Summer School – day two

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1 aha

Look at Figure 1, it shows the output of a magic function.

```
library(TestPackage)
a <- add_2(seq(1:10))
plot(a)
```

Adding 2 to 4 we get 6.

```
knitr::kable(head(cars),
             caption = "A table of the cars package"
             )
```

Look at the table 1.

Thanks to Xie (2016), Allaire et al. (2017), Xie (2014)

Xie knows what he (?) is doing (2014).

```
add_3(5)
```
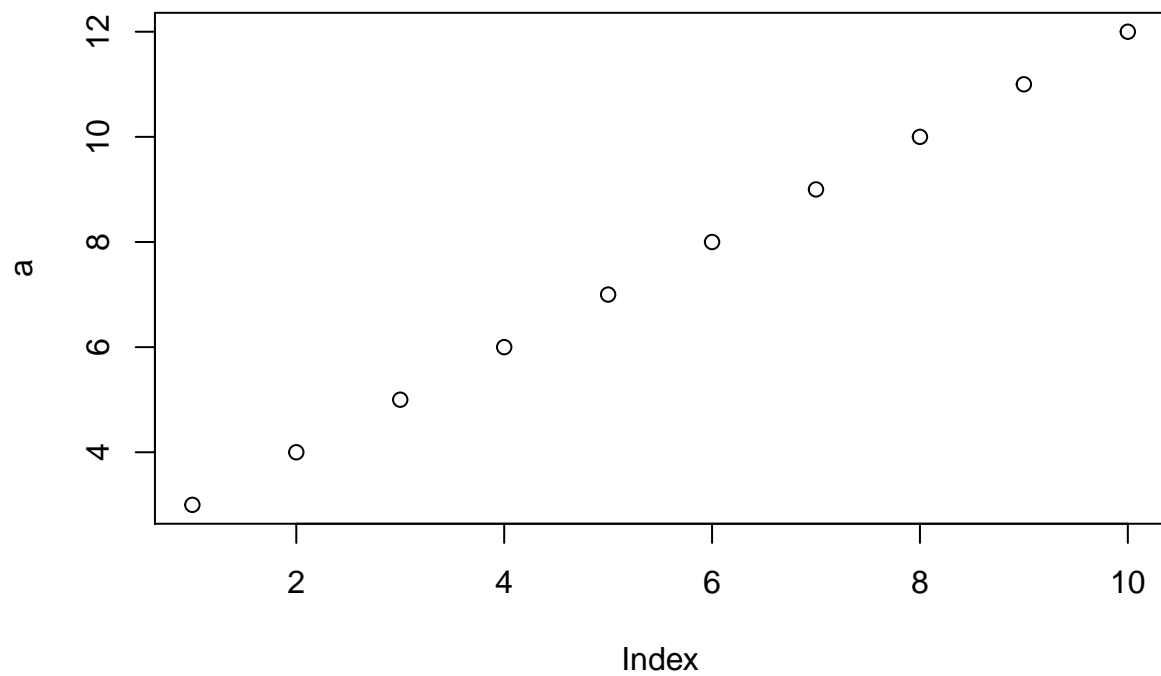
```
## [1] 8
```

Figure 1: add two

Table 1: A table of the cars package

speed	dist
4	2
4	10
7	4
7	22
8	16
9	10

2 Caching Tests

```r
library(tidyverse)
x <- rnorm(1e6) - 5e3
knitr::kable(head(x))
```

3 second column

```r
selsecond(mtcars)
```

```
##                     cyl
## Mazda RX4             6
## Mazda RX4 Wag         6
## Datsun 710            4
## Hornet 4 Drive        6
## Hornet Sportabout     8
## Valiant               6
## Duster 360            8
## Merc 240D             4
## Merc 230              4
## Merc 280              6
## Merc 280C             6
## Merc 450SE            8
## Merc 450SL            8
## Merc 450SLC           8
## Cadillac Fleetwood    8
## Lincoln Continental   8
## Chrysler Imperial     8
## Fiat 128              4
## Honda Civic           4
## Toyota Corolla        4
## Toyota Corona         4
## Dodge Challenger      8
## AMC Javelin           8
## Camaro Z28            8
## Pontiac Firebird      8
## Fiat X1-9             4
## Porsche 914-2         4
## Lotus Europa          4
## Ford Pantera L        8
## Ferrari Dino          6
## Maserati Bora         8
## Volvo 142E            4
```

