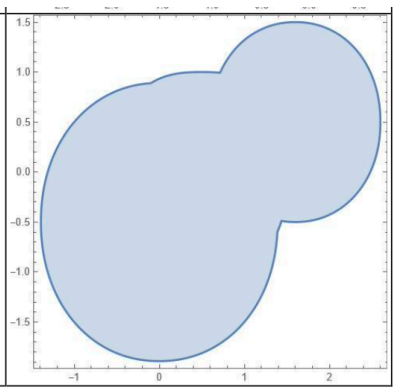
Task 3 : Calculation of square of a domain by Monter Carlo method

Show my data From Worksheet3

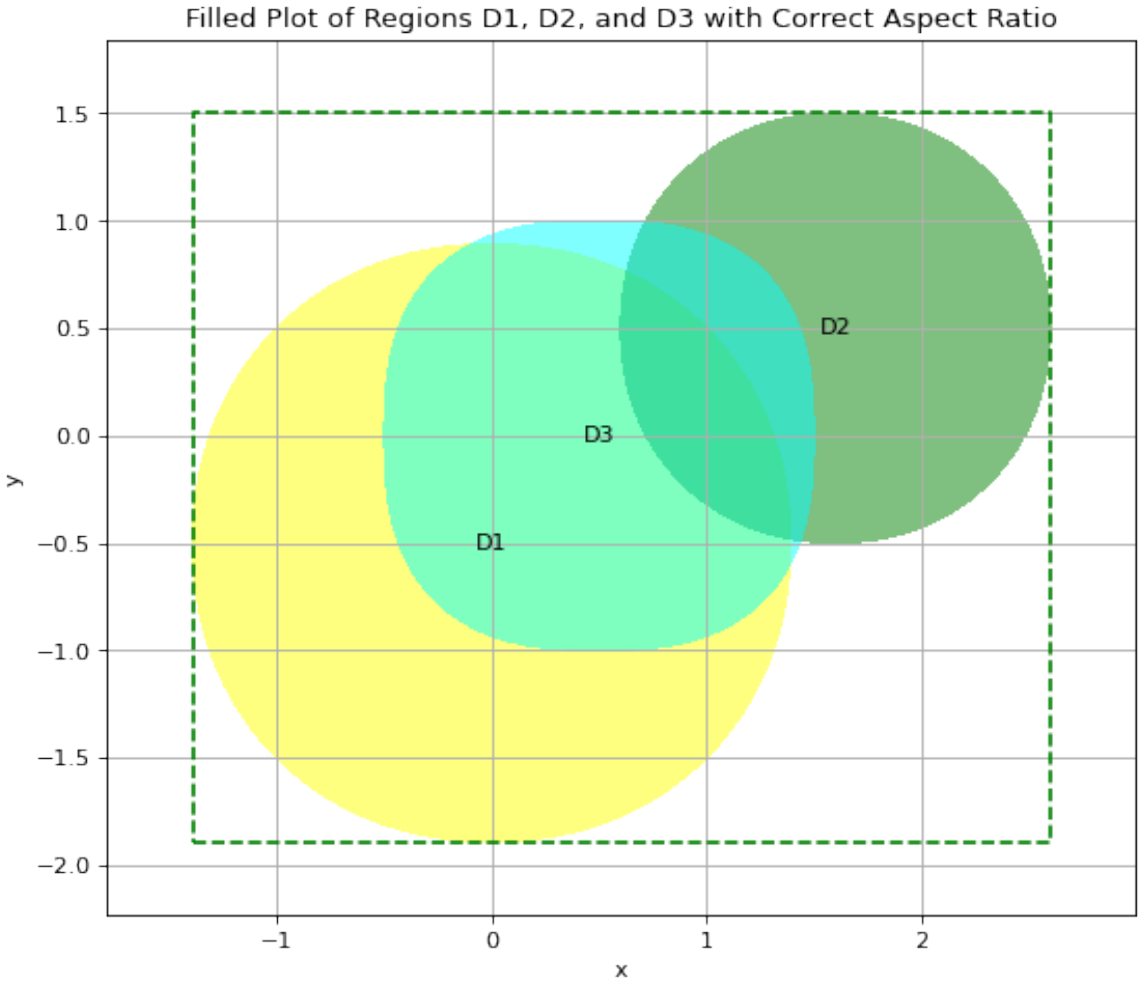
Yan Jingyu	{0, -0.5, 2.1, 2}	{1.6, 0.5, 2.1, 1}	{0.5, 0, 2.6, 1}	

