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# R Corner

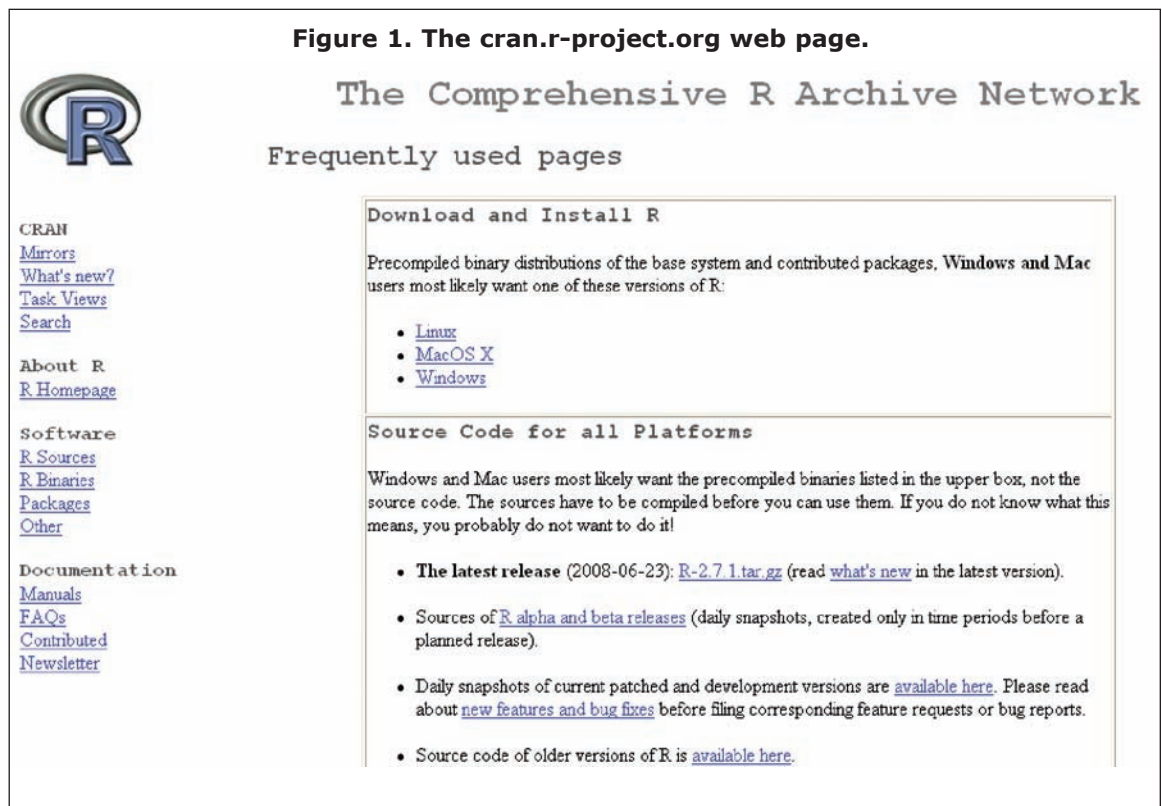
by Steven Craighead

**R**<sup>1</sup> has become the lingua franca of the statistical world. Personally, I believe that it also has a lot to offer us actuaries. Most of our models can be constructed within Excel, but there are still areas where other modeling languages can be useful. R is a good candidate because:

1. It is open source.
2. It runs on multiple platforms.
3. It is free.
4. It has over 1000 various packages available.
5. It can easily be integrated into multiple packages including Excel.
6. It is constantly improving with new statistical tools constantly being developed for R by researchers.

