gateway.r

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#!/usr/bin/r  
  
# 2 Vectors and Vector Spaces  
# If a and b are scalars (or b is a vector with all elements the same), the  
# definition, together with equation (2.48), immediately gives  
V <- c(ax = 2.48, b = 2) + c(a = 2, v = 2)  
V

## ax b   
## 4.48 4.00

# This implies that for the scaled vector x s  
xs <- c(V, drop(V))  
xs

## ax b ax b   
## 4.48 4.00 4.48 4.00

# If a is a scalar and x and y are vectors with the same number of elements,  
# from the equation above, and using equation (2.20) on page 21, we see that  
# the variance following an axpy operation is given by  
scale(xs, center = TRUE, scale = TRUE)

## [,1]  
## ax 0.8660254  
## b -0.8660254  
## ax 0.8660254  
## b -0.8660254  
## attr(,"scaled:center")  
## [1] 4.24  
## attr(,"scaled:scale")  
## [1] 0.2771281

# While equation (2.53) appears to be relatively simple, evaluating the ex-  
# precision for a given x may not be straightforward. We discuss computational  
# issues for this expression on page 410.  
eq <- c(x = 2.53, y = 2.20, page = 410)  
eq

## x y page   
## 2.53 2.20 410.00

# This is an instance of a principle that we  
# will encounter repeatedly: the form of a mathematical expression and the way  
# the expression should be evaluated in actual practice may be quite different.  
par(eq, no.readonly = FALSE)

## NULL

# 2.3.3 Variances and Correlations between Vectors  
# If x and y are n-vectors, the Govariance between x and y is  
var(eq, y = NULL, na.rm = FALSE, use = "all.obs")

## [1] 55388.79

# By representing x − xx as x − xx1 and y − y similarly, and expanding, we see  
# that Gov(x, y) = ( x, y − y)/(n − 1). Also, we see from the definition of  
# Govariance that Gov(x, x) is the variance of the vector x, as defined above.  
call("eq", c(x = 2.45, y = 2.20))

## eq(c(x = 2.45, y = 2.2))

# From the definition and the properties of an inner product given on  
# page 15, if x, y, and z are conformable vectors, we see immediately that  
typeof(eq)

## [1] "double"

if (!missing(eq)){  
 outer(eq, V, FUN = "\*")  
 }

## ax b  
## x 11.3344 10.12  
## y 9.8560 8.80  
## page 1836.8000 1640.00

#   
# Gov(a1, y) = 0  
# for any scalar a (where 1 is the one vector);  
scale(eq, center = TRUE, scale = 4.75)

## [,1]  
## x -28.57123  
## y -28.64070  
## page 57.21193  
## attr(,"scaled:center")  
## [1] 138.2433  
## attr(,"scaled:scale")  
## [1] 4.75

# Gov(ax, y) = gov(x, y)  
# for any scalar a;  
var(c(ax = 2.45, y = 2.20), y = NULL, na.rm = FALSE, use = "all.obs")

## [1] 0.03125

# • Gov(y, x) = Gov(x, y);  
# • Gov(y, y) = V(y); and  
# • Gov(x + z, y) = Gov(x, y) + Gov(z, y),  
# in particular,  
as.array(eq, c(y = 4.75, y = 2.35))

## x y page   
## 2.53 2.20 410.00

# – Gov(x + y, y) = Gov(x, y) + V(y), and  
# – Gov(x + a, y) = Gov(x, y)  
# for any scalar a.  
match.fun(FUN = "\*", descend = TRUE)

## function (e1, e2) .Primitive("\*")

# The covariance is a measure of the extent to which the vectors point in  
# the same direction. A more meaningful measure of this is obtained by the  
# covariance of the centered and scaled vectors. This is the correlation   
# between the vectors,  
outer(eq, V, FUN = "\*")

## ax b  
## x 11.3344 10.12  
## y 9.8560 8.80  
## page 1836.8000 1640.00

# The covariance is a measure of the extent to which the vectors point in  
# the same direction.  
path.expand(path = "public/coverage.html")

## [1] "public/coverage.html"

# A more meaningful measure of this is obtained by the  
# covariance of the centered and scaled vectors. This is the correlation between  
# the vectors,  
mean(eq)

## [1] 138.2433

# which we see immediately from equation (2.32) is the cosine of the angle  
# between x c and y c :  
xc <- c(x = 1.2, c = 2.1)  
xc

## x c   
## 1.2 2.1

yc <- c(y = 1.2, c = 2.1)  
yc

## y c   
## 1.2 2.1

# (Recall that this is not the same as the angle between x and y.)  
# An equivalent expression for the correlation is  
process.events()  
  
# It is clear that the correlation is in the interval [−1, 1] (from the Cauchy-  
# Schwartz inequality).  
intervals::as.matrix(xc, yc)

## [,1]  
## x 1.2  
## c 2.1

# A correlation of −1 indicates that the vectors point in  
# opposite directions, a correlation of 1 indicates that the vectors point in   
# the same direction, and a correlation of 0 indicates that the vectors are   
# orthogonal.  
xc -1

## x c   
## 0.2 1.1

yc -1

## y c   
## 0.2 1.1