Week 3 R functions

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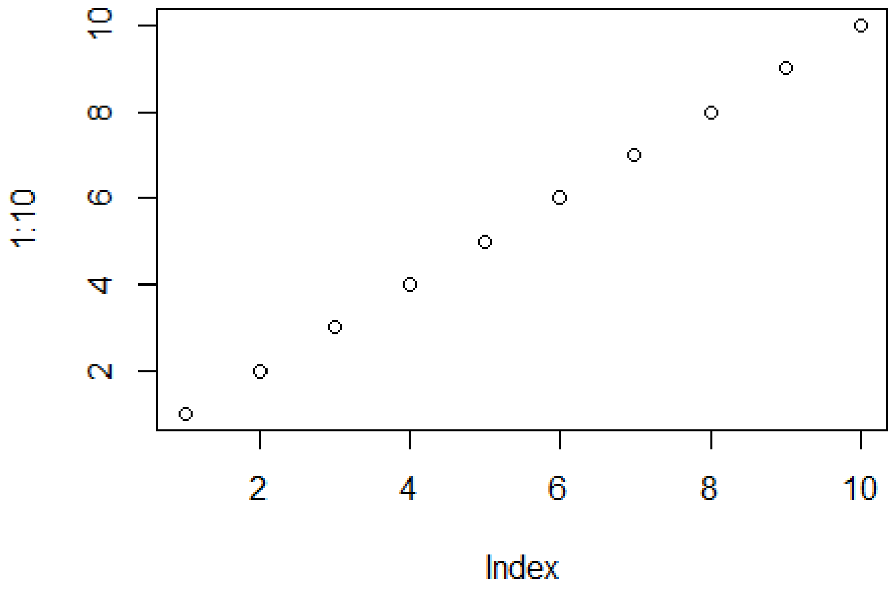
This week we are introducing **R functions** how to write functions.

Questions to answer:

> Q1.Write a function grade() to determine an overall grade from a vector of student homework assignment scores dropping the lowest single score.If a student misses a homework(i.e. has an NA value)this can be used as a score to be potentially dropped.Your final function should be adquately explained with code comments and be able to work on an example class gradebook such as this one in CSV format:“https://tinyurl.com/gradeinput”[3pts]

```
plot(1:10)
```



```
#Example input vectors to start with

student1<-c(100,100,100,100,100,100,100,90)

student2<-c(100,NA,90,90,90,90,97,80)
```

```
student3<-c(90,NA,NA,NA,NA,NA,NA,NA)
```

Follow the guidelines from class

```
# Straight forward mean()
student1<-c(100,100,100,100,100,100,100,90)

mean(student1)

## [1] 98.75

# Which element of the vector is the lowest?
which.min(student1)

## [1] 8
```

Excluding the lowest score from mean() calculation

```
# Will return everything except the eight element of the vector
student1[-8]

## [1] 100 100 100 100 100 100 100
```

Can use answer from which.min() to return all other elements of the vector

```
# First working line
mean(student1[-which.min(student1)])

## [1] 100
```

Other students data

```
student2<-c(100,NA,90,90,90,90,97,80)
mean(student2, na.rm=TRUE)

## [1] 91

#student3<-c(90,NA,NA,NA,NA,NA,NA,NA)
mean(student3, na.rm=TRUE)

## [1] 90
```

replacing all NA values with zero

```
student2<-c(100,NA,90,90,90,90,97,80)
x <- student2

is.na(x)

## [1] FALSE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE

which( is.na(x))
```

```
## [1] 2
```

“Mask” the NA elements

```
x[-which(is.na(x))]

## [1] 100  90  90  90  90  97  80
```

make NA elements zero

```
# Useful tool
x[is.na(x)] <- 0
x

## [1] 100   0  90  90  90  90  97  80

mean(x)

## [1] 79.625
```

Dropping lowest score

```
x[is.na(x)] <- 0
mean(x[-which.min(x)])

## [1] 91

student3<-c(90,NA,NA,NA,NA,NA,NA,NA)
x <-  student3
x[is.na(x)] <- 0
mean(x[-which.min(x)])

## [1] 12.85714
```

Making the function

```
grade <- function(x) {
  x[is.na(x)] <- 0
  mean(x[-which.min(x)])
}

grade(student1)

## [1] 100

grade(student2)

## [1] 91

grade(student3)

## [1] 12.85714

#' Calculate the average score for a vector of student scores after dropping
the lowest score.
```

```
#' Missing values will be treated as zero
#'
#' @param x A numberic vector of homework scores
#'
#' @return Average score
#' @export
#'
#' @examples
#' student = c(100, NA, 90, 97)
#' grade(student)
#'
grade <- function(x) {
  # mask NA with zero
  #Treat missing values as zero
  x[is.na(x)] <- 0
  # Exclude lowest score from mean
  mean(x[-which.min(x)])
}
```

