### Introduction

Why use R?

Why not use a spreadsheet?

Todays workshop

* A common scenario
* A friend has emailed you her data in a spreadsheet
* Todays workshop is not about impressing with R code

Why not use a spreadsheet?

* Data manipulation in Excel is VERY risk and time consuming
* A rage of software packages are available for Excel
* Large data sets can exceed the size limits of standard programs
* Spreadsheets don’t have the inherent understanding of statistics that R has
* For example handling of NA’s
* R is hot!

Why use R?

Why use R?

* Its free
* Its available on most operating systems Windows, OS X, Linux
* There are huge numbers of packages available
* Its becoming the international standard for statistics

Getting Started

Some References

### References

[1]   James P. Howard. R Cookbook. O’Reilly Media, Inc, 2011.

[2]   Phil Spector. Data Manipulation with R. Use R series Springer, 2008

Getting Started

Installing R!

Download it

* Open [http://www.r-\_project.org](http://www.r-project.org)
* Click CRAN (Under download on Top Left)
* Click <http://cran.ms.unimelb.edu.au/> University of Melbourne

Windows

* Select Windows
* Select Base
* Download R (suggest latest version)

OS X

* Select Select OS X
* Select R-3.2.2.pkg (or the version that matches your OS version)

Getting Started

How about RStudio

* <https://www.rstudio.com/products/rstudio/download/>
* Its also on your thumb drive

Getting Started

Basic steps

2+5

## [1] 7

# Create a sequence of numbers   
X = 2:10   
  
# Display basic statistical measures   
summary(X)

##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    
##       2       4       6       6       8      10

# use q() to quit

-

Getting Started

Help Functions

To access the documentation type

help.start()   
help(summary)   
args(summary)   
example(sd)   
??package

Help Functions

Search the Web

To search R documentation

* RSiteSearch(”key phrase”)
* help(adf.test,package=”tseries”)
* To search for a tutorial for a package vignette(package=”packagename”)
* For an intro to vignettes see [https://cran.r-\_project.org/web/packages/sos/vignettes/sos.pdf](https://cran.r-project.org/web/packages/sos/vignettes/sos.pdf)
* Examples on the web <http://shiny.rstudio.com/gallery/>

Custom Google search focused on R-specific websites

<http://rseek.org>

Coding Q&A site

<http://stackoverflow.com> <http://stats.stakexchange.com>

### Some manners

Iterative development

Working Creatively

Research on how to work creatively based on case studies of successful R&D projects developed into Agile

* Keep the manages away
* Work sustainably
* People over process
* Iterative development

### Basic R Data types

R Data types

Lists, frames and tables

Vectors

* Vectors l ← c(1,3,4,7,11)
* Refer to elements using array l[c(2,5)] 2nd and 5th elements of l

Data Frames

a <- c(35,23,24,65)   
e <- c("Peter", "John", "Mark", NA)   
f <- c(TRUE,TRUE,TRUE,FALSE)   
team <- data.frame(a,e,f)   
names(team) <- c("Age","Names","Passed") # variable names   
str(team)

## 'data.frame': 4 obs. of  3 variables:    
##  $ Age   : num  35 23 24 65    
##  $ Names : Factor w/ 3 levels "John","Mark",..: 3 1 2 NA    
##  $ Passed: logi  TRUE TRUE TRUE FALSE

-

### Reading our file

Lets read the table

Check the current directory

Where are we

getwd()   
setwd(”/Users/pcru”)   
dir() #This lists the files   
ls()  #This lists the variables

<http://www.statmethods.net/input/contents.html>

Lets read the table

Reading a table

To read a csv table as a table try

tab1 ← as.matrix(read.csv(file=”filetable.csv”, sep=”,”, header=FALSE))

But our table is an excel file

* What about a package?
* [http://www.thertrader.com/2014/02/11/a-\_million-\_ways-\_to-\_connect-\_r-\_and-\_excel/](http://www.thertrader.com/2014/02/11/a-million-ways-to-connect-r-and-excel/)
* Lets use the R package xlsx

### Getting help on packages

R Packages

CRAN

Where from

* install command
* install.packages(pkgs)

Citing Packages

[https://cran.r-\_project.org/web/packages/RefManageR/vignettes/TestRmd.html](https://cran.r-project.org/web/packages/RefManageR/vignettes/TestRmd.html)

 x<-citation()   
 toBibtex(x)

## @Manual{,    
##   title = {R: A Language and Environment for Statistical Computing},    
##   author = {{R Core Team}},    
##   organization = {R Foundation for Statistical Computing},    
##   address = {Vienna, Austria},    
##   year = {2014},    
##   url = {http://www.R-project.org/},    
## }

-

Lets read the table

An example

table1←read.xlsx2(”1\_R Wkshp\_dummy data\_OTU table.xlsx”, sheetName =   
   
”Sheet1”,header=FALSE,rowNames=FALSE,transpose=TRUE,endRow=18)

Loading the xlsx package

## Loading required package: xlsx

## Warning: package ’xlsx’ was built under R version 3.1.3

## Loading required package: rJava

## Warning: package ’rJava’ was built under R version 3.1.3

## Loading required package: methods## Loading required package: xlsxjars## Loading required package: xtable

-

Lets read the table

The columns are wrong

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
|  |  |  |  |  |  |  |  |
| 1 | Group | Contaminated |  |  |  |  |  |
| 2 | Site | 1 |  |  | 2 |  |  |
| 3 | Sample ID | 10000 | 10001 | 10002 | 10003 | 10004 | 10005 |
| 4 | Rep | 1 | 2 | 3 | 1 | 2 | 3 |
| 5 | phormidiaceae | 24872 | 24872 | 5822 | 7538 | 7201 | 7538 |
| 6 | streptococcaceae | 11 | 7 | 14 | 8 | 10 | 8 |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

Lets read the table

Transpose the table

Transposing

We need to transpose the table and set the column names correctly

table1t=setNames(data.frame(t(table1[,-1])),table1[,1])

