Class06: Calculating Overall Grades

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Function Basics

All functions in R have at least 3 things

- A **name** (we pick this)
- Input **arguments** (there can be loads, comma seperated)
- A **body**

Example input vectors to work with

```
# 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)
```

I can use the 'mean()' function to get the average

```
mean(student1)
```

```
[1] 98.75
```

I can find the lowest value using the `min()` function

```
min(student1)
```

```
[1] 90
```

Try using the 'which.min()' function

```
which.min(student1)
```

```
[1] 8
```

Can we use the minus index trick?

```
student1[-8]
```

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

Sure can:

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

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

Combining all the functions together

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

```
[1] 100
```

Try for student 2

```
mean(student2[- which.min(student2)])
```

```
[1] NA
```

Should we exclude NA?

```
mean(student3, na.rm= TRUE)
```

```
[1] 90
```

We need another way of replacing NA with 0.

Combining the function together

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

```
[1] NA
```

Rewrite my snippet to be more simple

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

```
[1] 91
```

Q1. Write a function grade() to determine an overall grade from a vector of student homework assignment scores dropping the lowest single score. Now I can make my function -> `grade()`

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

Now use that to grade student2 etc.(remember to run a function so it comes up in your environment)

```
grade(student2)
```

```
[1] 91
```

Grading the Whole Class

Loading the data frame data for student grades

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

```
          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
```

Now I want to use the `apply()` function

```
results <- apply(student_grades, MARGIN = 1, FUN = grade)
results
```

```
 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]

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

```
student-18
        18
```

student-18 was the top scoring student

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

```
hw_results <- apply(student_grades, MARGIN = 2, FUN = grade)
hw_results
```

```
     hw1      hw2      hw3      hw4      hw5
89.36842 76.63158 81.21053 89.63158 83.42105
```

Finding the hw with the lowest average

```
which.min(hw_results)
```

```
hw2
  2
```

hw2 was the hardest assignment.

Q4. Optional Extension: From your analysis of the gradebook, which homework was most predictive of overall score (i.e. highest correlation with average grade score)? [1pt]

```
mask <- student_grades
mask[ is.na(mask) ] <- 0
cor(mask$hw5, results)
```

```
[1] 0.6325982
```

Can I apply the `cor()` function over the mask gradebook?

```
hw_correlation <- apply(mask, 2, cor, y=results)
hw_correlation
```

```
      hw1       hw2       hw3       hw4       hw5
0.4250204 0.1767780 0.3042561 0.3810884 0.6325982
```

Finding the hw with the highest correlation.

```
which.max(hw_correlation)
```

```
hw5
  5
```

hw5 was the most predictive of overall score.