Interesting Simulation

1 Find an approximate value of pi by scattering the needles

（１） Experiment overview

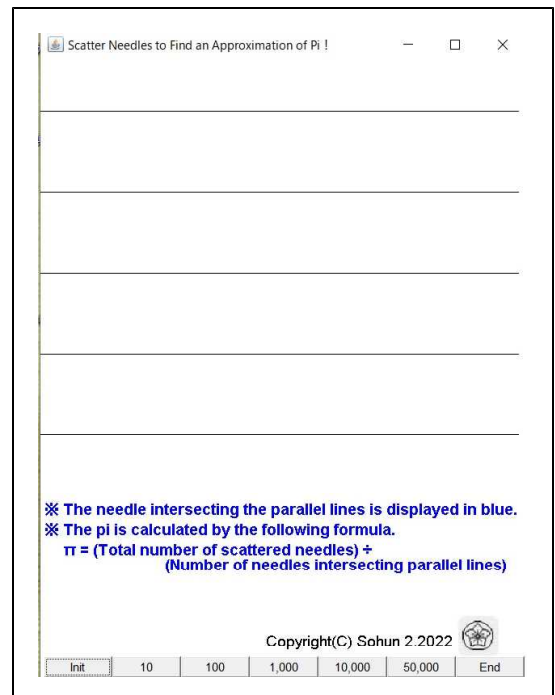Draw parallel lines at equal intervals and scatter the needles randomly over the lines.

All needles are the same length , and the distance between parallel lines is twice the length of the needles. The scattered needles either intersect parallel lines or are between parallel lines and do not intersect.

At this time , the approximate value of pi can be found using the following formula.

pi ＝ （Total number of scattered needles） ÷ （Number of needles intersecting parallel lines）

（２） Experimental result （Java version simulation）

① When the needles have not yet been scattered

【Experiment day】
    January 9 . 2024
【PC used】
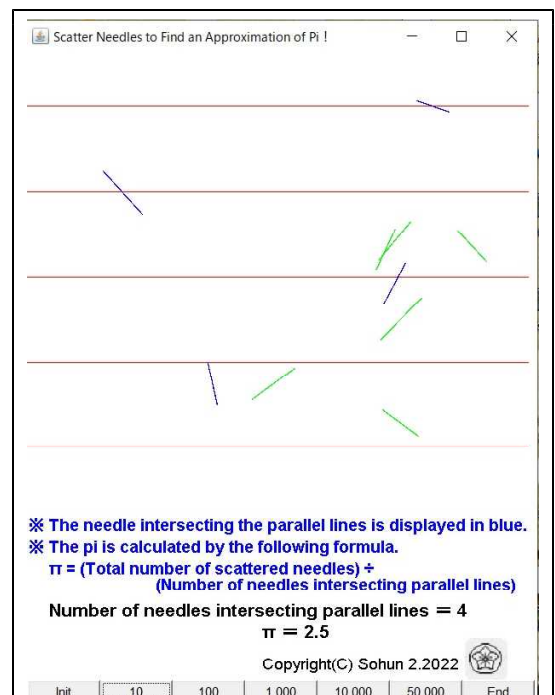   Lavie NX850 / N
【Software used】
    Self-made software 『Scatter needles to find
        an approximate value of pi ！ （Java）』

② When 10 needles are scattered

Total number of scattered needles ＝ 10

Number of needles
    intersecting parallel lines ＝ 4

Approximate value of pi ＝ 10 ÷ 4

                        ＝ 2．5

Interesting Simulation

01.09.2024
Sohun

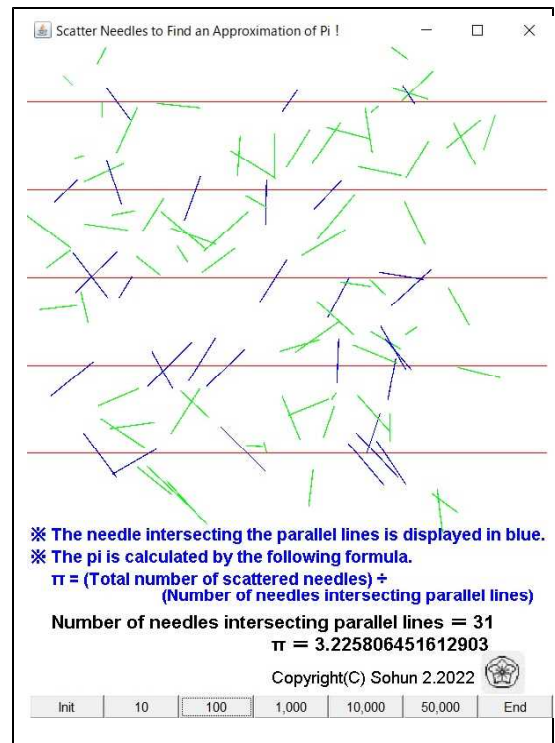## 1 Find an approximate value of pi by scattering the needles

（2）Experimental result（Java version simulation）

③ When 100 needles are scattered

Total number of scattered needles ＝ 100

Number of needles
intersecting parallel lines ＝ 31

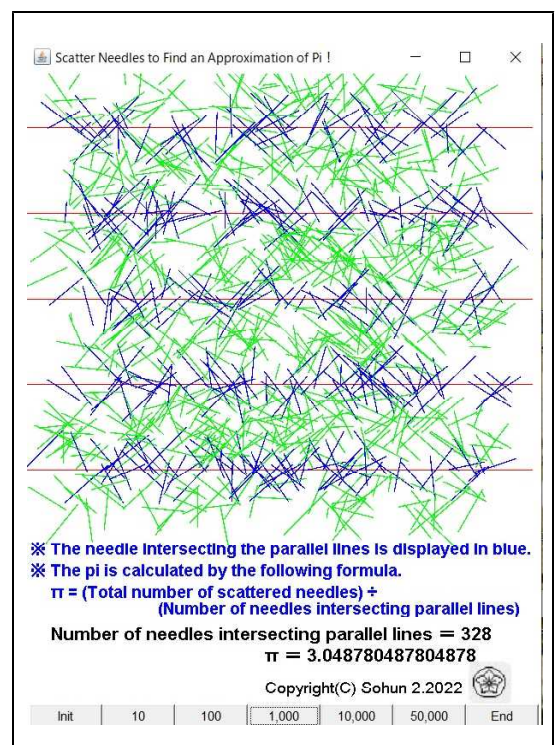Approximate value of pi ＝ 100 ÷ 31

＝ 3．225806 ···

④ When 1000 needles are scattered

Total number of scattered needles ＝ 1000

Number of needles
intersecting parallel lines ＝ 328

Approximate value of pi ＝ 1000 ÷ 328

＝ 3．048780 ···

Interesting Simulation

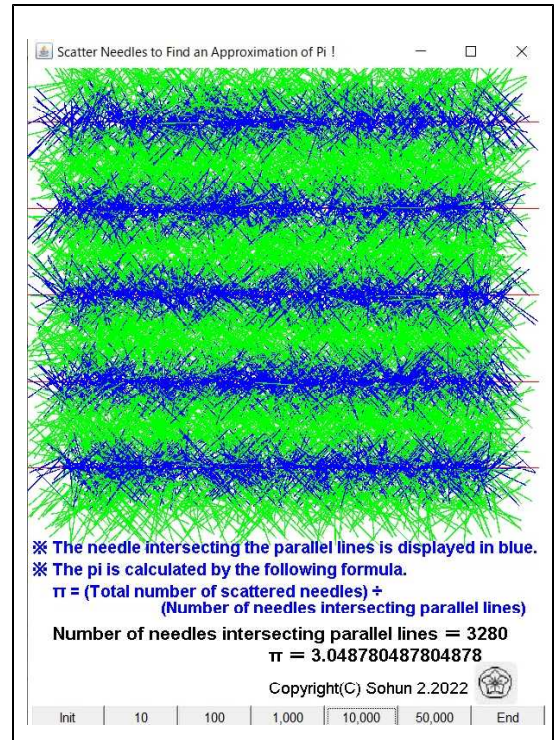## 1　Find an approximate value of pi by scattering the needles

（2）Experimental result（Java version simulation）

⑤ When 10000 needles are scattered

Total number of scattered needles ＝ 10000

Number of needles
　　　intersecting parallel lines ＝ 3280

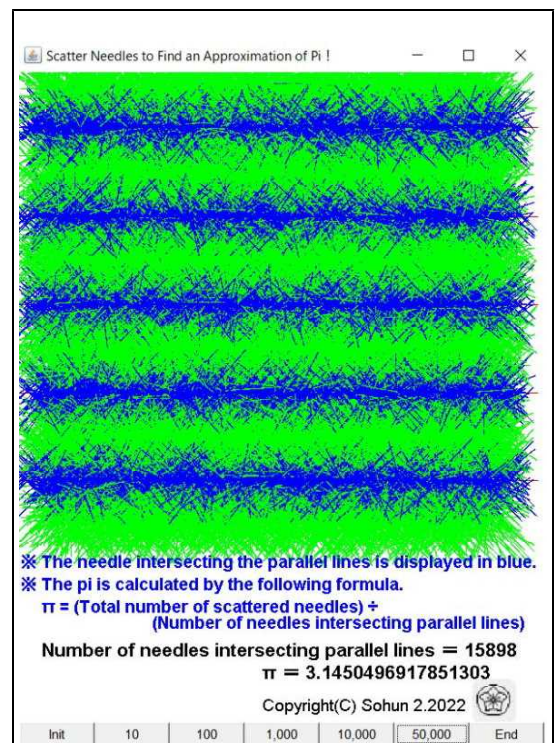Approximate value of pi ＝ 10000 ÷ 3280

　　　　　　　 ＝ 3．048780 ···

⑥ When 50000 needles are scattered

Total number of scattered needles ＝ 50000

Number of needles
　　　intersecting parallel lines ＝ 15898

Approximate value of pi ＝ 50000 ÷ 15898

　　　　　　　 ＝ 3．145049 ···

Interesting Simulation

2 Find an approximate value of pi by scattering 10-yen coins

（1） Experiment overview

Draw equally spaced parallel lines vertically and horizontally（grid lines）, and randomly scatter 10-yen coins on them.