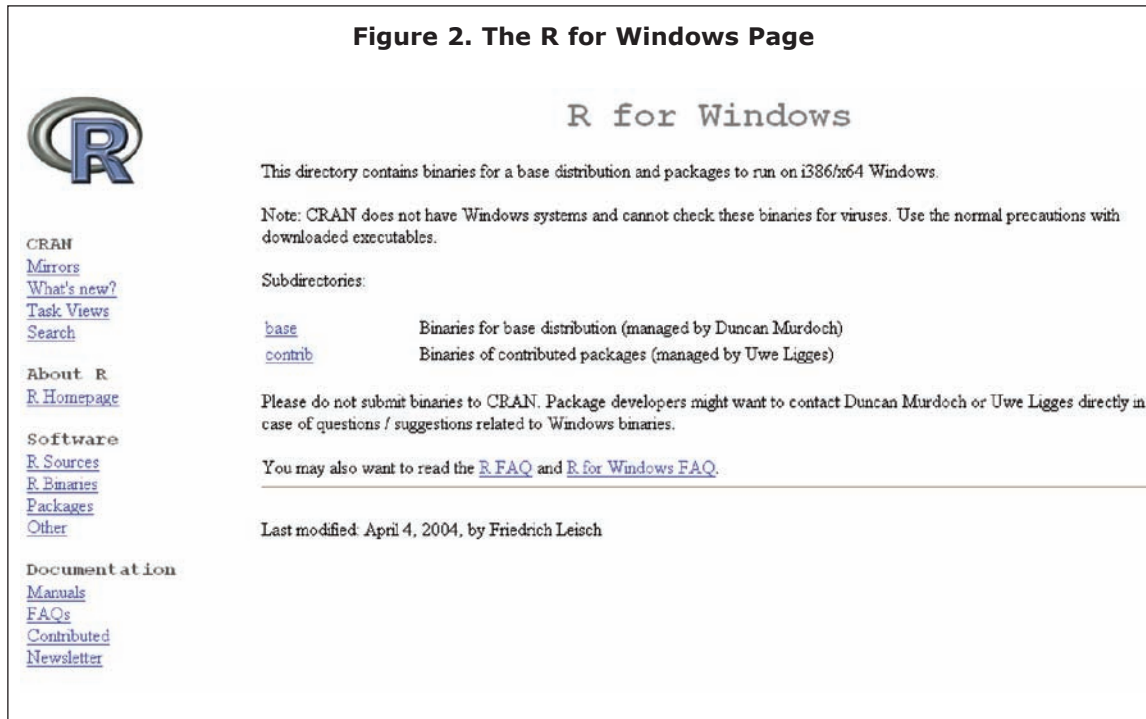
I am going to write a series of columns on R for the readers of CompAct and Expanding Horizons explaining how to use R as well as describing various packages available.

By the end of this article you should know how to locate, download and install R. I will also tell you how to start and end R and how to access the help features. The next article I will dedicate to how to get data into and out of R and how to access the data from a dataframe, which is the most common data structure within R. Other articles will follow outlining how to create modeling formulae and using R to model not just linear regression but other predictive models such as GLM and GAM.



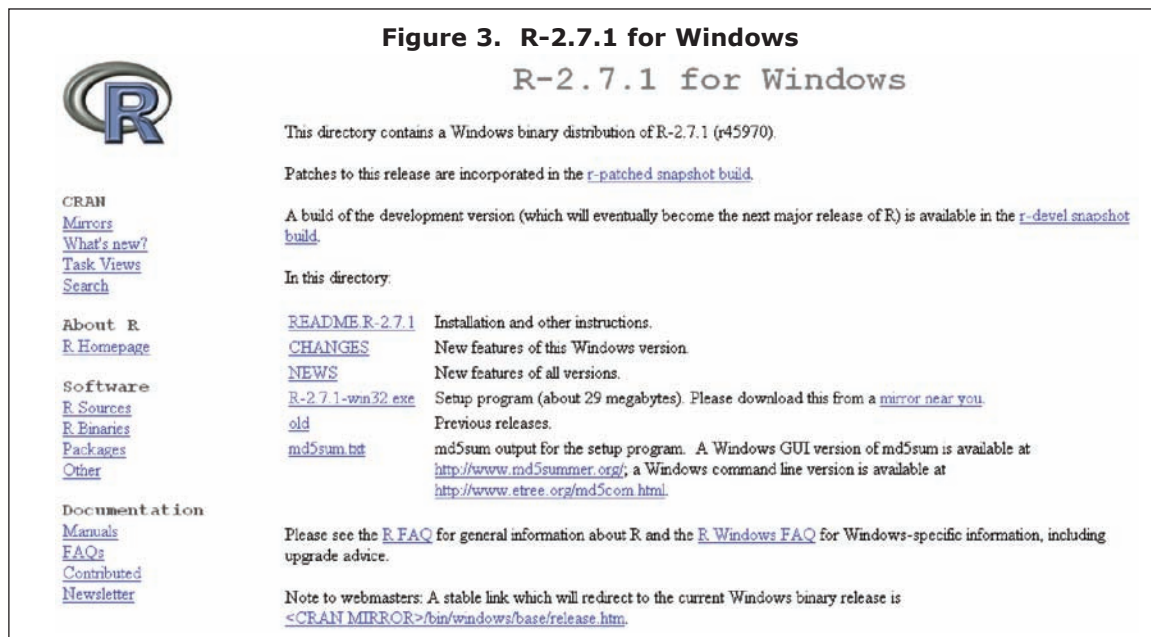
R is located on "The Comprehensive R Archive Network," whose Web site is <http://cran.r-project.org/>. When you go to the site, the homepage displays the frequently used pages. See Figure 1. Note that the first set of choices is on how to download and install R from existing pre-compiled binaries for Linux, Mac and Windows. Choose your favorite operating system platform and you will go to a Web page that allows you to choose between base and contributed packages. Due to my limited access to testing other operating systems, in the remainder of this article I will only describe how to install the Windows binary. Notice in Figure 2, you will have the two choices of base and contrib. Initially, choose base and download the most current release. At the time of the writing of this article, version 2.7.1 is available.

