

Unix command line; editors

Tools for Reproducible Research

Karl Broman

Biostatistics & Medical Informatics, UW–Madison

`kbroman.org`

`github.com/kbroman`

`@kwbroman`

Course web: kbroman.org/Tools4RR

Windows vs. Mac OSX vs. Linux

Remote vs. Not

If you're stuck with Windows...

Consider **Cygwin** or **Git Bash**
(and perhaps **Mintty**)

If you use a Mac...

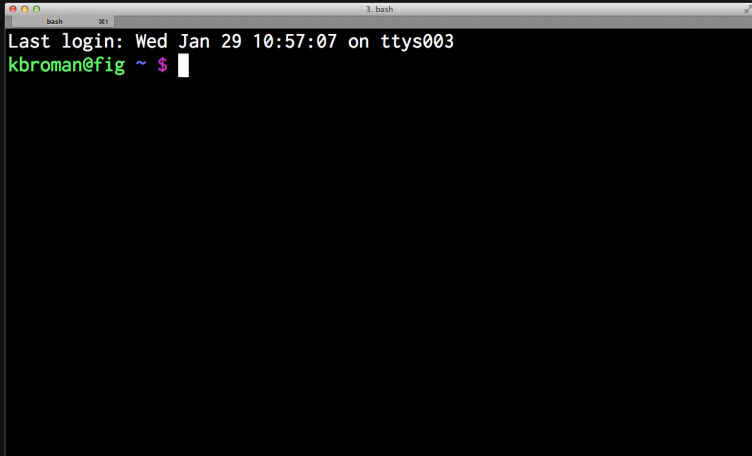
Consider Homebrew and iTerm2

Also the XCode command line tools

The command line is your friend

- ▶ Don't touch that mouse!
- ▶ Scriptable
- ▶ Flexible

The shell

A screenshot of a terminal window. The title bar at the top shows standard macOS window controls (red, yellow, green buttons) and the text '3. bash'. The terminal content displays 'Last login: Wed Jan 29 10:57:07 on ttys003' in white text. Below this, the prompt 'kbroman@fig ~ \$' is shown, with 'kbroman@fig' in green, '~' in blue, and '\$' in red. A white cursor is positioned to the right of the '\$' symbol.

```
bash 0x1 3. bash
Last login: Wed Jan 29 10:57:07 on ttys003
kbroman@fig ~ $
```

Options: `tcsh`, `bash`, `zsh`

Basics

- ▶ Directory structure

Absolute vs. relative paths

```
ls -l ~/..
```

- ▶ Creating, removing, changing directories

```
mkdir
```

```
rmdir
```

```
cd
```

```
cd -
```

- ▶ Moving, copying, removing files

```
mv
```

```
cp
```

```
rm -i
```

~/.bash_profile

```
export PATH=./usr/local/bin:$PATH
export LD_LIBRARY_PATH=/usr/local/lib

noclobber=1      # prevent overwriting of files
IGNOREEOF=1      # disable Ctrl-D as a way to exit
HISTCONTROL=ignoredups

alias cl='clear;cd'
alias rm='rm -i'
alias mv='mv -i'
alias cp='cp -i'
alias ls='ls -GF'
alias 'l.='='ls -d .[a-zA-Z]*'
alias ll='ls -lh'
alias md='mkdir'
alias rd='rmdir'
alias rmb='rm .*~ *~ *.bak *.bk!'

alias Rb='R CMD build --force --resave-data'
alias Ri='R CMD INSTALL --library=/Users/kbroman/Rlibs'
alias Rc='R CMD check --library=/Users/kbroman/Rlibs'
alias Rcc='R CMD check --as-cran --library=/Users/kbroman/Rlibs'
```


Redirection and pipes

```
$ locate article.cls > output.txt
$ locate book.cls >> output.txt
$ grep texmf output.txt

$ locate article.cls | grep texmf

$ locate article.cls | grep texmf | less

$ locate article.cls | wc -l
$ locate article.cls | grep texmf | wc -l

$ cat file1.txt file2.txt > combined.txt
```

Wild cards

```
$ grep blah *.txt
```

```
$ ls blah.???
```

```
$ ls [a-z]*
```

```
$ ls /usr/bin/[auz]*
```

```
$ ls /usr/bin/[auz]*.*
```

Suspend/foreground/background

```
$ R CMD BATCH input.R output.txt &  
  
$ R CMD BATCH input.R output.txt  
[ctrl-Z]  
$ bg  
  
$ emacs afile.txt  
[ctrl-Z]  
$ fg
```