3.1 some data

```r
library(binford)
data(LRB)
knitr::kable(head(LRB))
```

3.2 Interpolation

```
load("./data/Precipitation.RData")

test <- data.frame(test)
library(sp)
coordinates(test) <- ~lon+lat
proj4string(test) <- CRS("+init=epsg:4326")
test2 <- spTransform(test, CRS("+init=epsg:32634"))
plot(test2)

library(raster)
##srtm <- getData("SRTM", lon=mean(coordinates(test)[,1]), lat=mean(coordinates(test)[,2]))
srtm <- raster("srtm_41_05.tif")
srtm <- crop(srtm, extent(test)+1)
plot(srtm)

srtm3 <- projectRaster(srtm, crs=CRS("+init=epsg:32634"))
srtm3 <- aggregate(srtm3, fact = 3)
library(gstat)
```

3.3 idw

```
rain_idw <- idw(mean_r~1, test2, as(srtm3, "SpatialGridDataFrame"))
plot(rain_idw)
```

3.4 kriging

```
plot(variogram(mean_r~1, loc = test2, cloud = TRUE))

va <- variogram(mean_r~1, loc = test2, cutoff = 80000, width = 5000)
plot(va)

plot(va, vgm(8e+04, "Exp", 5e+04, 5000))
fva <- fit.variogram(va, vgm(8e+04, "Exp", 5e+04, 5000),
                     fit.method = 7) ## ordinary least squares; default
plot(va, fva)

rain_krige <- krige(mean_r~1, test2, as(srtm3, "SpatialGridDataFrame"), fva)
plot(rain_krige)

rain_krige2 <- brick(rain_krige)
plot(rain_krige2)
```

3.5 Automatic Kriging

```
library(automap)
rainautkrige <- automap::autoKrige(mean_r~1, test2, as(srtm3, "SpatialGridDataFrame"))
str(rainautkrige)
plot(rainautkrige)
tmp <- rainautkrige[[1]]
tmp <- raster(tmp)
tmp2 <- raster(rain_krige)
```

```
tmp3 <- tmp2-tmp
plot(tmp3)

## or using Reduce function (that needs a list)
plot(Reduce("-", list(tmp2,tmp)))
```

3.6 Kriging with external drift

```
names(srtm3) <- "altitude"

test3 <- test2[!is.na(test2$altitude),]
rainkwed <- automap::autoKrige(mean_r~altitude, test3, as(srtm3, "SpatialGridDataFrame"))
plot(rainkwed)
```

4 Point Pattern

```
harran <- read.table("../data/Sites_HarranPlain.csv", sep = ",", header=TRUE)
str(harran)

## 'data.frame':    344 obs. of  5 variables:
##  $ X.1            : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ Name           : Factor w/ 166 levels "Ahmet Aslan Tar. (FALSCH)",..: 9 40 40 62 62 62 62 64 6
##  $ X              : num  38.8 38.9 38.9 38.9 38.9 ...
##  $ Y              : num  37.6 37.7 37.7 37.2 37.2 ...
##  $ Mentioned_Epoch: Factor w/ 179 levels "","-","Aceramic Neolithic ",..: 175 150 139 162 108 151
```

