Summary statistics - Edge angle analysis

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# Goal of the script

This script computes standard descriptive statistics for each group.  
The groups are based on:

* Edge (E1/E2/E3)
* Tool type
* Site
* Distance to origin

It computes the following statistics:

* n (sample size = length): number of measurements
* smallest value (min)
* largest value (max)
* mean
* median
* standard deviation (sd)

dir\_in <- "analysis/derived\_data/"  
dir\_out <- "analysis/summary\_stats/"

Raw data must be located in ~/analysis/derived\_data/.  
Formatted data will be saved in ~/analysis/summary\_stats/. The knit directory for this script is the project directory. —

# Load packages

library(openxlsx)

Warning: package 'openxlsx' was built under R version 4.0.3

library(R.utils)  
library(tools)  
library(doBy)

Warning: package 'doBy' was built under R version 4.0.3

# Get name, path and information of the file

data\_file <- list.files(dir\_in, pattern = "\\.Rbin$", full.names = TRUE)  
md5\_in <- md5sum(data\_file)  
info\_in <- data.frame(file = basename(names(md5\_in)), checksum = md5\_in,   
 row.names = NULL)

The checksum (MD5 hashes) of the imported files are:

file checksum  
1 EdgeAngle.Rbin c0fbf0d522d77a70c3a828b8ba7880fc

# Load data into R object

imp\_data <- loadObject(data\_file)  
str(imp\_data)

'data.frame': 58516 obs. of 11 variables:  
 $ Site : chr "Balve" "Balve" "Balve" "Balve" ...  
 $ ID : chr "MU-022" "MU-022" "MU-022" "MU-022" ...  
 $ Tool\_type : chr "KM\_dex" "KM\_dex" "KM\_dex" "KM\_dex" ...  
 $ Section : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Angle\_number : int 1 2 3 4 5 6 7 8 9 10 ...  
 $ Distance\_origin: num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Segment : num 2 2 2 2 2 2 2 2 2 2 ...  
 $ Three\_point : num 158.6 137.6 124 105.4 89.5 ...  
 $ Two\_lines : num 137.9 106.4 71.6 41.4 35.9 ...  
 $ Best\_fit : num 138.8 107.7 70.5 42.2 30.8 ...

The imported file is: “~/analysis/derived\_data/EdgeAngle.Rbin”

# Define numeric variables

num.var <- 9:length(imp\_data)

The following variables will be used:

[9] Three\_point  
[10] Two\_lines  
[11] Best\_fit

# Compute summary statistics

## Create function to compute the statistics at once

nminmaxmeanmedsd <- function(x){  
 y <- x[!is.na(x)]  
 n\_test <- length(y)  
 min\_test <- min(y)  
 max\_test <- max(y)  
 mean\_test <- mean(y)  
 med\_test <- median(y)  
 sd\_test <- sd(y)  
 out <- c(n\_test, min\_test, max\_test, mean\_test, med\_test, sd\_test)  
 names(out) <- c("n", "min", "max", "mean", "median", "sd")  
 return(out)  
}

## Compute the summary statistics in groups

### Edge

edge <- summaryBy(. ~ Edge+Section+Distance\_origin,   
 data = imp\_data[c("Edge", "Section", "Distance\_origin" ,  
 names(imp\_data)[num.var])],   
 FUN = nminmaxmeanmedsd)  
str(edge)

