Beihang University
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Beijing, October 12rd, 2020
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Computer Science and Programming Homework October 12rd, 2020

Task 1 *Loop*

The Taylor expansion of $\arctan x$ is

$$\arctan x = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + ... \tag{3}$$

1. Write a function which receive a parameter x, and then return $\arctan x$.
   Hint: Just take the first 1000 terms of the Taylor series to approximate it

2. Let's set x to 1. Write a program to compute π. And compare your result $\pi = 3.1415926535...$
   Hint: $\arctan 1 = \pi/4$

Task 2 *Loop and decision making*

We can also use another way to compute π. Think about randomly selecting a point inside a square whose vertexes are (0,0), (1,0), (0,1) and (1,1). The probability that the distance from this point to the origin is less than 1 is $\pi/4$.

1. Write a function to compute the distance between a point and the origin. This function should receive two parameters, the x and y coordinates of this point, and return the distance.

2. Write a program to select 10000 points and count the number of points that are less than 1 away from the origin. Then, use your result to estimate π.

   Hint: Add a line "`import random`" in the front of your code and use "`random.uniform(0,1)`" to generate random number between 0 and 1. As shown below. (see here for more detail about this function.)

```
import random
x=random.uniform(0,1)
y=random.uniform(0,1)
```