chapter 2:

TP 5
P 1

1. write a comprehension that would plot a line of 51 points, connecting points [2,1] and [4,3]. your graph should have a scale of 10 and your code should just be one line.

2nd parameter of plot function should be 10

Solution

[4,3] - [2,1] = [2,2]

plot(add2(scalar_vector_mult(i/50, [2,2]), [2,1])
for i in range(51)], 10)

51 points - 1 = 50

final answer

scalar_vector_mult is used for the points creation between the difference of the coordinates (i.e. [2,2]) and the origin([0,0]) add2 is then used to adjust the source coordinate to be the coordinate subtracted (i.e. [2,1] instead of [0,0]. In other words, it does a translation.

Convex Combination

- An expression of the form $\alpha u + \beta V$ where $\alpha, \beta \geq 0$ and $\alpha + \beta = 1$ is called a convex combination of u and V.
- The result is a vector, not a scalar.
- convex combination is used for convex hulls, which are used for collision detection/avoidance.
- vectors must be equal in size

ex: $u = [25]$ Provide the convex combination

$V = [75]$

$\alpha = .25$

$\beta = .75$

Solution:

$.25[25] + .75[75] = [6.25] + [56.25] = [62.5]$

ex: $u = \begin{bmatrix} 16 \\ 8 \end{bmatrix}$ $\alpha = .5$

$V = \begin{bmatrix} 12 \\ 15 \end{bmatrix}$ $\beta = .5$

Solution:

$\alpha u + \beta V = .5 \begin{bmatrix} 16 \\ 8 \end{bmatrix} + .5 \begin{bmatrix} 12 \\ 15 \end{bmatrix} = \begin{bmatrix} 8 \\ 4 \end{bmatrix} + \begin{bmatrix} 6 \\ 7.5 \end{bmatrix} = \begin{bmatrix} 14 \\ 11.5 \end{bmatrix}$

Dot product

- For two D-vectors u and V, the dot product is the sum of the product corresponding entries:

$$u \cdot v = \sum_{k \in D} u[k]\, v[k]$$

- u and v need to be the same size
- the result is a scalar
- used in matrix multiplication.

ex: Find the dot product:

$u = [5, 3, 2, 19, 2]$

$v = [1, 2, 3, 4, 5]$

Solution:

$u \cdot v = 5 \times 1 + 3 \times 2 + 2 \times 3 + 19 \times 4 + 2 \times 5 = 103$

matrix multiplication

- multiplying matrices to create a new matrix.
- If multiplying A and B (i.e. $A \times B$), assuming A and B are matrices, then the column count of A should equal the row count of B. Otherwise, you can't multiply.
- Not commutative:

  $A \times B \neq B \times A$
- You use dot product in your multiplication steps.