# Matrices

## 1. Creating

# Question: Let's create a matrix mymat  
# ---  
#   
mymat <- matrix(1:12,4,3)  
  
# print out mymat  
# ---  
#   
mymat

## [,1] [,2] [,3]  
## [1,] 1 5 9  
## [2,] 2 6 10  
## [3,] 3 7 11  
## [4,] 4 8 12

# Question: Let's use the byrow=TRUE argument to create a matrix   
# by rows instead of by columns as shown below  
# ---  
mymat <- matrix(1:12,ncol=3,byrow=TRUE)  
  
# print out the mymat variable  
mymat

## [,1] [,2] [,3]  
## [1,] 1 2 3  
## [2,] 4 5 6  
## [3,] 7 8 9  
## [4,] 10 11 12

## 2. Naming

#### 2.1 Matrix Naming

# Question: Lets create the vectors kenya, ethiopia and chad  
# ---  
#   
kenya <- c(460.998, 314.4)   
ethiopia <- c(290.475, 247.900)   
chad <- c(309.306, 165.8)

#create a matrix geography\_matrix  
# ---  
#   
geography\_matrix <- matrix(c(kenya, ethiopia, chad), nrow = 3, byrow = TRUE)  
geography\_matrix

## [,1] [,2]  
## [1,] 460.998 314.4  
## [2,] 290.475 247.9  
## [3,] 309.306 165.8

#naming geography\_matrix  
# ---  
#  
location <- c("Lat", "Long")  
countries <- c("Kenya", "Ethiopia", "Chad")  
location

## [1] "Lat" "Long"

countries

## [1] "Kenya" "Ethiopia" "Chad"

#name the columns with location  
# ---  
#   
#   
colnames(geography\_matrix) <- location  
geography\_matrix

## Lat Long  
## [1,] 460.998 314.4  
## [2,] 290.475 247.9  
## [3,] 309.306 165.8

#name the rows with countries  
# ---  
rownames(geography\_matrix) <- countries  
  
# print out final geography\_matrix  
# ---  
#  
#   
geography\_matrix

## Lat Long  
## Kenya 460.998 314.4  
## Ethiopia 290.475 247.9  
## Chad 309.306 165.8

## Challenge   
# ---  
# Question: Create a matrix family with column names Name, Age, Gender and Occupation.   
# Populate it with 5 your own family members.  
# ---  
#   
  
janet <- c("Janet",35,"F","Lecturer")   
jepkoech <- c("Jepkoech",28,"F","CO")  
vincent<- c("Vincent", 26, "M","IT/DS")  
claries <- c("Claries",23,"F","Hairdressing/Lecturer")  
andrew<- c("Andrew", 20,"M","Engineer")  
  
  
family\_matrix <- matrix(c(janet, jepkoech, vincent,claries,andrew), nrow = 5, byrow = TRUE)  
  
details <- c("Name", "Age", "Gender", "Occupation")  
members <- c("Janet", "Jepkoech", "Vincent", "Claries", "Andrew")  
  
colnames(family\_matrix) <- details   
#rownames(family\_matrix) <- members  
  
family\_matrix

## Name Age Gender Occupation   
## [1,] "Janet" "35" "F" "Lecturer"   
## [2,] "Jepkoech" "28" "F" "CO"   
## [3,] "Vincent" "26" "M" "IT/DS"   
## [4,] "Claries" "23" "F" "Hairdressing/Lecturer"  
## [5,] "Andrew" "20" "M" "Engineer"

## 3. Adding a Column

You can add a row to a matrix using the rbind() function.

#### 3.1 Adding a Column

## Example   
# ---  
# Question: Create the matrix x below  
# ---  
#   
x <- matrix(1:9, nrow = 3)  
x

## [,1] [,2] [,3]  
## [1,] 1 4 7  
## [2,] 2 5 8  
## [3,] 3 6 9

# Then add a column as shown  
# ---  
#   
cbind(x, c(1, 2, 3))

## [,1] [,2] [,3] [,4]  
## [1,] 1 4 7 1  
## [2,] 2 5 8 2  
## [3,] 3 6 9 3

## Challenge   
# ---  
# Question: Add a column residence to your fictional family matrix that you had created earlier  
# ---  
#   
colnames(family\_matrix, Residence)

