Lab 2
APPLIED LINEAR ALGEBRA FOR IT - 501032

1 Exercises

Exercise 1: Write a command to create vectors and get the number of elements in each vector. $\mathbf{x} = \begin{pmatrix} 1 & 3 & 5 & 2 & 9 \end{pmatrix}$ and $\mathbf{y} = \begin{pmatrix} -1 & 3 & 15 & 27 & 29 \end{pmatrix}$

Exercise 2: Write a command to create the following vectors with n elements (user-defined variable)

(a) $\mathbf{b} = \begin{pmatrix} 12 & 14 & 16 & 18 & 20 & 22 & 24 & 26 & 28 & 30 & 32 & \dots \end{pmatrix}$

(b) $\mathbf{c} = \begin{pmatrix} 31 & 33 & 35 & 37 & 39 & 41 & 43 & 45 & 47 & 49 & 51 & \dots \end{pmatrix}$

(c) $\mathbf{x} = \begin{pmatrix} \dots & -5 & -4 & -3 & -2 & -1 & 0 & 1 & 2 & 3 & 4 & 5 & \dots \end{pmatrix}$, (It notes that $n_{new} = 2n + 1$)

(d) $\mathbf{y} = \begin{pmatrix} \dots & 5 & 4 & 3 & 2 & 1 & 0 & -1 & -2 & -3 & -4 & -5 & \dots \end{pmatrix}$, (It notes that $n_{new} = 2n + 1$)

(e) $\mathbf{z} = \begin{pmatrix} 10 & 8 & 6 & 4 & 2 & 0 & -2 & -4 \end{pmatrix}$

(f) $\mathbf{w} = \begin{pmatrix} 1 & \frac{1}{2} & \frac{1}{4} & \frac{1}{8} & \frac{1}{16} & \frac{1}{32} & \frac{1}{64} & \frac{1}{128} & \dots \end{pmatrix}$

(g) $\mathbf{d} = \begin{pmatrix} 1 & 1 & \frac{1}{2} & \frac{1}{3} & \frac{1}{5} & \frac{1}{8} & \frac{1}{13} & \frac{1}{21} & \dots \end{pmatrix}$

(h) $\mathbf{e} = \begin{pmatrix} \frac{1}{2} & \frac{1}{3} & \frac{1}{5} & \frac{1}{7} & \frac{1}{11} & \frac{1}{13} & \frac{1}{17} & \frac{1}{19} & \frac{1}{23} & \dots \end{pmatrix}$

(i) $\mathbf{a} = \begin{pmatrix} 1 & 3 & 6 & 10 & 15 & 21 & 28 & 36 & \dots \end{pmatrix}$

(j) $\mathbf{n} = \begin{pmatrix} \frac{1}{2} & \frac{1}{5} & \frac{1}{10} & \frac{1}{17} & \dots \end{pmatrix}$

(k) $\mathbf{p} = \begin{pmatrix} 0 & \frac{1}{2} & \frac{2}{3} & \frac{3}{4} & \frac{4}{5} & \dots \end{pmatrix}$

(l) Create **o** vector that contains the characters from *'a'* to *'z'*

(m) Create **s** vector that contains the characters $\begin{pmatrix} 'A' & 'D' & 'G' & 'J' & \dots \end{pmatrix}$

Exercise 3: Write a command to create the following vector by logarithmic spacing method
$\mathbf{x} = \begin{pmatrix} 10^1 & 10^2 & 10^3 & 10^4 & 10^5 & \dots & 10^n \end{pmatrix}$

Exercise 4: Let two vectors $\mathbf{x} = \begin{pmatrix} 1 & 2 & 3 \end{pmatrix}$ and $\mathbf{y} = \begin{pmatrix} 98 & 12 & 33 \end{pmatrix}$. Write a command to create a vector $\mathbf{z} = \begin{pmatrix} 1 & 2 & 3 & 98 & 12 & 33 \end{pmatrix}$ from **x** and **y**.

Exercise 5: Let two vectors $\mathbf{x} = \begin{pmatrix} 1 & 2 & 3 \end{pmatrix}$ and $\mathbf{y} = \begin{pmatrix} 4 & 5 & 6 \end{pmatrix}$. Write a command to create a vector $\mathbf{z} = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$

Exercise 6: Let $\mathbf{x} = \begin{pmatrix} 0 & 2 & 4 & 6 & 8 & 10 & 12 & 14 & 16 & 18 & 20 \end{pmatrix}$. Write a command to perform the following:

(a) Take the first sixth elements in the vector $\mathbf{x}$

(b) Take the last fifth elements in the vector $\mathbf{x}$

(c) Take the first, fourth, and last elements in the vector $\mathbf{x}$

(d) Take the first, third, fifth, and seventh elements in the vector $\mathbf{x}$

(e) Take the elements with the odd indices in the vector $\mathbf{x}$

(f) Take the elements with the even indices in the vector $\mathbf{x}$

Exercise 7: Let $\mathbf{x} = \begin{pmatrix} 3 & 11 & -9 & -131 & -1 & 1 & -11 & 91 & -6 & 407 & -12 & -11 & 12 & 153 & 371 \end{pmatrix}$

(a) Find the maximize in the vector $\mathbf{x}$.

(b) Find the minimize in the vector $\mathbf{x}$.

(c) Find the index of the values of $\mathbf{x}$ that are greater than 10.

(d) Write command to reverse $\mathbf{x}$ vector.

(e) Write command to sort $\mathbf{x}$ vector in ascending order.

(f) Write command to sort $\mathbf{x}$ vector in descending order.

(g) Write command to count how many times have that $x_i + x_j = 0, (i \neq j)$.

(h) Write command to count total number of duplicate elements in $\mathbf{x}$ vector.

(i) Write command to create a new $\mathbf{y}$ vector which $y_i = x_i + x_{n-i-1}$, where n is the length of $\mathbf{x}$ vector.

(j) Write command to create a new $\mathbf{w}$ vector which contains Armstrong/ Narcissistic numbers in $\mathbf{x}$ vector.

> **Hint:** Definition of ***Armstrong/ Narcissistic*** number: a given number base $\mathbf{b}$ is a number that is the sum of its own digits each raised to the power of the number of digits. For example, the number 153 in base $b = 3$ is a Narcissistic number, because $b = 3$ and $153 = 1^3 + 5^3 + 3^3$

(k) Write command to delete all negative numbers in $\mathbf{x}$ vector.

(l) Write command to find median value in $\mathbf{x}$ vector.

(m) Write command to calculate the sum of all values which are less than mean value in $\mathbf{x}$ vector.

(n) Write command to create a new vector which each negative value is replaced by its absolute value.