'data.frame': 427 obs. of 21 variables:  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Section : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Distance\_origin : num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Three\_point.n : num 225 224 223 220 219 217 213 210 209 204 ...  
 $ Three\_point.min : num 26 21.6 6.1 12.7 14.7 10.1 7.7 7.9 9.2 7.6 ...  
 $ Three\_point.max : num 169 153 149 142 133 ...  
 $ Three\_point.mean : num 90.9 77.4 69.8 64.4 60.4 ...  
 $ Three\_point.median: num 88 76.5 68.8 63.5 59.5 ...  
 $ Three\_point.sd : num 25.6 25.9 25.5 24.3 23.6 ...  
 $ Two\_lines.n : num 225 224 223 220 219 217 213 210 209 204 ...  
 $ Two\_lines.min : num 22.2 6.7 2 0 0.1 0.3 0.8 0.1 0.4 0 ...  
 $ Two\_lines.max : num 154 139 142 128 115 ...  
 $ Two\_lines.mean : num 78.6 60 52 46.9 41.5 ...  
 $ Two\_lines.median : num 77.3 57.5 51.5 45 40.5 34.1 30.9 29.3 28.6 26.4 ...  
 $ Two\_lines.sd : num 25.8 27.6 26.8 25.9 23.5 ...  
 $ Best\_fit.n : num 225 224 223 220 219 217 213 210 209 204 ...  
 $ Best\_fit.min : num 11.8 5.3 0.3 0.2 0 0.9 0.8 0.2 0.2 0 ...  
 $ Best\_fit.max : num 170 143 169 167 170 ...  
 $ Best\_fit.mean : num 82.1 60.4 54.6 48.5 43.8 ...  
 $ Best\_fit.median : num 77.5 56.6 52.3 44.5 41.7 ...  
 $ Best\_fit.sd : num 23 28.1 29.5 28.5 27.3 ...

### Tool type + section

tool\_sec <- summaryBy(. ~ Tool\_type+Edge+Section,   
 data = imp\_data[c("Tool\_type", "Edge", "Section",  
 names(imp\_data)[num.var])],   
 FUN = nminmaxmeanmedsd)  
str(tool\_sec)

'data.frame': 306 obs. of 21 variables:  
 $ Tool\_type : chr "flakes" "flakes" "flakes" "flakes" ...  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Section : num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Three\_point.n : num 20 22 20 21 22 21 22 21 11 12 ...  
 $ Three\_point.min : num 22 42.6 54.3 37.3 47.6 49.1 45.1 48.9 60.5 91.9 ...  
 $ Three\_point.max : num 115.8 92.7 104.7 75 97.9 ...  
 $ Three\_point.mean : num 59.4 58.3 69.4 51.8 59.5 ...  
 $ Three\_point.median: num 58.8 56.1 63.8 49.7 54.9 ...  
 $ Three\_point.sd : num 21.3 13 14.2 11.1 12.6 ...  
 $ Two\_lines.n : num 20 22 20 21 22 21 22 21 11 12 ...  
 $ Two\_lines.min : num 0.5 23.1 37.6 26.1 37.8 33 38.2 31.9 47.7 54.5 ...  
 $ Two\_lines.max : num 87.2 80.2 91.3 65.5 80.8 ...  
 $ Two\_lines.mean : num 39.5 43.3 53 46.2 46.8 ...  
 $ Two\_lines.median : num 42.5 39.5 48.9 43.9 42.9 ...  
 $ Two\_lines.sd : num 21.5 14.1 14.9 12.6 10.4 ...  
 $ Best\_fit.n : num 20 22 20 21 22 21 22 21 11 12 ...  
 $ Best\_fit.min : num 2.3 19.5 37.7 26.5 38.7 28.4 37.7 30.9 47.2 54.2 ...  
 $ Best\_fit.max : num 76.2 75.6 90.9 68 78.6 ...  
 $ Best\_fit.mean : num 39.6 43.2 53.1 46.8 46.8 ...  
 $ Best\_fit.median : num 41.1 39.5 48.5 41.7 43 ...  
 $ Best\_fit.sd : num 19.7 14.4 15.1 13.1 10.7 ...

### Tool type + distance to origin

tool\_dist <- summaryBy(. ~ Tool\_type+Edge+Distance\_origin,   
 data = imp\_data[c("Tool\_type", "Edge", "Distance\_origin",  
 names(imp\_data)[num.var])],   
 FUN = nminmaxmeanmedsd)  
str(tool\_dist)

