# Week 1 Lab

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## Problem 1

Create two data vectors $x$ and $y$ that contain the integers 1 to 21 and −10 to 10. Print both vectors.

```
x <- c(1:21)
x
```

```
 [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21
```

```
y <- c(-10:10)
y
```

```
 [1] -10  -9  -8  -7  -6  -5  -4  -3  -2  -1   0   1   2   3   4   5   6   7   8
[20]   9  10
```

Do the following:

(a) Add, subtract, multiply, and divide $x$ by $y$. Place a comment after each line of code explaining what operation you are performing in words.

```
x+y #adding x & y
```

```
 [1] -9 -7 -5 -3 -1  1  3  5  7  9 11 13 15 17 19 21 23 25 27 29 31
```

```
x-y #subtracting x & y
```

```
 [1] 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11
```

```
x*y #multiplying by x & y
```

```
 [1] -10 -18 -24 -28 -30 -30 -28 -24 -18 -10   0  12  26  42  60  80 102 126 152
[20] 180 210
```

```
x/y #dividing x by y
```

```
 [1]  -0.1000000  -0.2222222  -0.3750000  -0.5714286  -0.8333333  -1.2000000
 [7]  -1.7500000  -2.6666667  -4.5000000 -10.0000000         Inf  12.0000000
[13]   6.5000000   4.6666667   3.7500000   3.2000000   2.8333333   2.5714286
[19]   2.3750000   2.2222222   2.1000000
```

(b) Find the mean of each data set.

```
mean(x) #mean of vector x
```

```
[1] 11
```

```
mean(y) #mean of vector y
```

```
[1] 0
```

(c) Find the corrected sum of squares for each data set. The formula for this is:

$$\sum (x_i - \bar{x})^2$$

```
sum((x-mean(x))^2)
```

```
[1] 770
```

```
sum((y-mean(y))^2)
```

```
[1] 770
```

(d) Find the mean of the product of $x$ and $y$.

```
mean(x*y)
```

```
[1] 36.66667
```

# Problem 2

| Participant: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Score standing on level ground: | 56 | 50 | 41 | 65 | 47 | 50 | 64 | 48 | 47 | 57 |
| Score standing on a slope: | 38 | 50 | 46 | 46 | 42 | 41 | 49 | 38 | 49 | 55 |

Create a data frame called `data` with the `Problem_2.png` image on Canvas. Create your own column names as you see fit. Print `data`.

```
data <- data.frame(
  "Participants" = c(1:10),
  "Level Ground" = c(56,50,41,65,47,50,64,48,47,57),
  "Slope" = c(38,50,46,46,42,41,49,38,49,55)
)
data
```

```
   Participants Level.Ground Slope
1             1           56    38
2             2           50    50
3             3           41    46
4             4           65    46
5             5           47    42
6             6           50    41
7             7           64    49
8             8           48    38
9             9           47    49
10           10           57    55
```

Add a column to `data` which is the ratio of the score standing on level ground to the score standing on a slope. Print `data`.

```
LevelGround <- c(56,50,41,65,47,50,64,48,47,57)
Slope <-c(38,50,46,46,42,41,49,38,49,55)
data["Ratio"] <- LevelGround/Slope
data
```

```
   Participants Level.Ground Slope     Ratio
1             1           56    38 1.4736842
2             2           50    50 1.0000000
3             3           41    46 0.8913043
4             4           65    46 1.4130435
5             5           47    42 1.1190476
6             6           50    41 1.2195122
7             7           64    49 1.3061224
8             8           48    38 1.2631579
9             9           47    49 0.9591837
10           10           57    55 1.0363636
```

Find the mean of the score standing on level ground and the mean score standing on a slope.

```
mean(data$Level.Ground)
```

```
[1] 52.5
```

```
mean(data$Slope)
```

```
[1] 45.4
```

