

## Workshop: Introduction to Scilab

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Larsen and Toubro Institute of Technology, Powai, Mumbai

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### 1. Getting Started

- (a) 04:17: Perform the following calculations on the scilab command line:

$$phi = \frac{\sqrt{5} + 1}{2}$$

$$psi = \frac{\sqrt{5} - 1}{2}$$

Find  $1/phi$  and  $1/psi$

- (b) 6:06: Verify Euler's identity: Is  $e^{\pi i} + 1$  close to zero?  
Compare with  $\cos(\pi) + i\sin(\pi)$

### 2. Matrix Operations

- (a) 03:15: In Scilab, enter the following Matrices:

$$A = \begin{bmatrix} 1 & 1/2 \\ 1/3 & 1/4 \\ 1/5 & 1/6 \end{bmatrix}, \quad B = [5 \quad -2], \quad C = \begin{bmatrix} 4 & 5/4 & 9/4 \\ 1 & 2 & 3 \end{bmatrix}$$

Using Scilab commands, compute each of the following, if possible.

- |                      |                            |
|----------------------|----------------------------|
| i. $A * C$           | v. $(2 * C - 6 * A') * B'$ |
| ii. $A * B$          | vi. $A * C - C * A$        |
| iii. $A + C'$        | vii. $A * A' + C' * C$     |
| iv. $B * A - C' * A$ |                            |

Explain the errors, if any.

- (b) 04:15: From the video:
- Find  $E(:, :)$
  - Extract the second column of E
  - Extract the first and last columns of E

- (c) 05:46: If  $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 1 \\ 4 & 1 & 5 \end{bmatrix}$

Find the upper triangular form of A by using commands on rows.

- (d) 07:28: Represent the following linear system as a matrix equation. Solve the system using the inverse method:

$$\begin{aligned} x + y + 2z - w &= 3 \\ 2x + 5y - z - 9w &= -3 \\ 2x + y - z + 3w &= -11 \\ x - 3y + 2z + 7w &= -5 \end{aligned}$$

- (e) 08:01: Try solving the above system using the backslash method.
- (f) 08:38: Verify the solution from the previous question.
- (g) 09:38: Try  $\det(A)$ ,  $A^2$ ,  $A^3$  and Eigenvalues of A (from the previous question). Also multiply A by an identity matrix of the same size.

### 3. Conditional Branching

- (a) 1:20: Write a code to check if a given number  $n$  is less than equal to 10, if yes display its square.(for  $n= 4, 13$  and 10)
- (b) 2:04: Write a code to check if a number is less than 10 if yes then display  $> 10$ , if it is greater than 10 then display  $> 10$  else display the number. (for  $n= 4, 13$  and 10)
- (c) 2:26: Write the previous code in one line.
- (d) 3:09: Write a code using select case conditional construct to check whether a given number is a multiple of 10 (take 5 values/multiples) if so display it.

### 4. Iteration

- (a) 0:42: Create a vector starting from 1 to 10
- (b) 1:02: Create a vector from 2 to 20 with an increment of 3
- (c) 1:55: Write a for loop to display all the even numbers between 1 to 50
- (d) 2:55: Write a code that takes an input vector  $x=1:10$  . Displays the values of  $x$  and comes out of loop when value of  $x$  is 8.
- (e) 3:31: Write a code that takes an input vector  $x=1:2:10$  and displays only last two values of the vector.
- (f) 4:44: find summation of vector  $x = [1\ 2\ 6\ 4\ 2]$ , using iterative procedure.hint:length()add each number using for loop
- (g) 5:20: Write a code using while loop to display odd numbers from 1 to 25
- (h) 5:40: Write a code using while to which take input from 0 to 15 in increments of 1 and display number 10 and 15

### 5. Plotting

- (a) 01:12: Create a linearly spaced vector from 0 to 1 with 10 points
- (b) 01:12: Create a linearly spaced vector from 0 to 1 with 11 points
- (c) 01:35: plot  $\sin(x)$  versus  $x$ .
- (d) 02:50: Use plot2d and try changing the color to red. Also try style = -1
- (e) 03:53: Put a title: "Sine", and labels, 'x axis' and 'y axis'
- (f) 05:50: Plot  $\sin(x)$  and  $\cos(x)$  on the same window.
- (g) 06:08: Create a legend for the above plots
- (h) 09:25: Now plot  $\sin(x)$  and  $\cos(x)$  as subplots on the same window.
- (i) 10:10: Save your plot

## 6. Scripts and Functions

- (a) 02:48:
- Create a scilab script file to display time on console window. (hint: clock())
  - Create a scilab script file to display product of a matrix A and inverse of A.  
 $A = [1, 1; 1, -1]$
  - Create a scilab script file to plot 'x' vs 'sin(x)'. 'x' varies from -2p to 2p. (Use plot2d())
- (b) 05:04:
- Create a function file to calculate sum and difference of any two numbers. The output should be the sum and difference of numbers.
  - Create a function file to calculate the rowwise and columnwise mean and standard deviation of a user defined matrix. Display the matrix, its mean and standard deviation in output. (hint; mean(), stdev() )
- (c) 09:05:
- Create an inline function to sort the elements of a random vector in descending order. (hint: gsort())
  - Create an inline function to round up the elements of a vector [1.9, 2.3, -1.1, 50.5] to the nearest integer. (hint: round())
- (d) 10:30:
- Create a function file to calculate LU factorization of a matrix. (hint: lu()).
  - Create a function file to that takes two matrices A and B as input. Calculate their trace.
    - If trace of A is greater than trace of B display 1.
    - If trace of B is greater than trace of A display -1.
    - If both traces are equal display 0.
- (e) Create a function file to evaluate and plot following function for x(x varies from -1 to 1 with step size of 0.1).

$$f(x) = x^2 - \sin(x), \quad x \leq 0$$

$$x(x) = \cos(x), \quad x > 0$$

(hint : if else)

- (f) Create an inline scilab function file to 3-d plot of parametric curve (Given a=2). t = varies form 0 to  $2\pi$  (with 100 intermediate points).

$$x = a * \cos(t);$$

$$y = a * \sin(t);$$

(hint : linspace(), param3d())