DoS: 08-02-23

Q 1. Generate a vector d of 20 random integers in the range 1 to 6.

Q 2. Given the three matrices.

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \quad B = \begin{bmatrix} i & 1-i & 2+i \\ 0 & -1 & 3-i \\ 0 & 0 & -i \end{bmatrix} \quad C = \begin{bmatrix} 1 & 1 & 1 \\ 0 & sqrt(2)i & -sqrt(2)i \\ 1 & -1 & -1 \end{bmatrix}$$

Calculate AB - BA, $A^2 + B^2 + C^2$, ABC, $\sqrt{A} + \sqrt{B} + \sqrt{C}$, e^A $(e^B + e^C)$ and find the range, inverse, trace, determinant, condition number and singular values of A, B and C.

Q 3. Define a square matrix A of dimension 5 whose elements are random numbers.

- Extract the sub-matrix of A formed by rows 2 to 4 and columns 3 to 4.
- Delete rows 2 to 4 of matrix A, as well as column 5.
- Exchange the first and last rows of the matrix A.
- Exchange the first and last columns of the matrix A.
- Insert a column of 1s to the right of the matrix A.
- Insert a column of 1s to the left of the matrix A.
- Insert two rows of 1s at the top of matrix A.
- Perform the same operation at the bottom.

Q 4. Enter the following three matrices.

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

Create a matrix G by putting matrices A, B, and C on its diagonal and do the following operations on matrix G.

- Delete the last row and last column of the matrix.
- Extract the first 4×4 submatrix from G.
- Replace G (5, 5) with 4

- find eigen values and eigen vector of G.

Q 5. The steady-state current I, flowing in a circuit that contains a resistance R = 5, capacitance C = 10, and inductance L = 4 in series is given by

$$I = \frac{E}{\sqrt{R^2 + \left(2\pi\omega L - \frac{1}{2\pi\omega C}\right)^2}}$$

where E = 2 and ω = 2 are the input voltage and angular frequency, respectively. Compute the value of I.

Q 6. It has been suggested that the population of the United States may be modeled by the formula,

$$P(t) = \frac{197273000}{1 + e^{-0.03134(t - 1913.25)}}$$

where *t* is the date in years. Write a program to compute and display the population every *ten* years from 1790 to 2000. [**Hint:** Use vectorization]

Q 7. Evaluate:

$$K(m) = \int_0^{\pi/2} \frac{1}{\sqrt{1 - m^2 \sin^2 \theta}} d\theta$$

where *m=π/4*.

Q 8. Generate a table of conversions from degrees (first column) to radians (second column). Degrees should go from 0° to 360° in steps of 10°.

Q 9. Calculate the value of a function $f(x, y) = x^2 + y^2$ at *x=1* and *y=2*. [**Hint:** use inline command]

Q 10. Solve the differential equation in MATLAB: $\frac{dy}{dt} = ty$.