DM583: Solutions to Exercise 1 (Introduction to R)

2024-03-11

Exercise 1.1: Get Started with R

There isn't really any solution to this item, just play around with the `help()` command to learn about the others, e.g.:

```
help("install.packages")
```

Exercise 1.2: Dimensionless Arrays (Vectors) in R

```
# Item 1.2 (a):
vec <- c(5, -3.2, 0, 8.9, -1)
vec
```

```
## [1]  5.0 -3.2  0.0  8.9 -1.0
```

```
# Item 1.2 (b):
min_vec <- min(vec)
max_vec <- max(vec)
mean_vec <- mean(vec)
mean_abs_vec <- mean(abs(vec))
print(c(min_vec, max_vec, mean_vec, mean_abs_vec))
```

```
## [1] -3.20  8.90  1.94  3.62
```

```
# Item 1.2 (c):
vec[3] <- 42
vec
```

```
## [1]  5.0 -3.2 42.0  8.9 -1.0
```

```
# Item 1.2 (d):
vec2 = 2*vec
vec2
```

```
## [1] 10.0 -6.4 84.0 17.8 -2.0
```

```
vec_sum = vec + vec2
vec_sum
```

```
## [1]  15.0  -9.6 126.0  26.7  -3.0
```

```
# Item 1.2 (e):
vec_rand = rnorm(n=30)
vec_rand
```

```
##  [1]  1.53151178 -0.68987472  0.15911588 -0.45592525 -1.88226819  0.60445727
##  [7]  0.58033127  0.50774577  1.00918291  0.07925506  0.89157543  1.18322965
## [13] -1.66515372 -0.18527734 -0.82829403 -0.18117198 -0.17804331 -0.59837666
## [19]  0.23434291 -0.98408457  0.65995468 -1.08345807 -0.51555957  1.08809029
## [25] -0.14694151 -1.70482442 -0.21217110  0.64511800 -0.08638982  2.13490199
```

```
mean(vec_rand)
```

```
## [1] -0.002966711
```

```
vec_rand[26:30]
```

```
## [1] -1.70482442 -0.21217110  0.64511800 -0.08638982  2.13490199
```

Exercise 1.3: Matrices (Dimensional Arrays) in R

```
# Item 1.3 (a):
mat22 <- rbind(c(1, 1),c(1, 1))
mat22
```

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

```
# Item 1.3 (b):
mat22_neg <- -mat22
mat22_neg
```

```
##      [,1] [,2]
## [1,]   -1   -1
## [2,]   -1   -1
```

```
mat22_nullified = mat22 + mat22_neg
mat22_nullified
```

```
##      [,1] [,2]
## [1,]    0    0
## [2,]    0    0
```

```
# Item 1.3 (c):
mat22_aux <- rbind(c(3, 3),c(-1, -1))
mat22_aux
```

```
##      [,1] [,2]
## [1,]    3    3
## [2,]   -1   -1
```

```
mat22_doubled = mat22%*%mat22_aux # With Matrix Multiplication
mat22_doubled
```

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

```
mat22_doubled = mat22*rbind(c(2,2),c(2,2)) # With Element-Wise Multiplication
mat22_doubled
```

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

```
mat22_doubled = mat22*2 # With Scalar Multiplication
mat22_doubled
```

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

Exercise 1.4: Data Frames and Exploration of Datasets in R

```
# Item 1.4 (a):
help("CO2")
```

```
# Item 1.4 (b):
is.data.frame(CO2)
```

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

```
str(CO2)
```

```
## Classes 'nfnGroupedData', 'nfGroupedData', 'groupedData' and 'data.frame':   84 obs. of  5 va
riables:
##  $ Plant    : Ord.factor w/ 12 levels "Qn1"<"Qn2"<"Qn3"<..: 1 1 1 1 1 1 1 2 2 2 ...
##  $ Type     : Factor w/ 2 levels "Quebec","Mississippi": 1 1 1 1 1 1 1 1 1 1 ...
##  $ Treatment: Factor w/ 2 levels "nonchilled","chilled": 1 1 1 1 1 1 1 1 1 1 ...
##  $ conc     : num  95 175 250 350 500 675 1000 95 175 250 ...
##  $ uptake   : num  16 30.4 34.8 37.2 35.3 39.2 39.7 13.6 27.3 37.1 ...
##  - attr(*, "formula")=Class 'formula'  language uptake ~ conc | Plant
##   .. ..- attr(*, ".Environment")=<environment: R_EmptyEnv>
##  - attr(*, "outer")=Class 'formula'  language ~Treatment * Type
##   .. ..- attr(*, ".Environment")=<environment: R_EmptyEnv>
##  - attr(*, "labels")=List of 2
##   ..$ x: chr "Ambient carbon dioxide concentration"
##   ..$ y: chr "CO2 uptake rate"
##  - attr(*, "units")=List of 2
##   ..$ x: chr "(uL/L)"
##   ..$ y: chr "(umol/m^2 s)"
```

```
# Item 1.4 (c):
head(CO2)
```

```
##   Plant   Type  Treatment conc uptake
## 1   Qn1 Quebec nonchilled   95   16.0
## 2   Qn1 Quebec nonchilled  175   30.4
## 3   Qn1 Quebec nonchilled  250   34.8
## 4   Qn1 Quebec nonchilled  350   37.2
## 5   Qn1 Quebec nonchilled  500   35.3
## 6   Qn1 Quebec nonchilled  675   39.2
```

```
# Item 1.4 (d):
summary(CO2)
```

```
##      Plant             Type         Treatment       conc          uptake
##  Qn1    : 7   Quebec     :42   nonchilled:42   Min.   :  95   Min.   : 7.70
##  Qn2    : 7   Mississippi:42   chilled   :42   1st Qu.: 175   1st Qu.:17.90
##  Qn3    : 7                                    Median : 350   Median :28.30
##  Qc1    : 7                                    Mean   : 435   Mean   :27.21
##  Qc3    : 7                                    3rd Qu.: 675   3rd Qu.:37.12
##  Qc2    : 7                                    Max.   :1000   Max.   :45.50
##  (Other):42
```

```
# Item 1.4 (e):
is.factor(CO2$Plant)
```

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

```
is.ordered(CO2$Plant)
```

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

```
levels(CO2$Plant)
```

```
##  [1] "Qn1" "Qn2" "Qn3" "Qc1" "Qc3" "Qc2" "Mn3" "Mn2" "Mn1" "Mc2" "Mc3" "Mc1"
```

```
is.factor(CO2$Type)
```

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

```
is.ordered(CO2$Type)
```

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

```
levels(CO2$Type)
```

```
## [1] "Quebec"      "Mississippi"
```