## [1] "Name" "Age" "Gender" "Occupation"

cbind(family\_matrix, c('Ravine', 'Kijabe', "Nairobi","Kericho","Kakamega"))

## Name Age Gender Occupation   
## [1,] "Janet" "35" "F" "Lecturer" "Ravine"   
## [2,] "Jepkoech" "28" "F" "CO" "Kijabe"   
## [3,] "Vincent" "26" "M" "IT/DS" "Nairobi"   
## [4,] "Claries" "23" "F" "Hairdressing/Lecturer" "Kericho"   
## [5,] "Andrew" "20" "M" "Engineer" "Kakamega"

## 4. Adding a Row

#### 4.1 Adding a Row

## Example   
# ---  
# Question: Creating a matrix x  
# ---  
#   
x <- matrix(1:9, nrow = 3)  
  
# You can also add a row using the cbind() function  
# ---  
#   
rbind(x,c(1,2,3))

## [,1] [,2] [,3]  
## [1,] 1 4 7  
## [2,] 2 5 8  
## [3,] 3 6 9  
## [4,] 1 2 3

## Challenge   
# ---  
# Question: Add a fictional character to your fictional family matrix  
# ---  
#   
#   
family <- rbind(family\_matrix,c("Linet","34","F","Lawyer"))  
family

## Name Age Gender Occupation   
## [1,] "Janet" "35" "F" "Lecturer"   
## [2,] "Jepkoech" "28" "F" "CO"   
## [3,] "Vincent" "26" "M" "IT/DS"   
## [4,] "Claries" "23" "F" "Hairdressing/Lecturer"  
## [5,] "Andrew" "20" "M" "Engineer"   
## [6,] "Linet" "34" "F" "Lawyer"

## 5. Selecting a Matrix

## Example   
# ---  
# Question: Select the following matrix  
# ---  
#   
x <- matrix(1:9, nrow = 3)  
  
# Select the elements from the above matrix   
# By uncommenting the following lines.  
# ---  
#   
x

## [,1] [,2] [,3]  
## [1,] 1 4 7  
## [2,] 2 5 8  
## [3,] 3 6 9

x[1,3] # select the element at 1nd row, 3rd column

## [1] 7

x[2, ] # the 2nd row

## [1] 2 5 8

x[ ,3] # the 3rd column

## [1] 7 8 9

## Challenge   
# ---  
# Question: Select the last member of your family member   
# ---  
#   
#family\_matrix  
#  
family[6,]

## Name Age Gender Occupation   
## "Linet" "34" "F" "Lawyer"

## 6. Operations

### Matrix addition & subtraction

#### 6.1 Matrix Addition & Subtraction

## Example   
# ---  
# Question: Matrix addition and subtract require the matrices to have the same dimensions.   
# Let's start by creating matrices x and y.  
# ---  
#   
x <- matrix(c(3, 9, -1, 4, 2, 6), nrow = 2)  
y <- matrix(c(5, 2, 0, 9, 3, 4), nrow = 2)

# Print matrix x  
x

## [,1] [,2] [,3]  
## [1,] 3 -1 2  
## [2,] 9 4 6

# Print matrix y  
y

## [,1] [,2] [,3]  
## [1,] 5 0 3  
## [2,] 2 9 4

#Add the matrices and print out the result  
x+y

## [,1] [,2] [,3]  
## [1,] 8 -1 5  
## [2,] 11 13 10

# Subtract the matrices  
x-y

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

### Matrix Multiplication & Division

#### 6.2 Matrix Multiplication & Division

## Challenge  
# ---  
# Question: Let's create two 2 x 3 matrices x and y  
# ---  
x <- matrix(c(3, 9, -1, 4, 2, 6), nrow = 2)  
y <- matrix(c(5, 2, 0, 9, 3, 4), nrow = 2)

#multiply these matrices, assign the result to to the variable z  
z <- x\*y  
z

## [,1] [,2] [,3]  
## [1,] 15 0 6  
## [2,] 18 36 24

#divide matrix x by y and assign the result to the variable z  
z <- x/y  
z

## [,1] [,2] [,3]  
## [1,] 0.6 -Inf 0.6666667  
## [2,] 4.5 0.4444444 1.5000000