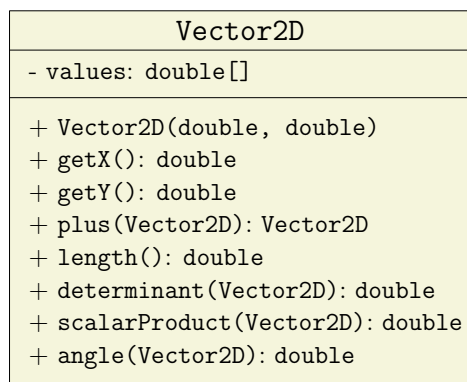


Java Tutorial – Exercise 3

Before working on this exercise, please watch the videos of the tutorial until Chapter 12. Links to these videos can be found under:

<https://www.geoinfo.uni-bonn.de/en/teaching/java-tutorial>

Task 1



Given the UML diagram above, implement the Java class `Vector2D`. The class has the attribute `values` of type `double[]` defining the x and y component of a 2D vector. Implement the following methods.

1. A constructor `Vector2D(double, double)` for the instantiation of new vectors, which expects two parameters for setting the attribute `values`.
2. The two getters `getX()` and `getY()` which return the x and y component, respectively.
3. A method `plus(Vector2D)` that adds two vectors and returns the sum as a new vector.
4. A method `length()` that returns the length of a vector.
5. A method `determinant(Vector2D)`, such that `a.determinant(b)` yields the determinant of the matrix (a, b).
6. A method `scalarProduct(Vector2D)` that returns the scalar product of two vectors.
7. A method `angle(Vector2D)` that returns the angle between two vectors. Use the two methods `length()` and `scalarProduct(Vector2D)` to calculate the angle.

Given two vectors

$$\vec{v}_1 = \begin{pmatrix} 4.0 \\ 6.5 \end{pmatrix} \quad \text{and} \quad \vec{v}_2 = \begin{pmatrix} 5.0 \\ 1.5 \end{pmatrix}, \quad (1)$$

instantiate \vec{v}_1 and \vec{v}_2 as objects of class `Vector2D` in the method `main`. Compute the lengths of both vectors as well as the vector sum, the determinant $\vec{v}_1.\text{determinant}(\vec{v}_2)$, the scalar product and the angle between them.