-

<http://rgm3.lab.nig.ac.jp/RGM/R_rdfile?f=Ecdat/man/read.transpose.Rd&d=R_CC> [http://stackoverflow.com/questions/17288197/reading-\_a-\_csv-\_file-\_organized-\_horizontally](http://stackoverflow.com/questions/17288197/reading-a-csv-file-organized-horizontally)

Fields across many columns

Replicating first column

Lets do it the easy way first

ctridx<-which(table1t$Group=="Control")   
table1t$Group[1:48]<-"Contaminated"   
table1t$Group[(ctridx+1):48]<-"Control"

-

ttt←table1t$Site   
for(i in c(2:length(table1t$Site)))   
{   
    temp←as.character(table1t$Site[i])   
    tempb←as.character(ttt[i-1])   
    if(table1t$Site[i]==””)   
    {   
         ttt[i]←tempb   
    }   
    if(!table1t$Site[(i)]==””)   
    {   
        ttt[i]←temp   
    }   
}   
table1t$Site←ttt

## X3    
##  1    
## Levels:  1 2 3 4 FALSE TRUE    
## X4    
##  1    
## Levels:  1 2 3 4 FALSE TRUE    
## X5    
##  2    
## Levels:  1 2 3 4 FALSE TRUE    
## X6    
##  2    
## Levels:  1 2 3 4 FALSE TRUE    
## X7    
##  2    
## Levels:  1 2 3 4 FALSE TRUE    
## X8    
##  1    
## Levels:  1 2 3 4 FALSE TRUE    
## X9    
##  1    
## Levels:  1 2 3 4 FALSE TRUE    
## X10    
##   1    
## Levels:  1 2 3 4 FALSE TRUE    
## X11    
##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X12    
##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X13    
##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X14    
##   1    
## Levels:  1 2 3 4 FALSE TRUE    
## X15    
##   1    
## Levels:  1 2 3 4 FALSE TRUE    
## X16    
##   1    
## Levels:  1 2 3 4 FALSE TRUE    
## X17

##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X18    
##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X19    
##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X20    
##   1    
## Levels:  1 2 3 4 FALSE TRUE    
## X21    
##   1    
## Levels:  1 2 3 4 FALSE TRUE    
## X22    
##   1    
## Levels:  1 2 3 4 FALSE TRUE    
## X23    
##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X24    
##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X25    
##   2    
## Levels:  1 2 3 4 FALSE TRUE    
## X26    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X27    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X28    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X29    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X30    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X31    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X32

##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X33    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X34    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X35    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X36    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X37    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X38    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X39    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X40    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X41    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X42    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X43    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X44    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X45    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X46    
##   3    
## Levels:  1 2 3 4 FALSE TRUE    
## X47

##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X48    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## X49    
##   4    
## Levels:  1 2 3 4 FALSE TRUE    
## rowNames    
##    FALSE    
## Levels:  1 2 3 4 FALSE TRUE    
## transpose    
##      TRUE    
## Levels:  1 2 3 4 FALSE TRUE

-

### Working with strings

How to work with strings

stringer package

* require(stringr)

Lets look at this package

* stri\_c(str1,str2)

concatenates two string

* str\_len(str)

require(stringr)

## Loading required package: stringr

table1t$Rep<-str\_replace(table1t$Rep,"[rep]{3}?","\\1")   
table1t$Rep<-str\_replace(table1t$Rep,"A","1")   
table1t$Rep<-str\_replace(table1t$Rep,"B","2")   
table1t$Rep<-str\_replace(table1t$Rep,"C","3")   
table1t$Rep<-as.factor(table1t$Rep)

-

Lets read the table

Reading a table of other types

* <http://www.statmethods.net/input/importingdata.html>
* [http://stackoverflow.com/questions/17288197/reading-\_a-\_csv-\_file-\_organized-\_horizontally](http://stackoverflow.com/questions/17288197/reading-a-csv-file-organized-horizontally)
* <http://rgm3.lab.nig.ac.jp/RGM/R_rdfile?f=Ecdat/man/read.transpose.Rd&d=R_CC>
* Input files from Stata

library(foreign)   
mydata ← read.dta(”c:/mydata.dta”)

Morning Tea Time

Back in 20min

Need coffee !!

### Working with Data Types

Lets read the next table

Reading a table using xlxs

setwd("/Users/pcru/SizeDoesMatter1")   
#dir()   
table2<-read.xlsx2("2\_R Wkshp\_dummy data\_Env Data\_incl2outliersMK.xlsx", sheetName ="Sheet2",header=TRUE,rowNames=FALSE)

-

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  | Group | Site | Sample.ID | Rep | Spill.date | Sample.collection.date |
|  |  |  |  |  |  |  |
| 1 | Contaminated | 1 | 10000 | 1 | 14-May-14 | 15.5.14 |
| 2 | Contaminated | 1 | 10001 | 2 | 14-May-14 | 15.5.14 |
| 3 | Contaminated | 1 | 10002 | 3 | 14-May-14 | 15.5.14 |
| 4 | Contaminated | 2 | 10003 | 1 | 14-May-14 | 15.5.14 |
| 5 | Contaminated | 2 | 10004 | 2 | 14-May-14 | 15.5.14 |
| 6 | Contaminated | 2 | 10005 | 3 | 14-May-14 | 15.5.14 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Lets read the next table

Reading a table

Oh NO

* All columns have been set to factors
* Dates have different formats

str(table2[,1:11])

## 'data.frame': 48 obs. of  11 variables:    
##  $ Group                 : Factor w/ 2 levels "Contaminated",..: 1 1 1 1 1 1 1 1 1 1 ...    
##  $ Site                  : Factor w/ 4 levels "1","2","3","4": 1 1 1 2 2 2 1 1 1 2 ...    
##  $ Sample.ID             : Factor w/ 18 levels "10000","10001",..: 1 2 3 4 5 6 7 8 9 1 ...    
##  $ Rep                   : Factor w/ 9 levels "1","2","3","A",..: 1 2 3 1 2 3 7 8 9 7 ...    
##  $ Spill.date            : Factor w/ 2 levels "14-May-14","N/A": 1 1 1 1 1 1 1 1 1 1 ...    
##  $ Sample.collection.date: Factor w/ 4 levels "15.5.14","17/5/14",..: 1 1 1 1 1 1 2 2 2 2 ...    
##  $ labnum                : Factor w/ 36 levels "2000","2001",..: 1 2 3 4 5 6 7 8 9 19 ...    
##  $ phosphate..ppb.       : Factor w/ 39 levels "10","105","108",..: 27 30 28 26 25 27 12 15 13 7 ...    
##  $ ammonia..ppb.         : Factor w/ 41 levels "10","103","1042",..: 10 14 15 6 7 4 31 34 32 28 ...    
##  $ chlorophyll..ug.L.    : Factor w/ 38 levels "1","10","11",..: 20 23 21 25 17 18 16 14 15 12 ...    
##  $ DO....                : Factor w/ 31 levels "100","120","31",..: 5 4 3 7 6 5 8 7 9 11 ...

