

36-463/663: Multilevel & Hierarchical Models

Fall 2016

HW01 – Due Tue, 6 September 2016

- Please turn the homework in online at the Blackboard website, under Assignments. Upload one file per person. It can be pdf, doc, docx, or txt, but pdf is strongly preferred.
- Please install R, version 3.3.1 or later, on your personal computer using the instructions under the appropriate link in the “Download and Install R” section of <https://cran.r-project.org/>. After R is installed,
 - In your web browser, open <http://www.cs.cmu.edu/~10702/R2/Rintro.pdf> so you can read it.
 - If you have never used R before, type in all of the examples from Rintro.pdf into R.
 - If you have used R before, read the examples in Rintro.pdf and try to predict what will happen. Type in any examples where you are not sure.
- For the exercises below, please download the course notes *Using R for Data Analysis and Graphics: Introduction, Code and Commentary*, by J. H. Maindonald, Centre for Mathematics and Its Applications, Australian National University (usingR.pdf), and the accompanying data file (usingR.RData). You can get these at

<http://www.stat.cmu.edu/~brian/463-663/hw01>

Save the file “usingR.RData” to whatever directory or folder you will work on this assignment in. Then start R, and use “change directory” under the “File” menu in R (or use the R command `setwd()`) to change to that directory.

Install the “usingR” files with the command

```
> load("usingR.RData")
```

and verify that all the files have been installed with the `ls()` command, as follows:

```
> ls()
[1] "ais"           "anesthetic"    "austpop"       "Cars93.summary"
[5] "dewpoint"      "dolphins"      "elasticband"   "florida"
[9] "hills"         "huron"         "islandcities"  "kiwishade"
[13] "leafshape"     "milk"          "moths"         "oddbooks"
[17] "orings"        "possum"        "primates"      "rainforest"
[21] "seedrates"     "tinting"
```

It is not necessary to do anything else to load individual data files for this assignment, just use the data files as indicated in the MainDonald class notes. If you quit R, save your workspace; R will save your work in a file called “.RData”. If you double-click on the “.RData” file to restart R, all your old work, including the above files, should be accessible again.

Exercises

1. Read & try all of Chapter 1 of Maindonald. You may also need the data file `austpop.txt` which you can also find in <http://www.stat.cmu.edu/~brian/463/hw01>. Then please do and turn in the following exercises:
 - (a) Chapter 1, #1.
 - (b) Chapter 1, #2.
 - (c) Chapter 1, #3.
2. Read & try all of Chapter 2 of Maindonald. You will use the data sets you created for Chapter 1, as well as some of the data sets you loaded with “`load(usingR.Rdata)`”. Then please do and turn in the following exercises:
 - (a) Chapter 2, #1.
 - (b) Chapter 2, #2.
 - (c) Chapter 2, #5. Note that the formula for the volume of a sphere didn’t quite come out right in the notes. It is $4\pi r^3/3$. What happens when you type “pi” at the R prompt?
 - (d) Chapter 2, #6.
3. Read & try all of Chapter 3 of Maindonald. Again you will use the data sets you have created or loaded previously. Note that all of the following commands produce graphing windows¹: `dev.new()`, `x11()`, `windows()` (for MS Windows), `quartz()` (for Macs); and `dev.off()` makes the graphing window go away. Then please do and turn in the following exercises:
 - (a) Chapter 3, #1. Note: I personally think `lag.plot(huron$mean.height, do.lines=F)` looks better (and easier to interpret!) than just `lag.plot(huron$mean.height)`.
 - (b) Chapter 3, #3.
 - (c) Chapter 3, #5.
4. This exercise is intended to make sure you can install and run the `jags` software for Bayesian model fitting, which we will be doing later in the course. *There is nothing to turn in for this exercise.*
 - (a) Install `jags` on your computer (Mac, Windows or Linux) from <http://mcmc-jags.sourceforge.net/>. For at least Mac and Windows, there are installable binaries so there is no need to compile `jags` from C source code.
 - (b) Install the package `R2jags` in your R system (`R2jags` can be installed from the USA (PA1) CRAN mirror using the pulldown menus in R (Packages → Install Package(s)...)).
 - (c) Install the package `rube` in your R system (download the zip file (Windows) or tar/gz file (Mac/Linux) from <http://www.stat.cmu.edu/~hseltman/rube/> (install using the pulldown menus in R (Packages → Install Package(s) from local zip files...)).
 - (d) Work through the R exercise outlined in the file `basicExample.R` in the hw00 area of the class website <http://www.stat.cmu.edu/~brian/463>.

If you encounter anything mystifying in the above exercises, please discuss with me and/or the TA.

Some good online sources for R help:

- QuickR: <http://www.statmethods.net/>
- Cookbook for R: <http://www.cookbook-r.com/>

¹See also <http://doingbayesiandataanalysis.blogspot.com/2012/01/graphics-plots-in-r-for-macos-linux-and.html>.