The width of the parallel lines that make up the grid lines is the same as the diameter of a ten-yen coin. The scattered ten-yen coins either overlap with the grid points or are on the grid lines but do not overlap with the grid points.

At this time , the approximate value of pi can be found using the following formula.

pi ＝ （Number of 10-yen coins that overlap with grid points） ÷
（Total number of scattered 10-yen coins） × 4

（2） Experimental result（Java version simulation）

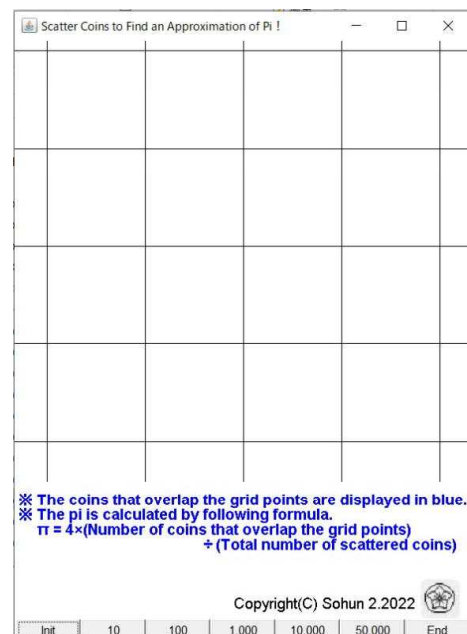① When 10-yen coins have not yet been scattered

【Experiment day】
January 9 . 2024
【PC used】
Lavie NX850 / N
【Software used】
Self-made software 『Throw coins to find
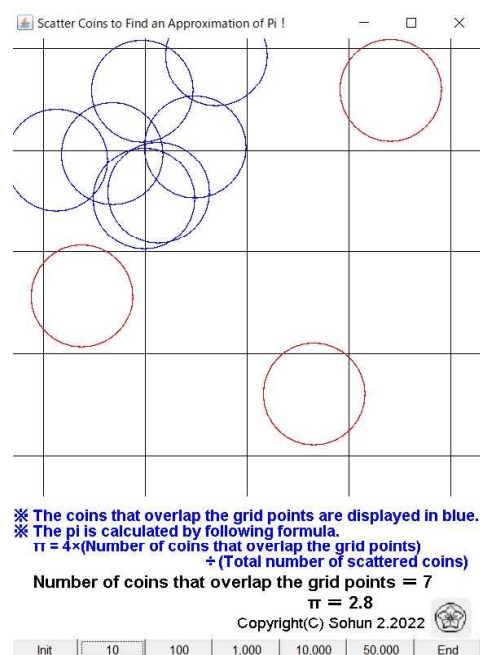an approximate value of pi !（Java）』

② When 10 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 10

Number of 10-yen coins that overlap with
grid points ＝ 7

Approximate value of pi ＝ 7 ÷ 10 × 4

＝ 2. 8

Interesting Simulation

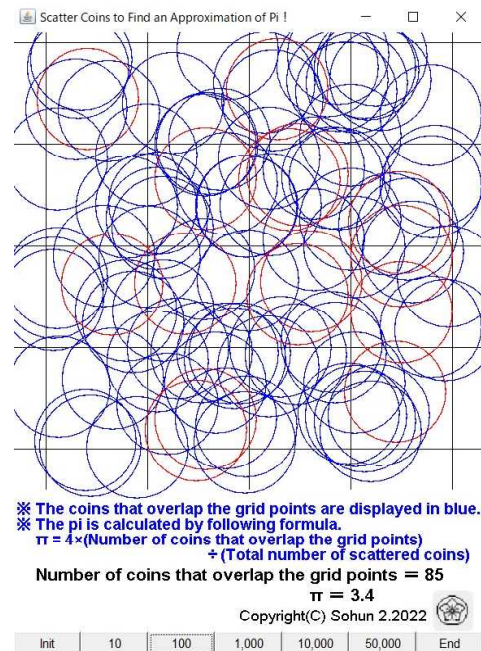## 2 Find an approximate value of pi by scattering 10-yen coins

（2）Experimental result（Java version simulation）

③ When 100 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 100

Number of 10-yen coins that overlap with
           grid points ＝ 85

Approximate value of pi ＝ 85 ÷ 100 × 4
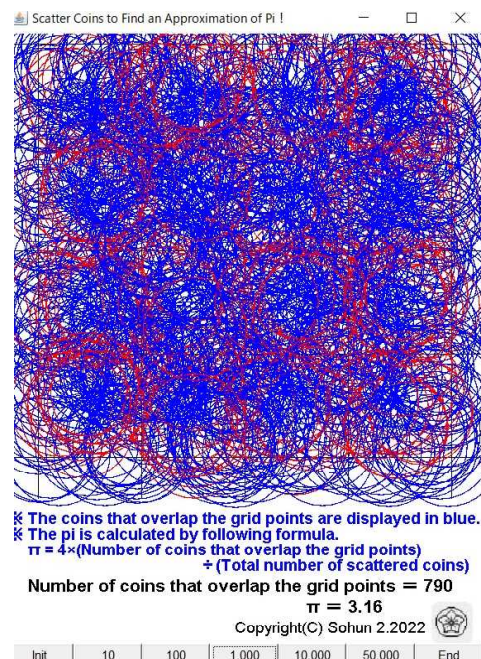
         ＝ 3．4

④ When 1000 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 1000

Number of 10-yen coins that overlap with
           grid points ＝ 790

Approximate value of pi ＝ 790 ÷ 1000 × 4

         ＝ 3．16

Interesting Simulation

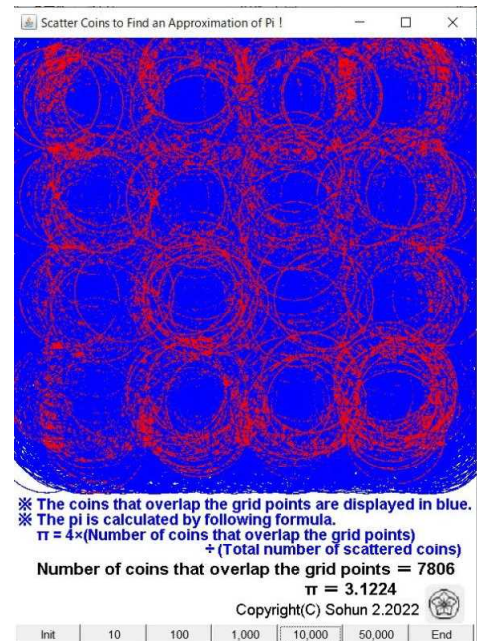## 2 Find an approximate value of pi by scattering 10-yen coins

（2）Experimental result（Java version simulation）

⑤ When 10000 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 10000

Number of 10-yen coins that overlap with
grid points ＝ 7806

Approximate value of pi ＝ 7806 ÷ 10000 × 4
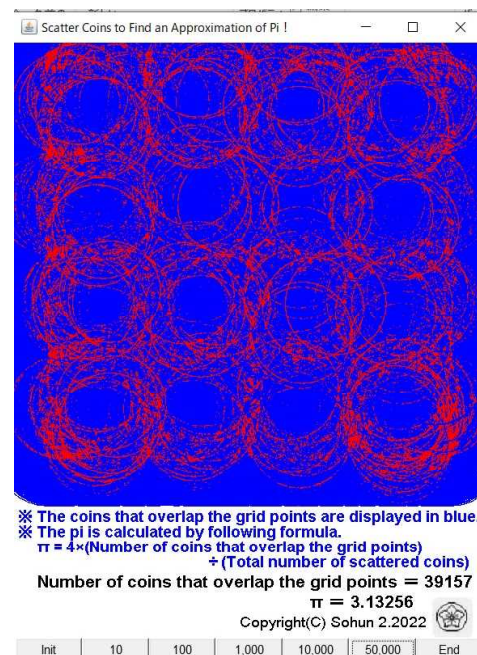
＝ 3. 1224