Equation of domains' boundaries:

$$D_1 : |x|^{2.1} + |y + 0.5|^{2.1} = 2$$

$$D_2 : |x - 1.6|^{2.1} + |y - 0.5|^{2.1} = 1.0$$

$$D_3 : |x - 0.5|^{2.6} + |y|^{2.6} = 1$$

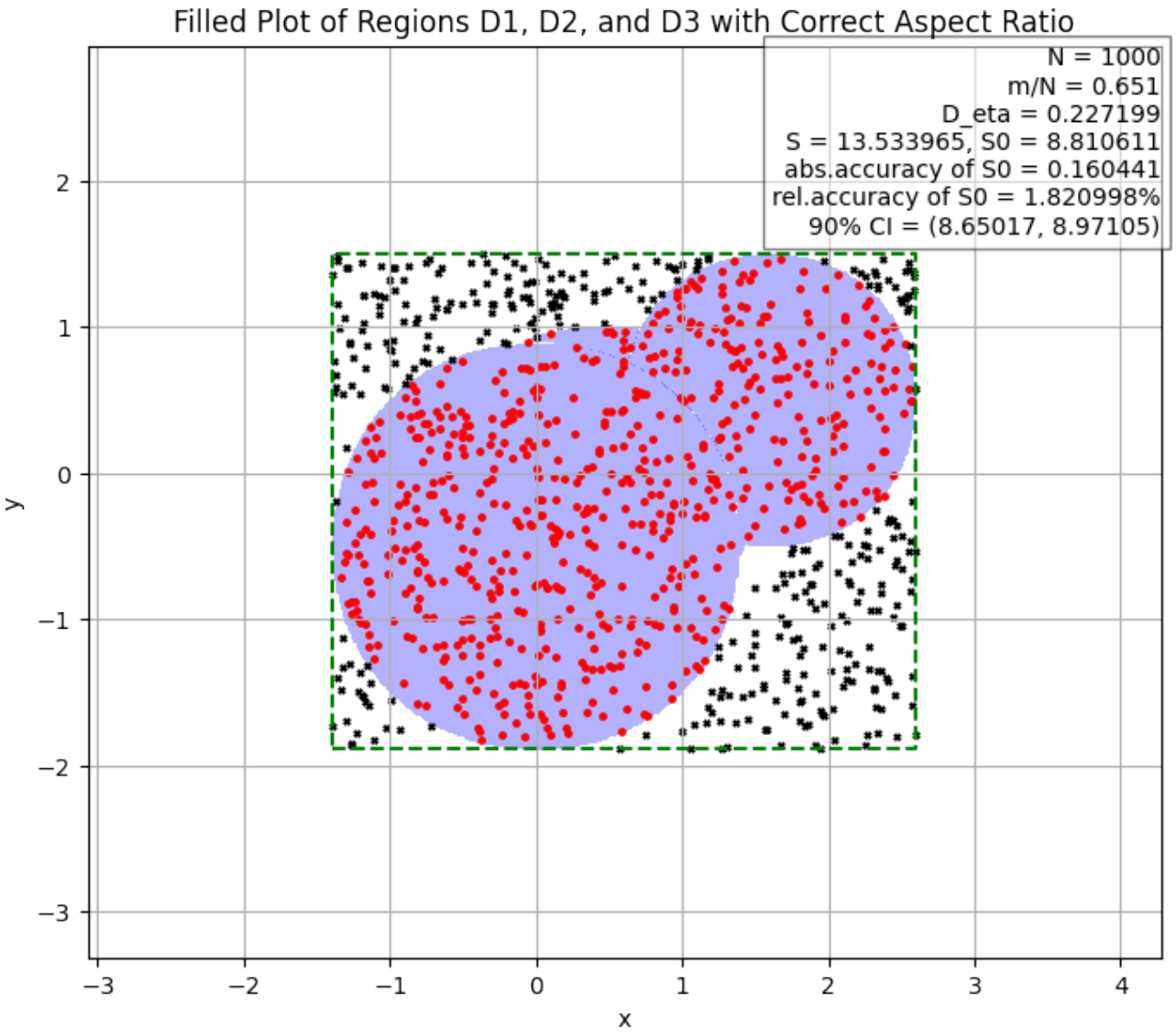


Domain D—the union of domains D1, D2, D3

Solution

We can find R, $R = [-1.3910656192458295, 2.6] \times [-1.8910656192458295, 1.5]$, square $S = 13.533965405578599$

After calculation, the following conclusions are drawn:



Accuracy of the square S_0 for different sample size (confidence probability 90%)