-

Lets break it down

First lets reed a few rows only

table2<-read.xlsx2("2\_R Wkshp\_dummy data\_Env Data\_incl2outliersMK.xlsx", sheetName = "Sheet2",header=TRUE,rowNames=FALSE,as.Data.frame=FALSE,colIndex=c(1:5),stringsAsFactors=FALSE,colClasses=c("character","numeric","numeric",rep("character",2)),endRow=4)   
sapply(table2,mode)

##         Group          Site     Sample.ID           Rep    Spill.date    
##   "character"     "numeric"     "numeric"   "character"   "character"    
##      rowNames as.Data.frame    
##     "logical"     "logical"

sapply(table2,class)

##         Group          Site     Sample.ID           Rep    Spill.date    
##   "character"     "numeric"     "numeric"   "character"   "character"    
##      rowNames as.Data.frame    
##     "logical"     "logical"

-

Lets read the next table

Setting the data types

colClasses

* The variable colClasses can be used to specify the row types.
* We need to set stringsAsFactor=FALSE or all columns with be loaded as factors
* The dates are in a non standard format so we need to read them as chars first

table2b<-read.xlsx2("2\_R Wkshp\_dummy data\_Env Data\_incl2outliersMK.xlsx", sheetName = "Sheet2",header=TRUE,rowNames=FALSE,as.Data.frame=FALSE,colIndex=c(1:11),stringsAsFactors=FALSE,colClasses=c("character",rep("numeric",2),"character",rep("character",2),rep("numeric",6)))   
sapply(table2,class)

##         Group          Site     Sample.ID           Rep    Spill.date    
##   "character"     "numeric"     "numeric"   "character"   "character"    
##      rowNames as.Data.frame    
##     "logical"     "logical"

-

Lets read the next table

Setting the Date Type

table2f<-table2   
table2f$Spill.date<-as.Date(table2f$Spill.date,"%d-%b-%y")   
table2f$Sample.collection.date<-as.Date(table2f$Sample.collection.date,"%d.%m.%y")

## Error in as.Date.default(table2f$Sample.collection.date, "%d.%m.%y"): do not know how to convert ’table2f$Sample.collection.date’ to class "Date"

#sapply(table2f,mode)   
sapply(table2f,class)

##         Group          Site     Sample.ID           Rep    Spill.date    
##   "character"     "numeric"     "numeric"   "character"        "Date"    
##      rowNames as.Data.frame    
##     "logical"     "logical"

-

Lets read the next table

Setting the Date Type

colClasses

* The as.Data method can take a format string as the second variable
* The format strings are described in help on strptime
* But Spill.data has two formats
* We can use the if else function to combine them

table2bf<-table2b   
table2bf$Spill.date<-as.Date(table2bf$Spill.date,"%d-%b-%y")   
cdate1<-as.Date(table2bf$Sample.collection.date,"%d.%m.%y")   
cdate2<-as.Date(table2bf$Sample.collection.date,"%d/%m/%y")   
table2bf$Sample.collection.date<-as.Date(ifelse(!is.na(cdate1),as.Date(cdate1),as.Date(cdate2)), origin="1970-01-01")   
table2bf$Group<-as.factor(table2bf$Group)   
table2bf$Rep<-as.factor(table2bf$Rep)   
na\_count <-sapply(table2bf, function(y) sum(length(which(is.na(y)))))   
na\_count

##                  Group                   Site              Sample.ID    
##                      0                      0                      0    
##                    Rep             Spill.date Sample.collection.date    
##                      0                     24                      0    
##                 labnum        phosphate..ppb.          ammonia..ppb.    
##                      0                      0                      0    
##     chlorophyll..ug.L.                 DO....               rowNames    
##                      0                      0                      0    
##          as.Data.frame    
##                      0

dated<-table2bf$Sample.collection.date-table2bf$Spill.date

-

### Working with string

Lets read the next table

Just fix the Rep column using the stringer package again

require(stringr)   
table2bf$Rep<-str\_replace(table2bf$Rep,"[rep]{3}?","\\1")   
table2bf$Rep<-str\_replace(table2bf$Rep,"A","1")   
table2bf$Rep<-str\_replace(table2bf$Rep,"B","2")   
table2bf$Rep<-str\_replace(table2bf$Rep,"C","3")   
table2bf$Rep<-as.factor(table2bf$Rep)   
str(table2bf)

## 'data.frame': 48 obs. of  13 variables:    
##  $ Group                 : Factor w/ 2 levels "Contaminated",..: 1 1 1 1 1 1 1 1 1 1 ...    
##  $ Site                  : num  1 1 1 2 2 2 1 1 1 2 ...    
##  $ Sample.ID             : num  10000 10001 10002 10003 10004 ...    
##  $ Rep                   : Factor w/ 3 levels "1","2","3": 1 2 3 1 2 3 1 2 3 1 ...    
##  $ Spill.date            : Date, format: "2014-05-14" "2014-05-14" ...    
##  $ Sample.collection.date: Date, format: "2014-05-15" "2014-05-15" ...    
##  $ labnum                : num  2000 2001 2002 2003 2004 ...    
##  $ phosphate..ppb.       : num  3020 3253 3169 2999 2879 ...    
##  $ ammonia..ppb.         : num  13880 14598 14676 10984 11657 ...    
##  $ chlorophyll..ug.L.    : num  302 323 315 352 289 296 254 248 250 220 ...    
##  $ DO....                : num  34 33 31 38 36 34 40 38 41 45 ...    
##  $ rowNames              : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...    
##  $ as.Data.frame         : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...