⑥ When 50000 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 50000

Number of 10-yen coins that overlap with
grid points ＝ 39157

Approximate value of pi ＝ 39157 ÷ 50000 × 4

＝ 3. 13256

Interesting Simulation

3　Find an approximate value of pi by scattering sesame seeds

（1）Experiment overview

    Draw a square and a circle inscribed in it , then scatter sesame seeds randomly on top of it.
The scattered sesame seeds either fit in a circle or are in a square but not in a circle.
At this time , the approximate value of pi can be found using the following fomula.
pi ＝ （Number of sesame seeds in a circle） ÷

                                      （Total number of scattered sesame seeds）× 4

（2）Experimental result（Java version simulation）

① When sesame seeds have not yet been scattered
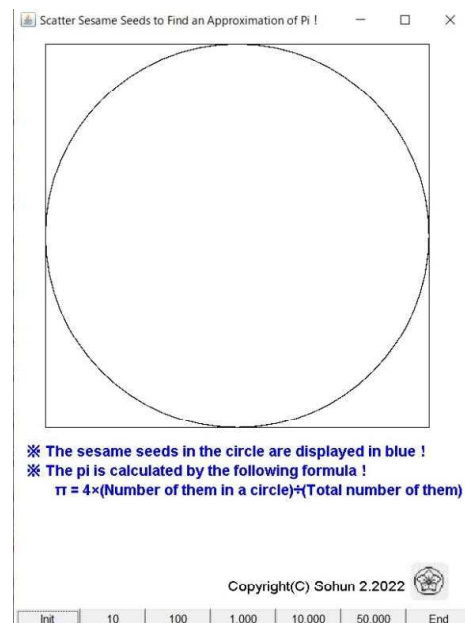
【Experiment day】
    January 9 . 2024
【PC used】
    Lavie NX850 / N
【Software used】
    Self-made software 『Scatter sesame seeds to find
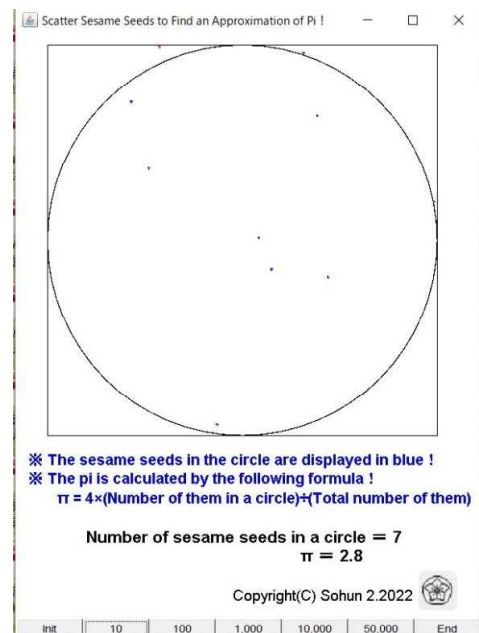   an approximate value of pi !（Java）』

② When 10 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 10

Number of sesame seeds in a circle　＝ 7

Approximate value of pi ＝ 7 ÷ 10 × 4

              ＝ 2．8

Interesting Simulation

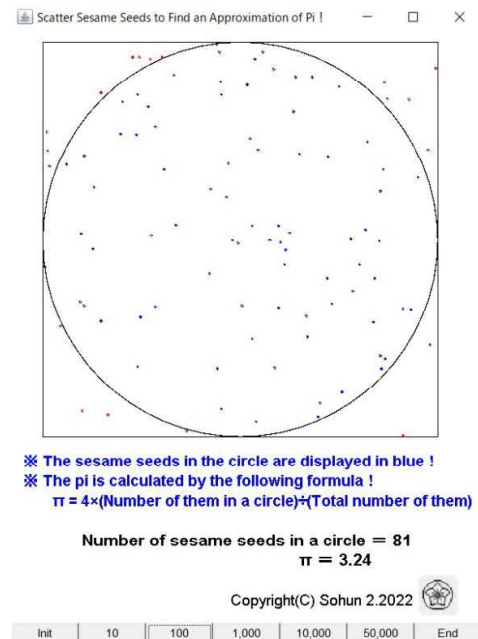## 3 Find an approximate value of pi by scattering sesame seeds

（２）Experimental result（Java version simulation）

③ When 100 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 100

Number of sesame seeds in a circle ＝ 81

Approximate value of pi ＝ 81 ÷ 100 × 4
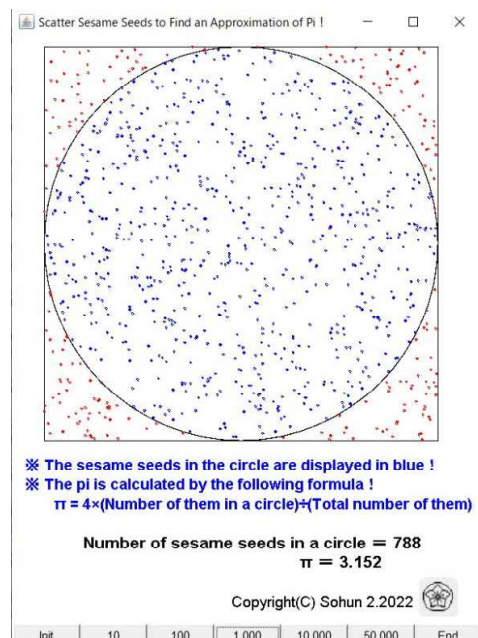
＝ 3．24

④ When 1000 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 1000

Number of sesame seeds in a circle ＝ 788

Approximate value of pi ＝ 788 ÷ 1000 × 4

＝ 3．152

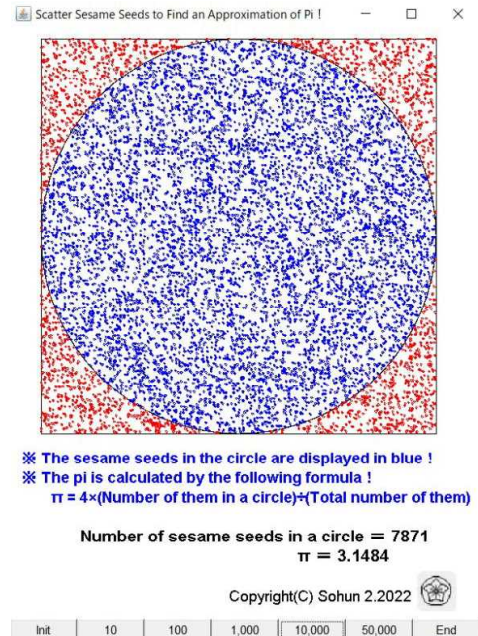## 3 Find an approximate value of pi by scattering sesame seeds

（２）Experimental result（Java version simulation）

⑤ When 10000 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 10000

Number of sesame seeds in a circle ＝ 7871

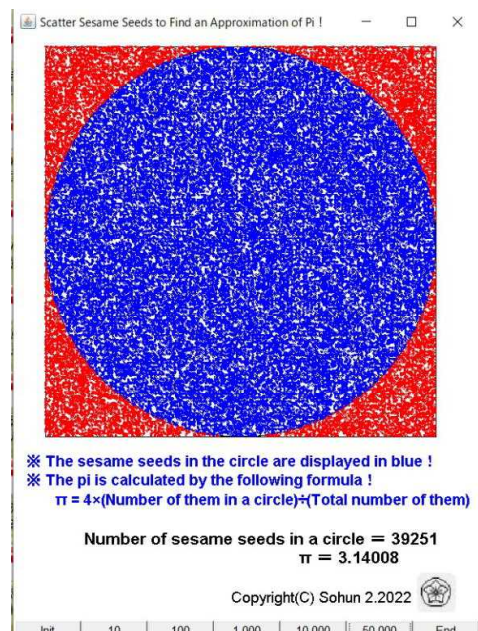Approximate value of pi ＝ 7871 ÷ 10000 × 4

＝ 3．1484

⑥ When 50000 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 50000

Number of sesame seeds in a circle ＝ 39251

Approximate value of pi ＝ 39251 ÷ 50000 × 4

＝ 3．14008

Interesting Simulation

4 Find an approximate value of pi by scattering the needles

（1） Experiment overview

Draw parallel lines at equal intervals and scatter the needles randomly over the lines.
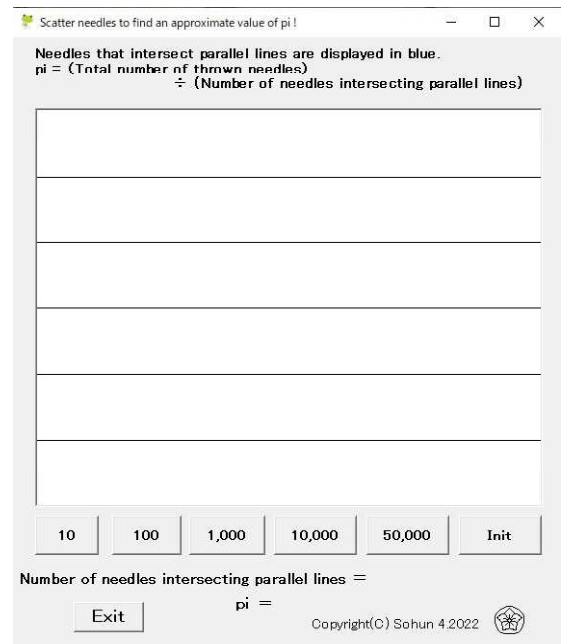
All needles are the same length , and the distance between parallel lines is twice the length of the needles. The scattered needles either intersect parallel lines or are between parallel lines and do not intersect.

