Class 6: R Functions

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Today we will explore R functions.

We will start with calculating a grade for these example students.

```
# 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)
```

We could use the mean() function to calculate an average.

```
mean(student2, na.rm = TRUE)
```

```
## [1] 91
```

How does the is.na() function work? Let's try it out on student2.

```
x <- is.na(student2)
```

We can use this result to get at our NA values (i.e, the TRUE positions).

```
student2[ is.na(student2)] <- 0
student2
```

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

```
student3[is.na(student3)] <- 0
student3
```

```
## [1] 90  0  0  0  0  0  0  0
```

```
mean(student3)
```

```
## [1] 11.25
```

```
student2[is.na(student2)] <- 0
mean(student2[-which.min(student2)])
```

```
## [1] 91
```

```
student3[is.na(student3)] <- 0
mean(student3[-which.min(student3)])
```

```
## [1] 12.85714
```

```
student1[-which.min(student1)]
```

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

```
x <- student3
x[is.na(x)] <- 0
x <- x[-which.min(x)]
mean(x)
```

```
## [1] 12.85714
```

We are close to our working code snipet that willl be the body of our first function.

```
# First set NA values to zero
x[is.na(x)] <- 0
# Remove lowest score and calculate average
mean(x[-which.min(x)])
```

```
## [1] 15
```

Now we can turn this into our first function. We will call this function 'grade'

All R functions have 3 things - a name - input arguments - body

```
grade <- function(x){
# First set NA values to zero
  x[is.na(x)] <- 0
# Remove lowest score and calculate average
  mean(x[-which.min(x)])
}
```

```
grade(student3)
```

```
## [1] 12.85714
```

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

We can use the 'apply()' function to grade the whole class.

```
scores <- apply(gradebook, 1, grade)
scores
```

```
##  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. Who is the top scoring student overall in the gradebook?

```
which.max(scores)
```

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

Q3. which homework was toughest on students (i.e. obtained the lowest scores overall?

```
hw.mean <- (apply(gradebook,2,mean, na.rm = TRUE))
which.min(hw.mean)
```

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

```
boxplot(gradebook)
```