-

### How to I merge two data sets

How to I merge two data sets

Using the merge command

The inbuilt command merge

* R has a command merge
* Lets start looking at the first 9 lines of the tables and merge them using the Sample ID
* Because otherwise its not uniques

merge(x, y, by = intersect(names(x), names(y)),   
      by.x = by, by.y = by, all = FALSE, all.x = all, all.y = all,   
      sort = TRUE, suffixes = c(”.x”,”.y”),   
      incomparables = NULL, ...)

tab1c<-table1t[1:9,]   
tab2c<-table2b[1:9,]   
m1<-merge(tab1c,tab2c,by.x="Sample ID",by.y="Sample.ID")   
m2<-merge(table1t,table2bf,by.x=c("Group","Site","Sample ID"),by.y=c("Group","Site","Sample.ID"))   
m3<-merge(table1t,table2bf,by.x=c("Group","Site","Sample ID","Rep"),by.y=c("Group","Site","Sample.ID","Rep"))

-

Lunch Time

Back in 30 min

Provided

How to I append two data sets

Lets load a third data set

Follow up data from contaminated site

table3←read.xlsx2(”3\_Follow up data from contaminated site\_MK.xlsx”, sheetName =”Sheet1”,header=TRUE,rowNames=FALSE,colClasses=c(rep(”character”,3),rep(”character”,2),rep(”numeric”,18)))   
table3f←table3   
table3f$Spill.date←as.Date(table3f$Spill.date,”%d.%m.%y”)   
table3f$Sample.collection.date←as.Date(table3f$Sample.collection.date,”%d.%m.%y”)   
sapply(table3f,mode)   
sapply(table3f,class)

How to I append two data sets

Lets load a third data set

Joining table 3 to are merged tables

* We need to be careful to match everything
* Install the plyr package This has lots of useful functions for renaming var etc
* This means we need columns for corynebacteriaceae and porphyromondaceae
* should these be NA or 0
* we will do one of each. generally we would use NA but in this case 0 is perhaps better

require(plyr)   
Sample.ID←rep(20000,3)   
table3fi←cbind(table3f,Sample.ID)   
#how many columns I can't count   
ncol(table3fi)   
ncol(m3)   
#now get the cols all right   
table3fii←table3fi[c(1,2,24,3,4:23)]   
m3i←m3[c(1:4,19:20,5:18,21:26)]   
setdiff(names(m3i),names(table3fii))   
m3ii←rename(m3i,c(”Sample ID”=”Sample.ID”))   
corynebacteriaceae←rep(0,nrow(table3fii))   
porphyromondaceae←rep(NA,nrow(table3fii))   
table3fiii←cbind(table3fii, corynebacteriaceae, porphyromondaceae)   
setdiff(names(m3ii),names(table3fiii))   
   
m3ii[,c(7:24)] ← sapply(m3ii[,c(7:24)],as.numeric)   
m3ii[,c(1:4)] ←sapply(m3ii[,c(1:4)],as.character)   
#m3ii[,c(”Site”)] ←sapply(m3ii[,c(”Site”)],as.character)   
   
table3fiii[,c(1:4)] ← sapply(table3fiii[,c(1:4)],as.character)   
table3fiii[,c(7:24)] ← sapply(table3fiii[,c(7:24)],as.numeric)   
table4←rbind(m3ii,table3fiii)   
table4[,1] ← sapply(table4[,1],as.factor)

require(plyr)

## Loading required package: plyr

Sample.ID<-rep(20000,3)   
table3fi<-cbind(table3f,Sample.ID)   
#how many columns I can't count   
ncol(table3fi)

## [1] 24

ncol(m3)

## [1] 27

#now get the cols all right   
table3fii<-table3fi[c(1,2,24,3,4:23)]   
m3i<-m3[c(1:4,19:20,5:18,21:26)]   
setdiff(names(m3i),names(table3fii))

## [1] "Sample ID"          "corynebacteriaceae" "porphyromondaceae"

m3ii<-rename(m3i,c("Sample ID"="Sample.ID"))   
corynebacteriaceae<-rep(0,nrow(table3fii))   
porphyromondaceae<-rep(NA,nrow(table3fii))   
table3fiii<-cbind(table3fii, corynebacteriaceae, porphyromondaceae)   
setdiff(names(m3ii),names(table3fiii))

## character(0)

m3ii[,c(7:24)] <- sapply(m3ii[,c(7:24)],as.numeric)   
m3ii[,c(1:4)] <-sapply(m3ii[,c(1:4)],as.character)   
#m3ii[,c("Site")] <-sapply(m3ii[,c("Site")],as.character)   
  
table3fiii[,c(1:4)] <- sapply(table3fiii[,c(1:4)],as.character)   
table3fiii[,c(7:24)] <- sapply(table3fiii[,c(7:24)],as.numeric)   
table4<-rbind(m3ii,table3fiii)   
table4[,1] <- sapply(table4[,1],as.factor)

-

Another Break

### Fat or wide

Reshaping Tables

reshape2

reshape2

vignette(reshape)

R package

RQLlite

RSQLite

* Suppose merge is not enough? I know about SQL and want to do joins
* Lets Install RSQLite
* We also need to install DBI

## Loading required package: RSQLite## Loading required package: gsubfn## Loading required package: proto

## Warning in doTryCatch(return(expr), name, parentenv, handler): unable to load shared object ’/Library/Frameworks/R.framework/Resources/modules//R\_X11.so’:##  dlopen(/Library/Frameworks/R.framework/Resources/modules//R\_X11.so, 6): Library not loaded: /opt/X11/lib/libSM.6.dylib##  Referenced from: /Library/Frameworks/R.framework/Resources/modules//R\_X11.so##  Reason: image not found

## Could not load tcltk.  Will use slower R code instead.## Loading required package: chron

## Warning: package ’chron’ was built under R version 3.1.3

## Loading required package: tcltk

-

 db <- dbConnect(SQLite(), dbname="Test.sqlite")   
#getConfig()$staged.queries   
# sqldf(attach "Test1.sqlite" as new)   
dbBegin(db)

