Properties of inner products

Quiz, 5 questions

4.5/5 points (90%)



Congratulations! You passed!

Next Item



1/1 point

1

The function

$$\beta(\mathbf{x}, \mathbf{y}) = \mathbf{x}^T \begin{bmatrix} 2 & -1 \\ -1 & 1 \end{bmatrix} \mathbf{y}$$

is



not symmetric

Un-selected is correct



symmetric



Correct

Yes:
$$\beta(\mathbf{x}, \mathbf{y}) = \beta(\mathbf{y}, \mathbf{x})$$



bilinear

Correct

Yes:

- ullet eta is symmetric. Therefore, we only need to show linearity in one argument.
- For any $\lambda \in \mathbb{R}$ it holds that $\beta(\mathbf{x} + \lambda \mathbf{z}, \mathbf{y}) = \beta(\mathbf{x}, \mathbf{y}) + \lambda \beta(\mathbf{z}, \mathbf{y})$. This holds because of the rules for vector-matrix multiplication and addition.



positive definite



Quiz, 5 questions

Yes the matrix has only positive eigenvalues and $eta(\mathbf{x},\mathbf{x})>0$ for all $\mathbf{x}
eq \mathbf{0}$ and

	res, the matrix has only positive eigenvalues and $p(\mathbf{x}, \mathbf{x}) >$	0 101	all 2
Drat	perties of imper-products		
101	JOINTED TO SENT STREET		
	F (,)		

4.5/5 points (90%)

not positive definite

Un-selected is correct

not bilinear

Un-selected is correct

not an inner product

Un-selected is correct

an inner product

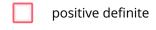
It's symmetric, bilinear and positive definite. Therefore, it is a valid inner product.

0.50 / 1 point

The function

$$\beta(\mathbf{x}, \mathbf{y}) = \mathbf{x}^T \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \mathbf{y}$$

is



This should not be selected

Try to compute $\beta(\mathbf{x}, \mathbf{x})$ with $\mathbf{x} = [1, 1]^T$.

not an inner product

This should be selected

Properties of inner products Quiz, 5 questions of bilinear

4.5/5 points (90%)

Un-selected is correct

not positive definite

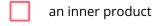
This should be selected

bilinear

Correct

Correct:

- β is symmetric. Therefore, we only need to show linearity in one argument.
- $\beta(\mathbf{x} + \lambda \mathbf{z}, \mathbf{y}) = \beta(\mathbf{x}, \mathbf{y}) + \lambda \beta(\mathbf{z}, \mathbf{y})$. This holds because of the rules for vector-matrix multiplication and addition.



This should not be selected

No, it is not positive definite.

symmetric

Correct

Correct: $\beta(\mathbf{x}, \mathbf{y}) = \beta(\mathbf{y}, \mathbf{x})$

not symmetric

Un-selected is correct



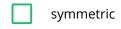
1/1 point

3.

Properties of inner products Quiz, 5 questions $\beta(\mathbf{x}, \mathbf{y}) = \mathbf{x}^T \begin{bmatrix} 2 & 1 \\ -1 & 1 \end{bmatrix} \mathbf{y}$

4.5/5 points (90%)

is



Un-selected is correct

not symmetric

Correct

Correct: If we take $\mathbf{x} = [1, 1]^T$ and $\mathbf{y} = [2, -1]^T$ then $\beta(\mathbf{x}, \mathbf{y}) = 0$ but $\beta(\mathbf{y}, \mathbf{x}) = 6$. Therefore, β is not symmetric.

bilinear

Correct

Correct.

not bilinear

Un-selected is correct

an inner product

Un-selected is correct

not an inner product

Correct

Correct: Symmetry is violated.



1/1 point

4

The function Properties of inner products

4.5/5 points (90%)

Quiz, 5 questions $\beta(\mathbf{x}, \mathbf{y}) = \mathbf{x}^T \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \mathbf{y}$

is

not bilinear

Un-selected is correct

not positive definite

Un-selected is correct

bilinear

Correct

It is the dot product, which we know already. Therefore, it is positive bilinear.

positive definite

Correct

It is the dot product, which we know already. Therefore, it is positive definite.

not an inner product

Un-selected is correct

symmetric

Correct

It is the dot product, which we know already. Therefore, it is symmetric.

not symmetric

Un-selected is correct

an inner product

 $\begin{array}{l} Prop \mbox{\it errites} \ of \ inner \ products \\ \mbox{\it Quiz, 5 questions} \ dot \ product, \ which \ we \ know \ already. \ Therefore, it is also \ an \ inner \ product. \end{array}$

4.5/5 points (90%)



1/1 point

5.

For any two vectors $\mathbf{x}, \mathbf{y} \in \mathbb{R}^2$ write a short piece of code that defines a valid inner product.

```
import numpy as np
 2
 3
    def dot(a, b):
      """Compute dot product between a and b.
 4
 5
        a, b: (2,) ndarray as R^2 vectors
 6
 7
 8
      Returns:
9
        a number which is the dot product between a, b
10
11
12
      dot_product = a.T @ np.eye(a.shape[0]) @ b
13
14
      return dot_product
15
16 # Test your code before you submit.
                                                                                         Run
17
   a = np.array([1,0])
18 b = np.array([0,1])
                                                                                         Reset
   print(dot(a,b))
```

Correct Response

Good job!

