GENG-8030 Computational Methods and Modeling for Engineering Applications

Summer 2023

Tutorial 1

All questions were taken from the course textbook:

Title	MATLAB for engineering applications
Author	William J. Palm
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Chapter 1: An Overview of MATLAB

27. Use MATLAB to plot the function $T = 7 \ln t - 8e^{0.3t}$ over the interval $1 \leq t \leq 3$. Put a title on the plot and properly label the axes. The variable T represents temperature in degrees Celsius; the variable t represents time in minutes.

30. A *cycloid* is the curve described by a point P on the circumference of a circular wheel of radius r rolling along the x axis. The curve is described in parametric form by the equations

$$x = r(\phi - \sin\phi)$$
$$y = r(1 - \cos\phi)$$

Use these equations to plot the cycloid for $r = 10$ in. and $0 \leq \phi \leq 4\pi$.

35. Write a script file to compute the three roots of the cubic equation

$$x^3 + ax^2 + bx + c = 0$$

Use the `input` function to let the user enter values for a, b, and c.

Chapter 2: Numeric, Cell and Structure Arrays

10. Consider the following arrays.

$$\mathbf{A} = \begin{bmatrix} 1 & 4 & 2 \\ 2 & 4 & 100 \\ 7 & 9 & 7 \\ 3 & \pi & 42 \end{bmatrix} \qquad \mathbf{B} = \ln(\mathbf{A})$$

Write MATLAB expressions to do the following.

a. Select just the second row of **B**.

b. Evaluate the sum of the second row of **B**.

c. Multiply the second column of **B** and the first column of **A** element by element.

d. Evaluate the maximum value in the vector resulting from element-by-element multiplication of the second column of **B** with the first column of **A**.

e. Use element-by-element division to divide the first row of **A** by the first three elements of the third column of **B**. Evaluate the sum of the elements of the resulting vector.

11.* *a.* Create a three-dimensional array **D** whose three "layers" are these matrices:

$$\mathbf{A} = \begin{bmatrix} 3 & -2 & 1 \\ 6 & 8 & -5 \\ 7 & 9 & 10 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 6 & 9 & -4 \\ 7 & 5 & 3 \\ -8 & 2 & 1 \end{bmatrix} \quad \mathbf{C} = \begin{bmatrix} -7 & -5 & 2 \\ 10 & 6 & 1 \\ 3 & -9 & 8 \end{bmatrix}$$

b. Use MATLAB to find the largest element in each layer of **D** and the largest element in **D**.

23.* The mechanical work W done in using a force F to push a block through a distance D is $W = FD$. The following table gives data on the amount of force used to push a block through the given distance over five segments of a certain path. The force varies because of the differing friction properties of the surface.

	Path segment				
	1	**2**	**3**	**4**	**5**
Force (N)	400	550	700	500	600
Distance (m)	3	0.5	0.75	1.5	5

Use MATLAB to find (*a*) the work done on each segment of the path and (*b*) the total work done over the entire path.

27. The potential energy stored in a spring is kx2/2, where k is the spring constant and xis the compression in the spring. The force required to compress the spring is kx. The following table gives the data for five springs:

	Spring				
	1	2	3	**4**	5
Force **(N)**	II	7	8	10	9
Spring constant k (N/111)	1000	600	900	1300	700

Use MATLAB to find *(a)* the compression x in each spring and *(b)* the potential energy stored in each spring.