'data.frame': 400 obs. of 21 variables:  
 $ Tool\_type : chr "flakes" "flakes" "flakes" "flakes" ...  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Distance\_origin : num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Three\_point.n : num 19 18 18 18 18 18 18 18 18 17 ...  
 $ Three\_point.min : num 49.7 49.1 45.8 43 42.2 40.5 34.1 29.7 22 38.5 ...  
 $ Three\_point.max : num 120 109 107 105 107 ...  
 $ Three\_point.mean : num 90.6 78.2 70.6 65.7 62.2 ...  
 $ Three\_point.median: num 89 79.5 71.2 65.3 61.5 ...  
 $ Three\_point.sd : num 18.6 14.8 13.7 13.5 13.8 ...  
 $ Two\_lines.n : num 19 18 18 18 18 18 18 18 18 17 ...  
 $ Two\_lines.min : num 49.9 43.9 34.1 26.6 14.2 0.5 4.4 24 33.1 24.8 ...  
 $ Two\_lines.max : num 111.4 99.9 101.5 106.8 109.9 ...  
 $ Two\_lines.mean : num 80.6 61.7 53.7 50.2 48 ...  
 $ Two\_lines.median : num 80.8 58.4 51 47.5 47.5 ...  
 $ Two\_lines.sd : num 16.1 13.5 15 16.1 18.3 ...  
 $ Best\_fit.n : num 19 18 18 18 18 18 18 18 18 17 ...  
 $ Best\_fit.min : num 62 41.7 31.9 25.5 20.2 8.2 2.3 23.1 33.1 25.4 ...  
 $ Best\_fit.max : num 112 96 100 111 109 ...  
 $ Best\_fit.mean : num 81.5 60.9 53.6 49.9 48.4 ...  
 $ Best\_fit.median : num 76.4 59 50.8 47.1 46.9 ...  
 $ Best\_fit.sd : num 14.8 13.1 15.2 17.2 17.4 ...

### Tool type + section + distance to origin

tool\_sec\_dist <- summaryBy(. ~ Tool\_type+Edge+Section++Distance\_origin,   
 data = imp\_data[c("Tool\_type", "Edge", "Section", "Distance\_origin",  
 names(imp\_data)[num.var])],   
 FUN = nminmaxmeanmedsd)  
str(tool\_sec\_dist)

'data.frame': 3554 obs. of 22 variables:  
 $ Tool\_type : chr "flakes" "flakes" "flakes" "flakes" ...  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Section : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Distance\_origin : num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Three\_point.n : num 2 2 2 2 2 2 2 2 2 1 ...  
 $ Three\_point.min : num 81.4 72.7 59.8 53.1 46.5 40.5 34.1 29.7 22 52.5 ...  
 $ Three\_point.max : num 115.8 86.1 76.8 69.3 63.8 ...  
 $ Three\_point.mean : num 98.6 79.4 68.3 61.2 55.1 ...  
 $ Three\_point.median: num 98.6 79.4 68.3 61.2 55.1 ...  
 $ Three\_point.sd : num 24.32 9.48 12.02 11.46 12.23 ...  
 $ Two\_lines.n : num 2 2 2 2 2 2 2 2 2 1 ...  
 $ Two\_lines.min : num 74.1 49.1 34.1 26.6 14.2 0.5 4.4 24 33.1 24.8 ...  
 $ Two\_lines.max : num 87.2 59.5 54 45.4 46.4 50.2 47.2 39.7 49.5 24.8 ...  
 $ Two\_lines.mean : num 80.7 54.3 44 36 30.3 ...  
 $ Two\_lines.median : num 80.7 54.3 44 36 30.3 ...  
 $ Two\_lines.sd : num 9.26 7.35 14.07 13.29 22.77 ...  
 $ Best\_fit.n : num 2 2 2 2 2 2 2 2 2 1 ...  
 $ Best\_fit.min : num 72.3 50 31.9 25.5 20.2 8.2 2.3 23.1 33.1 25.4 ...  
 $ Best\_fit.max : num 76.2 59 54.9 43.6 46.1 51.8 47.3 38.6 55.3 25.4 ...  
 $ Best\_fit.mean : num 74.2 54.5 43.4 34.5 33.1 ...  
 $ Best\_fit.median : num 74.2 54.5 43.4 34.5 33.1 ...  
 $ Best\_fit.sd : num 2.76 6.36 16.26 12.8 18.31 ...

