Scilab

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Introduction

What is `Scilab`?

A free alternative to `MATLAB`

What can it do?

1. Advanced calculator
2. Programming
3. Plotting, visualisation

Simple calculations

Try out these and see if they give expected results

```
1  2+3-4
2  4^2
3  4**4
4  6/4
5  2+(2^2-(1/2))
6  1e-3 + 1d-2
```

See what happens when you add a semicolon

```
6/4;
```

Variables

All calculations are stored by default in `ans`

```
6/4;
ans
```

You can specify a variable to store the value instead

```
pi_approx = 22/7;
```

And see its value later

```
pi_approx
disp(pi_approx)
```

More on variables

Some useful pre-defined variables

```
1 %pi
2 %e
3 %i
4 %t
5 %f
6 %inf
7 %nan
8 %eps
```

Pre-defined functions

See if the outputs of these lines are as expected

```
1 abs(-2)
2 min(3,4,5)
3 max(-2,-3,-4)
4 sin(%pi/2)
5 cos(%pi)
6 tan(%pi/4)
7 asin(1)/(%pi/2)
8 exp(2)/%e^2
9 log10(100)
10 log(%e)
```

Auto-completion: hit TAB

Other `Scilab` windows

- ▶ Variable Browser
  - Only lists user-defined variables
  - To list all variables:

    ```
    whos
    ```

  - You can delete all or specific user-defined variables

    ```
    pi_approx = 22/7;
    disp(pi_approx)
    clear pi_approx
    disp(pi_approx)
    ```

- ▶ Command History
  - Execute an old command by double clicking
  - Can also navigate using ↑ and ↓ keys
  - Clear screen using `clc`
- ▶ File Browser
  - Useful when working with multiple files

Basic matrix creation

Wrap inside `[]`, use `,` and `;` to fill rows and columns

```
x = [1,2,3]
y = [4;5;6;7]
A = [1,0;0,1]
```

Scilab will warn you if the dimensions are inconsistent

```
B = [1,2,3;4,5]
```

Adding `'` will transpose the matrix

```
B = [1,2,3;4,5,6];
B'
```

You can fill matrices with pre-existing matrices

```
row1 = [1,2,3,4];
row2 = [5,6,7,8];
M = [row1;row2]
```

Special functions for matrix creation

Creating ranges

```
i = 1:10
j = 1:2:10
x = 0:0.1:1
y = linspace(0,1,25)
```

Some useful commands for creating dummy matrices of required size

```
A = zeros(2,2)
B = ones(3,2)
M = eye(3,3)
```

Can you make sense of this result?

```
M = [[zeros(1,2);ones(1,2);eye(2,2)],ones(4,1)]
```

Matrix operations

Scalar operations affect all elements
of matrices

```
A = eye(3,3);
A*2
A/4
A+5
```

Scilab automatically figures out
matrix operations too

```
B = 2*ones(3,3)
A+B
A*B
B^2
```

Special element wise operations

```
A.+B
A.*B
A.^B
A./B
A.^2
```

Matrix functions

Most `Scilab` functions can operate element-wise on matrices

```
A = %pi/2*[0,1;2,3];
sin(A)
```

Some special functions for matrices

```
length(A)
size(A)
sum(A)
det(A)
inv(A)
trace(A)
```

Matrix indexing

Access elements using `(row,col)`

```
A = eye(3,3);
A(1,2) = 2;
A
```

A single index can also be used:
increments column-wise

```
A(4)
```

Extract rows and columns using `:`

```
A(:,2)
A(1,:)
```

Special symbol `$`

```
A($,3)
```

Arrays can also be used to access
and modify

```
A([1,2],2)
A(4,:) = [10,20,30]
```

See if this makes sense

```
A = eye(4,4);
j = [2,4];
A(1,j) = j
A([7,8]) = 50
A($,$) = -1
B = [9,10;j];
A(B) = 100
```

Strings

Wrap in `""` or `''`

```
fname = "Vachan";
lname = 'Potluri';
fname + lname
```

Function `string` converts variables to strings

```
A = eye(2,2)
string(A)
```

Saving and loading data

`Scilab` has a working directory

```
pwd
```

Working directory can be changed from File Browser

Function `save` saves user-defined variables to a file in working directory

```
x = 1.5;
A = [1,2;3,4]
save("data.dat")
```

These variables can be loaded for use later

```
listvarinfile("data.dat")
load("data.dat")
```

Accessing help

Scilab's built-in help functionality is very useful

```
help
help save
```

Exercises[1]

Exercise 1

The pressure drop Δp required for a flow rate Q in a pipe of diameter D is

$$\Delta p = 4.52 \frac{Q^{1.85}}{C^{1.7} D^{4.87}}$$

Find Δp for these combinations of flow rates and diameters:

► $Q = 50$, 100, 200, 400 and 1000

► $D = 0.5$, 1, 1, 2 and 4

Exercise 2

A magic square is a matrix in which all rows, columns and diagonals sum to same number.

❶ Generate a magic square of size 10

❷ Verify its properties

Hint: search `Scilab` help for the function `testmatrix`

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[1]Amos Gilat. *MATLAB: An Introduction with Applications*. 6th ed. Wiley, 2017.