## [1] TRUE

dbWriteTable(db,"table1",table1t,overwrite=TRUE)

## [1] TRUE

dbReadTable(db,"table1")

##                  Group  Site Sample.ID   Rep phormidiaceae    
## X2        Contaminated     1     10000     1         24872    
## X3        Contaminated     1     10001     2         24872    
## X4        Contaminated     1     10002     3          5822    
## X5        Contaminated     2     10003     1          7538    
## X6        Contaminated     2     10004     2          7201    
## X7        Contaminated     2     10005     3          7538    
## X8        Contaminated     1     10006     1          8467    
## X9        Contaminated     1     10007     2          7340    
## X10       Contaminated     1     10008     3          8467    
## X11       Contaminated     2     10000     1          2000    
## X12       Contaminated     2     10001     2          2083    
## X13       Contaminated     2     10002     3          1899    
## X14       Contaminated     1     10003     1          1947    
## X15       Contaminated     1     10004     2          2733    
## X16       Contaminated     1     10005     3          2385    
## X17       Contaminated     2     10006     1           800    
## X18       Contaminated     2     10007     2           738    
## X19       Contaminated     2     10008     3           800    
## X20       Contaminated     1     10003     1           200    
## X21       Contaminated     1     10004     2           189    
## X22       Contaminated     1     10005     3           271    
## X23       Contaminated     2     10006     1            46    
## X24       Contaminated     2     10007     2            62    
## X25       Contaminated     2     10008     3            94    
## X26       Contaminated     3     10009     1            24    
## X27            Control     3     10010     2            64    
## X28            Control     3     10011     3            21    
## X29            Control     4     10012     1            56    
## X30            Control     4     10013     2            27    
## X31            Control     4     10014     3            53    
## X32            Control     3     10015     1           115    
## X33            Control     3     10016     2            97    
## X34            Control     3     10017     3            45    
## X35            Control     4     10009     1            33    
## X36            Control     4     10010     2            51    
## X37            Control     4     10011     3            47    
## X38            Control     3     10012     1           105    
## X39            Control     3     10013     2            72    
## X40            Control     3     10014     3           115    
## X41            Control     4     10015     1            18    
## X42            Control     4     10016     2            54    
## X43            Control     4     10017     3            33

## X44            Control     3     10012     1            36    
## X45            Control     3     10013     2            58    
## X46            Control     3     10014     3            36    
## X47            Control     4     10015     1            60    
## X48            Control     4     10016     2           164    
## X49            Control     4     10017     3            79    
## rowNames         FALSE FALSE     FALSE F1LSE         FALSE    
## transpose         TRUE  TRUE      TRUE  TRUE          TRUE    
##           streptococcaceae vibrionaceae enterobacteriaceae    
## X2                      11           33                131    
## X3                       7           40                200    
## X4                      14           40                200    
## X5                       8           95                151    
## X6                      10           83                140    
## X7                       8           95                151    
## X8                       5           29                132    
## X9                       5           51                168    
## X10                      5           29                132    
## X11                     10           34                 97    
## X12                     17           38                 91    
## X13                     27           31                 51    
## X14                      0            0                  2    
## X15                      1            0                  1    
## X16                      0            0                  2    
## X17                     26           33                 34    
## X18                     22           58                 42    
## X19                     26           33                 34    
## X20                      6            5                 39    
## X21                      2            3                 23    
## X22                      5            1                 39    
## X23                      3            9                 55    
## X24                      1            5                 95    
## X25                      3            0                 55    
## X26                      2            6                 36    
## X27                      3            3                 36    
## X28                      0            4                 30    
## X29                      1           30                 79    
## X30                      5            9                129    
## X31                      1            1                124    
## X32                      0           10                 52    
## X33                      4            6                 13    
## X34                      0            2                  9    
## X35                      4            4                 11    
## X36                      0           10                 41    
## X37                      0            3                 29

## X38                     10           39                288    
## X39                     10           29                413    
## X40                     12           34                481    
## X41                      5            2                 43    
## X42                      3            5                 50    
## X43                      4            5                 86    
## X44                     10            4                 28    
## X45                     12            1                 28    
## X46                      1            0                 44    
## X47                      4            7                 48    
## X48                      2           11                111    
## X49                      3            5                 88    
## rowNames             FALSE        FALSE              FALSE    
## transpose             TRUE         TRUE               TRUE    
##           verrucomicrobiaceae chloroflexaceae aeromonadaceae    
## X2                        977             351             20    
## X3                       1500             246             76    
## X4                        844             246             76    
## X5                       1006              41              1    
## X6                       1112              83              6    
## X7                       1195              41              0    
## X8                       1805              23              0    
## X9                       1906              28              0    
## X10                      1902              23              0    
## X11                      1244              40              1    
## X12                      1933              40              1    
## X13                      1244              80              0    
## X14                       251               1              0    
## X15                       271               0              1    
## X16                       299               0              0    
## X17                      1348             209              1    
## X18                      3612             205              0    
## X19                      1348             209              3    
## X20                       176               1              0    
## X21                       211               0              3    
## X22                       183               1              0    
## X23                       544               0              9    
## X24                       611               1              0    
## X25                       544               0              1    
## X26                       471               0              0    
## X27                       500               0              1    
## X28                       541               0              0    
## X29                      1405               3              1    
## X30                      1678               1              1    
## X31                      1360               0              0

