Rcourse:
Programming in R

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1. Back to input files
   - Review on data frame
   - Factors

2. Programming
   - Conditional execution
   - Loops
   - Executing a command from a script
   - Writing your own functions
   - lapply() and tapply()
   - How to avoid slow R code

Contents

Review on data frame

Generic functions:

```
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Example 1: wghtcls ”smoker” lifespan
”3” 0 50.3
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```
> riscfactor <-
read.table("lifespandata2.txt",header=TRUE)
```

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Example 2: wghtcls,smoker,lifespan
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> riscfactor <- read.csv("lifespandata.csv")
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read.table("lifespandata.csv",header=TRUE, sep=",",
fill=TRUE)
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Review on data frame

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> riscfactor <- read.csv("lifespandata.csv")
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fill=TRUE)
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Example 3: weight class smoker lifespan
3 0 50.3
3 0 52.8

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> riscfactor <- read.csv("lifespandata.csv")
> riscfactor <-
read.table("lifespandata.csv",header=TRUE, sep=",",
fill=TRUE)
```

Example 3: weight class smoker lifespan
3 0 50.3
3 0 52.8

```
> riscfactor <-
read.table("lifespandata2.txt",header=TRUE)
```

You have to change the first line of the file because of the space between weight and class.

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Factors

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chr [1:5] "female" "male" "male" "female" "female"
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> x <-factor(x)
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> levels(x)
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> x <-factor(x)
> levels(x)
[1] "female" "male"
> str(x)
Factor w/ 2 levels "female","male":  1 2 2 1 1
```

Factors

Example with numbers:

```
> y <- rep(c(17,17,18),4); str(y)
num [1:12] 17 17 18 17 17 18 17 17 18 17 ...
```

Factors

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> y <- rep(c(17,17,18),4); str(y)
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> summary(y)
Min.  1st Qu.  Median Mean 3rd Qu.  Max.
17.00 17.00 17.00 17.33 18.00 18.00
```

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Factor w/ 2 levels "17","18":  1 1 2 1 1 2 1 1 2 1 ...
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8 4
```

Back to input files

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```

Back to input files

By default read.table() sets text variables as factors and not numerical variables.
This can be changed by specifying the class of the columns.

```
riscfactor <-
read.table("lifespandata.txt",header=TRUE,
colClasses=c("factor","numeric","numeric"))
```

Or by changing the variables afterwards.

```
riscfactor$wghtcls <- factor(riscfactor$wghtcls)
```

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If(), else() and ifelse()

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Example:

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> x <- 4
> if (x==5) {x <- x+1} else {x <- x*2}
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if ( condition ) { commands1 } else { commands2 }
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Example:

```
> x <- 4
> if (x==5) {x <- x+1} else {x <- x*2}
> x
[1] 8
```

Conditional execution

Other examples:

```
if ( x != 5 & x>3 ) { x <- x+1 ; 17+2 } else { x <- x*2
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if ( x != 5 & x>3 ) { x <- x+1 ; 17+2 } else { x <- x*2
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Other examples:

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if ( x != 5 & x>3 ) { x <- x+1 ; 17+2 } else { x <- x*2
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`break` stops all loops
`next` goes directly to the next iteration of the loop

Examples

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x + i }
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```

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> y <- 1; j <- 1
> while ( y < 12 & j < 8 ) { y <- y*2 ; j <- j + 1}
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y is 16 and j is 4

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> z <- 3
> repeat { z<- z^2; if ( z>100 ) { break }; print(z)}
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> x <- 0 > for ( i in 1:5 ) { if (i==3) { next } ; x <-
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```

y is 16 and j is 4

```
> z <- 3
> repeat { z<- z^2; if ( z>100 ) { break }; print(z)}
[1] 9
[1] 81
```

The loop stopped after 81^2 so z is 6561.

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Executing a command from a script

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You can specify the current working directory using the command `setwd()`