**Figure 2. The R for Windows Page**



Observe from Figure 3, the availability of the file R-2.7.1-win-32.exe (or whatever the latest version is). Download this file to some location on your hard disk. Next run the executable and begin the installation process.

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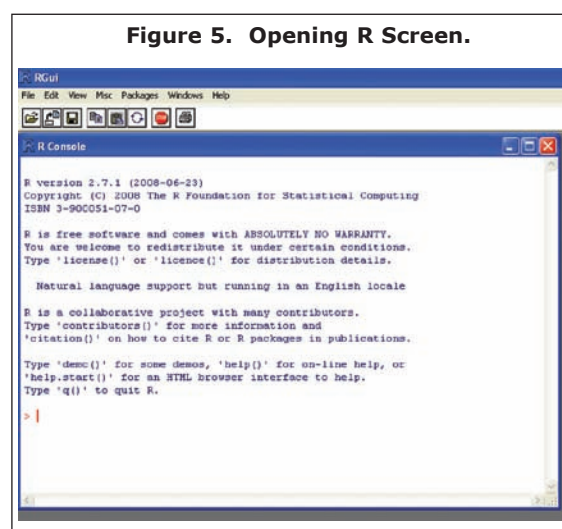
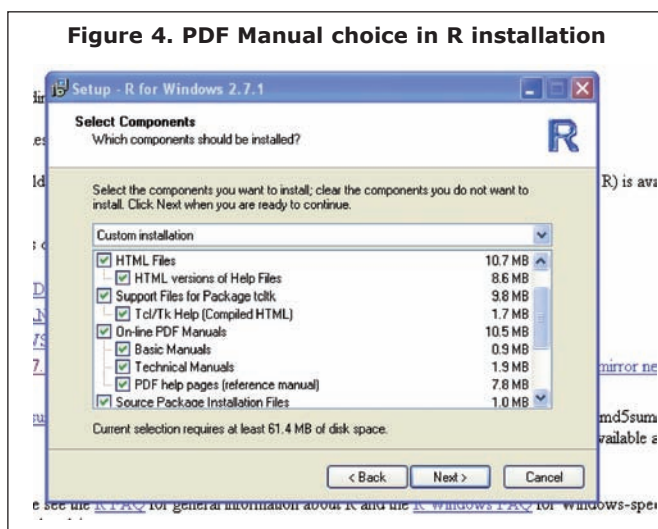
If you choose the default installation directory, R will be installed in C:\Program Files\R\R-2.7.1. Note how the release is installed under a general R folder. I suggest that you make sure to keep your releases separate because of potential future conflicts with new releases.

The installer will then ask what support files you want to have installed with the base installation. I suggest that you should include the technical manuals as well as the reference manual. These will become handy as you expand your modeling skills. See Figure 4.

I also suggest that you use the default startup options as well.

To run R from your Start button, choose the Programs tab and select the R selection and then choose the current release under that selection.

Figure 5 displays an empty R console that will then appear. R will suggest that you should run demo() for some examples, or help() for on-line help or help-start() for an html based help browser for R. It also states that to exit, you type q() and press return.



