

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. $\mathbf{x} = (1 \ 3 \ 5 \ 2 \ 9)$ and $\mathbf{y} = (-1 \ 3 \ 15 \ 27 \ 29)$

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

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

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

(c) $\mathbf{x} = (\dots \ -5 \ -4 \ -3 \ -2 \ -1 \ 0 \ 1 \ 2 \ 3 \ 4 \ 5 \ \dots)$

(d) $\mathbf{y} = (\dots \ 5 \ 4 \ 3 \ 2 \ 1 \ 0 \ -1 \ -2 \ -3 \ -4 \ -5 \ \dots)$

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

(f) $\mathbf{w} = \left(1 \ \frac{1}{2} \ \frac{1}{4} \ \frac{1}{8} \ \frac{1}{16} \ \frac{1}{32} \ \frac{1}{64} \ \frac{1}{128} \ \dots\right)$

(g) $\mathbf{d} = \left(1 \ 1 \ \frac{1}{2} \ \frac{1}{3} \ \frac{1}{5} \ \frac{1}{8} \ \frac{1}{13} \ \frac{1}{21} \ \dots\right)$

(h) $\mathbf{e} = \left(\frac{1}{2} \ \frac{1}{3} \ \frac{1}{5} \ \frac{1}{7} \ \frac{1}{11} \ \frac{1}{13} \ \frac{1}{17} \ \frac{1}{19} \ \frac{1}{23} \ \dots\right)$

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

(j) $\mathbf{n} = \left(\frac{1}{2} \ \frac{1}{5} \ \frac{1}{10} \ \frac{1}{17} \ \dots\right)$

(k) $\mathbf{p} = \left(0 \ \frac{1}{2} \ \frac{2}{3} \ \frac{3}{4} \ \frac{4}{5} \ \dots\right)$

(l) Create \mathbf{o} vector that contains the characters from 'a' to 'z'

(m) Create \mathbf{s} vector that contains the characters ('A' 'D' 'G' 'J' ...)

Exercise 3: Write a command to create the following vector by logarithmic spacing method

$$\mathbf{x} = (10^1 \ 10^2 \ 10^3 \ 10^4 \ 10^5 \ \dots \ 10^n)$$

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

Exercise 5: Let two vectors $\mathbf{x} = (1 \ 2 \ 3)$ and $\mathbf{y} = (4 \ 5 \ 6)$. Write a command to create a vector

$$\mathbf{z} = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$$

Exercise 6: Let $\mathbf{x} = (0 \ 2 \ 4 \ 6 \ 8 \ 10 \ 12 \ 14 \ 16 \ 18 \ 20)$. 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 $\mathbf{x} = (3 \ 11 \ -9 \ -131 \ -1 \ 1 \ -11 \ 91 \ -6 \ 407 \ -12 \ -11 \ 12 \ 153 \ 371)$

- (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.