Assignment 1 Solution

SCEM

2024-09-18

1. Create a data frame

Run the following code in Console:

```
animals <- c( "Snake", "Ostrich", "Cat", "Spider") # vector of city names
num_legs <- c(0, 2, 4, 8) # vector of populations
animals_df <-data.frame(animals,num_legs) # generating data frame
animals_df
```

```
##   animals num_legs
## 1   Snake        0
## 2 Ostrich        2
## 3     Cat        4
## 4  Spider        8
```

2. Check and delete objects

3. Create a data frame in R Scripts

4. Create a data frame in R Markdown

Step 1. Insert a block of R code.

```
animals <- c( "Snake", "Ostrich", "Cat", "Spider") # vector of city names
num_legs <- c(0, 2, 4, 8) # vector of populations
animals_df <-data.frame(animals,num_legs) # generating data frame
```

Step 2. Insert another block of code to print animals df.

```
animals_df
```

```
##   animals num_legs
## 1   Snake        0
## 2 Ostrich        2
## 3     Cat        4
## 4  Spider        8
```

5. Matrix operations

Use the seq() function to generate a sequence of numbers starting at 12 and decreasing to 2 in steps of -2.

```
x_vect = seq(12,2,-2)
print(x_vect)
```

```
## [1] 12 10  8  6  4  2
```

Now convert the vector x vect into a matrix (with 2 rows and 3 coloumns) called X, using the matrix() function

```
X = matrix(x_vect, nrow = 2, ncol = 3)
print(X)
```

```
##      [,1] [,2] [,3]
## [1,]   12    8    4
## [2,]   10    6    2
```

Next create a 2 by 2 matrix called Y consisting of a sequence of four numbers from 1-4. The matrix Y should look like this

```
Y = matrix(seq(4), 2, 2)
print(Y)
```

```
##      [,1] [,2]
## [1,]    1    3
## [2,]    2    4
```

In addition, create another 2 by 2 matrix called Z which looks as follows:

```
Z = matrix(c(4,6,8,10), 2,2)
print(Z)
```

```
##      [,1] [,2]
## [1,]    4    8
## [2,]    6   10
```

Matrix sums.

```
print(Y+Z)
```

```
##      [,1] [,2]
## [1,]    5   11
## [2,]    8   14
```

```
print(Z+Y)
```

```
##      [,1] [,2]
## [1,]    5   11
## [2,]    8   14
```

Matrix multiplication.

```
print(Y %*% X)
```

```
##      [,1] [,2] [,3]
## [1,]   42   26   10
## [2,]   64   40   16
```

Matrix element-wise multiplication.

```
print(Y*Z)
```

```
##      [,1] [,2]
## [1,]    4   24
## [2,]   12   40
```

```
print(Z*Y)
```

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

```
## [1,]    4   24
## [2,]   12   40
```

Answer Element-wise multiplication is commutative.

Matrix inverse.

Compute the matrix inverse Y^{-1} via the solve() function:

```
solve(Y)
```

```
##      [,1] [,2]
## [1,]   -2  1.5
## [2,]    1 -0.5
```

Next, check what you get from computing $Y^{-1}Y$ in R.

```
print(Y %*% solve(Y))
```

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

Answer It is an identity matrix.

Now compute $Y^{-1}X$. Your result should look like this

```
print(solve(Y) %*% X)
```

```
##      [,1] [,2] [,3]
## [1,]   -9   -7   -5
## [2,]    7    5    3
```

Can you do this without first computing Y^{-1}? Try running the help command on the solve() function by typing ? ?

```
solve(Y, X)
```

```
##      [,1] [,2] [,3]
## [1,]   -9   -7   -5
## [2,]    7    5    3
```

6. Writing a function within R

You will need to create an R script and put in the following code:

Step 1. Within your script create a short function called myFirstRFunc which takes in a single numerical argument n and outputs the sum of all those numbers strictly below n which are divisible by either 2 or 7 or both.

```
myFirstRFunc <- function(n){
  num <- 0
  for (i in 1:(n-1)){
    if (i%%2==0){
      num <- num + i
    } else if (i%%7==0){
      num <- num + i
    }
  }
  return (num)
}
```

```
print(myFirstRFunc(1000))
```

```
## [1] 284787
```

7 Further R Markdown exercises

Step 1. Within your R markdown insert a section heading called "Wave plot.

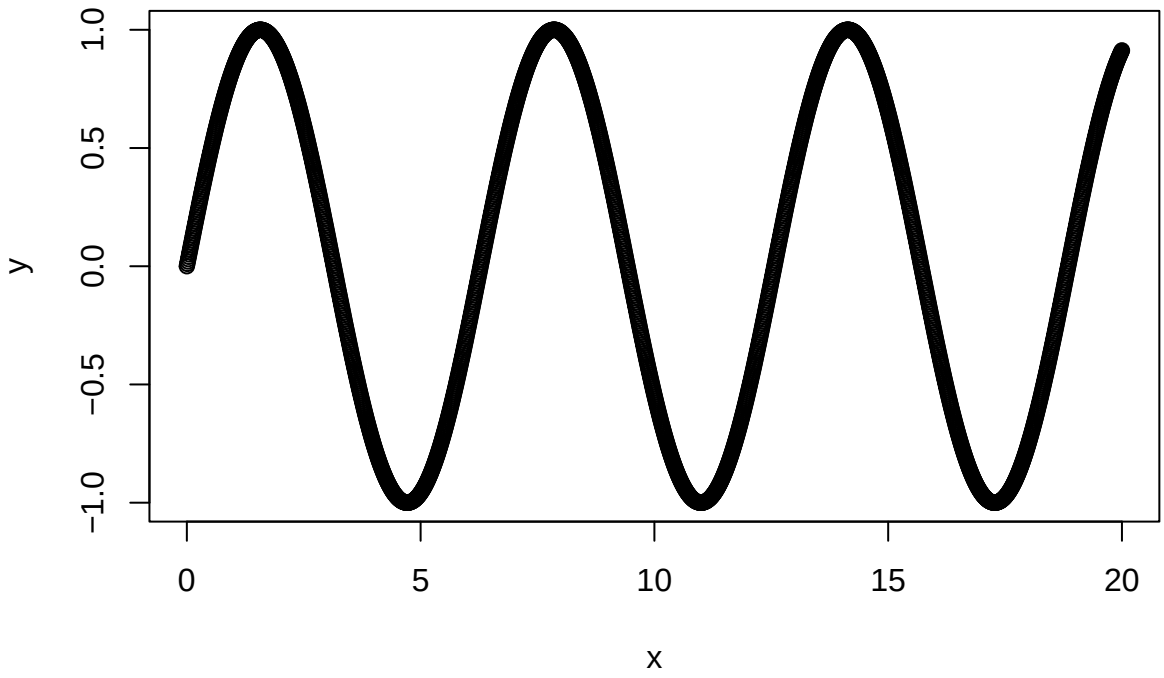
Here is the section heading: # Wave plot

Step 2. Insert a code block to do the following.

```
x = seq(0, 20, 0.01)
y = sin(x)
sin_df = data.frame(x,y)
head(sin_df,3)
```

```
##      x           y
## 1 0.00 0.000000000
## 2 0.01 0.009999833
## 3 0.02 0.019998667
```

```
plot(sin_df)
```



Step 3. Insert the following mathematical formula into your Markdown file.

$$\sin^2(x) + \cos^2(x) = 1$$

8 Version control with RStudio and git