fonts.r

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#!/usr/bin/r  
  
# Basic Properties of Matrices  
# In this chapter, we build on the notation introduced on page 5, and discuss  
# a wide range of basic topics related to matrices with real elements. Some of  
# the properties carry over to matrices with complex elements, but the reader  
# should not assume this. Occasionally, for emphasis, we will refer to “real”  
# matrices, but unless it is stated otherwise, we are assuming the matrices are  
# real.  
readline(prompt = "R>")

## R>

## [1] ""

vb\_script\_summary <- function(){  
 hap <- c(hap = 2.1, note = 1.2, top = 2.3)  
 hap  
}  
  
  
vb\_script\_summary()

## hap note top   
## 2.1 1.2 2.3

# The topics and the properties of matrices that we choose to discuss are  
# motivated by applications in the data sciences. In Chapter 8, we will consider  
# in more detail some special types of matrices that arise in regression analysis  
# and multivariate data analysis, and then in Chapter 9 we will discuss some  
# speciﬁc applications in statistics.  
eq.y = c(mx = 12.5, mp = 15.2, lp = 2.4)  
eq.y

## mx mp lp   
## 12.5 15.2 2.4

col2rgb(col = eq.y, alpha = FALSE)

## mx mp lp  
## red 0 255 255  
## green 0 255 0  
## blue 255 0 0

col\_summary <- function(df, col){  
 df <- c(state.abb)  
 col <- c(state.area)  
 c(df, col)  
}  
  
col\_summary(df = 1, col = 10)

## [1] "AL" "AK" "AZ" "AR" "CA" "CO" "CT" "DE"   
## [9] "FL" "GA" "HI" "ID" "IL" "IN" "IA" "KS"   
## [17] "KY" "LA" "ME" "MD" "MA" "MI" "MN" "MS"   
## [25] "MO" "MT" "NE" "NV" "NH" "NJ" "NM" "NY"   
## [33] "NC" "ND" "OH" "OK" "OR" "PA" "RI" "SC"   
## [41] "SD" "TN" "TX" "UT" "VT" "VA" "WA" "WV"   
## [49] "WI" "WY" "51609" "589757" "113909" "53104" "158693" "104247"  
## [57] "5009" "2057" "58560" "58876" "6450" "83557" "56400" "36291"   
## [65] "56290" "82264" "40395" "48523" "33215" "10577" "8257" "58216"   
## [73] "84068" "47716" "69686" "147138" "77227" "110540" "9304" "7836"   
## [81] "121666" "49576" "52586" "70665" "41222" "69919" "96981" "45333"   
## [89] "1214" "31055" "77047" "42244" "267339" "84916" "9609" "40815"   
## [97] "68192" "24181" "56154" "97914"

# 3.1 Basic Deﬁnitions and Notation  
# It is often useful to treat the rows or columns of a matrix as vectors. Terms  
# such as linear independence that we have deﬁned for vectors also apply to  
# rows and/or columns of a matrix.  
row.names(eq.y)  
row.script <- structure(c(mpx = 103 / 234, mpd = 106 / 234, mpr = 25 / 234),  
 class = "script"  
)  
row.script

## mpx mpd mpr   
## 0.4401709 0.4529915 0.1068376   
## attr(,"class")  
## [1] "script"

# The vector space generated by the columns  
# of the n × m matrix A is of order n and of dimension m or less, and is called  
# the column space of A, the range of A, or the manifold of A. This vector space  
# is denoted by  
range(eq.y, na.rm = FALSE)

## [1] 2.4 15.2

# (The argument of V(·) or span(·) can be either a matrix or a set of vectors.  
V.span <- SparseM::as.matrix(eq.y)  
V.span

## [,1]  
## mx 12.5  
## mp 15.2  
## lp 2.4

# Recall from Section 2.1.3 that if G is a set of vectors, the symbol span(G)  
# denotes the vector space generated by the vectors in G.) We also define the  
# row space of A to be the vector space of order m (and of dimension n or  
# less) generated by the rows of A; notice, however, the preference given to the  
# column space.  
spacetime::as.zoo(V.span)

##   
## 1 12.5  
## 2 15.2  
## 3 2.4

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# 3 Basic Properties of Matrices  
# Many of the properties of matrices that we discuss hold for matrices with  
# an infinite number of elements, but throughout this book we will assume that  
# the matrices have a kite number of elements, and hence the vector spaces  
# are of kite order and have a kite number of dimensions.  
base::sin(V.span)

## [,1]  
## mx -0.0663219  
## mp 0.4863987  
## lp 0.6754632

# Similar to our definition of multiplication of a vector by a scalar, we define  
# the multiplication of a matrix A by a scalar c as  
simplify2array(V.span, higher = TRUE)

## [,1]  
## mx 12.5  
## mp 15.2  
## lp 2.4

# The a ii elements of a matrix are called diagonal elements; an element  
# a ij with i < j is said to be “above the diagonal”, and one with i > j is  
# said to be “below the diagonal”.  
ii <- edit(V.span)  
ij <- c(sd = 2.1, diag(V.span, names = TRUE))  
ij

## sd   
## 2.1 12.5

# The vector consisting of all of the a ii ’s is  
# called the principal diagonal or just the diagonal. The elements a i,i+c k are  
# called “codiagonals” or “minor diagonals”.  
v = 26  
w = 127  
codetools::isConstantValue(v, w)

## [1] TRUE

# If the matrix has m columns, the  
# a i,m+1−i elements of the matrix are called skew diagonal elements. We use  
# terms similar to those for diagonal elements for elements above and below  
# the skew diagonal elements.  
m <- c(i = 12, m = 28)  
m + 1 + 12

## i m   
## 25 41

# If, in the matrix A with elements a ij for all i and j, a ij = a ji , A is   
# said to be symmetric. A symmetric matrix is necessarily square. A matrix A such  
# that a ij = −a hi is said to be skew symmetric. The diagonal entries of a skew  
# symmetric matrix must be 0.  
symnum(-1)

## [1] 1  
## attr(,"legend")  
## [1] 0 ' ' 0.3 '.' 0.6 ',' 0.8 '+' 0.9 '\*' 0.95 'B' 1

# A Hermitian matrix is  
# also necessarily square, and, of course, a real symmetric matrix is Hermitian.  
# A Hermitian matrix is also called a self-adjoint matrix.  
Hershey

## $typeface  
## [1] "serif" "sans serif" "script"   
## [4] "gothic english" "gothic german" "gothic italian"   
## [7] "serif symbol" "sans serif symbol"  
##   
## $fontindex  
## [1] "plain" "italic" "bold" "bold italic"   
## [5] "cyrillic" "oblique cyrillic" "EUC"   
##   
## $allowed  
## [,1] [,2]  
## [1,] 1 1  
## [2,] 1 2  
## [3,] 1 3  
## [4,] 1 4  
## [5,] 1 5  
## [6,] 1 6  
## [7,] 1 7  
## [8,] 2 1  
## [9,] 2 2  
## [10,] 2 3  
## [11,] 2 4  
## [12,] 3 1  
## [13,] 3 2  
## [14,] 3 3  
## [15,] 4 1  
## [16,] 5 1  
## [17,] 6 1  
## [18,] 7 1  
## [19,] 7 2  
## [20,] 7 3  
## [21,] 7 4  
## [22,] 8 1  
## [23,] 8 2