## X32                      1590               0              0    
## X33                       398               0              0    
## X34                       195               1              0    
## X35                      1213               7              2    
## X36                      3461              12              1    
## X37                      1688               3              0    
## X38                       590               1              1    
## X39                       598               0              0    
## X40                       639               1              0    
## X41                       949               0              0    
## X42                       974               0              0    
## X43                       662               0              0    
## X44                       267               0              0    
## X45                       249               2              0    
## X46                       337               0              0    
## X47                       625               0              0    
## X48                       886               0              0    
## X49                       791               0              0    
## rowNames                FALSE           FALSE          FALSE    
## transpose                TRUE            TRUE           TRUE    
##           staphylococcaceae clostridiaceae oceanospirillaceae    
## X2                      115            274               1438    
## X3                      342            288               1789    
## X4                      342            258               1789    
## X5                        4            365                  5    
## X6                        9            365                  2    
## X7                        4            365                  9    
## X8                        1            643                 14    
## X9                        1            941                 14    
## X10                       1            711                 14    
## X11                       0            204                 93    
## X12                       0            229                 72    
## X13                       0            285                 93    
## X14                       0              8               1080    
## X15                       0             12               1633    
## X16                       1             12               1080    
## X17                       4            400                747    
## X18                       7            733                636    
## X19                       2            299                747    
## X20                       1             76                256    
## X21                       0             63                263    
## X22                       2             85                256    
## X23                       1            136                284    
## X24                      20            643                293    
## X25                       1            136                293

## X26                       0             31                189    
## X27                       1             59                510    
## X28                       0             42                215    
## X29                       0            143               2096    
## X30                       0            124                834    
## X31                       0            100                426    
## X32                       0             34                263    
## X33                       0             33               1095    
## X34                       0             18                523    
## X35                       0             96                273    
## X36                       0            100               1432    
## X37                       0             74                330    
## X38                       1            119               4584    
## X39                       1            181               3811    
## X40                       0            202               3165    
## X41                       0             38                380    
## X42                       0             29                548    
## X43                       0             56                403    
## X44                       0             62                394    
## X45                       0             58                311    
## X46                       0             66                376    
## X47                       0             66                773    
## X48                       0            167               1778    
## X49                       0             40               1289    
## rowNames              FALSE          FALSE              FALSE    
## transpose              TRUE           TRUE               TRUE    
##           synechococcaceae rhodospirillaceae corynebacteriaceae    
## X2                     471              1267                  0    
## X3                     498              1597                  0    
## X4                     692              1844                  0    
## X5                      20                70                  0    
## X6                      20                82                  0    
## X7                      48                70                  0    
## X8                      27                97                  0    
## X9                      83                97                  0    
## X10                     27                97                  0    
## X11                     61               579                  0    
## X12                     61               603                  0    
## X13                     61               579                  0    
## X14                    245              2245                  0    
## X15                    245              2001                  0    
## X16                    142              2834                  0    
## X17                     95              1432                  0    
## X18                     70              1834                  0    
## X19                     95              1432                  0

## X20                    101               786                  0    
## X21                    104               844                  0    
## X22                    101               826                  0    
## X23                     65              1833                  0    
## X24                     53              2528                  0    
## X25                     65              2999                  0    
## X26                     67               568                  0    
## X27                    128              1877                  0    
## X28                    152               582                  0    
## X29                    769              1699                  0    
## X30                    954              3145                  0    
## X31                    555              1171                  0    
## X32                     45               323                  0    
## X33                    164               911                  0    
## X34                    513               485                  0    
## X35                     75               732                  0    
## X36                    414              3101                  0    
## X37                    298              1262                  0    
## X38                    807              3586                  0    
## X39                   1916              5757                  0    
## X40                   1120              4168                  0    
## X41                    276               821                  0    
## X42                    394               489                  0    
## X43                    498               611                  0    
## X44                    212              1001                  0    
## X45                    301               889                  0    
## X46                    330               943                  0    
## X47                    521              1300                  0    
## X48                   1220              3013                  0    
## X49                    383              1255                  0    
## rowNames             FALSE             FALSE              FALSE    
## transpose             TRUE              TRUE               TRUE    
##           porphyromondaceae    
## X2                        0    
## X3                        0    
## X4                        0    
## X5                        0    
## X6                        0    
## X7                        0    
## X8                        0    
## X9                        0    
## X10                       0    
## X11                       0    
## X12                       0    
## X13                       0

## X14                       0    
## X15                       0    
## X16                       0    
## X17                       0    
## X18                       0    
## X19                       0    
## X20                       0    
## X21                       0    
## X22                       0    
## X23                       0    
## X24                       0    
## X25                       0    
## X26                       0    
## X27                       0    
## X28                       0    
## X29                       0    
## X30                       0    
## X31                       0    
## X32                       0    
## X33                       0    
## X34                       0    
## X35                       0    
## X36                       0    
## X37                       0    
## X38                       0    
## X39                       0    
## X40                       0    
## X41                       0    
## X42                       0    
## X43                       0    
## X44                       0    
## X45                       0    
## X46                       0    
## X47                       0    
## X48                       0    
## X49                       0    
## rowNames              FALSE    
## transpose              TRUE

dbListFields(db,"table1")

##  [1] "row\_names"           "Group"               "Site"    
##  [4] "Sample ID"           "Rep"                 "phormidiaceae"    
##  [7] "streptococcaceae"    "vibrionaceae"        "enterobacteriaceae"    
## [10] "verrucomicrobiaceae" "chloroflexaceae"     "aeromonadaceae"    
## [13] "staphylococcaceae"   "clostridiaceae"      "oceanospirillaceae"    
## [16] "synechococcaceae"    "rhodospirillaceae"   "corynebacteriaceae"    
## [19] "porphyromondaceae"

dbListTables(db)

## [1] "table1"

dbGetQuery(db, "SELECT \* from table1")