The `demo()` will give a list of various demonstrations available. You run these demonstrations by type `"demo ("demoprogram")` in R. For instance to look at the `"plotmath"` demo, type:

```
demo("plotmath")
```

You will see multiple displays of various mathematical formulas and symbols available, displayed in a separate graphics window. See Figure 6 for an example. The window may pause and you need to press enter to continue to the next example within the demo. Note the various commands that appear in the R environment.

Figure 6. Plotmath demo screen

Arithmetic Operators		Radicals	
$x + y$	<code>x+y</code>	$\sqrt{x}$	<code>sqrt(x)</code>
$x - y$	<code>x-y</code>	$\sqrt[y]{x}$	<code>sqrt(x, y)</code>
$x^y$	<code>x^y</code>	Relations	
$x/y$	<code>x/y</code>	$x = y$	<code>x=y</code>
$x \pm y$	<code>x±y</code>	$x \neq y$	<code>x≠y</code>
$x \propto y$	<code>x%~%y</code>	$x < y$	<code>x&lt;y</code>
$x \approx y$	<code>x%≈%y</code>	$x \leq y$	<code>x≤y</code>
$x \cdot y$	<code>x·y</code>	$x > y$	<code>x&gt;y</code>
$-x$	<code>-x</code>	$x \geq y$	<code>x≥y</code>
$+x$	<code>+x</code>	$x \approx y$	<code>x≈y</code>
Sub/Superscripts		$x \approx y$	<code>x≈y</code>
$x[i]$	<code>x[i]</code>	$x \equiv y$	<code>x≡y</code>
$x^2$	<code>x^2</code>	$x \propto y$	<code>x%~%y</code>
Juxtaposition		Typeface	
$x^y$	<code>x^y</code>	<code>plain(x)</code>	<code>x</code>
$xyz$	<code>paste(x, y, z)</code>	<code>italic(x)</code>	<code>x</code>
Lists		<code>bold(x)</code>	<code>x</code>
$x, y, z$	<code>list(x, y, z)</code>	<code>bolditalic(x)</code>	<code>x</code>
		<code>underline(x)</code>	<code>x</code>



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To use help, either type `help(command)` or `?command` in the R environment. For example, to find out help on the linear regression method, you can type:

```
?lm
or
help(lm)
```

Figure 7 displays an example of the Web browser that pops up with a description of Fitting Linear Models. If you page down through various help articles, various R commands will be displayed, which you can copy and paste into R.

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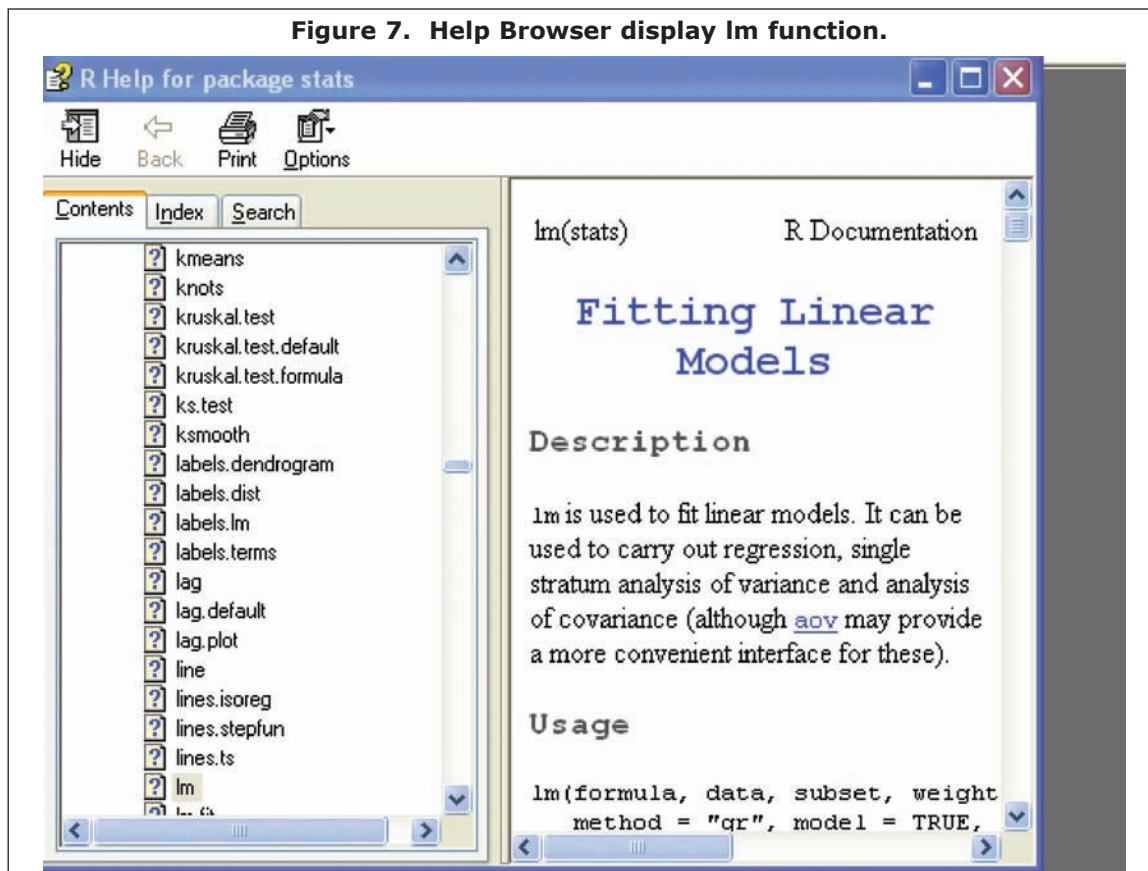


