Data Management and Artificial Intelligence
Homework 13

Task 1 *Monte Carlo Simulation for computing the integral under a function*

In this exercise, we want to use Monte Carlo Simulation for computing the integral of the function $f = \sin(x)$ in an interval $[xmin, xmax]$. Please perform the following steps, in order to obtain a solution:

1. Implement a Python function f , which the function value of parameter x (here: sin).

2. Implement a Python function which estimates a lower and upper bound for function values in a given interval $[a, b]$. The function should return a list $[ymin, ymax]$.

3. Implement Monte Carlo Simulation by generating a number of N uniformly distributed 2D points with $x \in [xmin, xmax]$ and $y \in [ymin, ymax]$. For each point, record whether the point contributes positively or negatively to the area under the curve.

4. Compute the result for $f = \sin(x)$ an $xmin = 0$ and $xmax = \pi$.

5. Visualize all points inside the curve area with blue dots by using matplotlib. Set the title of the chart to the computed integral value. The solution should look similar to:
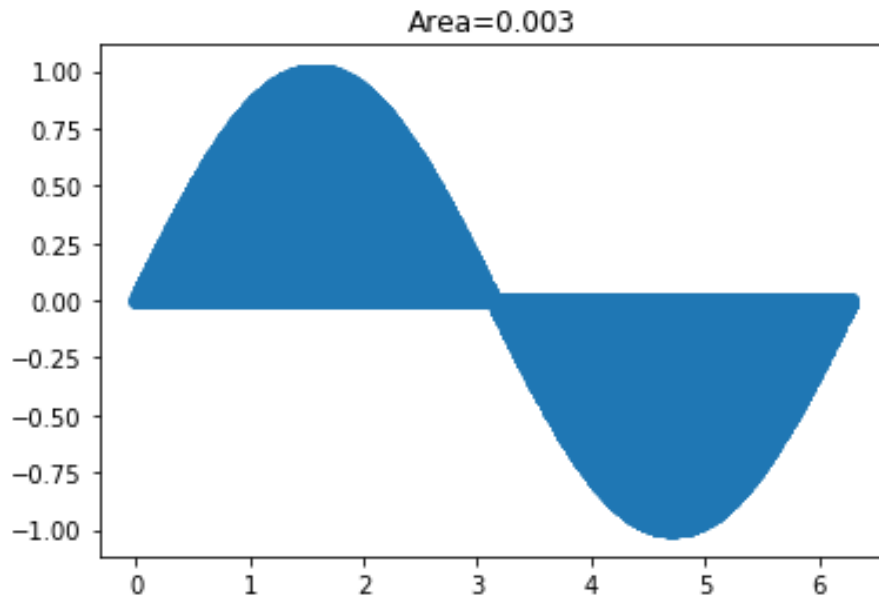

Figure 8: An example for Task 1.