##    row\_names        Group  Site Sample ID   Rep phormidiaceae    
## 1         X2 Contaminated     1     10000     1         24872    
## 2         X3 Contaminated     1     10001     2         24872    
## 3         X4 Contaminated     1     10002     3          5822    
## 4         X5 Contaminated     2     10003     1          7538    
## 5         X6 Contaminated     2     10004     2          7201    
## 6         X7 Contaminated     2     10005     3          7538    
## 7         X8 Contaminated     1     10006     1          8467    
## 8         X9 Contaminated     1     10007     2          7340    
## 9        X10 Contaminated     1     10008     3          8467    
## 10       X11 Contaminated     2     10000     1          2000    
## 11       X12 Contaminated     2     10001     2          2083    
## 12       X13 Contaminated     2     10002     3          1899    
## 13       X14 Contaminated     1     10003     1          1947    
## 14       X15 Contaminated     1     10004     2          2733    
## 15       X16 Contaminated     1     10005     3          2385    
## 16       X17 Contaminated     2     10006     1           800    
## 17       X18 Contaminated     2     10007     2           738    
## 18       X19 Contaminated     2     10008     3           800    
## 19       X20 Contaminated     1     10003     1           200    
## 20       X21 Contaminated     1     10004     2           189    
## 21       X22 Contaminated     1     10005     3           271    
## 22       X23 Contaminated     2     10006     1            46    
## 23       X24 Contaminated     2     10007     2            62    
## 24       X25 Contaminated     2     10008     3            94    
## 25       X26 Contaminated     3     10009     1            24    
## 26       X27      Control     3     10010     2            64    
## 27       X28      Control     3     10011     3            21    
## 28       X29      Control     4     10012     1            56    
## 29       X30      Control     4     10013     2            27    
## 30       X31      Control     4     10014     3            53    
## 31       X32      Control     3     10015     1           115    
## 32       X33      Control     3     10016     2            97    
## 33       X34      Control     3     10017     3            45    
## 34       X35      Control     4     10009     1            33    
## 35       X36      Control     4     10010     2            51    
## 36       X37      Control     4     10011     3            47    
## 37       X38      Control     3     10012     1           105    
## 38       X39      Control     3     10013     2            72    
## 39       X40      Control     3     10014     3           115    
## 40       X41      Control     4     10015     1            18    
## 41       X42      Control     4     10016     2            54    
## 42       X43      Control     4     10017     3            33

## 43       X44      Control     3     10012     1            36    
## 44       X45      Control     3     10013     2            58    
## 45       X46      Control     3     10014     3            36    
## 46       X47      Control     4     10015     1            60    
## 47       X48      Control     4     10016     2           164    
## 48       X49      Control     4     10017     3            79    
## 49  rowNames        FALSE FALSE     FALSE F1LSE         FALSE    
## 50 transpose         TRUE  TRUE      TRUE  TRUE          TRUE    
##    streptococcaceae vibrionaceae enterobacteriaceae verrucomicrobiaceae    
## 1                11           33                131                 977    
## 2                 7           40                200                1500    
## 3                14           40                200                 844    
## 4                 8           95                151                1006    
## 5                10           83                140                1112    
## 6                 8           95                151                1195    
## 7                 5           29                132                1805    
## 8                 5           51                168                1906    
## 9                 5           29                132                1902    
## 10               10           34                 97                1244    
## 11               17           38                 91                1933    
## 12               27           31                 51                1244    
## 13                0            0                  2                 251    
## 14                1            0                  1                 271    
## 15                0            0                  2                 299    
## 16               26           33                 34                1348    
## 17               22           58                 42                3612    
## 18               26           33                 34                1348    
## 19                6            5                 39                 176    
## 20                2            3                 23                 211    
## 21                5            1                 39                 183    
## 22                3            9                 55                 544    
## 23                1            5                 95                 611    
## 24                3            0                 55                 544    
## 25                2            6                 36                 471    
## 26                3            3                 36                 500    
## 27                0            4                 30                 541    
## 28                1           30                 79                1405    
## 29                5            9                129                1678    
## 30                1            1                124                1360    
## 31                0           10                 52                1590    
## 32                4            6                 13                 398    
## 33                0            2                  9                 195    
## 34                4            4                 11                1213    
## 35                0           10                 41                3461    
## 36                0            3                 29                1688

## 37               10           39                288                 590    
## 38               10           29                413                 598    
## 39               12           34                481                 639    
## 40                5            2                 43                 949    
## 41                3            5                 50                 974    
## 42                4            5                 86                 662    
## 43               10            4                 28                 267    
## 44               12            1                 28                 249    
## 45                1            0                 44                 337    
## 46                4            7                 48                 625    
## 47                2           11                111                 886    
## 48                3            5                 88                 791    
## 49            FALSE        FALSE              FALSE               FALSE    
## 50             TRUE         TRUE               TRUE                TRUE    
##    chloroflexaceae aeromonadaceae staphylococcaceae clostridiaceae    
## 1              351             20               115            274    
## 2              246             76               342            288    
## 3              246             76               342            258    
## 4               41              1                 4            365    
## 5               83              6                 9            365    
## 6               41              0                 4            365    
## 7               23              0                 1            643    
## 8               28              0                 1            941    
## 9               23              0                 1            711    
## 10              40              1                 0            204    
## 11              40              1                 0            229    
## 12              80              0                 0            285    
## 13               1              0                 0              8    
## 14               0              1                 0             12    
## 15               0              0                 1             12    
## 16             209              1                 4            400    
## 17             205              0                 7            733    
## 18             209              3                 2            299    
## 19               1              0                 1             76    
## 20               0              3                 0             63    
## 21               1              0                 2             85    
## 22               0              9                 1            136    
## 23               1              0                20            643    
## 24               0              1                 1            136    
## 25               0              0                 0             31    
## 26               0              1                 1             59    
## 27               0              0                 0             42    
## 28               3              1                 0            143    
## 29               1              1                 0            124    
## 30               0              0                 0            100

## 31               0              0                 0             34    
## 32               0              0                 0             33    
## 33               1              0                 0             18    
## 34               7              2                 0             96    
## 35              12              1                 0            100    
## 36               3              0                 0             74    
## 37               1              1                 1            119    
## 38               0              0                 1            181    
## 39               1              0                 0            202    
## 40               0              0                 0             38    
## 41               0              0                 0             29    
## 42               0              0                 0             56    
## 43               0              0                 0             62    
## 44               2              0                 0             58    
## 45               0              0                 0             66    
## 46               0              0                 0             66    
## 47               0              0                 0            167    
## 48               0              0                 0             40    
## 49           FALSE          FALSE             FALSE          FALSE    
## 50            TRUE           TRUE              TRUE           TRUE    
##    oceanospirillaceae synechococcaceae rhodospirillaceae    
## 1                1438              471              1267    
## 2                1789              498              1597    
## 3                1789              692              1844    
## 4                   5               20                70    
## 5                   2               20                82    
## 6                   9               48                70    
## 7                  14               27                97    
## 8                  14               83                97    
## 9                  14               27                97    
## 10                 93               61               579    
## 11                 72               61               603    
## 12                 93               61               579    
## 13               1080              245              2245    
## 14               1633              245              2001    
## 15               1080              142              2834    
## 16                747               95              1432    
## 17                636               70              1834    
## 18                747               95              1432    
## 19                256              101               786    
## 20                263              104               844    
## 21                256              101               826    
## 22                284               65              1833    
## 23                293               53              2528    
## 24                293               65              2999

