

Workshop: Introduction to Scilab
Funded by the National Mission on Education through ICT
Larsen and Toubro Institute of Technology, Powai, Mumbai

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:

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

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:

- i. Find $E(:, :)$
- ii. Extract the second column of E
- iii. 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 elemets 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 vaires 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 2π (with 100 intermediate points).

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

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

(hint : linspace(), param3d())