# Problem 3

`R` has a few build in data sets, convenient for learning new skills. For example, the famous `iris` data set is built in. In the code chunk below, type in `iris` into the chunk below and run it.

```
iris
```

| | Sepal.Length | Sepal.Width | Petal.Length | Petal.Width | Species |
|---|---|---|---|---|---|
| 1 | 5.1 | 3.5 | 1.4 | 0.2 | setosa |
| 2 | 4.9 | 3.0 | 1.4 | 0.2 | setosa |
| 3 | 4.7 | 3.2 | 1.3 | 0.2 | setosa |
| 4 | 4.6 | 3.1 | 1.5 | 0.2 | setosa |
| 5 | 5.0 | 3.6 | 1.4 | 0.2 | setosa |
| 6 | 5.4 | 3.9 | 1.7 | 0.4 | setosa |
| 7 | 4.6 | 3.4 | 1.4 | 0.3 | setosa |
| 8 | 5.0 | 3.4 | 1.5 | 0.2 | setosa |
| 9 | 4.4 | 2.9 | 1.4 | 0.2 | setosa |
| 10 | 4.9 | 3.1 | 1.5 | 0.1 | setosa |
| 11 | 5.4 | 3.7 | 1.5 | 0.2 | setosa |
| 12 | 4.8 | 3.4 | 1.6 | 0.2 | setosa |
| 13 | 4.8 | 3.0 | 1.4 | 0.1 | setosa |
| 14 | 4.3 | 3.0 | 1.1 | 0.1 | setosa |
| 15 | 5.8 | 4.0 | 1.2 | 0.2 | setosa |
| 16 | 5.7 | 4.4 | 1.5 | 0.4 | setosa |
| 17 | 5.4 | 3.9 | 1.3 | 0.4 | setosa |
| 18 | 5.1 | 3.5 | 1.4 | 0.3 | setosa |
| 19 | 5.7 | 3.8 | 1.7 | 0.3 | setosa |
| 20 | 5.1 | 3.8 | 1.5 | 0.3 | setosa |
| 21 | 5.4 | 3.4 | 1.7 | 0.2 | setosa |
| 22 | 5.1 | 3.7 | 1.5 | 0.4 | setosa |
| 23 | 4.6 | 3.6 | 1.0 | 0.2 | setosa |
| 24 | 5.1 | 3.3 | 1.7 | 0.5 | setosa |
| 25 | 4.8 | 3.4 | 1.9 | 0.2 | setosa |
| 26 | 5.0 | 3.0 | 1.6 | 0.2 | setosa |
| 27 | 5.0 | 3.4 | 1.6 | 0.4 | setosa |
| 28 | 5.2 | 3.5 | 1.5 | 0.2 | setosa |
| 29 | 5.2 | 3.4 | 1.4 | 0.2 | setosa |
| 30 | 4.7 | 3.2 | 1.6 | 0.2 | setosa |
| 31 | 4.8 | 3.1 | 1.6 | 0.2 | setosa |
| 32 | 5.4 | 3.4 | 1.5 | 0.4 | setosa |
| 33 | 5.2 | 4.1 | 1.5 | 0.1 | setosa |
| 34 | 5.5 | 4.2 | 1.4 | 0.2 | setosa |
| 35 | 4.9 | 3.1 | 1.5 | 0.2 | setosa |
| 36 | 5.0 | 3.2 | 1.2 | 0.2 | setosa |
| 37 | 5.5 | 3.5 | 1.3 | 0.2 | setosa |
| 38 | 4.9 | 3.6 | 1.4 | 0.1 | setosa |
| 39 | 4.4 | 3.0 | 1.3 | 0.2 | setosa |
| 40 | 5.1 | 3.4 | 1.5 | 0.2 | setosa |
| 41 | 5.0 | 3.5 | 1.3 | 0.3 | setosa |
| 42 | 4.5 | 2.3 | 1.3 | 0.3 | setosa |
| 43 | 4.4 | 3.2 | 1.3 | 0.2 | setosa |
| 44 | 5.0 | 3.5 | 1.6 | 0.6 | setosa |
| 45 | 5.1 | 3.8 | 1.9 | 0.4 | setosa |
| 46 | 4.8 | 3.0 | 1.4 | 0.3 | setosa |
| 47 | 5.1 | 3.8 | 1.6 | 0.2 | setosa |
| 48 | 4.6 | 3.2 | 1.4 | 0.2 | setosa |
| 49 | 5.3 | 3.7 | 1.5 | 0.2 | setosa |

