

Java Tutorial – Exercise 4

Before working on this exercise, please watch the videos of the tutorial until Chapter 15. Links to these videos can be found under:

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

Task 1

Point	Polygon	Building
- x: double - y: double	- vertices: Point[]	- footprint: Polygon - floorCount: int
+ Point(double, double) + getX(): double + getY(): double	+ Polygon(Point[]) + getVertices(): Point[] + area(): double	+ Building(Polygon, int) + getFootprint(): Polygon + getFloorCount(): int + totalArea(): double + readBuilding(String): Building + writeBuilding(String, Building)

Implement the Java classes **Point**, **Polygon** and **Building** according to the UML diagrams above. A polygon with n vertices is represented by an array of $n + 1$ vertices of the class **Point**, such that the first and last vertex are the same. A building contains information about its footprint as type **Polygon** and the number of floors as **int**. For each class, implement a constructor and the getter methods. Further, write the following methods.

1. A method **area()** in the class **Polygon** that returns a polygon's area A using the equation

$$A = \frac{1}{2} \sum_{i=1}^n (x_i - x_{i+1}) \cdot (y_i + y_{i+1}), \quad (1)$$

where $P_i = (x_i, y_i)$ is the i -th vertex (i.e., point) of the polygon. We assume $P_{n+1} = P_1$. Hence, a polygon with n vertices is represented by an array with $n + 1$ point elements.

2. A method **totalArea()** in the class **Building** that returns the total area of a building assuming that each floor has the same size. That is, the area of a building is equal to the area of the building's footprint times its number of floors.
3. A method **readBuilding(String)** in the class **Building** which reads a text file and returns a new instance of the class **Building**. The input **String** shall be the name of a file that consists of two lines of text. The first line contains an integer number

representing the number of floors of the building. The second line contains the building's footprint in WKT format.

Note: Use the method `Integer.parseInt(String)` to convert a `String` to a variable of type `int`. Use the method `countTokens` of the Java class `StringTokenizer` to determine the number of vertices of the polygon in the input.

4. A method `writeBuilding(String, Building)` in the class `Building` that writes information of a building to a text file with one line in the format

floorCount, footprint in WKT format, area of footprint, total area

As an example, such a line of text could be

4, POLYGON ((...)), 4265.245, 17060.98

As input, the method expects the name of the output file and a building.

Given the file `input.txt`, use the method `readBuilding(String)` to read the file and import an object of type `Building`. Compute both the area of the building's footprint as well as its total area and write a file `output.txt` using the method `writeBuilding(String, Building)`.