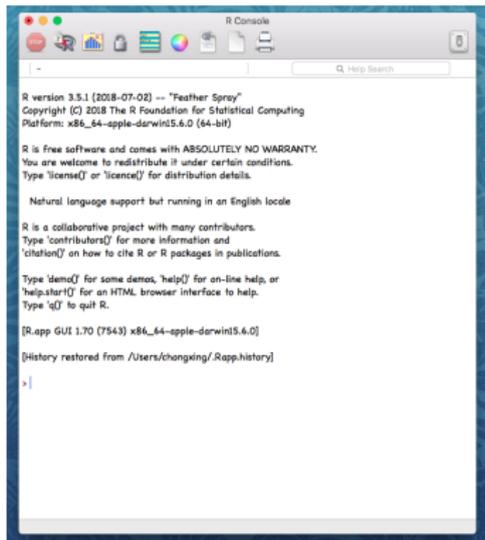
Step 5 - R ...

- Make sure the installation succeeded. The R editor's icon (R.app) should appear in "Applications" menu



Step 5 - R ...

- To test R, launch R.app.
 - Launching R.app will open the “R Console” window. This window is interactive (users can type and execute R code here).



```
R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin15.6.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

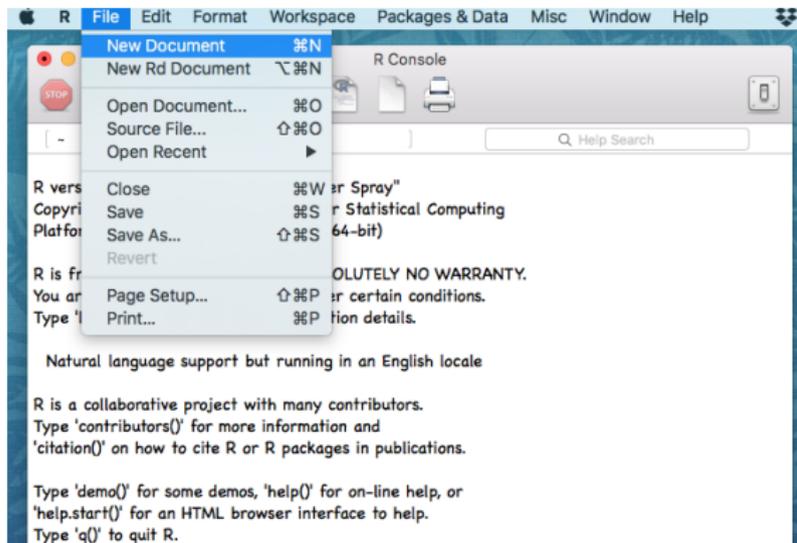
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[R.app GUI 1.70 (7543) x86_64-apple-darwin15.6.0]
[history restored from /Users/changing/.Rapp.history]

> |
```

Step 5 - R ...

- In the usual situation, the author will also open an R editor window for writing and saving R code. To open an editor window, go to “File” and choose “New Document”.



Step 5 - R ...

The screenshot shows two windows from an R installation on macOS. The left window is the 'R Console', which displays the output of the commands entered in the editor. The right window is the 'R Editor' (Untitled), showing the source code for the commands.

```

R Console
-----
> getwd()
[1] "/Users/chongxing"
> sessionInfo()
R version 3.5.1 (2018-07-02)
Platform: x86_64-apple-darwin15.6.0 (64-bit)
Running under: macOS High Sierra 10.13.6

Matrix products: default
BLAS: /Library/Frameworks/R.framework/Versions/3.5/Resources/lib/libRblas.0.dylib
LAPACK: /Library/Frameworks/R.framework/Versions/3.5/Resources/lib/libRlapack.dylib

locale:
[1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8

attached base packages:
[1] stats  graphics  grDevices  utils
[5] datasets  methods  base

loaded via a namespace (and not attached):
[1] compiler_3.5.1
>

R Editor (Untitled)
-----
1 getwd()
2 sessionInfo()

```

- Authors can type R commands in the editor window and “send them” into the R session
- The keyboard shortcut to send code from the editor to the R session is: `command` + `return`
- In this example, we have run `getwd()` and `sessionInfo()` in the editor window on the right side and the output appears in the R session on the left.

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Additional Editors are Optional

- R.app is a perfectly functional editing environment.
- It is not truly necessary to install additional editors in order to be productive on your Mac, and yet...
- Many R users do prefer to use other editors on a Macintosh

Editor 1 - Rstudio

Rstudio is a popular editor that can interact with an R session.

Visit <http://www.rstudio.com>, choose **Download Rstudio**, look for the Free RStudio Desktop license.