```
setwd(C:/Documents/R)
getwd()
```

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Syntax:

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myfun <- function (arg1, arg2, .   .   .)  { commands }
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return(y)
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se(1:4)
[1] 0.6454972
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myfun <- function (arg1, arg2, .   .   .)  { commands }
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Examples:

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se <- function(x)
{
y<-sqrt(var(x)/length(x))
return(y)
}
se(1:4)
[1] 0.6454972
 se("wrong type of argument")
[1] NA
Warning message:
In var(x) :  NAs introduced by coercion
```

Deal with non correct arguments

```
if (is.numeric(x)!=TRUE)
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stop("need numeric data")
}
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if (is.numeric(x)!=TRUE)
{
stop("need numeric data")
}

 se("wrong type of argument")
Error in se("wrong type of argument") :  need numeric
data
```

Deal with the missing data

```
x<-x[is.na(x)==FALSE]
```

Deal with the missing data

```
x<-x[is.na(x)==FALSE]

 se(c(1:4,NA))
[1] 0.6454972
```

Giving default values to the arguments

```
se <- function(x,na.rm=FALSE)
{ if (is.numeric(x)!=TRUE) {stop("need numeric data")}
if (na.rm==TRUE){x<-x[is.na(x)==FALSE]}
y<-sqrt(var(x)/length(x))}
```

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You can omit to write the name of the argument:

```
 se(c(NA,1:4), TRUE))
[1] 0.6454972
```

Giving default values to the arguments

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se <- function(x,na.rm=FALSE)
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y<-sqrt(var(x)/length(x))}
```

You can omit to write the name of the argument:

```
 se(c(NA,1:4), TRUE))
[1] 0.6454972
```

Or give na.rm before the vector.

But not both (omitting name and changing the order of arguments).

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The "..." argument allows you to pass arguments from one function to another.

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Example:

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se.sq <- function(x, ...)
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y<-se(x, ...)
return(y^2)
}
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se.sq(1:4)
[1] 0.4166667
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Example:

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se.sq <- function(x, ...)
{
y<-se(x, ...)
return(y^2)
}

se.sq(1:4)
[1] 0.4166667
se.sq(c(1:4, NA))
[1] NA
```

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se.sq <- function(x, ...)
{
y<-se(x, ...)
return(y^2)
}

se.sq(1:4)
[1] 0.4166667
se.sq(c(1:4, NA))
[1] NA
se.sq(c(1:4, NA))
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```

Returning several values

To do so use a vector or a list.

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```
ci.norm <- function(x,conf=0.95)
{
q <- qnorm(1-(1-conf)/2)
return(
list(lower=mean(x)-q*se(x),upper=mean(x)+q*se(x)))
}
```

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{
q <- qnorm(1-(1-conf)/2)
return(
list(lower=mean(x)-q*se(x),upper=mean(x)+q*se(x)))
}

ci.norm(rnorm(100))
$lower [1] -0.1499551
$upper [1] 0.2754680

ci.norm(rnorm(100,conf=0.99))
$lower [1] -0.1673693
$upper [1] 0.2443276
```

Contents

lapply() and tapply()

You use apply() and its derivatives to apply the same function to each element of an object.

```
v <- 1:4
sapply(v,factorial)
# returns a vector, lapply() would return a list
[1] 1 2 6 24
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tapply() is used for data frames.

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tapply() is used for data frames.
Example: data frame containing lifespan for people from 3 classes of weight. You want the mean lifespan for each class.

```
tapply(lifespan,weightcls,mean)
1 2 3
69 61 53
```

Contents

How to avoid slow R code

- R has to interpret your commands each time you run a script and it takes time to determine the type of your variables.
- So avoid using loops and calling functions again and again if possible
- Think in whole objects such as vectors or lists and apply operations to the whole object instead of looping through all elements.

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- So avoid using loops and calling functions again and again if possible
- Think in whole objects such as vectors or lists and apply operations to the whole object instead of looping through all elements.

```
x <- 0
for(i in 1:1000000) {x <- x+i}

sum(as.numeric(1:1000000))
```

Try on your computer!