Other useful tools

```
$ find . -name *.py

$ ps ux

$ top

$ df -hk

$ du -h
$ du -hd2

$ ln -s ~/Projects/SomeFriend/Data
$ ln -s ~/Projects/SomeFriend/Data SomeFriend_Data

$ tar xzvf qtl_1.29-2.tar.gz
$ tar czvf blah.tgz Blah/
$ tar tzvf blah.tgz

$ wget http://kbroman.org/Tools4RR/pages/resources.html
```

Further useful tools

```
$ whereis bash
$ type rm
$ type emacs

$ pwd

$ head afile.txt
$ tail afile.txt
$ head -n20 afile.txt

$ man head

$ kill 8453
$ kill -9 8453

$ history
$ !!
$ !-2
$ !503

$ ping www.google.com

$ ispell afile.txt
```

Opening a file from the command line

Windows:

```
$ start mypaper.pdf  
$ start http://google.com
```

Mac:

```
$ open mypaper.pdf  
$ open http://google.com
```

Moving around the command line

<code>ctrl-f, ctrl-b</code>	move forward and back
<code>ctrl-a, ctrl-e</code>	move to beginning and end of line
<code>ctrl-k, ctrl-u</code>	delete rest of line, or to the start
<code>ctrl-l</code>	clear the screen
<code>ctrl-c</code>	cancel what you've typed
<code>tab</code>	autocomplete command or file
<code>ctrl-p, ctrl-n</code>	forward and backward in history
<code>ctrl-r</code>	search for a previous command

File modes

```
kbroman@fig ~/Teaching/Tools4RR/Lectures (master) $ ll
total 8
drwxr-xr-x 27 kbroman staff 918B Jan 27 11:35 01_Intro/
drwxr-xr-x 30 kbroman staff 1.0K Jan 29 11:38 02_Unix/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:28 03_KnitrMarkdown/
drwxr-xr-x 37 kbroman staff 1.2K Jan 20 23:05 04_Git/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:28 05_Organization/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:28 06_EDA/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:28 07_ClearCode/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:28 08_Rpack/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:28 09_TestingDebugging/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:29 10_BigJobs/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:29 11_KnitrPapers/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:29 12_KnitrTalks/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:29 13_KnitrPosters/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:29 14_Python/
drwxr-xr-x 2 kbroman staff 68B Jan 14 06:29 15_Licenses/
-rwxr-xr-x 1 kbroman staff 488B Oct 23 16:18 createVersionWithNotes.rb*
kbroman@fig ~/Teaching/Tools4RR/Lectures (master) $
```


File modes/owner/group

```
sudo chown kbroman .  
chgrp -R staff .  
chmod +x createVersionWithNotes.rb  
chmod 755 02_Unix  
chmod 644 02_Unix/02_unix.tex  
chmod 700 Private_stuff
```

How to solve computing problems

- ▶ Try stuff!
- ▶ man pages and help files
- ▶ `blah -h` or `blah --help`
- ▶ Google
- ▶ Stackoverflow and other StackExchange sites
- ▶ Google with `site:stackoverflow.com`
- ▶ email lists and google groups
- ▶ friends or colleagues
- ▶ Twitter
- ▶ Buy a book. Buy all of the books.

Examples

- ▶ How do you suppress warnings in knitr?
- ▶ What symbol corresponds to the unicode `\u00B1`?
- ▶ What's the difference between `curl` and `wget`?
- ▶ What does "502 Bad Gateway" mean?
- ▶ "To open `gs` you need to install X11"
- ▶ `mclapply` isn't working in Windows
- ▶ How to ping a server in Python?
- ▶ Font shape ``EU1/pplx/m/n'` undefined
- ▶ `except KeyError, k: raise AttributeError, k`

Important principle

Learn to code by looking at good code.

Choose a good editor

- ▶ Emacs
- ▶ VIM
- ▶ RStudio
- ▶ Textwrangler
- ▶ Notepad++
- ▶ Sublime Text
- ▶ Atom

A good editor

- ▶ Doesn't require pointing-and-clicking
- ▶ Easy to get code between R and a script
- ▶ Syntax highlighting of code
- ▶ Automatic indentation
- ▶ Close parentheses/brackets/braces
- ▶ Browse code across files
- ▶ Integrated with other tools (e.g., version control)

Don't forget to look at the resources page

kbroman.org/Tools4RR/pages/resources.html