Problems for 2/9/2024

Engineering 104 - Fundamentals of Engineering Computing

Formatting, Organization & Code Comments - Complete the following problems in `Python` and include as part of the submission of the appropriate assignment. Your assignment file should include a proper heading, comments and show clear organizational structure with each problem clearly printed, separated and with each result variable clearly displayed. All problems worked should have a formatted/structured print-out. Print a string denoting each problem, with the solution to the problem clearly printed as a formatted string below the denoted problem. Separate each problem using a blank line in both the code and the printed results. Code comments should be completed throughout the file on every line of code by default. If this assignment requires you to write and submit additional auxiliary script, or any other files in the submission, please append your initials capitalized to the end of the file name.

Python, Lecture #12 Problems - Arrays I (12 Points)

Problem 12.1 (1 Point) - Define the variables $x = 3.4$ *and* $y = 5.8$ *and then use them to create an array/vector (assign it to a variable named e) that has the following elements:* x/y, $x + y$, xy, $cos(x)$, $y2$, *and* x.

Problem 12.2 (1 Point) - Define the array $s = \begin{bmatrix} 1 & 3 & 5 & 7 \end{bmatrix}$. *Use this vector in mathematical expressions to create the following arrays:*

$$a = \begin{bmatrix} 3 & 9 & 15 & 21 \end{bmatrix} \qquad b = \begin{bmatrix} 1 & 9 & 25 & 49 \end{bmatrix} \qquad c = \begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix} \qquad d = \begin{bmatrix} 6 & 6 & 6 & 6 \end{bmatrix}$$

Problem 12.3 (2 Point) - Using `arange` *and* `linspace` *commands, create a row vector array that starts at a value of 5 and ends at 50 with 25 evenly spaced increments. Print a statement that states which of the two methods was easier for this particular problem and why.*

Problem 12.4 (2 Points) - Using `arange` *and* `linspace` *commands, create a row vector array that starts at a value of 3 and ends at 42 with increments of 3. Print a statement that states which of the two methods was easier for this particular problem and why.*

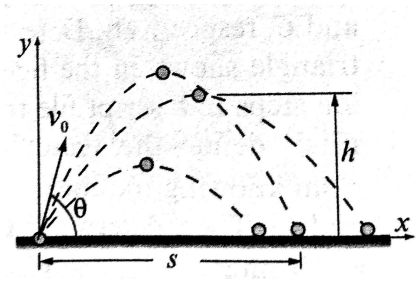
Problem 12.5 (2 Points) - Create the following matrices by typing one command. Do not type individual elements explicitly. You may have to research array operations such as transpose, `reshape`*,* `vstack` *and* `hstack` *[Hint: Try completing in multiple steps and then try and combine the steps].*

$$D = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 8 & 6 & 4 & 2 \end{bmatrix} \qquad E = \begin{bmatrix} 0 & 0 & 0 & 0 & 8 \\ 0 & 0 & 0 & 0 & 7 \\ 0 & 0 & 0 & 0 & 6 \end{bmatrix}$$

Problem 12.6 (2 Points) - The maximum distance s and the maximum height h that a projectile shot at an angle θ are given by:

$$s = \frac{v_0^2}{g} sin2\theta \qquad h = \frac{v_0^2 sin^2\theta}{2g}$$

where v_0 is the initial shooting velocity and $g = 9.81 m/s^2$. Determine $s(\theta)$ for $\theta = 15°, 25°, 35°, 45°, 55°, 65°, 75°$ if $v_0 = 275\ m/s$).



Problem 12.7 (2 Points) - The radius, r, of a sphere can be calculated from its volume, V, and the surface area S from the radius, r using the following equations:

$$r = \sqrt[3]{\frac{3V}{4\pi}} \qquad S = 4\pi r^2$$

Determine the radius and surface area of spheres with volumes of 4,000, 3,500, 3,000, 2,500, 2,000, 1,500 and 1,000 in^3. The values of r and S that are displayed should be rounded to the nearest hundredth of an inch.