At this time , the approximate value of pi can be found using the following formula.

pi ＝ （Total number of scattered needles） ÷ （Number of needles intersecting parallel lines）

（2） Experimental result （VB version simulation）

① When the needles have not yet been scattered

【Experiment day】
　　January 10 . 2024
【PC used】
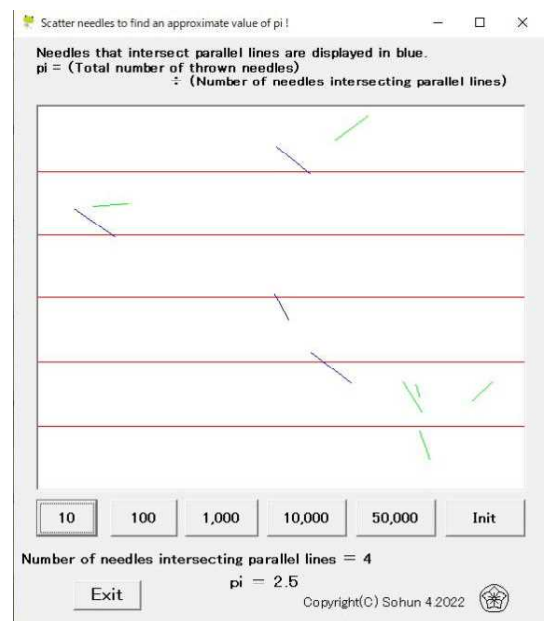　　Lavie NS600 / M
【Software used】
　　Self-made software 『Scatter needles to find an approximate value of pi !（VB）』

② When 10 needles are scattered

Total number of scattered needles ＝ 10

Number of needles
　　intersecting parallel lines ＝ 4

Approximate value of pi ＝ 10 ÷ 4

　　　　　　　　　　＝ 2．5

Interesting Simulation

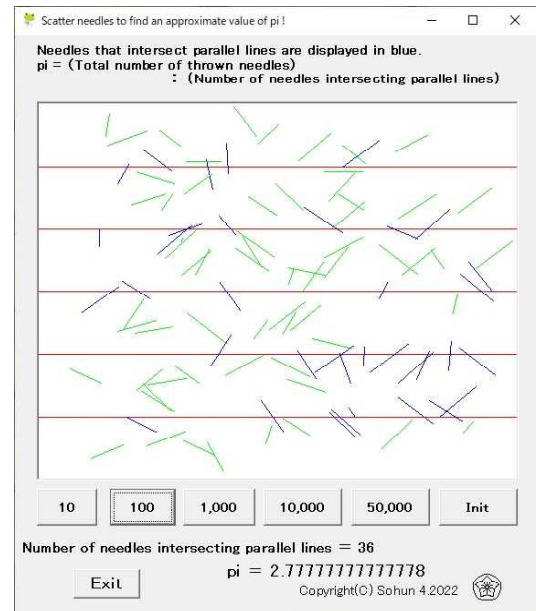## 4 Find an approximate value of pi by scattering the needles

（２）Experimental result（VB version simulation）

③ When 100 needles are scattered

Total number of scattered needles ＝ 100

Number of needles
intersecting parallel lines ＝ 36

Approximate value of pi ＝ 100 ÷ 36
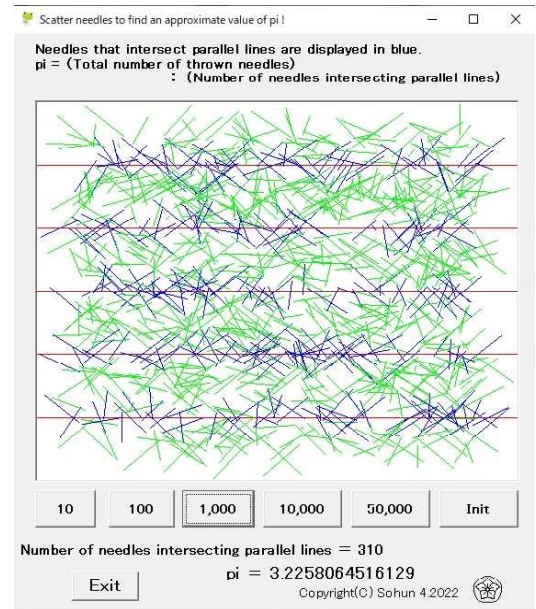
＝ 2. 777777 …

④ When 1000 needles are scattered

Total number of scattered needles ＝ 1000

Number of needles
intersecting parallel lines ＝ 310

Approximate value of pi ＝ 1000 ÷ 310

＝ 3. 225806 …

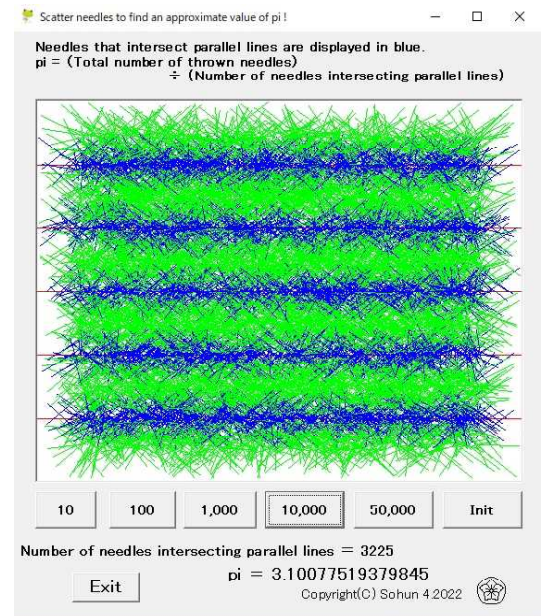## 4 Find an approximate value of pi by scattering the needles

（２） Experimental result（VB version simulation）

⑤ When 10000 needles are scattered

Total number of scattered needles ＝ 10000

Number of needles
        intersecting parallel lines ＝ 3225

Approximate value of pi ＝ 10000 ÷ 3225
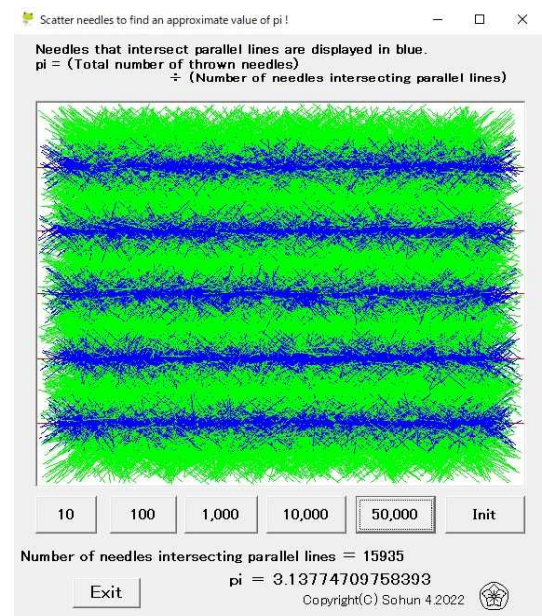
                ＝ 3．100775 ···

⑥ When 50000 needles are scattered

Total number of scattered needles ＝ 50000

Number of needles
        intersecting parallel lines ＝ 15935

Approximate value of pi ＝ 50000 ÷ 15935

                ＝ 3.137747 ···

Interesting Simulation

5　Find an approximate value of pi by scattering 10-yen coins

（1）Experiment overview

　　　　Draw equally spaced parallel lines vertically and horizontally（grid lines）, and randomly scatter 10-yen coins on them.
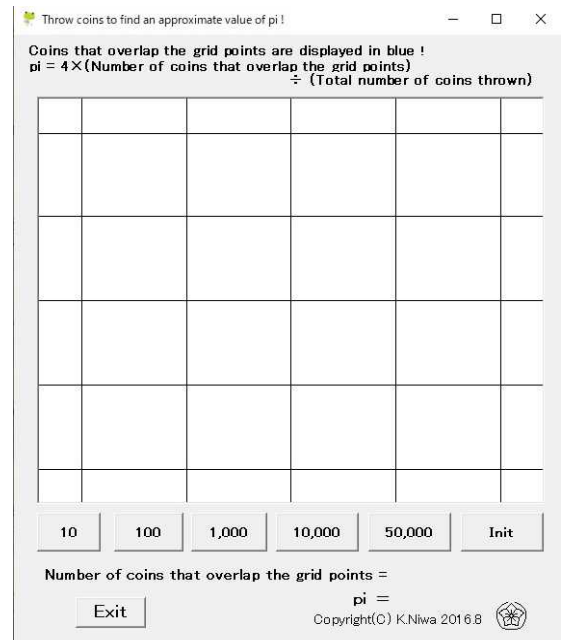
　　　The width of the parallel lines that make up the grid lines is the same as the diameter of a ten-yen coin. The scattered ten-yen coins either overlap with the grid points or are on the grid lines but do not overlap with the grid points.