N	S_0	**accuracy of** $p(\epsilon)$	**abs.accuracy of** S_0	**rel.accuracy of** S_0
10	10.82717232	0.08348413	1.129871330	10.4355%
25	10.28581371	0.060192	0.814636446	7.92%
60	8.797077514	0.04846070	0.655865493	7.4555%
150	8.481284987	0.03151895	0.426576316	5.0296%
	8.2218839	0.01967161	0.266234881	3.2381%

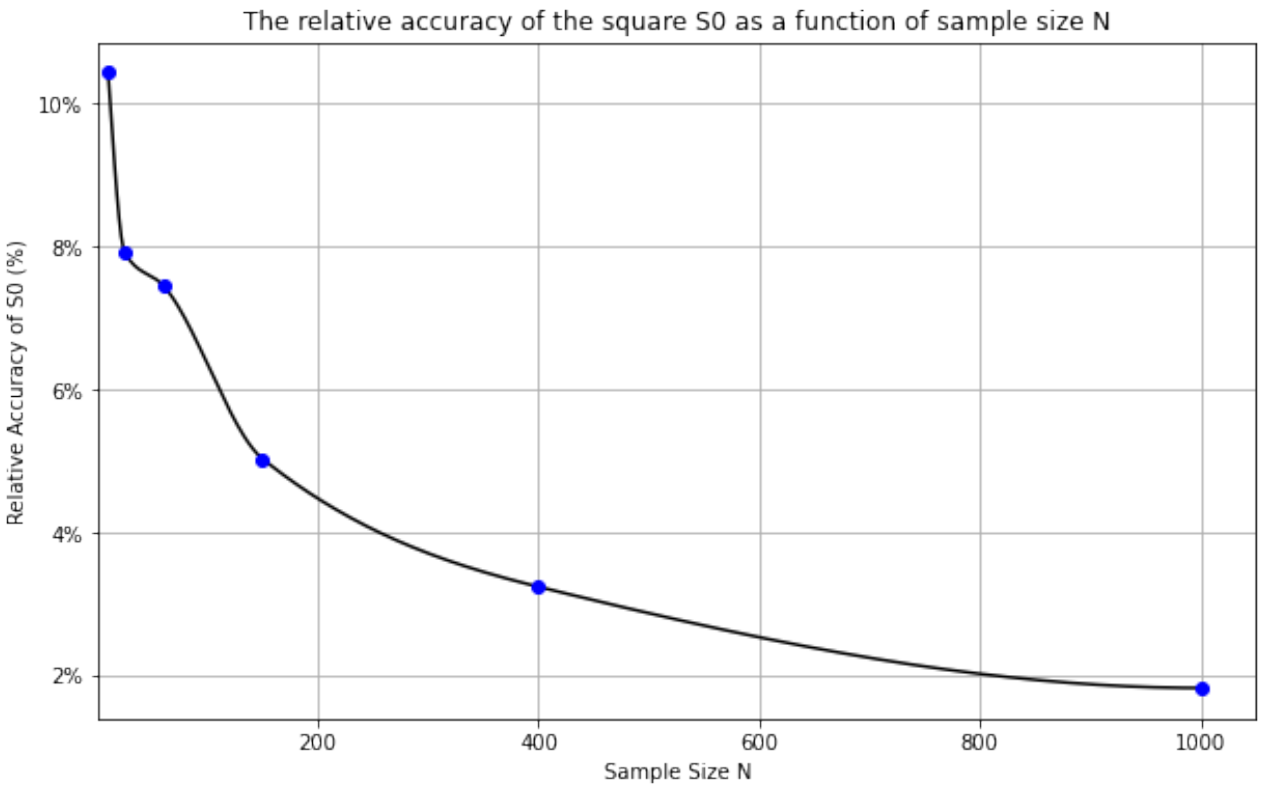
400	84			
1000	8.810611479	0.01185469	0.160441023	1.821%

The relative accuracy of the square S_0 equals 1.821%, so this value enough for the task.As the absolute accuracy for $N = 1000$, and confidence probability 90% equals 0.160441023, true value of the S_0 belongs to

$$(8.810611479 - 0.160441023, 8.810611479 + 0.160441023) = (8.65017, 8.97105)$$

with probability 0.90. $S_0 < 8.65017$ or $S_0 > 8.97105$ with probability $1 - 0.90 = 0.1$.

The dependence of the relative accuracy of the square S_0 on sample size is shown in Figure below



The relative accuracy of the square S_0 as a function of sample size N.