Figure 7. Help Browser display lm function.

Also, in the help browser you are able to index and search for various other objects or methods available within the base system.

Another helpful help command is "help.search("phrase")", where in the R environment you can look for various packages and methods and objects that contain the phrase that you enter.

For example, if you enter: help.search("phrase")

Look at Figure 8, for the R information screen that results from the help.search command.

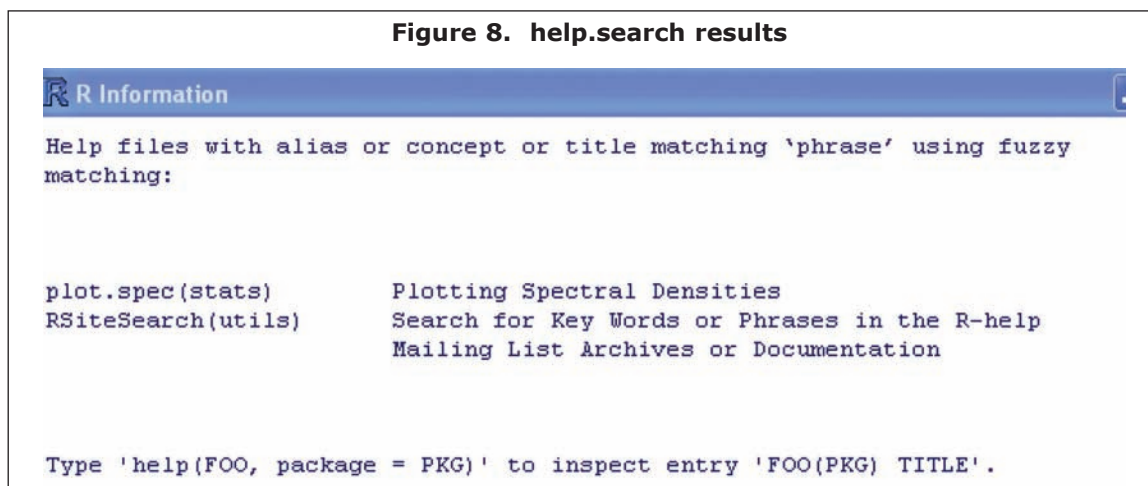


Figure 8. help.search results

Figure 8 is the R information screen that results from the help.search command.

Observe from Figure 8 that if you load the stats package and invoke help on the plot.spec function, you will find some use of the word "phrase."

By the way, you load packages by choosing the Load Package option off of the main menu Package choice. See Figure 9.

If you want to specify the subdirectory in which you want to work in Windows, choose the Change Directory option off of the File option of the main menu. From the main menu, you can observe how to save and load workspaces and history files. The workspace will contain your data and various functions and objects that you build, but the history files will store the command you enter in the R environment. As you develop your own models you will need to exploit these features.

One final thing, if you want to stop R from running some long process, press the Stop Sign Icon at the top of the environment.

Remember to type q() to exit.

I'm going to stop for now. Next column, we will look at various ways to get data into and out of R. 🖥️

**References:**

1. R Development Core Team (2008). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL <http://www.R-project.org>.

