Class 6: R Functions

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Quick Markdown intro

We can write text of course just like any file We can **style text to be bold** or **italic**

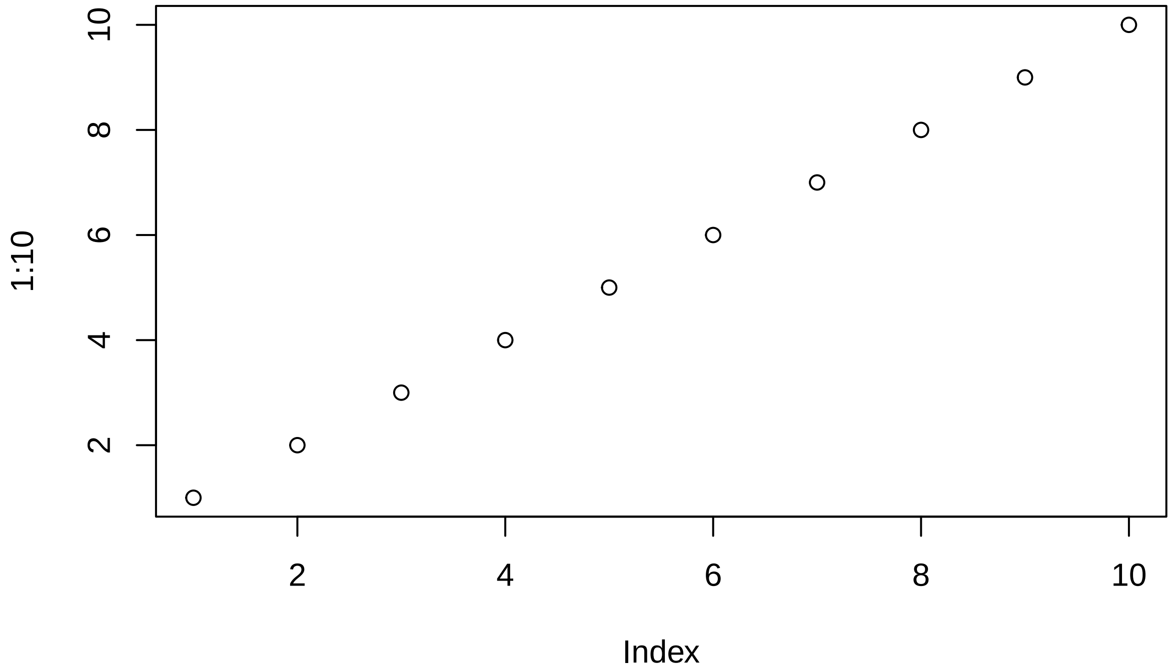
Do

- this
- and that
- and another thing

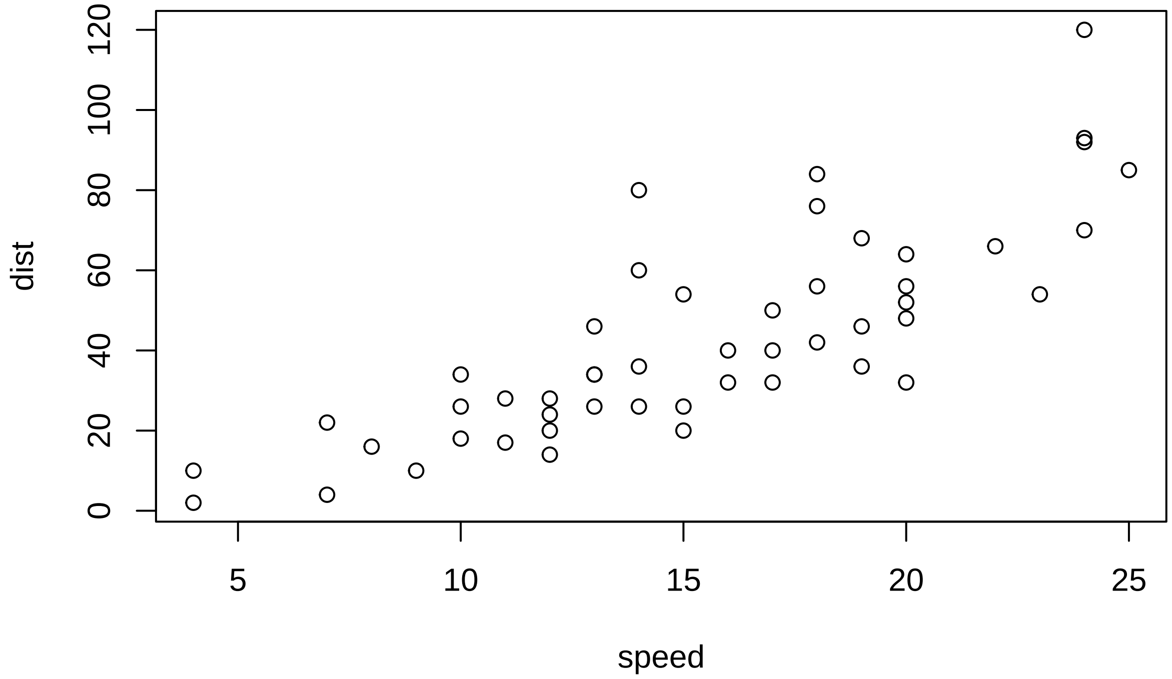
This is more text and this is a new line

We can include some code:

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



```
plot(cars)
```



# Time to write a function

> **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]

```
# 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)
```

First I want to find the lowest score. I can use the **min()** to ding it and the *which.min()* function to find where it is (i.e. its position in the vector)

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

```
## [1] 8
```

```
range(student1)
```

```
## [1]  90 100
```

I can use minus to get everything in the vector but the lowest score.