### Sample

ID <- summaryBy(. ~ ID+Tool\_type+Edge+Section+Distance\_origin,   
 data = imp\_data[c("ID", "Tool\_type", "Edge", "Section",  
 "Distance\_origin", names(imp\_data)[num.var])],   
 FUN = nminmaxmeanmedsd)  
str(ID)

'data.frame': 58516 obs. of 23 variables:  
 $ ID : chr "BU-001" "BU-001" "BU-001" "BU-001" ...  
 $ Tool\_type : chr "KM\_dex" "KM\_dex" "KM\_dex" "KM\_dex" ...  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Section : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Distance\_origin : num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Three\_point.n : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Three\_point.min : num 100 85.7 71.8 71.6 75.9 70.6 66.8 61.2 59.2 57.5 ...  
 $ Three\_point.max : num 100 85.7 71.8 71.6 75.9 70.6 66.8 61.2 59.2 57.5 ...  
 $ Three\_point.mean : num 100 85.7 71.8 71.6 75.9 70.6 66.8 61.2 59.2 57.5 ...  
 $ Three\_point.median: num 100 85.7 71.8 71.6 75.9 70.6 66.8 61.2 59.2 57.5 ...  
 $ Three\_point.sd : num NA NA NA NA NA NA NA NA NA NA ...  
 $ Two\_lines.n : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Two\_lines.min : num 87.3 58.6 58.3 85.8 69.9 46.4 35.2 35 44.1 33.2 ...  
 $ Two\_lines.max : num 87.3 58.6 58.3 85.8 69.9 46.4 35.2 35 44.1 33.2 ...  
 $ Two\_lines.mean : num 87.3 58.6 58.3 85.8 69.9 46.4 35.2 35 44.1 33.2 ...  
 $ Two\_lines.median : num 87.3 58.6 58.3 85.8 69.9 46.4 35.2 35 44.1 33.2 ...  
 $ Two\_lines.sd : num NA NA NA NA NA NA NA NA NA NA ...  
 $ Best\_fit.n : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Best\_fit.min : num 90.8 57 53.9 94.7 69.3 43.3 35.6 35.9 44.8 31 ...  
 $ Best\_fit.max : num 90.8 57 53.9 94.7 69.3 43.3 35.6 35.9 44.8 31 ...  
 $ Best\_fit.mean : num 90.8 57 53.9 94.7 69.3 43.3 35.6 35.9 44.8 31 ...  
 $ Best\_fit.median : num 90.8 57 53.9 94.7 69.3 43.3 35.6 35.9 44.8 31 ...  
 $ Best\_fit.sd : num NA NA NA NA NA NA NA NA NA NA ...

### Distance origin

dist <- summaryBy(. ~ ID+Tool\_type+Edge+Distance\_origin,   
 data = imp\_data[c("ID", "Tool\_type", "Edge", "Distance\_origin",  
 names(imp\_data)[num.var])],   
 FUN = nminmaxmeanmedsd)  
str(dist)

'data.frame': 6302 obs. of 22 variables:  
 $ ID : chr "BU-001" "BU-001" "BU-001" "BU-001" ...  
 $ Tool\_type : chr "KM\_dex" "KM\_dex" "KM\_dex" "KM\_dex" ...  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Distance\_origin : num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Three\_point.n : num 10 10 10 10 10 10 10 10 10 10 ...  
 $ Three\_point.min : num 76 67.2 62 58.2 56 54.5 53.6 53.2 52.5 50.8 ...  
 $ Three\_point.max : num 131.8 97.7 90.3 85.3 81.6 ...  
 $ Three\_point.mean : num 94.5 80.8 74 70.4 67.9 ...  
 $ Three\_point.median: num 93.8 80.2 71.9 68 64.2 ...  
 $ Three\_point.sd : num 15.36 9.15 8.92 9.24 9.15 ...  
 $ Two\_lines.n : num 10 10 10 10 10 10 10 10 10 10 ...  
 $ Two\_lines.min : num 69.6 53.6 47.8 41.6 44 32.2 31 16.2 1.6 3.8 ...  
 $ Two\_lines.max : num 98.2 89.1 78 85.8 73 62.6 64.4 56.7 48.8 46.5 ...  
 $ Two\_lines.mean : num 82 64.7 60.5 59.3 56.6 ...  
 $ Two\_lines.median : num 81.6 63 57.5 55 53.6 ...  
 $ Two\_lines.sd : num 8.8 10.6 11.3 13.3 11.8 ...  
 $ Best\_fit.n : num 10 10 10 10 10 10 10 10 10 10 ...  
 $ Best\_fit.min : num 68 52.6 43.3 42.6 40 30 29.9 12.8 0.3 4.3 ...  
 $ Best\_fit.max : num 92.8 93.5 79.6 94.7 76.3 63.8 68.6 56.1 47.9 46.8 ...  
 $ Best\_fit.mean : num 80.3 64.8 59.8 59.7 56.5 ...  
 $ Best\_fit.median : num 78.6 61.7 54.6 54.7 52.9 ...  
 $ Best\_fit.sd : num 7.76 11.8 12.13 15.28 12.99 ...

