

STAT540 Homework #1 Solution

2024-08-30

Problem 1(a)

Generate a vector x with 30 random numbers from uniform distribution, i.e., $U(0, 1)$. Show the values of x you get.

```
x <- runif(30, min=0, max=1)
x

## [1] 0.97033108 0.83172125 0.48559029 0.94307434 0.80798229 0.69893146
## [7] 0.59442157 0.12201959 0.46020885 0.00629211 0.18638541 0.47520444
## [13] 0.35038024 0.21561207 0.84490453 0.57821979 0.92089474 0.02008119
## [19] 0.64769006 0.22386209 0.34899957 0.13317287 0.06397794 0.93749153
## [25] 0.40355169 0.62507631 0.46722040 0.32753339 0.71034584 0.24823495
```

Problem 1(b)

Use the R built-in functions (find the functions on your own if you don't know them yet) to calculate the sample mean, median, and standard deviation of x .

```
sample_mean <- mean(x)
sample_mean
```

```
## [1] 0.4883137
```

```
sample_median <- median(x)
sample_median
```

```
## [1] 0.4712124
```

```
sample_sd <- sd(x)
sample_sd
```

```
## [1] 0.298868
```

The the sample mean is 0.488, the sample median is 0.471 and the sample standard deviation is 0.299.

Problem 1(c)

Run the command $y <- I(x > 0.5)$. Is y a numerical vector? Confirm or disapprove it by executing some appropriate R functions.

```
y <- I(x > 0.5)
y
```

```
## [1] TRUE TRUE FALSE TRUE TRUE TRUE TRUE FALSE FALSE FALSE FALSE FALSE
## [13] FALSE FALSE TRUE TRUE TRUE FALSE TRUE FALSE FALSE FALSE FALSE TRUE
## [25] FALSE TRUE FALSE FALSE TRUE FALSE
```

```
is.numeric(y)
```

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

```
class(y)
```

```
## [1] "AsIs"
```

```
is.logical(y)
```

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

The vector `y` is a logical vector. I can tell this because it is made up of FALSE and TRUE values. Also, using the `class()` function, it identified it as a logical vector. (Note: the “AsIs” class is applied when using the indicator function in R)

Problem 1(d)

Run the command `z=cbind(x,y)`. Is `z` a matrix or data frame? Is the second column of `z` a logic vector or numerical vector? Show the output of `summary(z)`.

```
z=cbind(x,y)
```

```
z
```

```
##           x y
## [1,] 0.97033108 1
## [2,] 0.83172125 1
## [3,] 0.48559029 0
## [4,] 0.94307434 1
## [5,] 0.80798229 1
## [6,] 0.69893146 1
## [7,] 0.59442157 1
## [8,] 0.12201959 0
## [9,] 0.46020885 0
## [10,] 0.00629211 0
## [11,] 0.18638541 0
## [12,] 0.47520444 0
## [13,] 0.35038024 0
## [14,] 0.21561207 0
## [15,] 0.84490453 1
## [16,] 0.57821979 1
## [17,] 0.92089474 1
## [18,] 0.02008119 0
## [19,] 0.64769006 1
## [20,] 0.22386209 0
## [21,] 0.34899957 0
## [22,] 0.13317287 0
## [23,] 0.06397794 0
## [24,] 0.93749153 1
## [25,] 0.40355169 0
## [26,] 0.62507631 1
## [27,] 0.46722040 0
## [28,] 0.32753339 0
## [29,] 0.71034584 1
## [30,] 0.24823495 0
```

```
is.data.frame(z)
```

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

```
is.matrix(z)
```

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

```
class(z)
```

```
## [1] "matrix" "array"
```

```
is.logical(z[, 2])
```

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

```
summary(z)
```

```
##           x           y
##  Min.      :0.006292   Min.      :0.0000
##  1st Qu.:0.229955     1st Qu.:0.0000
##  Median :0.471212     Median :0.0000
##  Mean   :0.488314     Mean    :0.4333
##  3rd Qu.:0.707492     3rd Qu.:1.0000
##  Max.    :0.970331     Max.     :1.0000
```

z (as shown from the code) is a matrix, not a dataframe. Because cbind creating a matrix. Hence, R coerces the logical y vector to convert it to 1s and 0s when combined with number values.

Problem 1(e)

What function can be used to change y into a character vector?

```
y_asChar <- as.character(y)
y_asChar
```

```
## [1] "TRUE"  "TRUE"  "FALSE" "TRUE"  "TRUE"  "TRUE"  "TRUE"  "FALSE" "FALSE"
## [10] "FALSE" "FALSE" "FALSE" "FALSE" "FALSE" "TRUE"  "TRUE"  "TRUE"  "FALSE"
## [19] "TRUE"  "FALSE" "FALSE" "FALSE" "FALSE" "TRUE"  "FALSE" "TRUE"  "FALSE"
## [28] "FALSE" "TRUE"  "FALSE"
```

```
is.character(y_asChar)
```

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

Note the “ ” around each value in the vector, as if it is a string.

Problem 1(f)

Run command `xx=diag(x)` in R. Is xx a vector or matrix? Find the length of xx by implementing `length(xx)` in R.

```
xx=diag(x)
is.vector(xx)
```

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

```
is.matrix(xx)
```

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

```
length(xx)
```

```
## [1] 900
```

Notably, `xx` is a matrix. The length of `xx` is 900.