## 25                189               67               568    
## 26                510              128              1877    
## 27                215              152               582    
## 28               2096              769              1699    
## 29                834              954              3145    
## 30                426              555              1171    
## 31                263               45               323    
## 32               1095              164               911    
## 33                523              513               485    
## 34                273               75               732    
## 35               1432              414              3101    
## 36                330              298              1262    
## 37               4584              807              3586    
## 38               3811             1916              5757    
## 39               3165             1120              4168    
## 40                380              276               821    
## 41                548              394               489    
## 42                403              498               611    
## 43                394              212              1001    
## 44                311              301               889    
## 45                376              330               943    
## 46                773              521              1300    
## 47               1778             1220              3013    
## 48               1289              383              1255    
## 49              FALSE            FALSE             FALSE    
## 50               TRUE             TRUE              TRUE    
##    corynebacteriaceae porphyromondaceae    
## 1                   0                 0    
## 2                   0                 0    
## 3                   0                 0    
## 4                   0                 0    
## 5                   0                 0    
## 6                   0                 0    
## 7                   0                 0    
## 8                   0                 0    
## 9                   0                 0    
## 10                  0                 0    
## 11                  0                 0    
## 12                  0                 0    
## 13                  0                 0    
## 14                  0                 0    
## 15                  0                 0    
## 16                  0                 0    
## 17                  0                 0    
## 18                  0                 0

## 19                  0                 0    
## 20                  0                 0    
## 21                  0                 0    
## 22                  0                 0    
## 23                  0                 0    
## 24                  0                 0    
## 25                  0                 0    
## 26                  0                 0    
## 27                  0                 0    
## 28                  0                 0    
## 29                  0                 0    
## 30                  0                 0    
## 31                  0                 0    
## 32                  0                 0    
## 33                  0                 0    
## 34                  0                 0    
## 35                  0                 0    
## 36                  0                 0    
## 37                  0                 0    
## 38                  0                 0    
## 39                  0                 0    
## 40                  0                 0    
## 41                  0                 0    
## 42                  0                 0    
## 43                  0                 0    
## 44                  0                 0    
## 45                  0                 0    
## 46                  0                 0    
## 47                  0                 0    
## 48                  0                 0    
## 49              FALSE             FALSE    
## 50               TRUE              TRUE

#dbDisconnect(db)

-

R package

svUnit

Another important component of TDD is refactoring and unit tests

* Refactoring <http://refactoring.com/>
* [http://www.r-\_bloggers.com/my-\_experience-\_of-\_learning-\_r-\_from-\_basic-\_graphs-\_to-\_performance-\_tuning/](http://www.r-bloggers.com/my-experience-of-learning-r-from-basic-graphs-to-performance-tuning/)
* TDD in R [http://www.slideserve.com/andrew/test-\_driven-\_development-\_in-\_r](http://www.slideserve.com/andrew/test-driven-development-in-r)
* Version Control tortiseSVN [ttp://tortoisesvn.net/}\itemGitHub\url{](ttp://tortoisesvn.net/%7d%0d%20%20%20%20%20\item%20GitHub%20\url%7b)ttps://github.com/

### Cleaning things up

Dropping row and columns

Dropping selected variables

Dropping Row and Columns with too many NAs

numNAs\_inData4\_rows ← apply(rawData4, 1, function(z) sum(is.na(z)))   
numNAs\_inData4\_col ← apply(table4, 2, function(z) sum(is.na(z))) # count NAs in Data4   
lessThan20 ← table4[!(numNAs\_inData4\_rows > 20),]   #only select the rows contain less Than 20 NAs   
lessThan20col ← table4[,!(numNAs\_inData4\_col > 20)]

Dropping row and columns

Dropping selected variables

Tidy Data

In tidy data:

* Each variable forms a column.
* Each observation forms a row.
* Each type of observational unit forms a table.
* [https://cran.r-\_project.org/web/packages/tidyr/vignettes/tidy-\_data.html](https://cran.r-project.org/web/packages/tidyr/vignettes/tidy-data.html)
* [http://pj.freefaculty.org/R/Rtips.html#toc-\_Subsection-\_1.11](http://pj.freefaculty.org/R/Rtips.html#toc-Subsection-1.11)

Spit out the dates and numbers

dates4←table4[,c(5,6)]   
abundance←table4[,c(7:25)]

Adding a new column

Calculating the number of days

Calculating the number of days

We can just subtract as.Date fields

dates4<-table4[,c(5,6)]   
abundance<-table4[,c(7:25)]   
 days<-dates4[,2]-dates4[,1]

-

### Centering data

Setting the Relative abundance

Normalizing data

sapply

* Also known as centring the data
* Ecological percentage of the sum of the variables
* We an use sweep to centre the data
* What about divide by 0

  sweepOutContinu←sweep(abundance,2,apply(abundance,2,min,na.rm=TRUE))   
 afterSweepContinu←sweep(sweepOutContinu,2,apply(sweepOutContinu,2,max,na.rm=TRUE),”/”)   
 table5←cbind(table4[,c(1:6)],afterSweepContinu,days)

Now lets have some fun

Making a heat map

Heat map. A graphical output Titles on R plots

A reference on where to go R thumbnails ggplot2 (scatter plot of 2 var and then 3 plots)

What next

Proposed future talks

Help is on the way

* My PhD students
* PhD student in Bioinformatics from Central South Uni

Your feedback on some ideas

* Using Sweave or Knitr
* Advanced Data Cleaning
* Network Centric data analysis

Resources

If you want to improve this style

### References

[1]   LaTeX Beamer http://latex-beamer.sourceforge.net/

[2]   Sharelatex Site https://www.sharelatex.com

[3]   A Data Cleaning Mooc https://www.sharelatex.com

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