| | | | | | |
|---|---|---|---|---|---|
| 50 | 5.0 | 3.3 | 1.4 | 0.2 | setosa |
| 51 | 7.0 | 3.2 | 4.7 | 1.4 | versicolor |
| 52 | 6.4 | 3.2 | 4.5 | 1.5 | versicolor |
| 53 | 6.9 | 3.1 | 4.9 | 1.5 | versicolor |
| 54 | 5.5 | 2.3 | 4.0 | 1.3 | versicolor |
| 55 | 6.5 | 2.8 | 4.6 | 1.5 | versicolor |
| 56 | 5.7 | 2.8 | 4.5 | 1.3 | versicolor |
| 57 | 6.3 | 3.3 | 4.7 | 1.6 | versicolor |
| 58 | 4.9 | 2.4 | 3.3 | 1.0 | versicolor |
| 59 | 6.6 | 2.9 | 4.6 | 1.3 | versicolor |
| 60 | 5.2 | 2.7 | 3.9 | 1.4 | versicolor |
| 61 | 5.0 | 2.0 | 3.5 | 1.0 | versicolor |
| 62 | 5.9 | 3.0 | 4.2 | 1.5 | versicolor |
| 63 | 6.0 | 2.2 | 4.0 | 1.0 | versicolor |
| 64 | 6.1 | 2.9 | 4.7 | 1.4 | versicolor |
| 65 | 5.6 | 2.9 | 3.6 | 1.3 | versicolor |
| 66 | 6.7 | 3.1 | 4.4 | 1.4 | versicolor |
| 67 | 5.6 | 3.0 | 4.5 | 1.5 | versicolor |
| 68 | 5.8 | 2.7 | 4.1 | 1.0 | versicolor |
| 69 | 6.2 | 2.2 | 4.5 | 1.5 | versicolor |
| 70 | 5.6 | 2.5 | 3.9 | 1.1 | versicolor |
| 71 | 5.9 | 3.2 | 4.8 | 1.8 | versicolor |
| 72 | 6.1 | 2.8 | 4.0 | 1.3 | versicolor |
| 73 | 6.3 | 2.5 | 4.9 | 1.5 | versicolor |
| 74 | 6.1 | 2.8 | 4.7 | 1.2 | versicolor |
| 75 | 6.4 | 2.9 | 4.3 | 1.3 | versicolor |
| 76 | 6.6 | 3.0 | 4.4 | 1.4 | versicolor |
| 77 | 6.8 | 2.8 | 4.8 | 1.4 | versicolor |
| 78 | 6.7 | 3.0 | 5.0 | 1.7 | versicolor |
| 79 | 6.0 | 2.9 | 4.5 | 1.5 | versicolor |
| 80 | 5.7 | 2.6 | 3.5 | 1.0 | versicolor |
| 81 | 5.5 | 2.4 | 3.8 | 1.1 | versicolor |
| 82 | 5.5 | 2.4 | 3.7 | 1.0 | versicolor |
| 83 | 5.8 | 2.7 | 3.9 | 1.2 | versicolor |
| 84 | 6.0 | 2.7 | 5.1 | 1.6 | versicolor |
| 85 | 5.4 | 3.0 | 4.5 | 1.5 | versicolor |
| 86 | 6.0 | 3.4 | 4.5 | 1.6 | versicolor |
| 87 | 6.7 | 3.1 | 4.7 | 1.5 | versicolor |
| 88 | 6.3 | 2.3 | 4.4 | 1.3 | versicolor |
| 89 | 5.6 | 3.0 | 4.1 | 1.3 | versicolor |
| 90 | 5.5 | 2.5 | 4.0 | 1.3 | versicolor |
| 91 | 5.5 | 2.6 | 4.4 | 1.2 | versicolor |
| 92 | 6.1 | 3.0 | 4.6 | 1.4 | versicolor |
| 93 | 5.8 | 2.6 | 4.0 | 1.2 | versicolor |
| 94 | 5.0 | 2.3 | 3.3 | 1.0 | versicolor |
| 95 | 5.6 | 2.7 | 4.2 | 1.3 | versicolor |
| 96 | 5.7 | 3.0 | 4.2 | 1.2 | versicolor |
| 97 | 5.7 | 2.9 | 4.2 | 1.3 | versicolor |
| 98 | 6.2 | 2.9 | 4.3 | 1.3 | versicolor |
| 99 | 5.1 | 2.5 | 3.0 | 1.1 | versicolor |
| 100 | 5.7 | 2.8 | 4.1 | 1.3 | versicolor |

