St. Xavier's College (Autonomous), Kolkata

Department of Statistics

MSc in Data Science

Paper code: MDTS 4113

Module 1

Linear Algebra

Handout for Problem sheet 1

1.1 Input a vector in R

Example:

 a <- c(1, 2, 3, 4)

1.2 Vector Functions used in R

Operation	Meaning
max(x)	maximum value in x
min(x)	minimum value in x
sum(x)	total of all the values in x
mean(x)	arithmetic average of the values in x
median(x)	median value in x
range(x)	vector of $\min(x)$ and $\max(x)$
var(x)	sample variance of x
cor(x,y)	correlation between vectors x and y
sort(x)	a sorted version of x
rank(x)	vector of the ranks of the values in x
order(x)	an integer vector containing the permutation to sort x into ascending order
quantile(x)	vector containing the minimum, lower quartile, median, upper quartile, and maximum of x
cumsum(x)	vector containing the sum of all of the elements up to that point
cumprod(x)	vector containing the product of all of the elements up to that point
cummax(x)	vector of non-decreasing numbers which are the cumulative maxima of the values in x up to that point
cummin(x)	vector of non-increasing numbers which are the cumulative minima of the values in x up to that point
pmax(x,y,z)	vector, of length equal to the longest of x, y or z, containing the maximum of x, y or z for the ith position in each

1.3 Transpose of vectors

Transposing a vector means turning a column (row) vector into a row (column) vector.

By default a vector is a column vector. When transposed, it becomes a row vector (1xn matrix).

t(a)

1.4 Multiplying a vector with a number

5*a

1.5 Sum of 2 vectors a and b

a+b

(Inner) product of vectors

sum(a*b)

1.6 The length (norm) of a vector

The length (or norm) of a vector a is

$$||a|| = \sqrt{a \cdot a} = \sqrt{\sum_{i=1}^{n} a_i^2}$$

sqrt(sum(a * a))

1.7 The 0–vector and 1–vector

The 0-vector is a vector with 0 on all entries.

rep(0, 5)

The 1-vector (sum vector) is a vector with 1 on all entries.

d <- rep(1, 5)

check: sum(a*d)   # reason why 1-vector is also called sum vector

1.8 Angle between 2 vectors

theta <- acos(sum(a*b) / (sqrt(sum(a * a)) * sqrt(sum(b * b))))

angle <- theta *180/pi   # in degrees from radians