Лабораторная 2

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Вариант 3

Траектории

Функция: $f(x, y) = 10x^2 + y^2$

Начальное приближение: $(10, 10)$

Искомая точность: 10^{-5} в значении

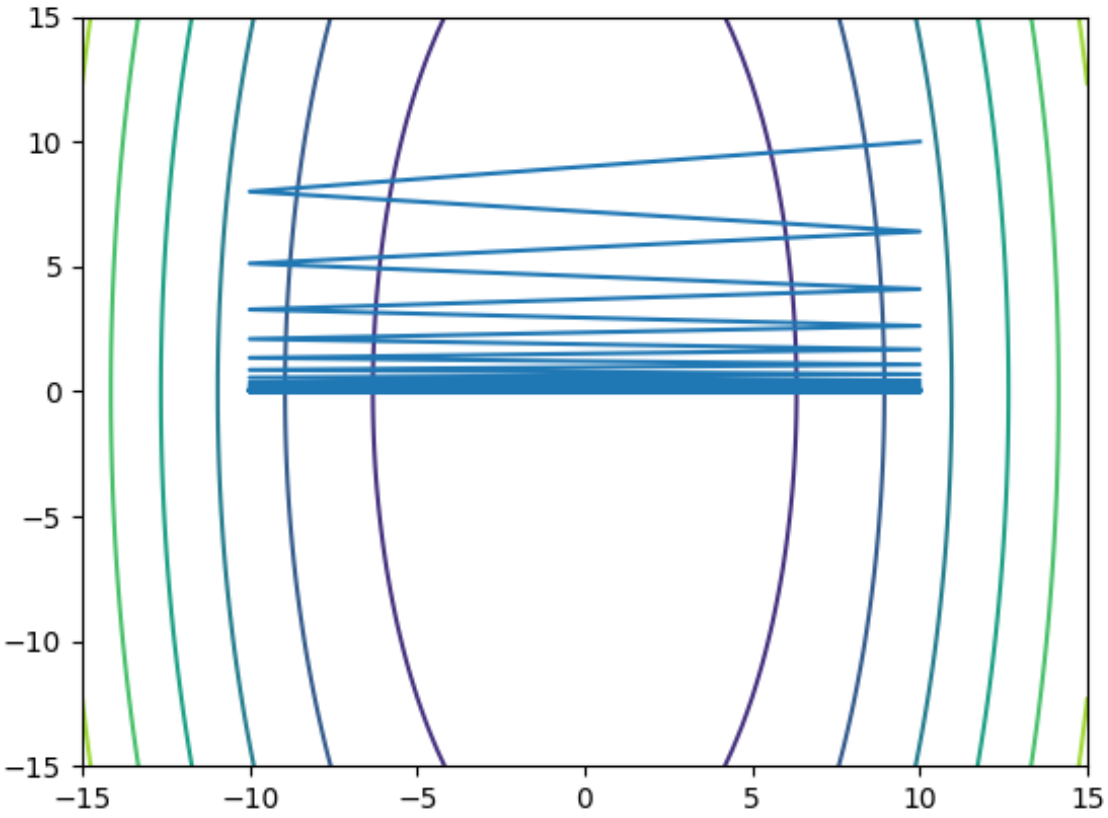

Figure 1: Постоянная 0.1. 35 итераций

Начальная точка: [10, 10]

название метода	10x$\hat{2}$+y$\hat{2}$	10000x$\hat{2}$+10000y$\hat{2}$	100000x$\hat{2}$+0.00001y$\hat{2}$
brent	9	2	2
break h0=0.7 eps=0.1 lambda=0.95	31	16	16
break h0=0.5 eps=0.9 lambda=0.9	50	60	64
golden	9	2	2
fibonacci	9	3	4

Начальная точка: [1, 100]

название метода	10x$\hat{2}$+y$\hat{2}$	10000x$\hat{2}$+10000y$\hat{2}$	100000x$\hat{2}$+0.00001y$\hat{2}$
brent	9	2	1932
break h0=0.7 eps=0.1 lambda=0.95	36	18	14
break h0=0.5 eps=0.9 lambda=0.9	50	69	53
golden	9	2	2
fibonacci	9	3	4

Начальная точка: [1, 10000]