4.1 Spatstat

```
library(sp)
coordinates(harran) <- ~X+Y
proj4string(harran) <- CRS("+init=epsg:4326")

harran <- spTransform(harran, CRSobj = CRS("+init=epsg:32637"))

library(spatstat)

## Loading required package: nlme

## Loading required package: rpart

##
## spatstat 1.51-0       (nickname: 'Poetic Licence')
## For an introduction to spatstat, type 'beginner'

##
## Note: spatstat version 1.51-0 is out of date by more than 11 weeks; a newer version should be ava

harran_ppp <- ppp(x = harran@coords[,1],
                  y = harran@coords[,2],
                  window = owin(xrange = harran@bbox[1,],
                               yrange = c(min(harran@coords[,2]), min(harran@coords[,2]+60000))))

## Warning: 56 points were rejected as lying outside the specified window

## Warning: data contain duplicated points
```

```
str(harran_ppp)
```

```
## List of 5
##  $ window    :List of 4
##   ..$ type  : chr "rectangle"
##   ..$ xrange: Named num [1:2] 477942 514430
##   .. ..- attr(*, "names")= chr [1:2] "min" "max"
##   ..$ yrange: num [1:2] 4062337 4122337
##   ..$ units :List of 3
##   .. ..$ singular  : chr "unit"
##   .. ..$ plural    : chr "units"
##   .. ..$ multiplier: num 1
##   .. ..- attr(*, "class")= chr "units"
##   ..- attr(*, "class")= chr "owin"
## $ n         : int 288
## $ x         : num [1:288] 493122 493122 493122 493122 485197 ...
## $ y         : num [1:288] 4119645 4119645 4119645 4119645 4109677 ...
## $ markformat: chr "none"
## - attr(*, "class")= chr "ppp"
## - attr(*, "rejects")=List of 5
##   ..$ window    :List of 5
##   .. ..$ type  : chr "polygonal"
##   .. ..$ xrange: num [1:2] 477664 514695
##   .. ..$ yrange: num [1:2] 4060911 4292855
##   .. ..$ bdry  :List of 1
##   .. .. ..$ :List of 2
##   .. .. .. ..$ x: num [1:10] 505940 502993 495642 477664 479054 ...
##   .. .. .. ..$ y: num [1:10] 4275964 4281593 4292855 4165265 4123978 ...
##   .. ..$ units :List of 3
##   .. .. ..$ singular  : chr "unit"
##   .. .. ..$ plural    : chr "units"
##   .. .. ..$ multiplier: num 1
##   .. .. ..- attr(*, "class")= chr "units"
##   .. ..- attr(*, "class")= chr "owin"
##   ..$ n         : int 56
##   ..$ x         : num [1:56] 479412 486771 486771 477942 477942 ...
##   ..$ y         : num [1:56] 4165159 4168843 4168843 4165163 4165163 ...
##   ..$ markformat: chr "none"
##   ..- attr(*, "class")= chr "ppp"
```

```
plot(harran_ppp)
```

```
## Warning: Interpretation of arguments maxsize and markscale has changed (in
## spatstat version 1.37-0 and later). Size of a circle is now measured by its
## diameter.
```

```
## Warning in plot.ppp(harran_ppp): 56 illegal points also plotted
```

harran_ppp
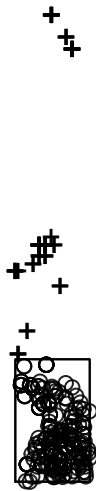
References

Allaire, JJ, Joe Cheng, Yihui Xie, Jonathan McPherson, Winston Chang, Jeff Allen, Hadley Wickham, Aron Atkins, Rob Hyndman, and Ruben Arslan. 2017. *Rmarkdown: Dynamic Documents for R.* https://CRAN.R-project.org/package=rmarkdown.

Xie, Yihui. 2014. "Knitr: A Comprehensive Tool for Reproducible Research in R." In *Implementing Reproducible Computational Research*, edited by Victoria Stodden, Friedrich Leisch, and Roger D. Peng. Chapman; Hall/CRC. http://www.crcpress.com/product/isbn/9781466561595.

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