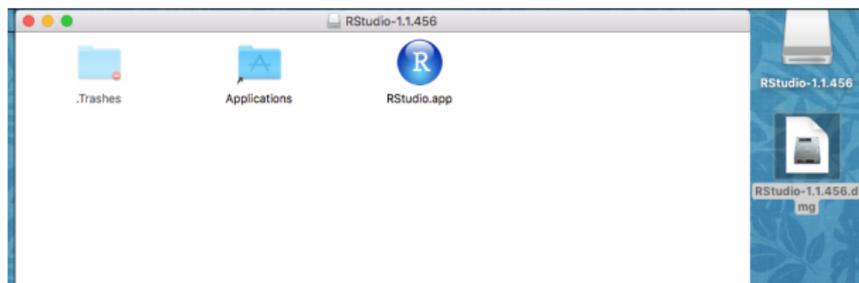
When we prepared this demonstration, we found **RStudio-1.1.456.dmg**.

The screenshot shows the RStudio website's download page. A table of installers is visible, with columns for 'Installers', 'Size', 'Date', and 'MD5'. A dialog box titled 'Opening RStudio-1.1.456.dmg' is overlaid on the page, asking 'What should Firefox do with this file?' and offering options: 'Open with DiskImageMounter (default)', 'Save File' (selected), and 'Do this automatically for files like this from now on.' The 'Save File' option is selected with a blue radio button.

Installers	Size	Date	MD5
RStudio 1.1.456 - Windows Vista/7/8/10		2018-07-19	72a31e0f0d4d817aab4bfbb9dc2b5ad
RStudio 1.1.456 - MacOS X 10.6+ (64-bit)			15b142bf96dc1a5b1dc556
RStudio 1.1.456 - Ubuntu 12.04-15.10/Debian 7+ (64-bit)			e3a3d697f40b7bb1ce961
RStudio 1.1.456 - Ubuntu 12.04-15.10/Debian 7+ (32-bit)			1358fa0146e4d14cd75be4
RStudio 1.1.456 - Ubuntu 16.04+/Debian 9+ (64-bit)			1add890bac633bd883f32
RStudio 1.1.456 - Fedora 19+/RedHat 7+/openSUSE 13.2+/SLES 12 SP2			1e2634f8a9fdd11ca1fb2d
RStudio 1.1.456 - Fedora 19+/RedHat 7+/openSUSE 13.2+/SLES 12 SP2 (32-bit)			1dbddddd0d35708752462
Zip/Tarballs			
Zip/tar archives			
RStudio 1.1.456 - Windows Vista/7/8/10			6d8c97acbe501270d89fa3
RStudio 1.1.456 - Ubuntu 12.04-15.10/Debian 8 (32-bit)	90 MB	2018-07-19	63117e159deca4d01221a8069bd45373
RStudio 1.1.456 - Ubuntu 12.04-15.10/Debian 8 (64-bit)	98.3 MB	2018-07-19	c53c32a71e400c6571e36c573f83dfde

Editor 1 - Rstudio ...

- Double click the `.dmg` file, then an installer panel will appear:



- Drag "RStudio.app" to "Applications" to begin installation

Editor 1 - Rstudio ...

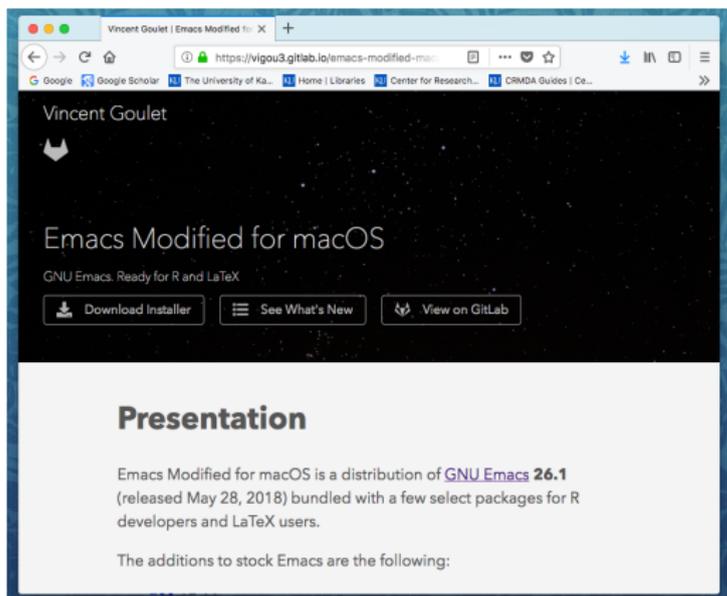
- Rstudio has some special (seemingly-always-under-development) features that require 3rd party software
 - Example: Pandoc <https://pandoc.org>. The Rstudio team now includes a snapshot of Pandoc along with Rstudio itself. Mainly for this reason, we do not (anymore) include Pandoc as one of the prerequisite programs for R that should be installed separately.