　　　At this time , the approximate value of pi can be found using the following formula.

pi ＝（Number of 10-yen coins that overlap with grid points）÷
　　　　　　　　　　　　　　　　　　（Total number of scattered 10-yen coins）× 4

（2）Experimental result（VB version simulation）

① When 10-yen coins have not yet been scattred

【Experiment day】
　　January 10 . 2024
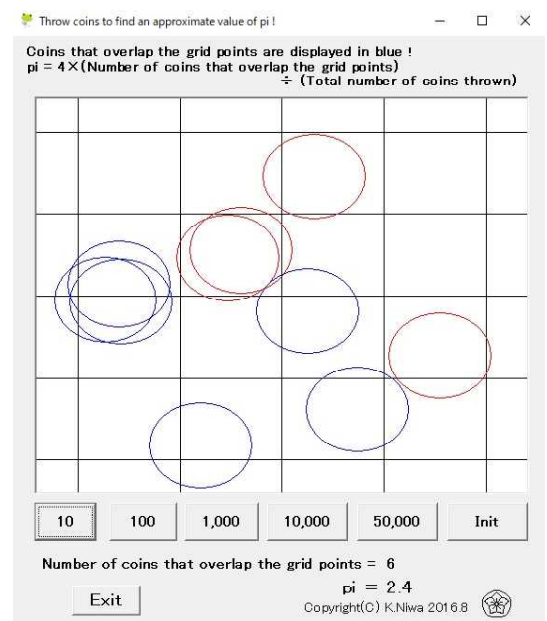【PC used】
　　Lavie NS600／M
【Software used】
　　Self-made software 『Throw coins to find
　　　　　　an approximate value of pi !（VB）』

② When t0 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 10

Number of 10-yen coins that overlap with
　　　　　　　　　　　　grid points ＝ 6

Approximate value of pi ＝ 6 ÷ 10 × 4

　　　　　　　　　＝ 2. 4

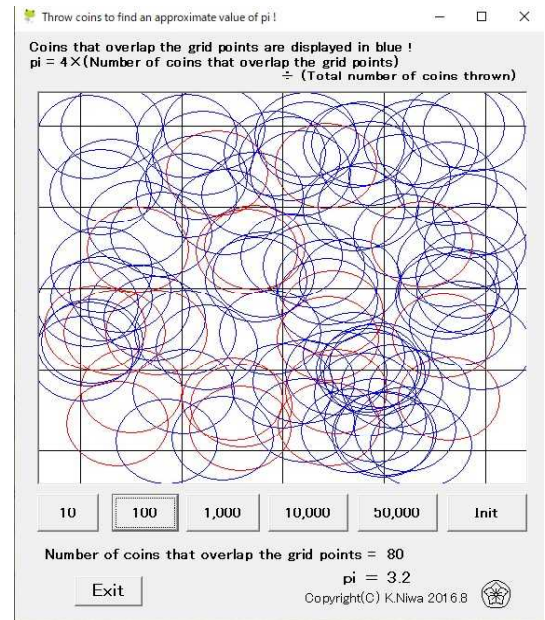## 5 Find an approximate value of pi by scattering 10-yen coins

（２）Experimental result（VB version simulation）

③ When t00 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 100

Number of 10-yen coins that overlap with
grid points ＝ 80

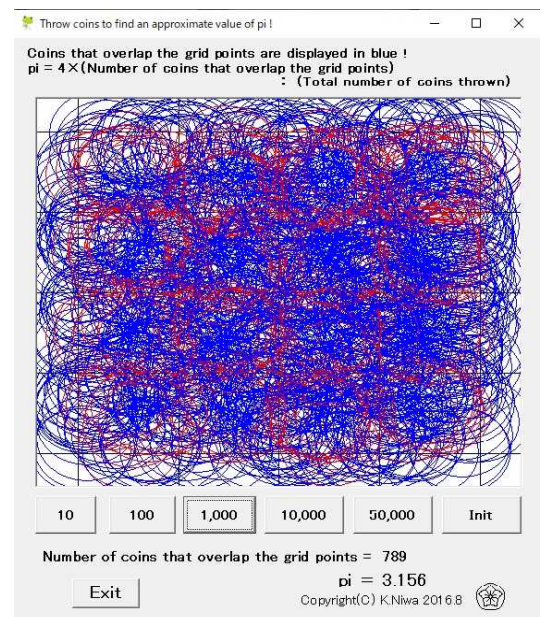Approximate value of pi ＝ 80 ÷ 100 × 4

＝ 3．2

④ When t000 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 1000

Number of 10-yen coins that overlap with
grid points ＝ 789

Approximate value of pi ＝ 789 ÷ 1000 × 4

＝ 3．156

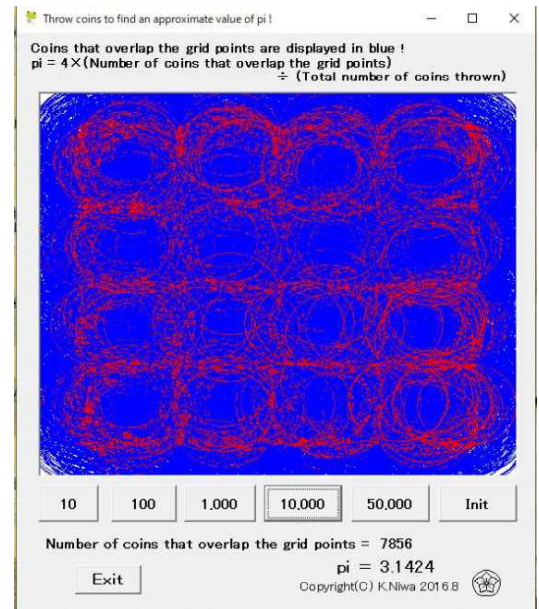## 5 Find an approximate value of pi by scattering 10-yen coins

（２）Experimental result（VB version simulation）

⑤ When 10000 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 10000

Number of 10-yen coins that overlap with
grid points ＝ 7856

Approximate value of pi ＝ 7856 ÷ 10000 × 4
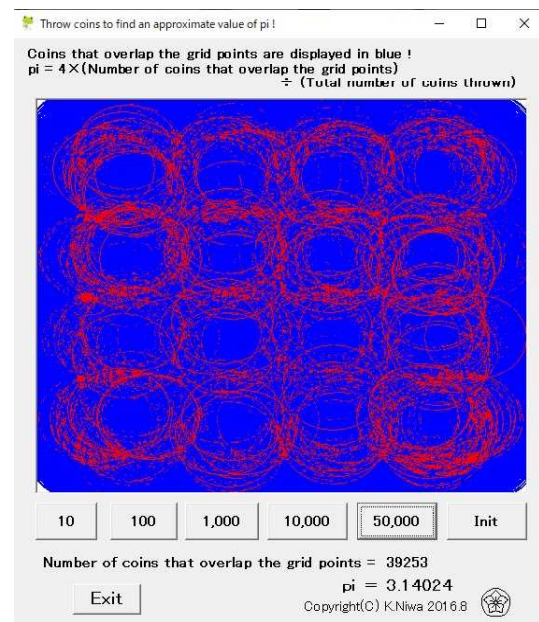
＝ 3. 1424

⑥ When 50000 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 50000

Number of 10-yen coins that overlap with
grid points ＝ 39253

Approximate value of pi ＝ 39253 ÷ 50000 × 4

＝ 3. 14024

Interesting Simulation

6 Find an approximate value of pi by scattering sesame seeds

（1） Experiment overview

Draw a square and a circle inscribed in it , then scatter sesame seeds randomly on top of it.
The scattered sesame seeds either fit in a circle or are in a square but not in a circle.
At this time , the approximate value of pi can be found using the following fomula.
pi ＝（Number of sesame seeds in a circle） ÷

