Problem Set - 1 (DB)

Srijan Kundu

Aug 29, 2022

```
library(pracma)
```

Consider the vectors a = (1, 2, 3, 4, 5, 6) and b = (10, -4, 6, 0, 5, 1). Do the following:

```
a = c(1,2,3,4,5,6)
b = c(10,-4,6,0,5,1)
```

Lengths of vectors a and b:

```
sqrt(sum(a*a))
```

```
## [1] 9.539392
```

```
sqrt(sum(b*b))
```

```
## [1] 13.34166
```

Access 4^{th} element of the vector b:

```
b[4]
```

```
## [1] 0
```

Access 2^{nd} and 5^{th} th element of vector b:

```
b[2]
```

```
## [1] -4
```

```
b[5]
```

```
## [1] 5
```

Which elements of b are greater than 2?

```
which(b>2)
```

```
## [1] 1 3 5
```

Enlist the values of b greater than 2.

```
b[b>2]
```

```
## [1] 10  6  5
```

Remove the first element of the vector b.

```
c = b[-1]
c
```

```
## [1] -4  6  0  5  1
```

Find maximum and minimum element of b.

```
max(b)
```

```
## [1] 10
```

```
min(b)
```

```
## [1] -4
```

Sum of the elements of b.

```
sum(b)
```

```
## [1] 18
```

Number of elements in b which are less than 3

```
length(b[b<3])
```

```
## [1] 3
```

Sum of the elements in b that are less than 3

```
sum(b[b<3])
```

```
## [1] -3
```

Mean of the elements of b

```
mean(b)
```

```
## [1] 3
```

Median of the elements of b

```
median(b)
```

```
## [1] 3
```

Range of the elements of b

```
range(b)
```

```
## [1] -4 10
```

Variance of the elements of b

```
var(b)
```

```
## [1] 24.8
```

Correlation between vectors a and b

```
cor(a,b)
```

```
## [1] -0.2576033
```

Sort the elements of b

```
sort(b)
```

```
## [1] -4  0  1  5  6 10
```

Find the vector containing the minimum, lower quartile, median, upper quartile, and maximum of b

```
summary(b)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   -4.00    0.25    3.00    3.00    5.75   10.00
```

Vector containing the sum of all of the elements up to that point of b

```
cumsum(b)
```

```
## [1] 10  6 12 12 17 18
```

Vector containing the product of all of the elements up to that point of b

```
cumprod(b)
```

```
## [1]   10  -40 -240    0    0    0
```

Vector of non-decreasing numbers which are the cumulative maxima of the values in b up to that point

```
cummax(b)
```

```
## [1] 10 10 10 10 10 10
```

Vector of non-increasing numbers which are the cumulative minima of the values in b up to that point

```
cummin(b)
```

```
## [1] 10 -4 -4 -4 -4 -4
```

a+b

```
a + b
```

```
## [1] 11 -2  9  4 10  7
```

a-b

```
a-b
```

```
## [1] -9  6 -3  4  0  5
```

a.b

```
dot(a, b)
```

```
## [1] 51
```

2. x=(0.9982, 0.9820, 0.2020, 0.6599, 0.9345, 0.1883), y=(0.5182, 0.3012, 0.4167, 0.5364, 0.0787, 0.4995), z=(0.2659, 0.1327, 0.4406, 0.6512, 0.0318, 0.3693).

```
x = c(0.9982,0.9820,0.2020,0.6599,0.9345,0.1883)
y = c(0.5182,0.3012,0.4167,0.5364,0.0787,0.4995)
z = c(0.2659,0.1237,0.4406,0.5412,0.0318,0.3693)
```

Find parallel minima and maxima using pmin and pmax functions.

```
pmin(x, y, z)
```

```
## [1] 0.2659 0.1237 0.2020 0.5364 0.0318 0.1883
```

```
pmax(x, y, z)
```

```
## [1] 0.9982 0.9820 0.4406 0.6599 0.9345 0.4995
```

Find sum of the three largest values in x.

```
x_1 <- sort(x, decreasing = TRUE)
sum(x_1[1:3])
```

```
## [1] 2.9147
```

Find the angle between x and y.

```
theta <- acos( sum(x*y) / ( sqrt(sum(x * x)) * sqrt(sum(y * y)) ) )
angle = theta*180/pi
angle
```

```
## [1] 41.61209
```

Euclidean distance between x and y.

```
euclidean_dist <- function(x, y) sqrt(sum((x - y)^2))
euclidean_dist(x, y)
```

```
## [1] 1.25876
```

Calculate the dot product between x and y.

```
dot(x, y)
```

```
## [1] 1.41879
```