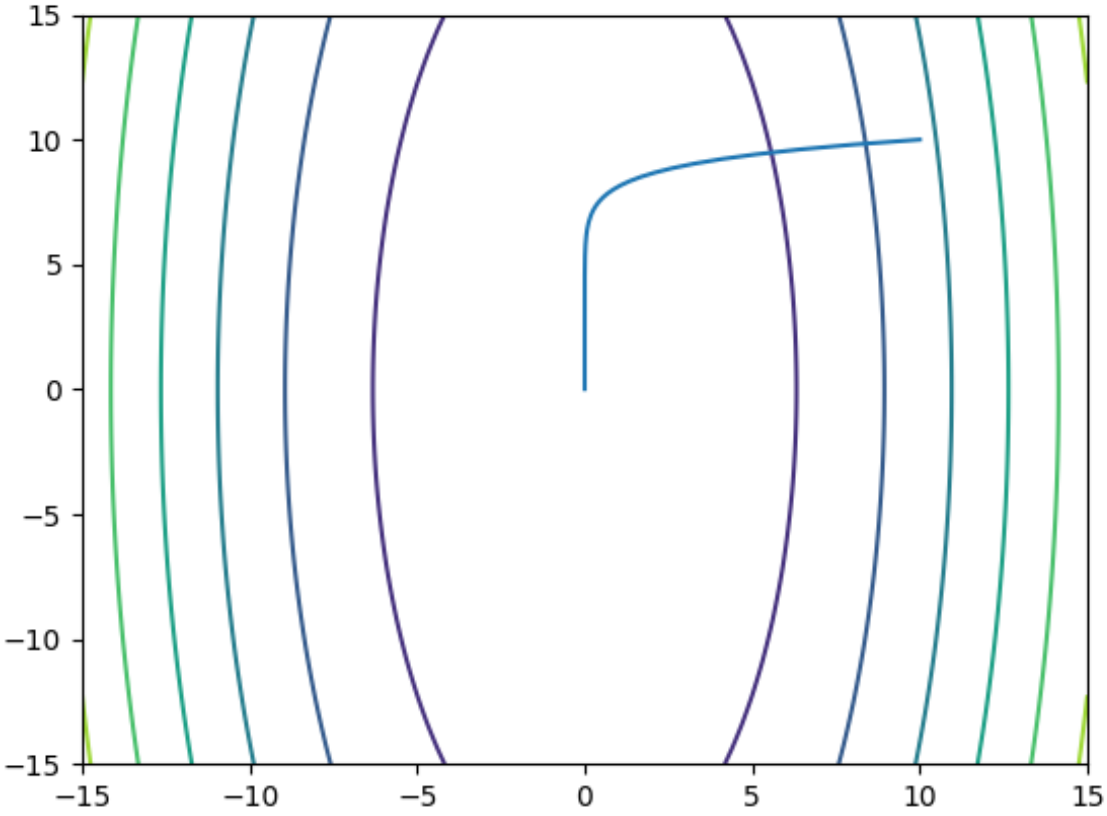

Figure 2: Постоянная 0.01. 320 итераций

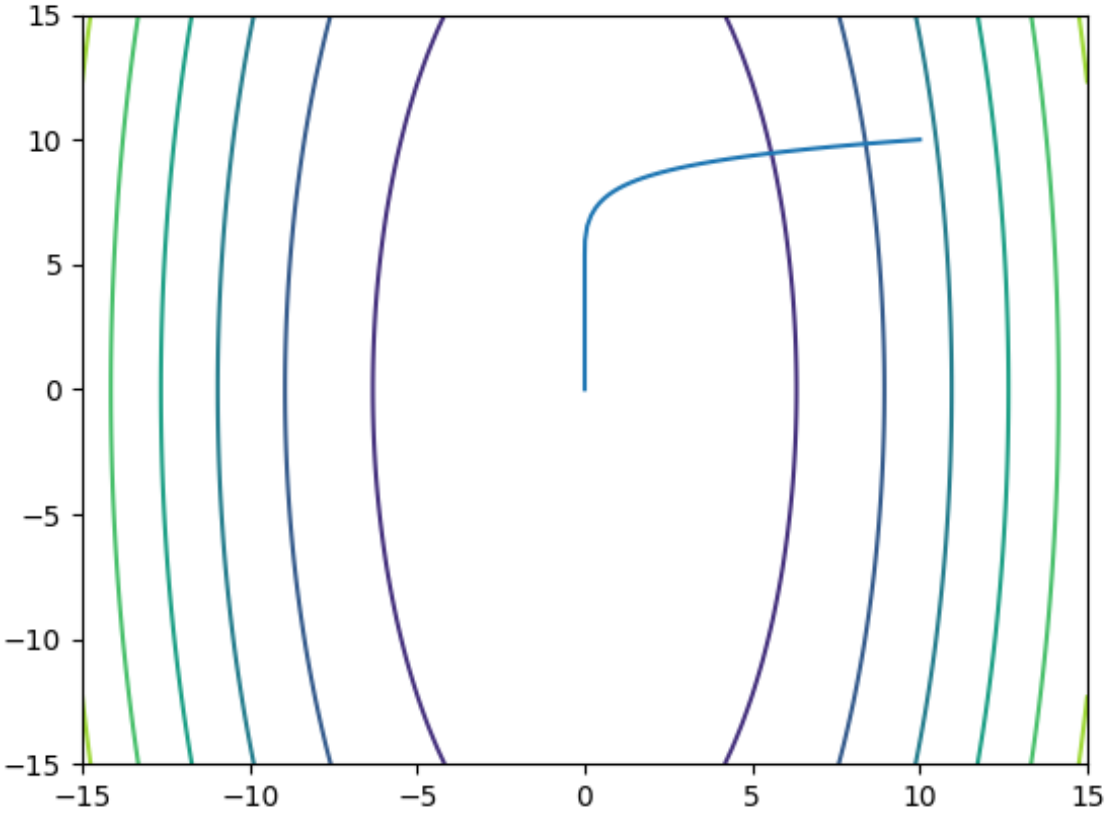

Figure 3: Дробление 1 0.95 0.95. 95 итераций

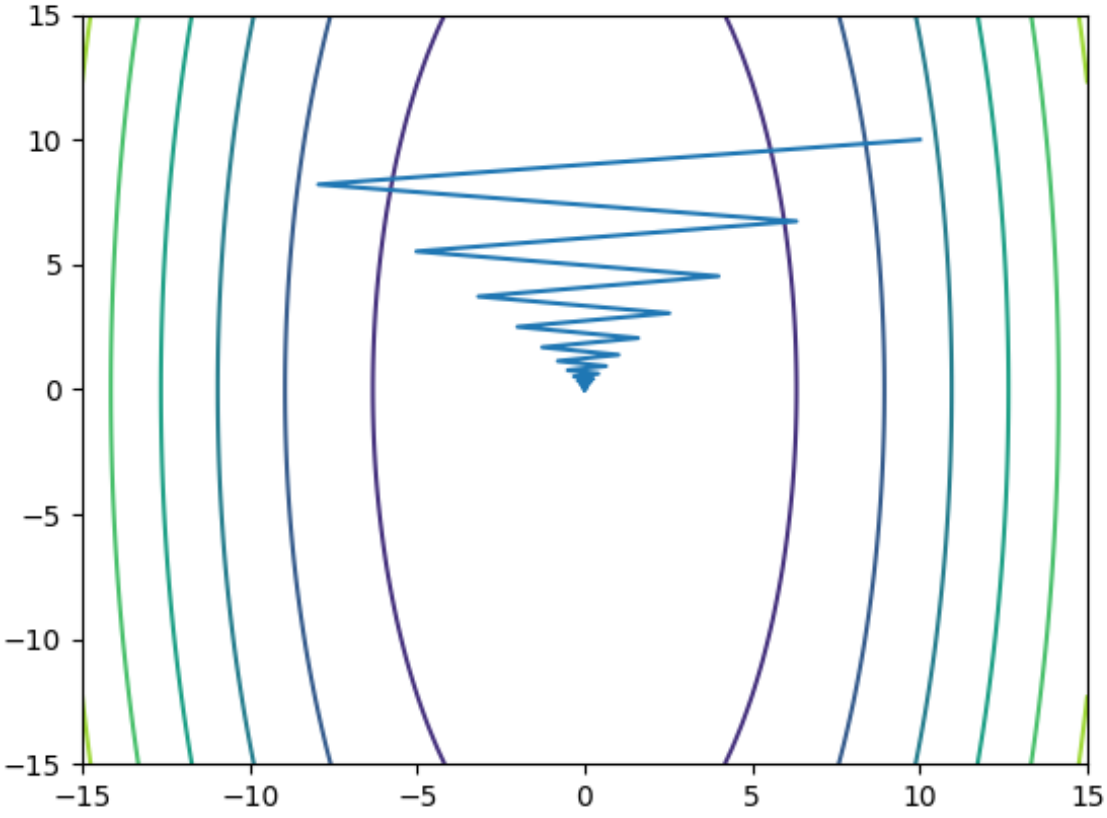

Figure 4: Дробление 1 0.1 0.95. 42 итерации

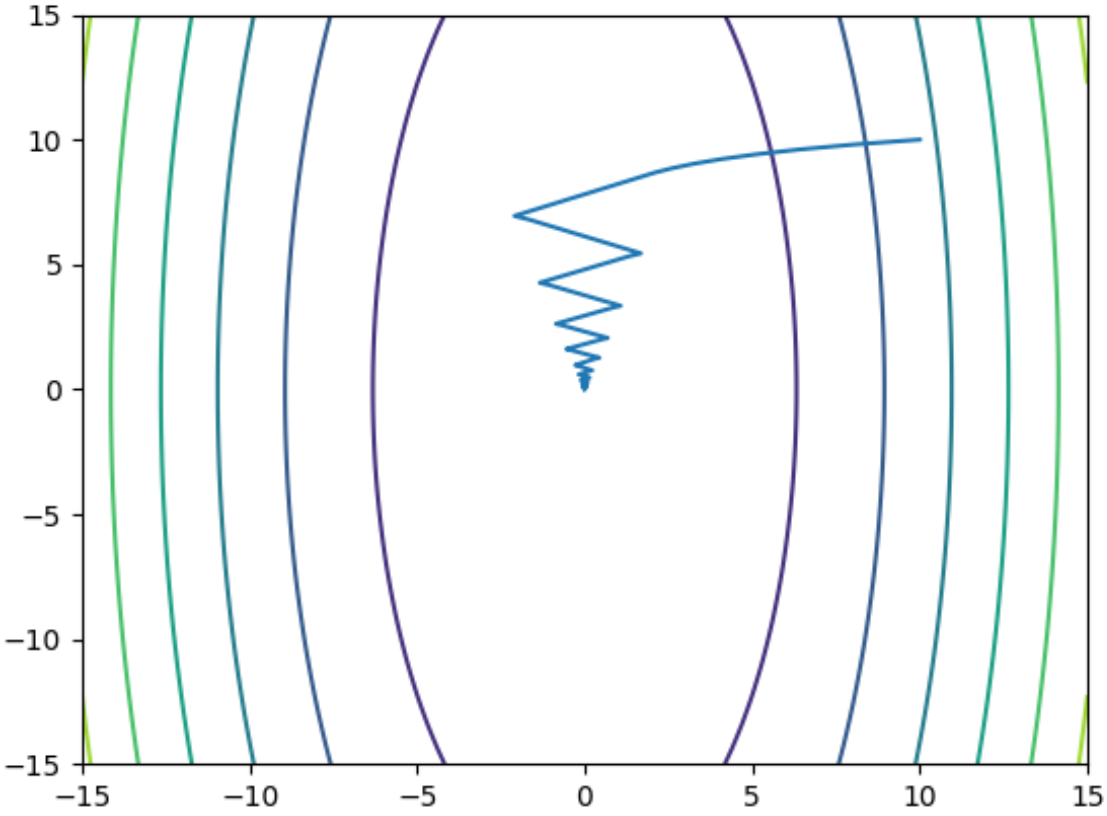

Figure 5: Дробление 1 0.1 0.1. 72 итерации

