Scilab

Manjusha Joshi

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1. Introduction

- scilab is a free software.
- It can work on windows as well as linux.
- scilab understands many mathematical data types like vectors, matrix, polynomial etc.
- scilab has inbuilt functions.
- It also allow us to do programming, in which we can use inbuilt commands e.g. rank, inv etc.
- ullet scilab is case sensitive. So V and v is different in scilab.



In scilab basic data type is vector.

$$-->$$
V= $[2,-4,5]$

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Define two vector U and V and try U + V.

U * V

U * V' What is your observation?

Try with other inbuilt functions of scilab like norm(V) size(U) etc.



Product of vectors:

Dot product and component wise product:

```
-->u

u =

1. 2. 3.

v =

2. 3. 4.
```

$$-->u.*v$$
ans =
2. 6. 12.



User define functions Rows and Columns -->u*v' ans = 20. -->u' *v ans = 2. 3. 4. 4. 6. 8. 6. 9. 12.

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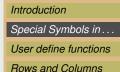
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Other interesting data type is Matrix. Here is an example of writing matrix in scilab.

$$B = [1, 2; 3, 4]$$
 $B = [1, 2; 3, 4]$

- 1. 2.
- 3. 4

Now try to write matrix A. such that $A = \begin{bmatrix} 1 & -3 & 2.4 \\ .5 & 0 & 3 \end{bmatrix}$



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With Matrix try

- A+B
- 3*A
- A*B
- B*A
- A-B



With matrix, linear algebra can be taught to students. For matrices there are in built commands like

- det(A)
- inv(A)
- size(A)
- length(A)
- spec(A)
- trace(A)
- diag(A)



2. Special Symbols in scilab

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Quit

```
-->%pi
%pi =
    3.1415927
-->%i
%i =
    i
-->%e
%e =
    2.7182818
-->%inf
%inf =
   Inf
```

-->%eps

%eps =

```
-->format(5)
 -->%e
 %e =
    2.72
-->format(20)
-->%e
 %e
    2.71828182845904509
```



Other function with matrices are:

- 1. 0. 0. 0. 1. 0.
- 0. 0. 1.
- zeros(3,2)
- ones(3,2)
- clean(inv(A))
- •
- -->int(10*rand(3,3)) ans =
 - 8. 9. 3
 - 6. 2. 2.
 - 3. 3. 5

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3. Rows and Columns

Consider matrix A

- 2. 3. 4.
- 4. 6. 8.
- 6. 9. 12.

Now to obtain 1st row: -->A(1,:)

2. 3. 4.

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To change
$$R_1 \rightarrow 2R_1$$

-->A(1,:)=2*A(1,:)

$$A =$$

To change
$$C_1 \to 5C_1$$

-->A(:,1)=5*A(:,1)

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To perform operation as
$$R_1 \rightarrow R_1 - R_2$$
 $-->A(1,:)=A(1,:)-A(2,:)$

$$A =$$

To perform operation as $R_2 \to R_2 - \frac{2}{3}R_3$ --> A (2,:) = A (2,:) - (2/3) *A (3,:)

$$A =$$

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4. Row Reduced Echelon Form

$$-->A=[4 -2 3; 12 2 -7; 20 -2 -1]$$

$$-->B=[3; -2; 4]$$
B =

4.

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```
-->rank(A)
ans =

2.

-->rank([A B])
ans =
```

The system of equations is consistant and it will have infinitely many solutions which can be given in terms of a parameter t.



Hence the solution to the system of equations AX = B is given by

$$x = 0.25t + 0.0625$$

 $y = 2t - 1.375$
 $z = t$

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$$X =$$

X

$$-->A=[x,2*x;x^2,x+3]$$

A =

x 2x

2

x 3 + x

-->det(A) ans =

 $2 \qquad 3 \\ 3x + x - 2x$

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It is also possible to find inverse of symbolic matrix. -->inv(A)

ans =

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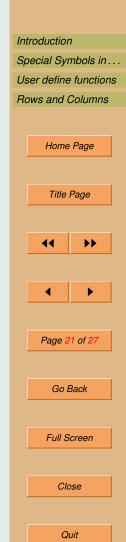
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```
Another way to define polynomial
-->poly(V,'x','coeff')
ans =

2
2 - 4x + 5x

-->poly([1,-2,3],'y','coeff')
ans =
```

1 - 2y + 3y



5. Polynomials and their roots

For odd degree polynomial with real coefficient there exists at least one real root. Also for a polynomial with real coefficient, complex roots, if any, occur in conjugate pairs.

Such results can be verified.

This property does not hold if some of the coefficients are complex.



$$-->f=(3+2*%i)*x^3+(7-%i)*x+1$$

f =

real part

$$1 + 7x + 3x$$
 imaginary part

$$-x + 2x$$

$$-0.4269950 - 1.3031021i$$

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Define Polynomial by coefficient way: -->x=poly(0,'x')

Х

$$-->v=[1,-2,3,4,-7,23]$$

V

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```
-->roots(f)
ans =

0.0993290 + 0.5705546i
0.0993290 - 0.5705546i
- 0.5850125
0.3453512 + 0.3198753i
0.3453512 - 0.3198753i
```

For odd degree polynomial with real coefficients there exists at least one real root.



Thanks!