| | | | | | |
|---|---|---|---|---|---|
| 101 | 6.3 | 3.3 | 6.0 | 2.5 | virginica |
| 102 | 5.8 | 2.7 | 5.1 | 1.9 | virginica |
| 103 | 7.1 | 3.0 | 5.9 | 2.1 | virginica |
| 104 | 6.3 | 2.9 | 5.6 | 1.8 | virginica |
| 105 | 6.5 | 3.0 | 5.8 | 2.2 | virginica |
| 106 | 7.6 | 3.0 | 6.6 | 2.1 | virginica |
| 107 | 4.9 | 2.5 | 4.5 | 1.7 | virginica |
| 108 | 7.3 | 2.9 | 6.3 | 1.8 | virginica |
| 109 | 6.7 | 2.5 | 5.8 | 1.8 | virginica |
| 110 | 7.2 | 3.6 | 6.1 | 2.5 | virginica |
| 111 | 6.5 | 3.2 | 5.1 | 2.0 | virginica |
| 112 | 6.4 | 2.7 | 5.3 | 1.9 | virginica |
| 113 | 6.8 | 3.0 | 5.5 | 2.1 | virginica |
| 114 | 5.7 | 2.5 | 5.0 | 2.0 | virginica |
| 115 | 5.8 | 2.8 | 5.1 | 2.4 | virginica |
| 116 | 6.4 | 3.2 | 5.3 | 2.3 | virginica |
| 117 | 6.5 | 3.0 | 5.5 | 1.8 | virginica |
| 118 | 7.7 | 3.8 | 6.7 | 2.2 | virginica |
| 119 | 7.7 | 2.6 | 6.9 | 2.3 | virginica |
| 120 | 6.0 | 2.2 | 5.0 | 1.5 | virginica |
| 121 | 6.9 | 3.2 | 5.7 | 2.3 | virginica |
| 122 | 5.6 | 2.8 | 4.9 | 2.0 | virginica |
| 123 | 7.7 | 2.8 | 6.7 | 2.0 | virginica |
| 124 | 6.3 | 2.7 | 4.9 | 1.8 | virginica |
| 125 | 6.7 | 3.3 | 5.7 | 2.1 | virginica |
| 126 | 7.2 | 3.2 | 6.0 | 1.8 | virginica |
| 127 | 6.2 | 2.8 | 4.8 | 1.8 | virginica |
| 128 | 6.1 | 3.0 | 4.9 | 1.8 | virginica |
| 129 | 6.4 | 2.8 | 5.6 | 2.1 | virginica |
| 130 | 7.2 | 3.0 | 5.8 | 1.6 | virginica |
| 131 | 7.4 | 2.8 | 6.1 | 1.9 | virginica |
| 132 | 7.9 | 3.8 | 6.4 | 2.0 | virginica |
| 133 | 6.4 | 2.8 | 5.6 | 2.2 | virginica |
| 134 | 6.3 | 2.8 | 5.1 | 1.5 | virginica |
| 135 | 6.1 | 2.6 | 5.6 | 1.4 | virginica |
| 136 | 7.7 | 3.0 | 6.1 | 2.3 | virginica |
| 137 | 6.3 | 3.4 | 5.6 | 2.4 | virginica |
| 138 | 6.4 | 3.1 | 5.5 | 1.8 | virginica |
| 139 | 6.0 | 3.0 | 4.8 | 1.8 | virginica |
| 140 | 6.9 | 3.1 | 5.4 | 2.1 | virginica |
| 141 | 6.7 | 3.1 | 5.6 | 2.4 | virginica |
| 142 | 6.9 | 3.1 | 5.1 | 2.3 | virginica |
| 143 | 5.8 | 2.7 | 5.1 | 1.9 | virginica |
| 144 | 6.8 | 3.2 | 5.9 | 2.3 | virginica |
| 145 | 6.7 | 3.3 | 5.7 | 2.5 | virginica |
| 146 | 6.7 | 3.0 | 5.2 | 2.3 | virginica |
| 147 | 6.3 | 2.5 | 5.0 | 1.9 | virginica |
| 148 | 6.5 | 3.0 | 5.2 | 2.0 | virginica |
| 149 | 6.2 | 3.4 | 5.4 | 2.3 | virginica |
| 150 | 5.9 | 3.0 | 5.1 | 1.8 | virginica |

You can treat the object `iris` just like `data` from Problem 3. Find the `min`, `max`, `median`, and `mean` of `Petal.Width`. Leave a comment after each line explaining what operation you are performing.

```
min(iris$Petal.Width) #minimum of petal width
```

```
[1] 0.1
```

```
max(iris$Petal.Width) #maximum of petal width
```

```
[1] 2.5
```

```
median(iris$Petal.Width) #median of petal width
```

```
[1] 1.3
```

```
mean(iris$Petal.Width) #mean of petal width
```

```
[1] 1.199333
```

## Submitting

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