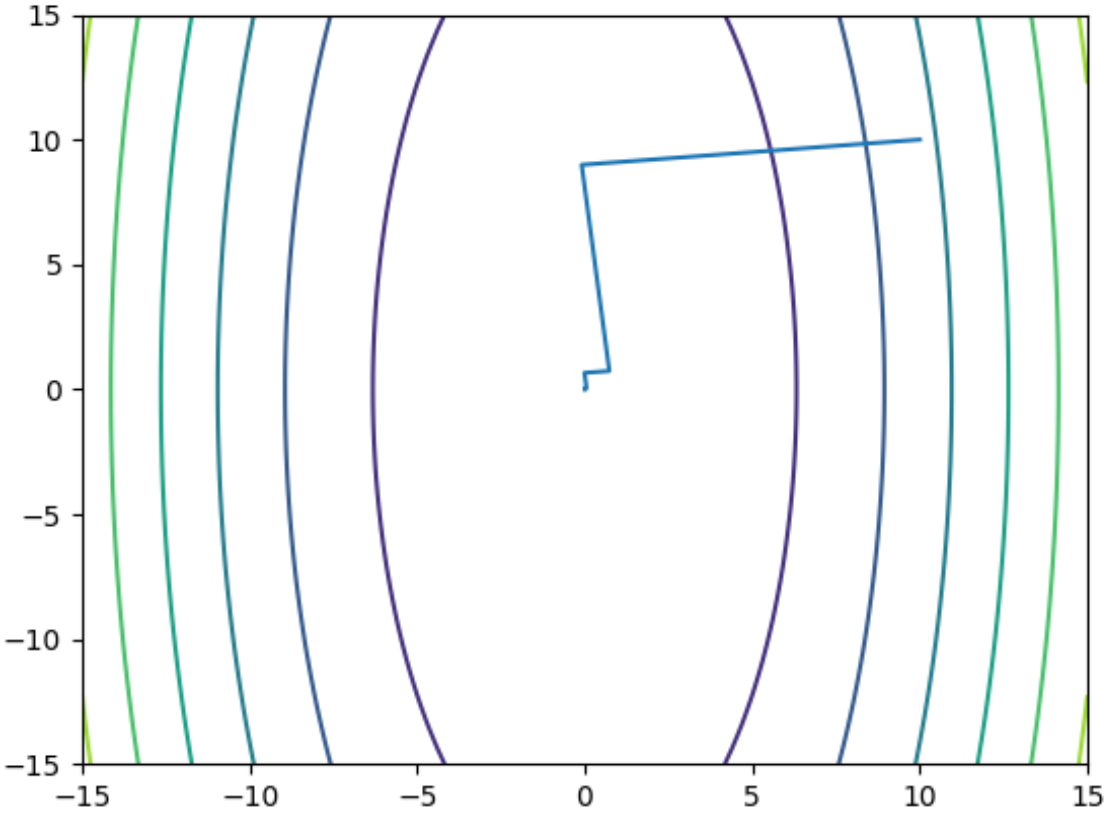

Figure 6: Золотое сечение. 9 итераций

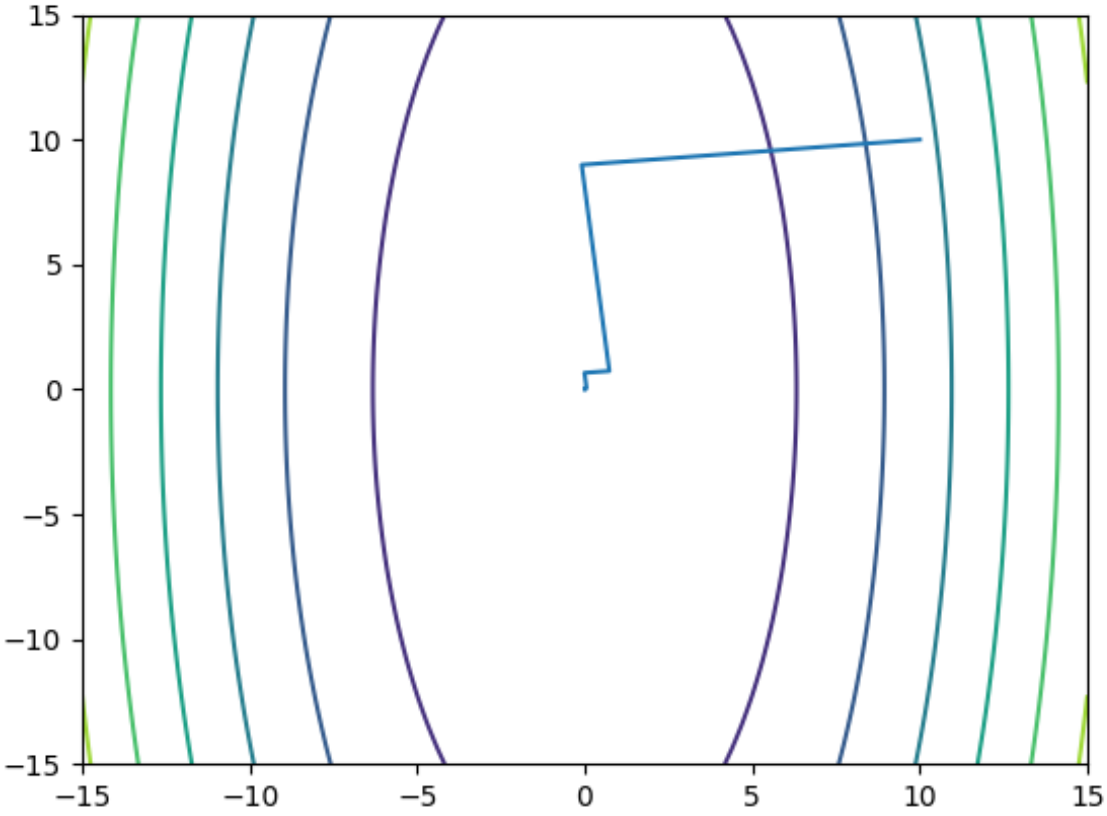

Figure 7: Фибоначчи. 9 итераций

название метода	$10x^2+y^2$	$10000x^2+10000y^2$	$100000x^2+0.00001y^2$
brent	4	2	11
break h0=0.7 eps=0.1 lambda=0.95	47	23	14
break h0=0.5 eps=0.9 lambda=0.9	72	90	53
golden	4	2	776
fibonacci	4	4	4

Начальная точка: [100, 1]

название метода	$10x^2+y^2$	$10000x^2+10000y^2$	$100000x^2+0.00001y^2$
brent	3	2	2
break h0=0.7 eps=0.1 lambda=0.95	25	18	19
break h0=0.5 eps=0.9 lambda=0.9	61	69	75
golden	3	2	2
fibonacci	4	3	4

Начальная точка: [10000, 1]

название метода	$10x^2+y^2$	$10000x^2+10000y^2$	$100000x^2+0.00001y^2$
brent	3	2	2
break h0=0.7 eps=0.1 lambda=0.95	27	23	24
break h0=0.5 eps=0.9 lambda=0.9	84	90	97
golden	3	2	2
fibonacci	5	4	5

Начальная точка: [1000, 10000]

название метода	$10x^2+y^2$	$10000x^2+10000y^2$	$100000x^2+0.00001y^2$
brent	74	2	439
break h0=0.7 eps=0.1 lambda=0.95	51	23	22
break h0=0.5 eps=0.9 lambda=0.9	75	90	86
golden	74	2	2
fibonacci	74	4	5