（Total number of scattered sesame seeds）× 4

（2） Experimental result（VB version simulation）

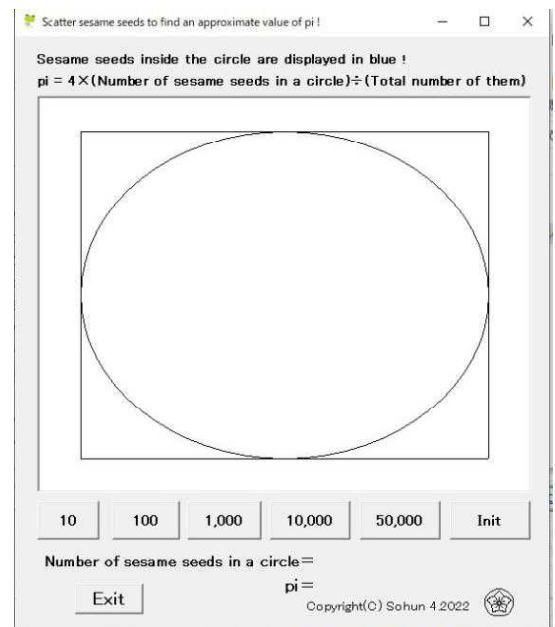① When sesame seeds have not yet been scattered

【Experiment day】
January 10 . 2024
【PC used】
Lavie NS600 / M
【Software used】
Self-made software 『Scatter sesame seeds
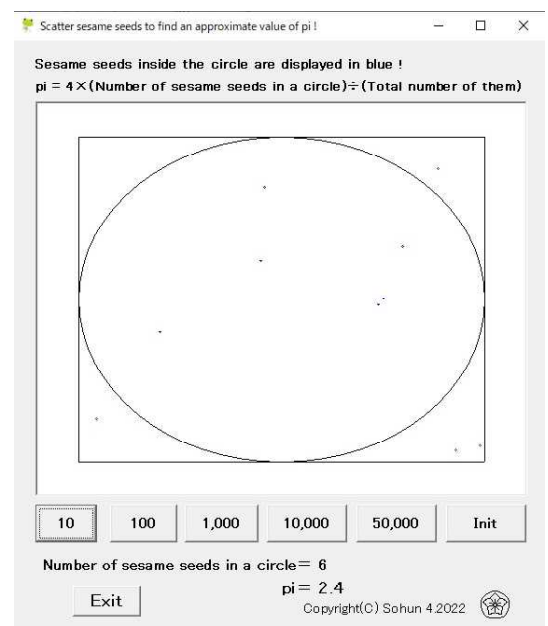to find an approximate value of pi !（VB）』

② When 10 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 10

Number of sesame seeds in a circle ＝ 6

Approximate value of pi ＝ 6 ÷ 10 × 4

＝ 2. 4

6 Find an approximate value of pi by scattering sesame seeds

（２）Experimental result（VB version simulation）

③ When 100 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 100

Number of sesame seeds in a circle ＝ 81

Approximate value of pi ＝ 81 ÷ 100 × 4

＝ 3. 24

④ When 1000 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 1000

Number of sesame seeds in a circle ＝ 773

Approximate value of pi ＝ 773 ÷ 1000 × 4

＝ 3. 092

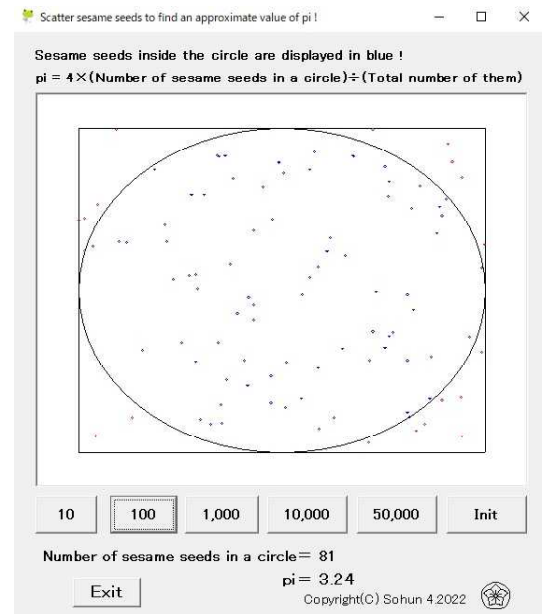## 6 Find an approximate value of pi by scattering sesame seeds

（２）Experimental result（VB version simulation））
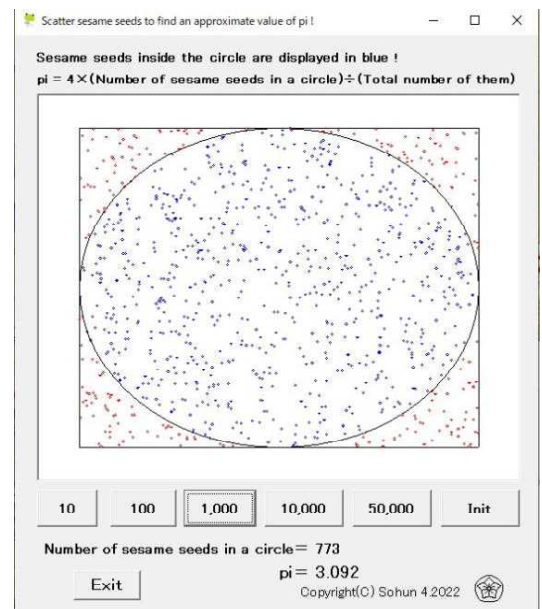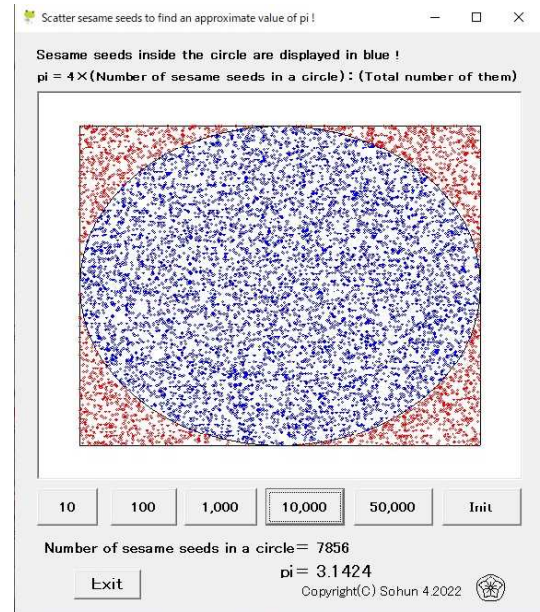
⑤ When 10000 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 10000

Number of sesame seeds in a circle ＝ 7856

Approximate value of pi ＝ 7856 ÷ 10000 × 4

＝ 3．1424

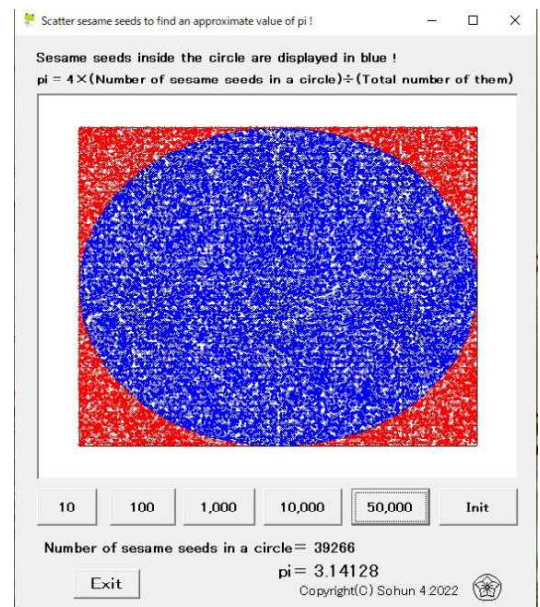⑥ When 50000 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 50000

Number of sesame seeds in a circle ＝ 39266

Approximate value of pi ＝ 39266 ÷ 50000 × 4

＝ 3．14128

Interesting Simulation

7 Find an approximate value of pi by scattering the needles

（1）Experiment overview

Draw parallel lines at equal intervals and scatter the needles randomly over the lines.

All needles are the same length , and the distance between parallel lines is twice the length of the needles. The scattered needles either intersect parallel lines or are between parallel lines and do not intersect.

