

python

The Python logo, consisting of two interlocking snakes, one blue and one yellow, is positioned below the word "python".

```
import turtle
turtle.setup(650,350,200,200)
turtle.penup()
turtle.fd(-250)
turtle.pendown()
turtle.pensize(25)
turtle.pencolor("purple")

for i in range(4):
    turtle.circle(40, 80)
    turtle.circle(-40, 80)
    turtle.circle(40, 80/2)
    turtle.fd(40)
    turtle.circle(16, 180)
    turtle.fd(40 * 2/3)
```

实例6: 圆周率的计算



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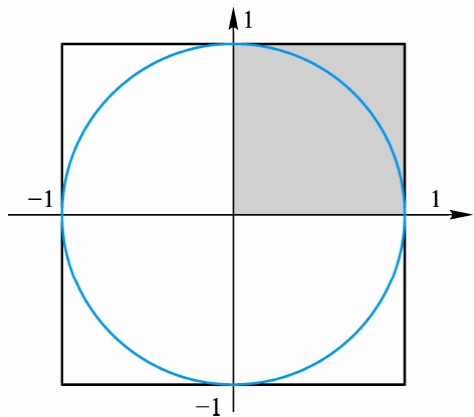
"圆周率的计算"问题分析

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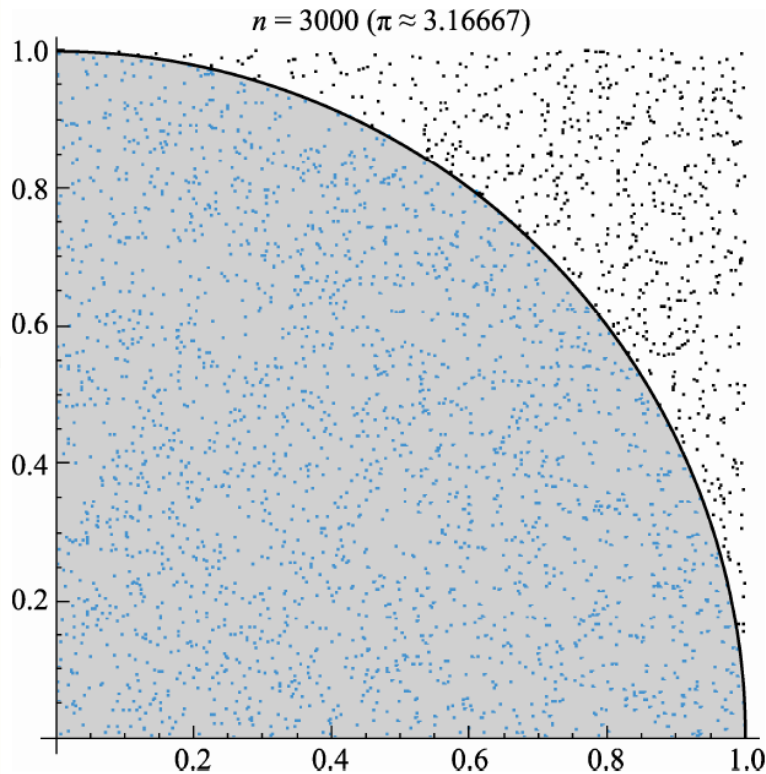
圆周率的近似计算公式

$$\pi = \sum_{k=0}^{\infty} \left[\frac{1}{16^k} \left(\frac{4}{8k+1} - \frac{2}{8k+4} - \frac{1}{8k+5} - \frac{1}{8k+6} \right) \right]$$

"圆周率的计算"问题分析



蒙特卡罗方法





"圆周率的计算"实例讲解

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圆周率的近似计算公式

$$\pi = \sum_{k=0}^{\infty} \left[\frac{1}{16^k} \left(\frac{4}{8k+1} - \frac{2}{8k+4} - \frac{1}{8k+5} - \frac{1}{8k+6} \right) \right]$$

```
#CalPiV1.py
```

```
pi = 0
```

```
N = 100
```

```
for k in range(N) :
```

```
    pi += 1/pow(16,k)*( \  
        4/(8*k+1) - 2/(8*k+4) - \  
        1/(8*k+5) - 1/(8*k+6))
```

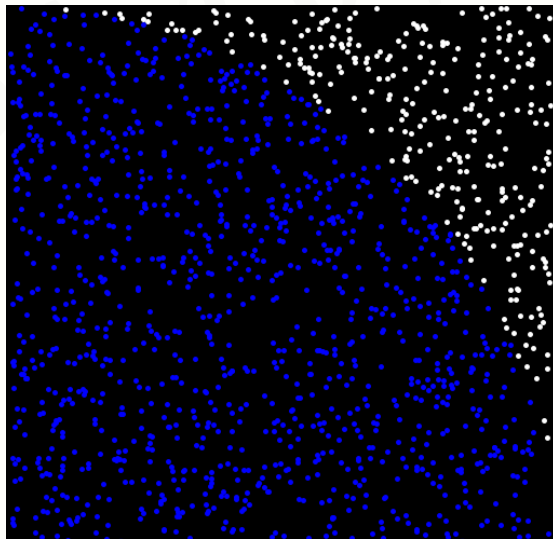
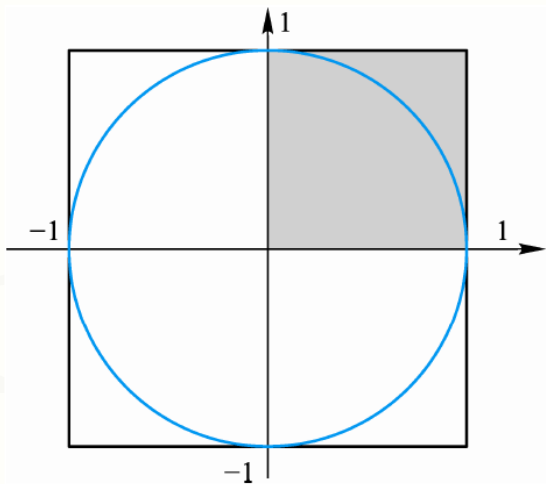
```
print("圆周率值是: {}".format(pi))
```