### Section

sec <- summaryBy(. ~ ID+Tool\_type+Edge+Section,   
 data = imp\_data[c("ID", "Tool\_type", "Edge", "Section",  
 names(imp\_data)[num.var])],   
 FUN = nminmaxmeanmedsd)  
str(sec)

'data.frame': 5400 obs. of 22 variables:  
 $ ID : chr "BU-001" "BU-001" "BU-001" "BU-001" ...  
 $ Tool\_type : chr "KM\_dex" "KM\_dex" "KM\_dex" "KM\_dex" ...  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Section : num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Three\_point.n : num 11 11 11 11 11 11 10 11 11 11 ...  
 $ Three\_point.min : num 54.2 54 51.3 55.7 52.8 49.5 56.7 47.1 50.5 54.6 ...  
 $ Three\_point.max : num 100 99.3 79.4 90.3 94.7 ...  
 $ Three\_point.mean : num 70.4 68 58.2 63.9 68.2 ...  
 $ Three\_point.median: num 70.6 64.9 54.5 60.5 66.2 ...  
 $ Three\_point.sd : num 13.4 12.36 8.51 9.86 14.06 ...  
 $ Two\_lines.n : num 11 11 11 11 11 11 10 11 11 11 ...  
 $ Two\_lines.min : num 31.4 16 41.5 40.7 31 33.1 38.1 8.8 1.6 10.9 ...  
 $ Two\_lines.max : num 87.3 80.7 69.6 73.6 84.1 72.6 82.4 80.2 98.2 91.2 ...  
 $ Two\_lines.mean : num 53.2 50.9 49.9 53.9 51.2 ...  
 $ Two\_lines.median : num 46.4 54.9 48.5 53.6 46.5 42.4 51.2 47.9 60.4 54.7 ...  
 $ Two\_lines.sd : num 20.54 18.36 7.13 9.56 18.64 ...  
 $ Best\_fit.n : num 11 11 11 11 11 11 10 11 11 11 ...  
 $ Best\_fit.min : num 31 16.6 44.6 41.6 30 32.7 38.2 8.4 0.3 11.2 ...  
 $ Best\_fit.max : num 94.7 75.1 68 76 82.3 74.5 78.7 78.5 92.8 93.5 ...  
 $ Best\_fit.mean : num 53.5 50.3 50.3 54.3 51.4 ...  
 $ Best\_fit.median : num 44.8 53.6 48.4 53.5 46.2 40 50.7 48.1 62.8 55.3 ...  
 $ Best\_fit.sd : num 22.67 17.79 6.34 10.28 18.71 ...

### Site

site <- summaryBy(. ~ Site+ID+Tool\_type+Edge+Section+Distance\_origin,   
 data = imp\_data[c("Site", "ID", "Tool\_type", "Edge", "Section",  
 "Distance\_origin",  
 names(imp\_data)[num.var])],  
 FUN = nminmaxmeanmedsd)  
str(site)