Using the entire data on the whole class CSVformat: "https://tinyurl.com/gradeinput"

```
url <- "https://tinyurl.com/gradeinput"
gradebook <- read.csv(url, row.names = 1)

apply(gradebook, 1, grade)

##  student-1  student-2  student-3  student-4  student-5  student-6 
student-7 
##      91.75      82.50      84.25      84.25      88.25      89.00 
94.00 
##  student-8  student-9 student-10 student-11 student-12 student-13 student-
14 
##      93.75      87.75      79.00      86.00      91.75      92.25 
87.75 
## student-15 student-16 student-17 student-18 student-19 student-20 
##      78.75      89.50      88.00      94.50      82.75      82.75
```

> Q2. Using your grade() function and the supplied gradebook, Who is the top scoring student overall in the gradebook?[3pts]

apply() function and save the results

```
results <- apply(gradebook, 1, grade)
sort(results, decreasing = TRUE)

## student-18  student-7  student-8 student-13  student-1 student-12 student-
16 
##      94.50      94.00      93.75      92.25      91.75      91.75 
89.50 
##  student-6  student-5 student-17  student-9 student-14 student-11 
student-3
```

```
##       89.00      88.25      88.00      87.75      87.75      86.00 
84.25 
##  student-4 student-19 student-20  student-2 student-10 student-15 
##       84.25      82.75      82.75      82.50      79.00      78.75
```

```
which.max(results)
```

```
## student-18 
##         18
```

Q3.From your analysis of the gradebook,which homework was toughest on students(i.e.obtained the lowest scores overall?[2pts]

```
gradebook
```

```
##            hw1 hw2 hw3 hw4 hw5
## student-1  100  73 100  88  79
## student-2   85  64  78  89  78
## student-3   83  69  77 100  77
## student-4   88  NA  73 100  76
## student-5   88 100  75  86  79
## student-6   89  78 100  89  77
## student-7   89 100  74  87 100
## student-8   89 100  76  86 100
## student-9   86 100  77  88  77
## student-10  89  72  79  NA  76
## student-11  82  66  78  84 100
## student-12 100  70  75  92 100
## student-13  89 100  76 100  80
## student-14  85 100  77  89  76
## student-15  85  65  76  89  NA
## student-16  92 100  74  89  77
## student-17  88  63 100  86  78
## student-18  91  NA 100  87 100
## student-19  91  68  75  86  79
## student-20  91  68  76  88  76
```

```
ave.scores <- apply(gradebook, 2, mean, na.rm=TRUE)
ave.scores
```

```
##      hw1      hw2      hw3      hw4      hw5 
## 89.00000 80.88889 80.80000 89.63158 83.42105
```

```
which.min(ave.scores)
```

```
## hw3 
##   3
```

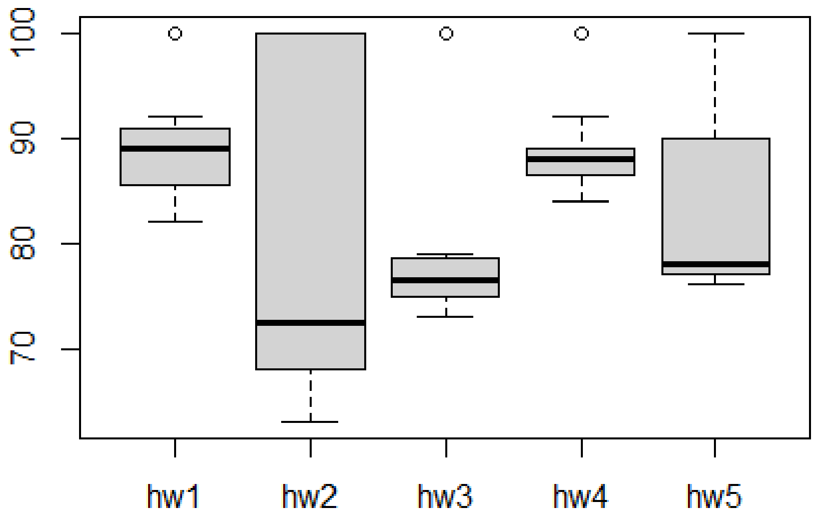
```
med.scores <- apply(gradebook, 2, median, na.rm=TRUE)
med.scores
```

```
##  hw1  hw2  hw3  hw4  hw5
## 89.0 72.5 76.5 88.0 78.0
```

```
which.min(med.scores)
```

```
## hw2
##   2
```

```
boxplot(gradebook)
```


hw1
hw2
hw3
hw4
hw5