

### Preamble

This assignment is carried out to understand basic programming constructs in Scilab such as Loops, User-defined and built-in functions, Matrices and plots.

### Exercises

**Q1.** Use Scilab built-in function ODE (ordinary differential equation) to solve the following second-order differential equation with two initial conditions. Also plot the integral curve of  $y$  with respect to  $t$ .

$$\frac{d^2 y}{dx^2} = -2y; \quad y(0) = 3; \quad y'(0) = 0;$$

Also use subplot function to illustrate the integral curve with varying initial conditions as follows.

Case A:  $y(0) = 1; y'(0) = 1$

Case B:  $y(0) = 4; y'(0) = 1$

**Q2.** Write a user defined function Map\_Matrix(A) to count the unique integers in the matrix A, and map these integers from the range (1, MAX) to (1, K) while preserving the order of the numbers (see the example below), where K is the count of unique integers in A, and MAX is the maximum value in A.

Input			Output		
7	13	25	1	2	3
123	233	254	5	8	9
169	207	50	6	7	4

a. Write a Scilab script that reads a grayscale image  $I$  and display the image; So  $I$  is a  $n \times n$  matrix where each  $I(i, j)$  is an integers from 1 to 255. (Use *imread* and *imshow* functions).

b. Find the indices of a pixel value  $p$  in  $I$ . Also find *max*, *min* of  $I$ .

b. Map the image using Map\_Matrix() function and display the image before and after mapping. Try with different grayscale images. (a sample image is shown below)



**Q3.** Write a Scilab script that generates a random integer value  $X$  in the range between 1 to 50. The script asks the user to input his guess about  $X$  and prints whether his guess is correct or not. If the guess is wrong, it has to say whether it is too low or high. Limit the number of attempts to guess  $X$  as 10. Also illustrate how the subsequent guesses converges to  $X$  through a plot taking  $i^{\text{th}}$  attempt in x-axis and guess in y-axis.

**Q4.** Write a script to compute Sigmoid function  $y = 1/(1 + \exp(-x))$ , for varying values of  $x$  in the range 1 to 100. Also draw the `plot(x,y)`.