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

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

Now I can call the **mean()** function to ge the average.

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

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

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

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

```
is.na(student2)
```

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

```
which(is.na(student2))
```

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

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

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

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

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

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

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

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

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

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

```
student4 <- c(100, NA, 90, "90", 90, 90, 97, 80)
```

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

And test if it works on a single vector

```
grade(student1)
```

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

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

```
##            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
```

```
apply(scores, 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
```

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

> **Q2** Who is the top scoring student?

```
which.max(ans)
```

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

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

```
apply(scores, 2, mean, na.rm=TRUE)
```

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

##Replace or mask NA values to zero

```
mask <- scores
  is.na(scores)
```

```
##              hw1   hw2   hw3   hw4   hw5
## student-1  FALSE FALSE FALSE FALSE FALSE
## student-2  FALSE FALSE FALSE FALSE FALSE
## student-3  FALSE FALSE FALSE FALSE FALSE
## student-4  FALSE  TRUE FALSE FALSE FALSE
## student-5  FALSE FALSE FALSE FALSE FALSE
## student-6  FALSE FALSE FALSE FALSE FALSE
## student-7  FALSE FALSE FALSE FALSE FALSE
## student-8  FALSE FALSE FALSE FALSE FALSE
## student-9  FALSE FALSE FALSE FALSE FALSE
## student-10 FALSE FALSE FALSE  TRUE FALSE
## student-11 FALSE FALSE FALSE FALSE FALSE
## student-12 FALSE FALSE FALSE FALSE FALSE
## student-13 FALSE FALSE FALSE FALSE FALSE
## student-14 FALSE FALSE FALSE FALSE FALSE
## student-15 FALSE FALSE FALSE FALSE  TRUE
## student-16 FALSE FALSE FALSE FALSE FALSE
## student-17 FALSE FALSE FALSE FALSE FALSE
## student-18 FALSE  TRUE FALSE FALSE FALSE
## student-19 FALSE FALSE FALSE FALSE FALSE
## student-20 FALSE FALSE FALSE FALSE FALSE
```

```
  mask[is.na(scores)]=0
  mask
```

```
##            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   0  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   0  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   0
## student-16  92 100  74  89  77
## student-17  88  63 100  86  78
## student-18  91   0 100  87 100
## student-19  91  68  75  86  79
## student-20  91  68  76  88  76
```

```
apply(mask, 2, mean)
```

```
##   hw1   hw2   hw3   hw4   hw5
## 89.00 72.80 80.80 85.15 79.25
```

```
which.min(apply(mask, 2, mean))
```

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

> “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]

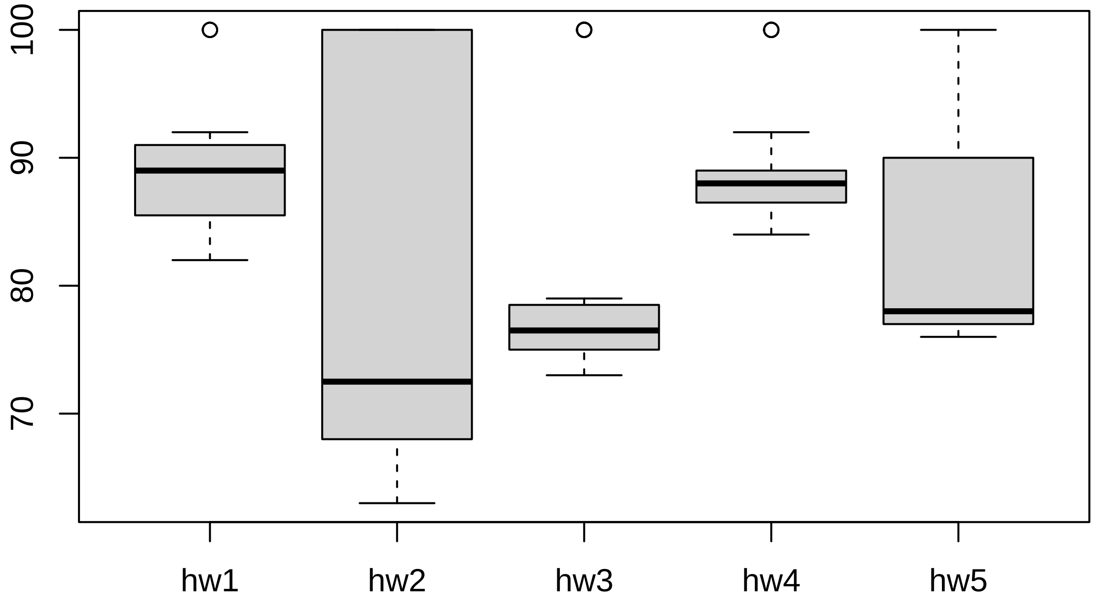
```
cor(mask$hw4, ans)
```

```
## [1] 0.3810884
```

```
apply(mask, 2, cor, ans)
```

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

```
boxplot(scores)
```


100
90
80
70
hw1
hw2
hw3
hw4
hw5