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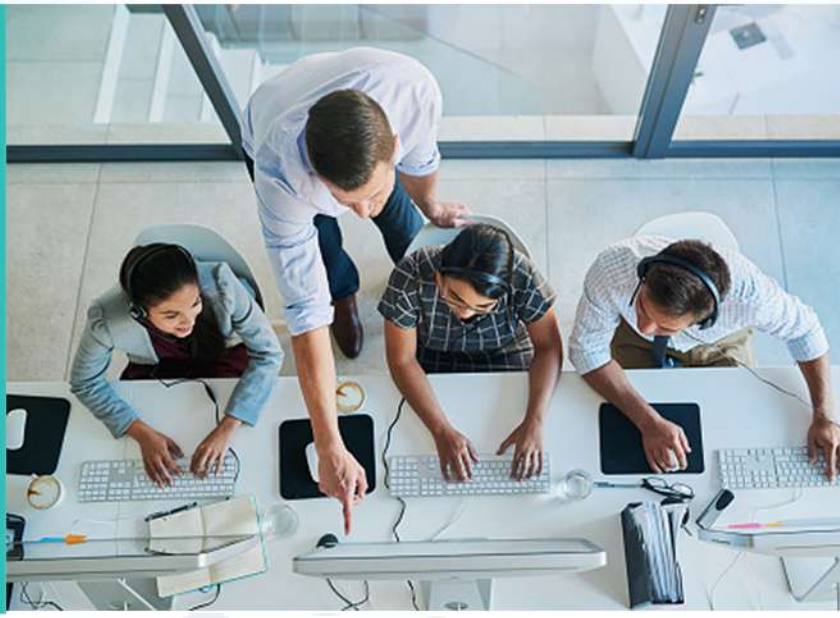

SciLab

Vector Operations in Scilab

INITIALISING VECTORS IN SCILAB

Vectors are denoted by square brackets in Scilab. A sequence of numbers separated by a comma defines a row vector. For example:

- m=[35,45,65,79,23]

m= 35. 45. 65. 79. 23.

Spaces have the same effect as a comma:

- m=[35 45 65 79 23]

m= 35. 45. 65. 79. 23.

The same data can also be arranged as a column vector. Here the sequence of numbers are separated by a semicolon

- m=[35;45;65;79;23]

```
m=  35
    45
    65
    79
    23
```

Scilab has some shorthand notations if the vector is an arithmetic progression of numbers. To define [1,2,3,4,5,6,7,8,9,10] we can command as follows:

```
A=[1:1:10]
A=1. 2. 3. 4. 5. 6. 7. 8. 9. 10
```

Here the starting number, increment value and upper limit are specified separated by a colon. Suppose we want to specify all the even numbers from 2 to 20 we proceed as follows:

```
B=[2:2:20]
B=2. 4. 6. 8. 10. 12. 14. 16. 18. 20
```

The increment (and the starting and ending values too) can also be fractions. The ending value need not be exactly calculated, the initialization would use the value closest to the ending value. For example:

```
C=[0:0.3:1]
C=0.0. 0.3. 0.6. 0.9.
```

If we are interested in creating a row vector or column vector of all elements zeros, it can be done using the function of a special zero. Let's see an example of a zero row vector of 5 elements.

- D=zeros(1,5)

D=0. 0. 0. 0. 0

Alternatively a zero column vector of 2 elements can be created as

- zeros (2,1)

ans= 0.

0.

We will later see that this function is defined generally on matrices and vectors are matrices with a number of columns or rows as one.

MATHEMATICAL OPERATIONS ON VECTORS

The various mathematical operations possible on vectors are listed as follows:

- Addition
- Subtraction
- Multiplication
- Division
- Element wise multiplication
- Element wise division
- Transpose

Now consider two vector sequences a and b to demonstrate the above operations

a=[10,20,30]

b=[1,2,3]

Addition

Addition of two vectors a and b is performed using the + operator. Both vectors must be of the same size. It is not possible to add a row vector and a column vector.

- a=[10,20,30]
- b=[5,10,15]
- a+b

ans= 15. 30. 45.

Subtraction

Subtraction uses the (-)operator. Here also both vectors have to be of the same size.

- a=[10,20,30]

- b=[5;10;15]

- a-b

ans= 5. 10. 15.

Multiplication

When multiplication is performed, one vector, either a or b, has to be a row vector and the other a column vector. In this example a is a row vector and b is a column vector.

- a=[10,20,30]
- b=[5;10;15]
- axb

ans=700

Division

The division is usually performed with a and b as row vectors

- a=[10,20,30]
- b=[5,10,15]
- a/b

ans=2

Element wise multiplication

Element wise multiplication on two sequences can be done using the (*) operator. Both vectors must necessarily be of the same size.

- a=[10,20,30]
- b=[5,10,15]
- a*b

ans= 50. 200. 450.

Element wise division

Element wise division is done on two sequences using (/) Operator. Both vectors must necessarily be of the same size.

- a=[10,20,30]
- b=[5,10,15]
- a/b

ans= 2. 2. 2.

Transpose

A row vector can be transformed into a column vector and vice versa using the (‘) operator which is mathematically called transpose.

- a=[10,20,30]

- a’
- ans=

10.

20.

30.

- b=[5;10;15]
- b’

ans= 5. 10. 15.

RELATIONAL OPERATIONS ON VECTORS

Scilab uses six relational operators for the mathematical comparison of vectors. Relational operations result in a vector of the same size, with the answer T when the relation is true and F when it is false.

“less than” relational operator<

x=[2 3 7 8], y=[2 4 5 1]

- z=x<y

z=F T F F

In the above operation, we can see that the second number 3 is less than 4. The mathematical comparison 3<4 yields True. In all the other cases the result is False.

“less than or equal to” relational operator <=

x=[2 3 7 8], y=[2 4 5 1];

- z=x>y

z=T T F F

Hence these results are false.

"greater than" relational operator>

x=[2 3 7 8], y=[2 4 5 1]

z=x>y

z=F F T T

"greater than or equal to" relational operator>=

x=[2 3 7 8], y=[2 4 5 1]

- z=x>=y

z=T F T T

"equal to" relational operator==

x=[2 3 7 8], y=[2 4 5 1]

- z= x==y

z=T F F F

"not equal to" relational operator~=

x=[2 3 7 8], y=[2 4 5 1]

- z= x~=y

z=F T T T

LOGICAL OPERATIONS ON VECTORS

Logical AND operator (&)

The operations result is a vector of the same size with the answer T when both the expression are True and F when it is false

- x=[2 3 7 8], y=[2 4 5 1]
- z=(x>y)&(x>2)

z=F F T T

Hence we can see the condition x is greater than y and that x is greater than 2 holds good for the third and fourth elements of vector x

Logical or operator(|)

The operation result in answer T if either of the expression are true

x=[0 3 7 8], y=[0 4 5 1]

- z=~(x|y)

z= F T T T

Logical Complement(~)

This operation results in answer T if the expression is false and vice versa

x=[0 3 7 8], y=[0 4 5 1]

z=~(x|y)

z= T F F F

From the operation, we can see that the result is the complement of x|y