At this time , the approximate value of pi can be found using the following formula.

pi ＝（Total number of scattered needles）÷（Number of needles intersecting parallel lines）

（2）Experimental result（Android version simulation）
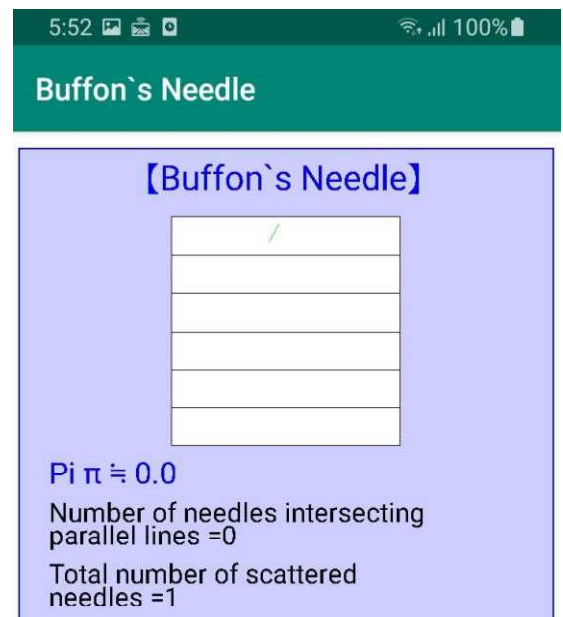
① When 1 needle is scattered

【Experiment day】
January 11 . 2024
【Smartphone used】
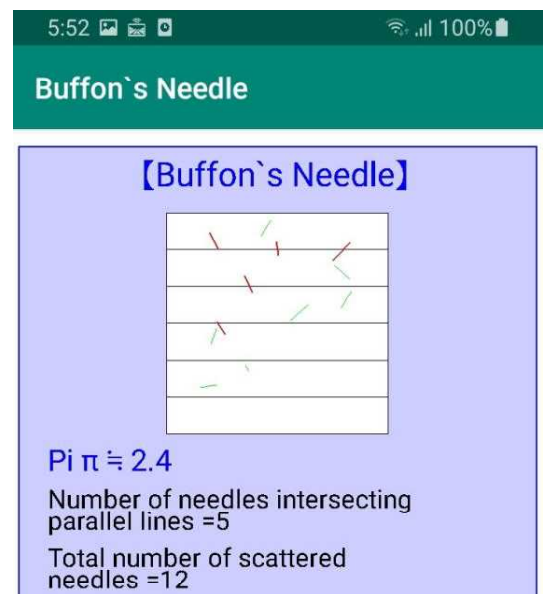Galaxy S9
【App used】
Self-made app 『Buffon's Needle !（Android）』

② When 12 needles are scattered

Total number of scattered needles ＝ 12

Number of needles
intersecting parallel lines ＝ 5

Approximate value of pi ＝ 12 ÷ 5

＝ 2．4

Interesting Simulation

7 Find an approximate value of pi by scattering the needles

（2）Experimental result（Android version simulation）

③ When 117 needles are scattered

Total number of scattered needles ＝ 117

Number of needles
intersecting parallel lines ＝ 38

Approximate value of pi ＝ 117 ÷ 38

＝ 3. 078947 ⋯

④ When 999 needles are scattered

Total number of scattered needles ＝ 999

Number of needles
intersecting parallel lines ＝ 314

Approximate value of pi ＝ 999 ÷ 314

＝ 3. 181528 ⋯

Interesting Simulation

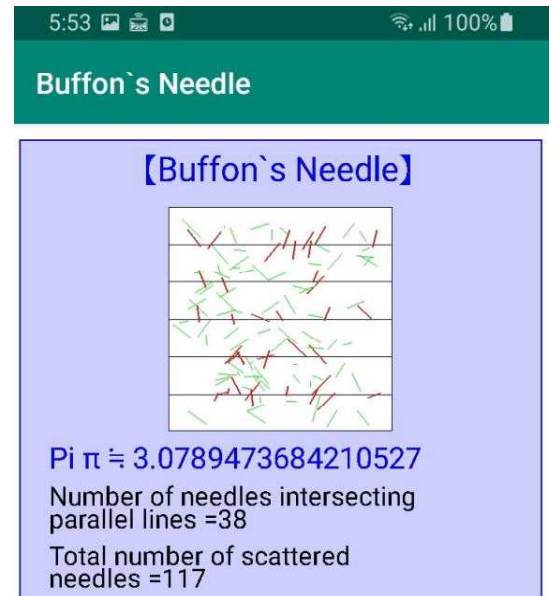## 7 Find an approximate value of pi by scattering the needles

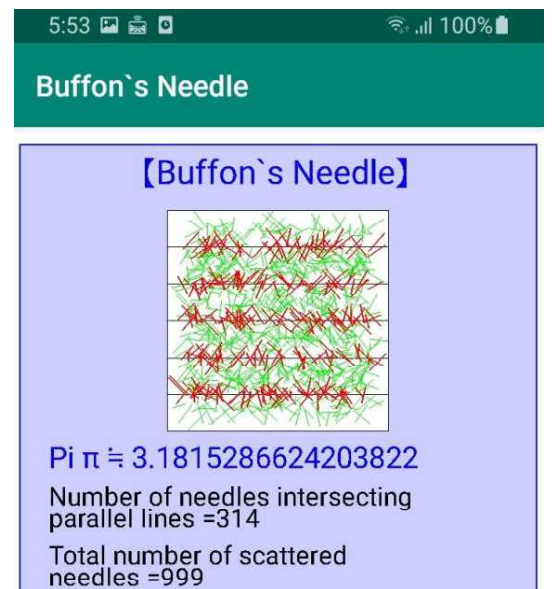（2）Experimental result（Android version simulation）

⑤ When 4998 needles are scattered

Total number of scattered needles ＝ 4998

Number of needles
　　intersecting parallel lines ＝ 1587

Approximate value of pi ＝ 4998 ÷ 1587

　　　　　　＝ 3.149338 ···
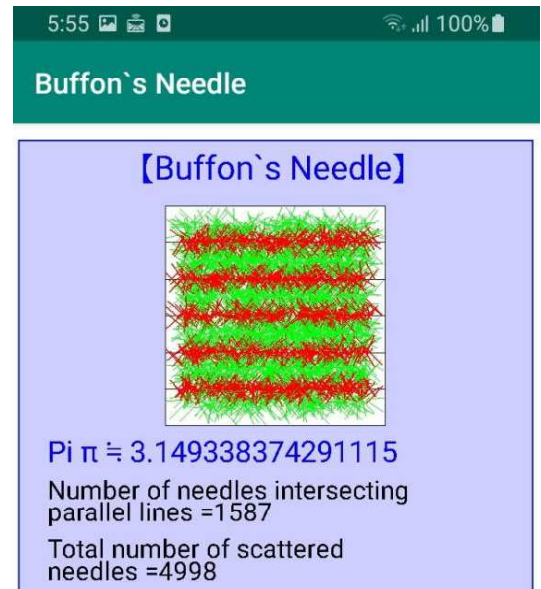
⑥ When 10000 needles are scattered

Total number of scattered needles ＝ 10000

Number of needles
　　intersecting parallel lines ＝ 3185

Approximate value of pi ＝ 10000 ÷ 3185

　　　　　　＝ 3.139717 ···

Interesting Simulation

8 Find an approximate value of pi by scattering 10-yen coins

（1）Experiment overview

   Draw equally spaced parallel lines vertically and horizontally（grid lines）, and randomly scatter 10-yen coins on them.

   The width of the parallel lines that make up the grid lines is the same as the diameter of a ten-yen coin. The scattered ten-yen coins either overlap with the grid points or are on the grid lines but do not overlap with the grid points.

   At this time , the approximate value of pi can be found using the following formula.

pi ＝（Number of 10-yen coins that overlap with grid points）÷
                                    （Total number of scattered 10-yen coins）× 4

（2）Experimental result（Android version simulation）

① When 1 10-yen coin is scattered
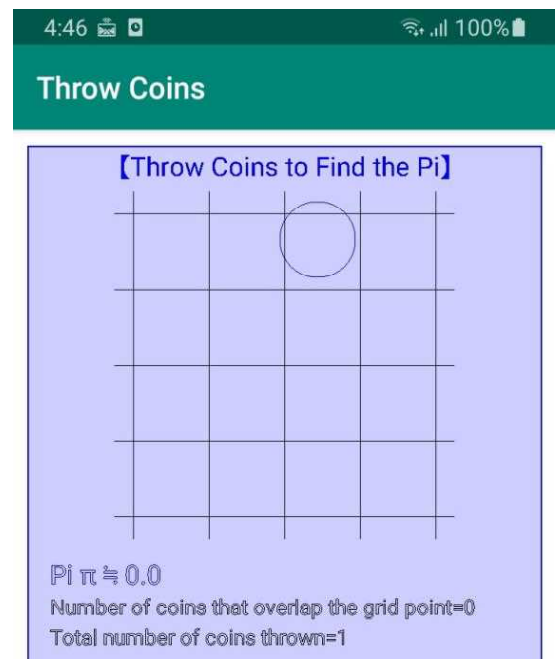
【Experiment day】
    January 11 . 2024
【Smartphone used】
    Galaxy S9
【App used】
    Self-made app 『Throw Coins
                    to Find the Pi !（Android）』

② When 11 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 11

Number of 10-yen coins that overlap with
                            grid points ＝ 10

Approximate value of pi ＝ 10 ÷ 11 × 4

                    ＝ 3. 636363 …

8 Find an approximate value of pi by scattering 10-yen coins

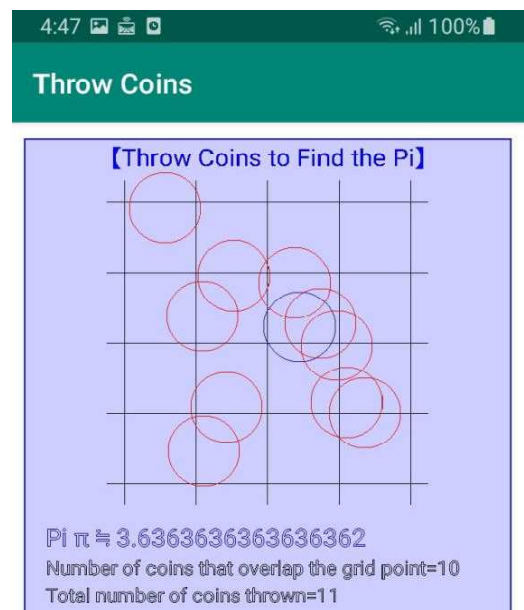（2） Experimental result（Android version simulation）

