IMSC. (MATHS & COMPUTING) - VI Sem.
LAB. ASSIGNMENT 2

COMPUTING LAB – MATLAB (**IMM6004**)

Date of Allotment: **28/01/2020** Date of Completion: **04/02/2020**

Matrices and Vector

Name	Operation(s) Performed
diag	create a matrix with a specified diagonal entries, or extract diagonal entries of a matrix
eye	create an identity matrix
ones	create a matrix filled with ones
rand	create a matrix filled with random numbers
zeros	create a matrix filled with zeros
linspace	create a row vector of linearly spaced elements
logspace	create a row vector of logarithmically spaced elements
colon notation	create a row vector with specified increment

Write a program on the following and display the output:

1. Use **diag** in MATLAB
   (a) Create a diagonal matrix with digonal entries $d = [1\ 2\ 3\ 4]$.
   (b) Find the diagonal entries of the matrix $A = [1:4; 5:8; 9:12]$.
2. Create a vector using
   (a) linspace $\begin{cases} Syntax1: & linspace(startValue, endValue) \\ Syntax2: & linspace(startValue, endValue, nelements) \end{cases}$
   (b) logspace $\begin{cases} Syntax1: & logspace(startValue, endValue) \\ Syntax2: & logspace(startValue, endValue, nelements) \end{cases}$
   (c) colon notation $\begin{cases} Syntax1: & startValue : endValue \\ Syntax2: & startValue : increment : endValue \end{cases}$
3. Write the output of the following code
   (a) A = ones(5,3),ones(5)
   (b) B = zeros(4,4)
   (c) C = eye(4)
   (d) D = rand(8)
   (e) D(:,3)
   (f) D(2,:)
   (g) D(2,3)

(h) D(3:6,3:6) = zeros(4,4)

4. Let A be a random matrix generated by **rand(8)**. Find the maximum values (a) in each column, (b) in each row, and (c) overall. Also use **find** to find the row and column indices of all elements that are larger than 0.25.

5. A *magic square* is an $n \times n$ matrix in which each integer $1, 2, \ldots, n^2$ appears once and for which all the row, column, and diagonal sums are identical. MATLAB has a command magic that returns magic squares. Check its output at a few sizes and use MATLAB to verify the summation property. (The antidiagonal sum will be the trickiest. Look for help on how to flip a matrix.)

6. Are the following true or false? Assume A is a generic $n \times n$ matrix

   (a) `A^(-1) equal to 1/A`

   (b) `A.^(-1) equal to 1./A`

7. Suppose p is a row vector of polynomial coefficients. What does this line do?

   (length(p)-1:-1:0).*p

8. Use the MATLAB commands **eye, ones** and **tril** to generate the Wilkinson matrix W which is defined as follows:

$$W_{ij} = \begin{cases} -1 \text{ if } i > j \\ 1 \text{ if } i = j \text{ or } j = n \\ 0 \text{ otherwise} \end{cases}$$

9. (a) Use **diag** to build the 16×16 matrix

$$D = \begin{bmatrix} -2 & 1 & 0 & 0 & \ldots & 0 & 1 \\ 1 & -2 & 1 & 0 & \ldots & 0 & 0 \\ 0 & 1 & -2 & 1 & 0 & \ldots & 0 \\ \vdots & \ddots & \ddots & \ddots & \ddots & \ddots & \vdots \\ 0 & \ldots & 0 & 1 & -2 & 1 & 0 \\ 0 & 0 & \ldots & 0 & 1 & -2 & 1 \\ 1 & 0 & 0 & \ldots & 0 & 1 & -2 \end{bmatrix}$$

   (b) Now see the help about **toeplitz** and use it to build D.

   (c) Use toeplitz and whatever else you need to build

$$\begin{bmatrix} 1 & 2 & 3 & \ldots & 8 \\ 0 & 1 & 2 & \ldots & 7 \\ \vdots & \vdots & \ddots & \ddots & \vdots \\ 0 & 0 & \ldots & 1 & 2 \\ 0 & 0 & \ldots & 0 & 1 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} 1 & \frac{1}{2} & \frac{1}{3} & \ldots & \frac{1}{8} \\ \frac{1}{2} & 1 & \frac{1}{2} & \ldots & \frac{1}{7} \\ \vdots & \vdots & \ddots & \ddots & \vdots \\ \frac{1}{7} & \frac{1}{6} & \ldots & 1 & \frac{1}{2} \\ \frac{1}{8} & \frac{1}{7} & \ldots & \frac{1}{2} & 1 \end{bmatrix}$$

   The second case looks best in **format rat**.