Be cautious how you launch RStudio

- Click the icon: the R working directory is not set correctly
- Suggestion: right click on an R file, then “Open With R”
- To run R commands: `command` + `return`

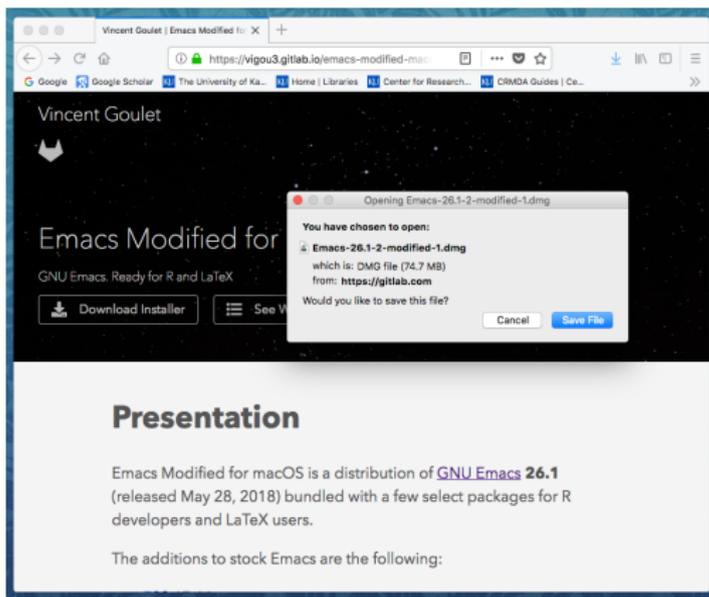
Editor 2 - Emacs

Browse the Emacs Modified for macOS package on Professor Vincent Goulet's Emacs website,
<https://vigou3.gitlab.io/emacs-modified-macos/>



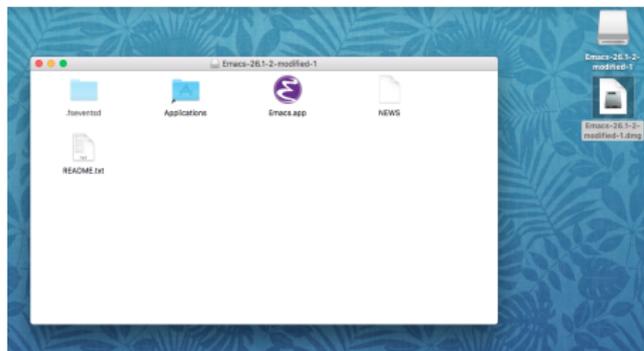
Editor 2 - Emacs ...

Choose “Download Installer”, that pulls download the .dmg file



Editor 2 - Emacs ...

Double click the .dmg file.



An installer panel will appear. Drag **Emacs.app** to **Applications** to begin installation

Consider customizing Emacs

- Emacs default settings are “bare bones.” The user can include valuable customizations in a settings file called `init.el`. See “[Emacs has no learning curve](#)”, some lecture notes about customizing Emacs.
- A reasonably up-to-date `init.el` that Professor Johnson uses is available in <http://pj.freefaculty.org/Software/favoriteEmacsFiles>
- Emacs/ESS default keystroke to run R commands is `command` + `return`
 - PJ's `init.el` will change that to: `shift` + `return`

Outline

- 1 Overview
- 2 Getting Started
 - Frequently Encountered Problems
- 3 Recommended Software
- 4 Install Editors (Optional)
- 5 Other Miscellaneous Installs
- 6 References

Other Useful Software

We will not provide detailed information on installation, but users should keep in mind some other steps that are worth keeping in mind.

- 1 Install a LaTeX distribution, such as MacTeX
<http://www.tug.org/mactex>.
- 2 The version of the BASH shell provided with macOS is outdated. To fix that, install the Homebrew software package framework and use it to obtain a new version of BASH.
- 3 See:
 - 1 Upgrade to bash 4 in Mac OS X for a bare bones description
 - 2 The Good (Tweak), the Bad (Mac), and the Ugly (Terminal) for a considerably more elaborate discussion
- 4 Pandoc is a universal document converter. It is also available for macOS <https://pandoc.org/installing.html>.

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References

R Core Team. (2018). R: A language and environment for statistical computing (Version 3.5.1) [Computer software manual]. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <https://cran.r-project.org/doc/manuals/r-release/fullrefman.pdf>