$$\pi = \sum_{k=0}^{\infty} \left[\frac{1}{16^k} \left(\frac{4}{8k+1} - \frac{2}{8k+4} - \frac{1}{8k+5} - \frac{1}{8k+6} \right) \right]$$

圆周率值是: 3.141592653589793

"圆周率的计算"实例讲解

蒙特卡罗方法



```
#CalPiV2.py
```

```
from random import random
```

```
from time import perf_counter
```

```
DARTS = 1000*1000
```

```
hits = 0.0
```

```
start = perf_counter()
```

```
for i in range(1, DARTS+1):
```

```
    x, y = random(), random()
```

```
    dist = pow(x ** 2 + y ** 2, 0.5)
```

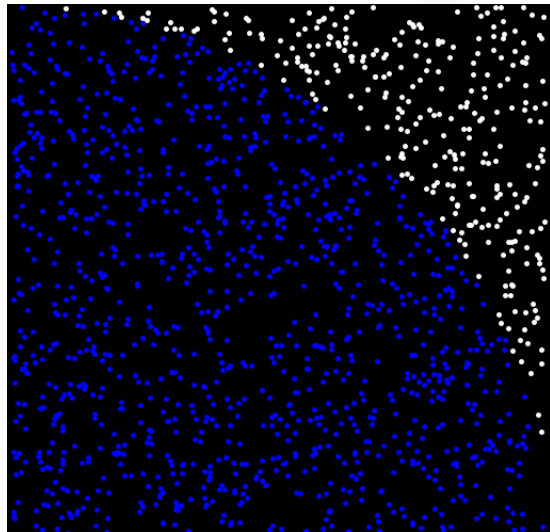
```
    if dist <= 1.0:
```

```
        hits = hits + 1
```

```
pi = 4 * (hits/DARTS)
```

```
print("圆周率值是: {}".format(pi))
```

```
print("运行时间是: {:.5f}s".format(perf_counter()-start))
```



准备好电脑，与老师一起编码吧！



"圆周率的计算"举一反三

#CalPiV2.py

```
from random import random
```

```
from time import perf_counter
```

```
DARTS = 1000*1000
```

```
hits = 0.0
```

```
start = perf_counter()
```

```
for i in range(1, DARTS+1):
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```
    x, y = random(), random()
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    dist = pow(x ** 2 + y ** 2, 0.5)
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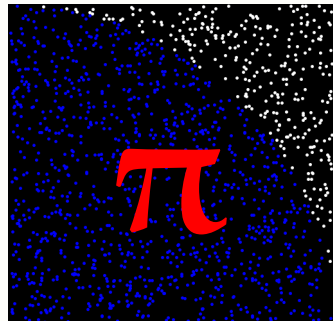
```
    if dist <= 1.0:
```

```
        hits = hits + 1
```

```
pi = 4 * (hits/DARTS)
```

```
print("圆周率值是: {}".format(pi))
```

```
print("运行时间是: {:.5f}s".format(perf_counter()-start))
```



原创 @嵩天老师团队



举一反三

理解方法思维

- **数学思维：找到公式，利用公式求解**
- **计算思维：抽象一种过程，用计算机自动化求解**
- **谁更准确？（不好说...）**

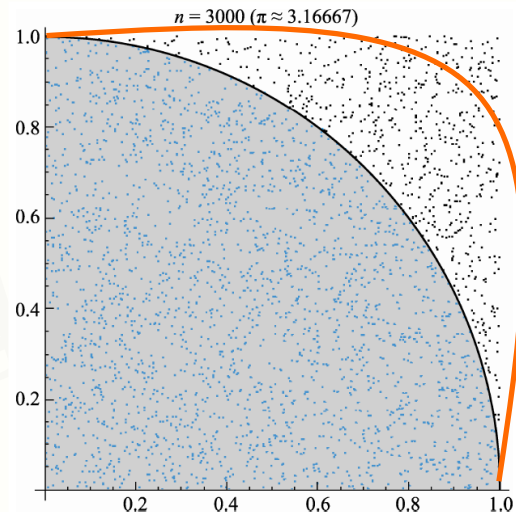
举一反三

程序运行时间分析

- 使用time库的计时方法获得程序运行时间
- 改变撒点数量，理解程序运行时间的分布
- 初步掌握简单的程序性能分析方法

举一反三

计算问题的扩展



- 不求解圆周率，而是某个特定图形的面积
- 在工程计算中寻找蒙特卡罗方法的应用场景