'data.frame': 58516 obs. of 24 variables:  
 $ Site : chr "Balve" "Balve" "Balve" "Balve" ...  
 $ ID : chr "MU-003" "MU-003" "MU-003" "MU-003" ...  
 $ Tool\_type : chr "KM+LSS\_sin" "KM+LSS\_sin" "KM+LSS\_sin" "KM+LSS\_sin" ...  
 $ Edge : chr "E1" "E1" "E1" "E1" ...  
 $ Section : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Distance\_origin : num 1 2 3 4 5 6 7 8 9 10 ...  
 $ Three\_point.n : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Three\_point.min : num 113.9 101.4 94.6 85.7 79.9 ...  
 $ Three\_point.max : num 113.9 101.4 94.6 85.7 79.9 ...  
 $ Three\_point.mean : num 113.9 101.4 94.6 85.7 79.9 ...  
 $ Three\_point.median: num 113.9 101.4 94.6 85.7 79.9 ...  
 $ Three\_point.sd : num NA NA NA NA NA NA NA NA NA NA ...  
 $ Two\_lines.n : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Two\_lines.min : num 102.3 85.2 69.8 59.1 51.2 ...  
 $ Two\_lines.max : num 102.3 85.2 69.8 59.1 51.2 ...  
 $ Two\_lines.mean : num 102.3 85.2 69.8 59.1 51.2 ...  
 $ Two\_lines.median : num 102.3 85.2 69.8 59.1 51.2 ...  
 $ Two\_lines.sd : num NA NA NA NA NA NA NA NA NA NA ...  
 $ Best\_fit.n : num 1 1 1 1 1 1 1 1 1 1 ...  
 $ Best\_fit.min : num 98 86.4 70.2 59.1 51.8 34.3 25.7 19.3 18.8 12.6 ...  
 $ Best\_fit.max : num 98 86.4 70.2 59.1 51.8 34.3 25.7 19.3 18.8 12.6 ...  
 $ Best\_fit.mean : num 98 86.4 70.2 59.1 51.8 34.3 25.7 19.3 18.8 12.6 ...  
 $ Best\_fit.median : num 98 86.4 70.2 59.1 51.8 34.3 25.7 19.3 18.8 12.6 ...  
 $ Best\_fit.sd : num NA NA NA NA NA NA NA NA NA NA ...

# Save data

## Format name of output file

file\_out <- "EdgeAngle\_stats"

The file will be saved as “~/analysis/summary\_stats/.[ext]”.

## Write to XLSX

write.xlsx(list(edge = edge, tool\_sec = tool\_sec, tool\_dist = tool\_dist, tool\_sec\_dist =  
 tool\_sec\_dist, ID = ID, dist = dist, sec =sec, site = site),   
 file = paste0(dir\_out, file\_out, ".xlsx"))

## Save R object

saveObject(list(edge = edge, tool\_sec = tool\_sec, tool\_dist = tool\_dist, ID = ID, dist =  
 dist, sec =sec, site = site),   
 file = paste0(dir\_out, file\_out, ".Rbin"))

# sessionInfo() and RStudio version

sessionInfo()

R version 4.0.2 (2020-06-22)  
Platform: x86\_64-w64-mingw32/x64 (64-bit)  
Running under: Windows 10 x64 (build 19041)  
  
Matrix products: default  
  
locale:  
[1] LC\_COLLATE=German\_Germany.1252 LC\_CTYPE=German\_Germany.1252   
[3] LC\_MONETARY=German\_Germany.1252 LC\_NUMERIC=C   
[5] LC\_TIME=German\_Germany.1252   
  
attached base packages:  
[1] tools stats graphics grDevices utils datasets methods   
[8] base   
  
other attached packages:  
[1] doBy\_4.6.8 R.utils\_2.10.1 R.oo\_1.24.0 R.methodsS3\_1.8.1  
[5] openxlsx\_4.2.3   
  
loaded via a namespace (and not attached):  
 [1] zip\_2.1.1 Rcpp\_1.0.6 compiler\_4.0.2 pillar\_1.4.7   
 [5] digest\_0.6.27 lattice\_0.20-41 evaluate\_0.14 lifecycle\_0.2.0   
 [9] tibble\_3.0.6 gtable\_0.3.0 pkgconfig\_2.0.3 rlang\_0.4.10   
[13] Matrix\_1.2-18 DBI\_1.1.1 yaml\_2.2.1 xfun\_0.20   
[17] dplyr\_1.0.3 stringr\_1.4.0 knitr\_1.31 generics\_0.1.0   
[21] vctrs\_0.3.6 grid\_4.0.2 tidyselect\_1.1.0 glue\_1.4.2   
[25] R6\_2.5.0 rmarkdown\_2.6 tidyr\_1.1.2 purrr\_0.3.4   
[29] ggplot2\_3.3.3 magrittr\_2.0.1 backports\_1.2.1 scales\_1.1.1   
[33] ellipsis\_0.3.1 htmltools\_0.5.1.1 MASS\_7.3-51.6 assertthat\_0.2.1   
[37] colorspace\_2.0-0 Deriv\_4.1.2 stringi\_1.5.3 munsell\_0.5.0   
[41] broom\_0.7.4 crayon\_1.4.0

RStudio version 1.3.1073.

END OF SCRIPT