③ When 117 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 117

Number of 10-yen coins that overlap with grid points ＝ 89

Approximate value of pi ＝ 89 ÷ 117 × 4

＝ 3．042735 …

Pi π ≒ 3.0427350427350426
Number of coins that overlap the grid point=89
Total number of coins thrown=117

④ When 992 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 992

Number of 10-yen coins that overlap with grid points ＝ 789

Approximate value of pi ＝ 789 ÷ 992 × 4

＝ 3．181451 …

Pi π ≒ 3.181451612903226
Number of coins that overlap the grid point=789
Total number of coins thrown=992

Interesting Simulation

8 Find an approximate value of pi by scattering 10-yen coins

（2）Experimental result（Android version simulation）

⑤ When 5007 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 5007

Number of 10-yen coins that overlap with
grid points ＝ 3897

Approximate value of pi ＝ 3897 ÷ 5007 × 4

＝ 3．113241 ···

⑥ When 10000 10-yen coins are scattered

Total number of scattered 10-yen coins ＝ 10000

Number of 10-yen coins that overlap with
grid points ＝ 7830

Approximate value of pi ＝ 7830 ÷ 10000 × 4

＝ 3．132

Interesting Simulation

9 Find an approximate value of pi by scattering sesame seeds

（1）Experiment overview

Draw a square and a circle inscribed in it , then scatter sesame seeds randomly on top of it.
The scattered sesame seeds either fit in a circle or are in a square but not in a circle.
At this time , the approximate value of pi can be found using the following fomula.

pi ＝（Number of sesame seeds in a circle）÷

(Total number of scattered sesame seeds)× 4

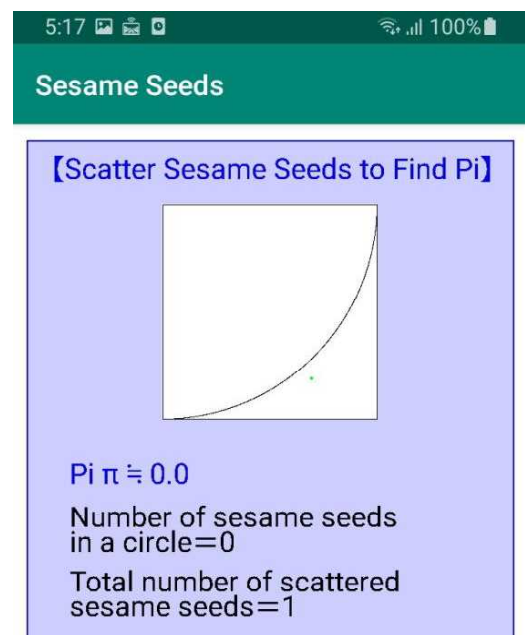（2）Experimental result（Android version simulation）

① When 1 sesame seed is scattered

【Experiment day】
January 11 . 2024
【Smartphone used】
Galaxy S9
【App used】
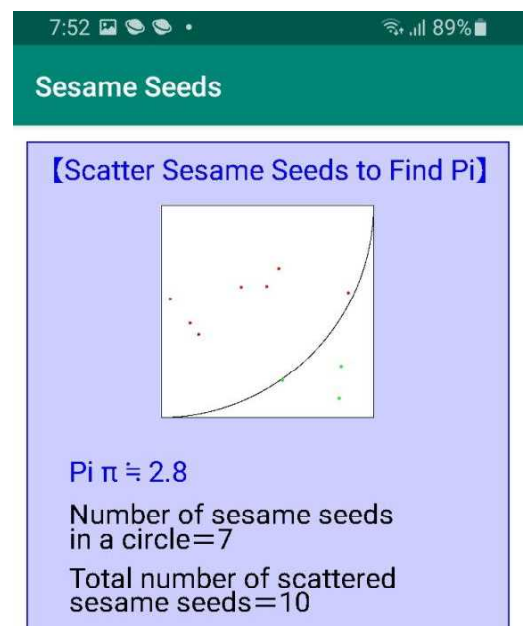Self-made app 『Scatter Sesame Seeds
to Find Pi !（Android）』

② When 10 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 10

Number of sesame seeds in a circle ＝ 7

Approximate value of pi ＝ 7 ÷ 10 × 4

＝ 2．8

Interesting Simulation

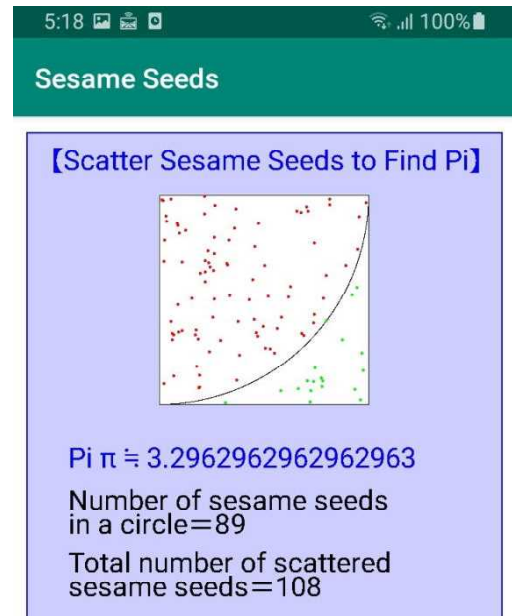## ９ Find an approximate value of pi by scattering sesame seeds

（２）Experimental result（Android version simulation）

③ When 108 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 108

Number of sesame seeds in a circle ＝ 89

Approximate value of pi ＝ 89 ÷ 108 × 4

＝ 3．296296 ⋯
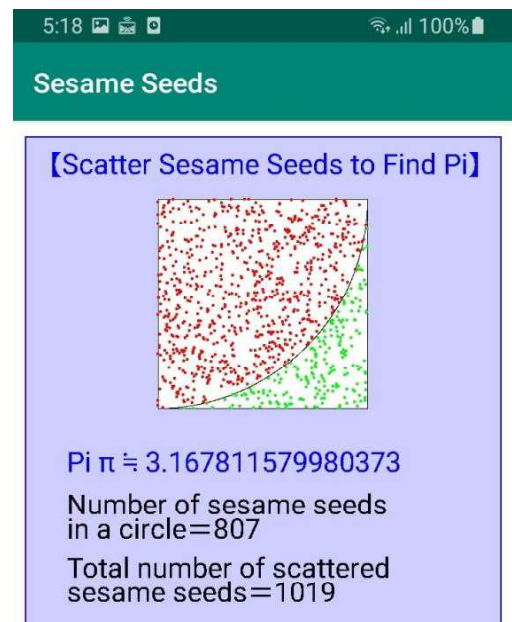
④ When 1019 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 1019

Number of sesame seeds in a circle ＝ 807

Approximate value of pi ＝ 807 ÷ 1019 × 4

＝ 3．167811 ⋯

Interesting Simulation

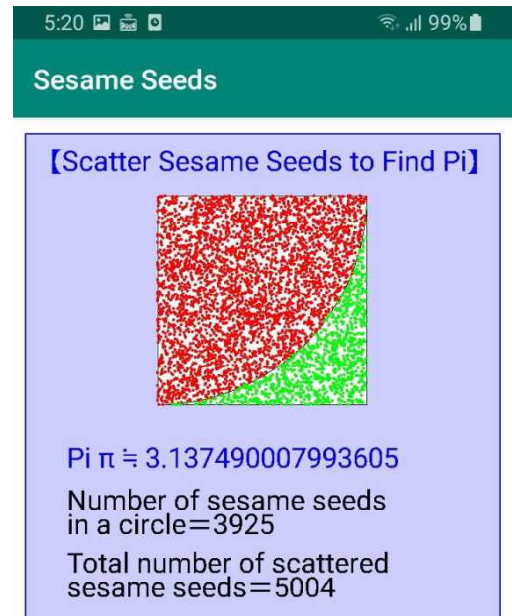## 9 Find an approximate value of pi by scattering sesame seeds

（2）Experimental result（Android version simulation）

⑤ When 5004 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 5004

Number of sesame seeds in a circle ＝ 3925

Approximate value of pi ＝ 3925 ÷ 5004 × 4

＝ 3．137490 …

⑥ When 10000 sesame seeds are scattered

Total number of scattered sesame seeds ＝ 10000

Number of sesame seeds in a circle ＝ 7868

Approximate value of pi ＝ 7868 ÷ 10000 × 4

＝ 3．1472