Сравнение метода сопряженных градиентов с обычным градиентным спуском Тесты с хорошим числом обусловленности: Тесты с плохим числом обусловленности:

```
Method:brent
size: 2
k=10.1 steps=9
k=1000.0010000000001 steps=4
k=100000000.0 steps=4
size: 3
k=2.9999999999999996 steps=2
k=10001.0001 steps=9053
k=10000499.98800075 steps=7
size: 4
k=4.0 steps=2
k=173.23394673100304 steps=7
k=17320.508364363905 steps=5
k=141774.46951415477 steps=13770
size: 6
k=7.4301405355945205 steps=13
k=2012487.2896767037 steps=2059
k=18.55397531527947 steps=40
Method:break h0=0.7 eps=0.1 lambda=0.95
size: 2
```

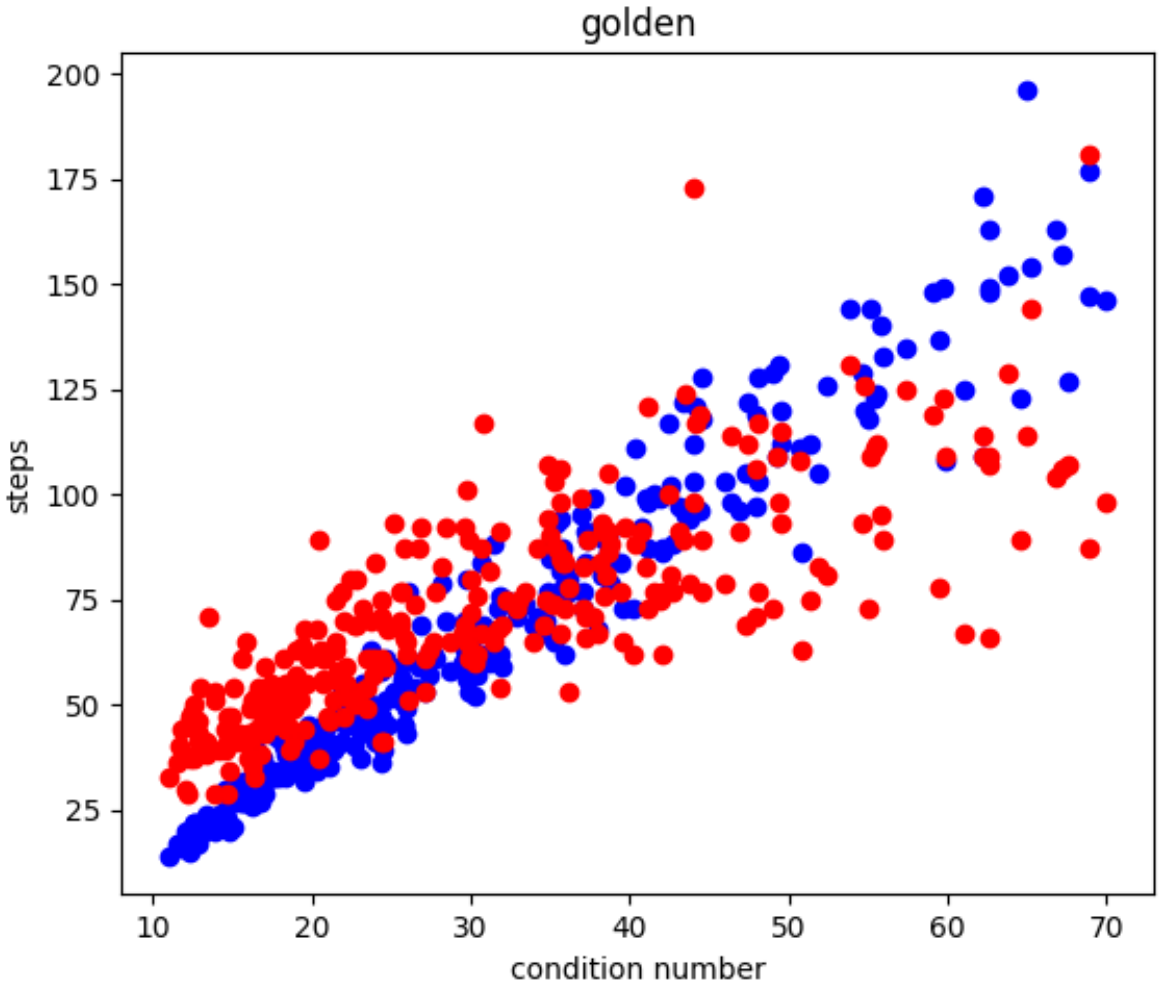

Figure 8: Размер задачи 10:

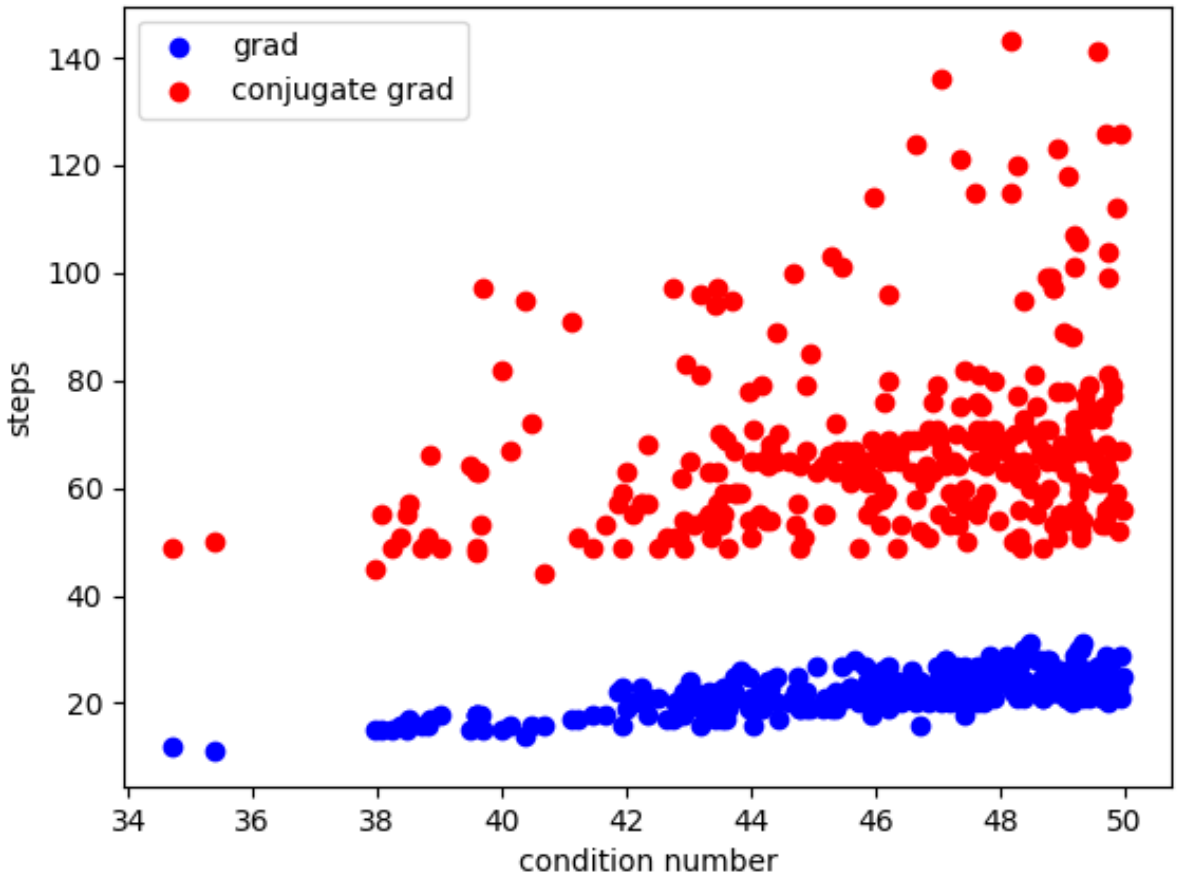

Figure 9: Размер задачи 30:

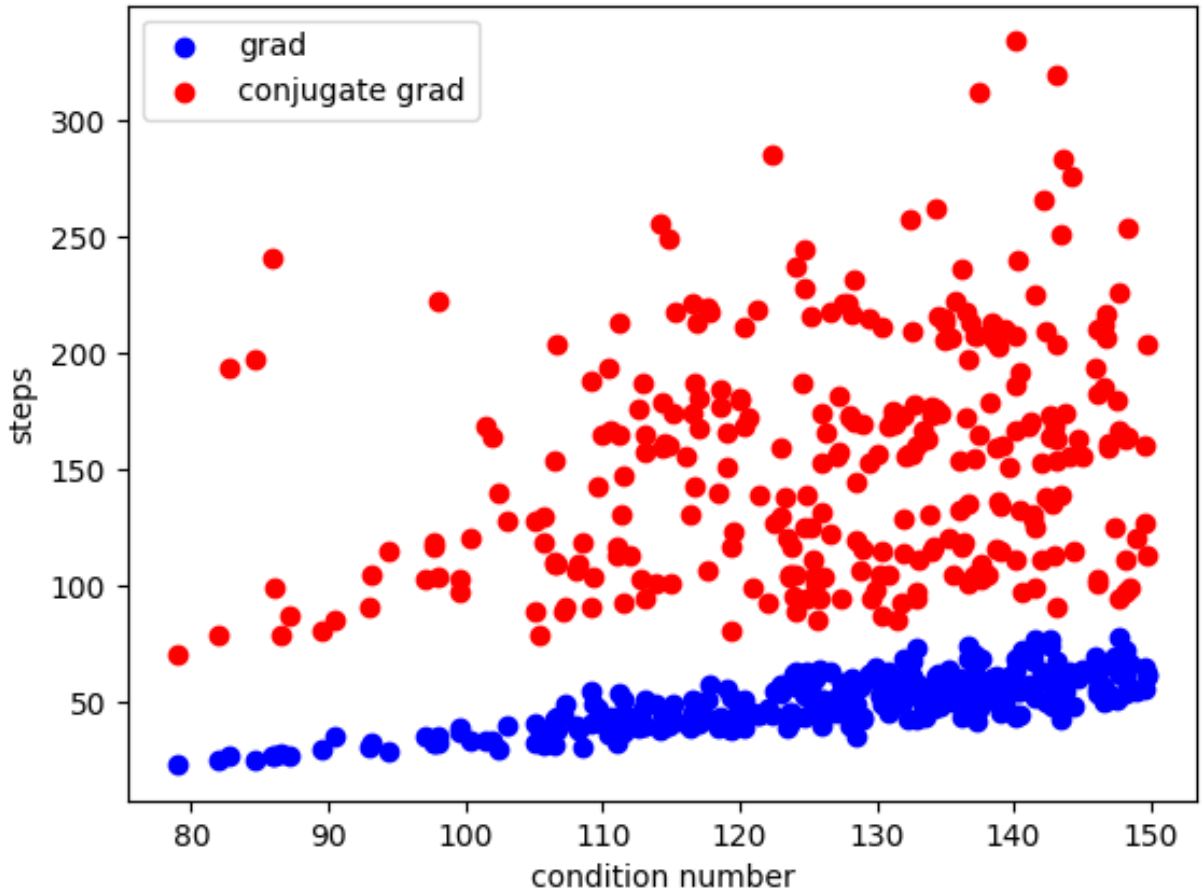

Figure 10: Размер задачи 50:

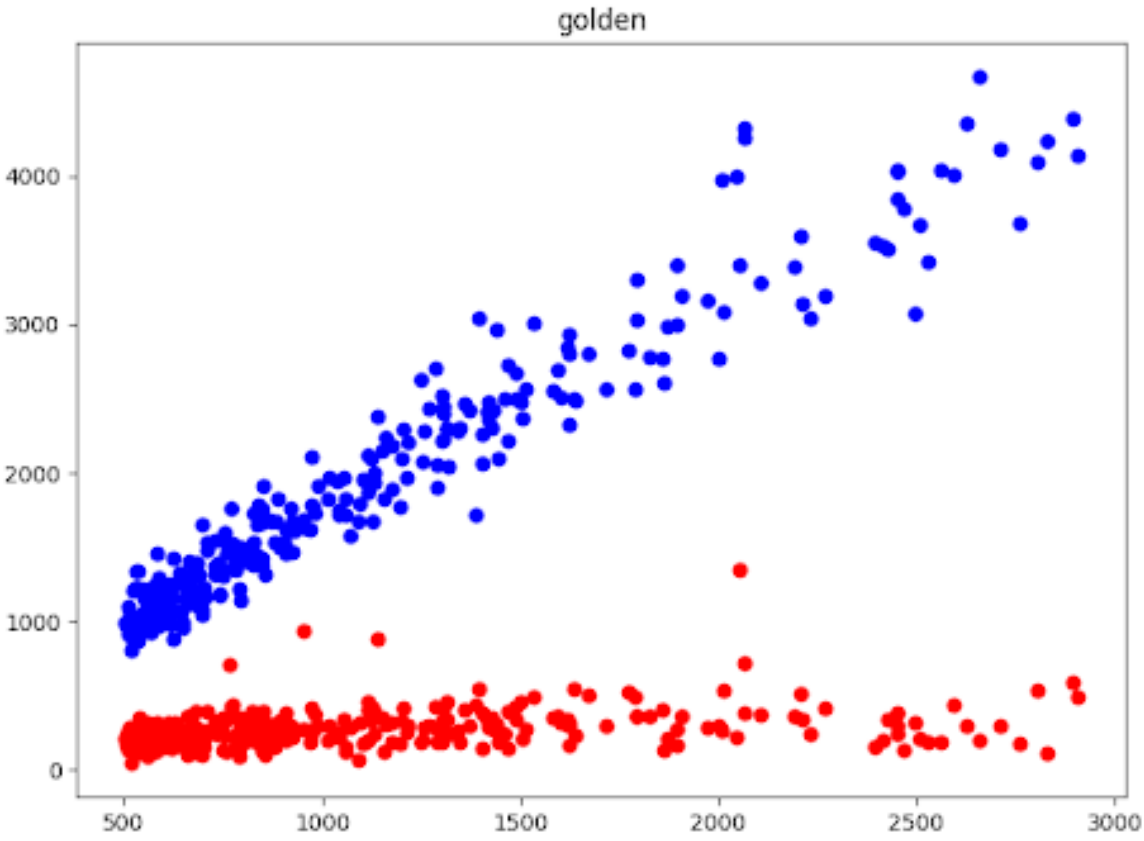

Figure 11: Размер задачи 3:

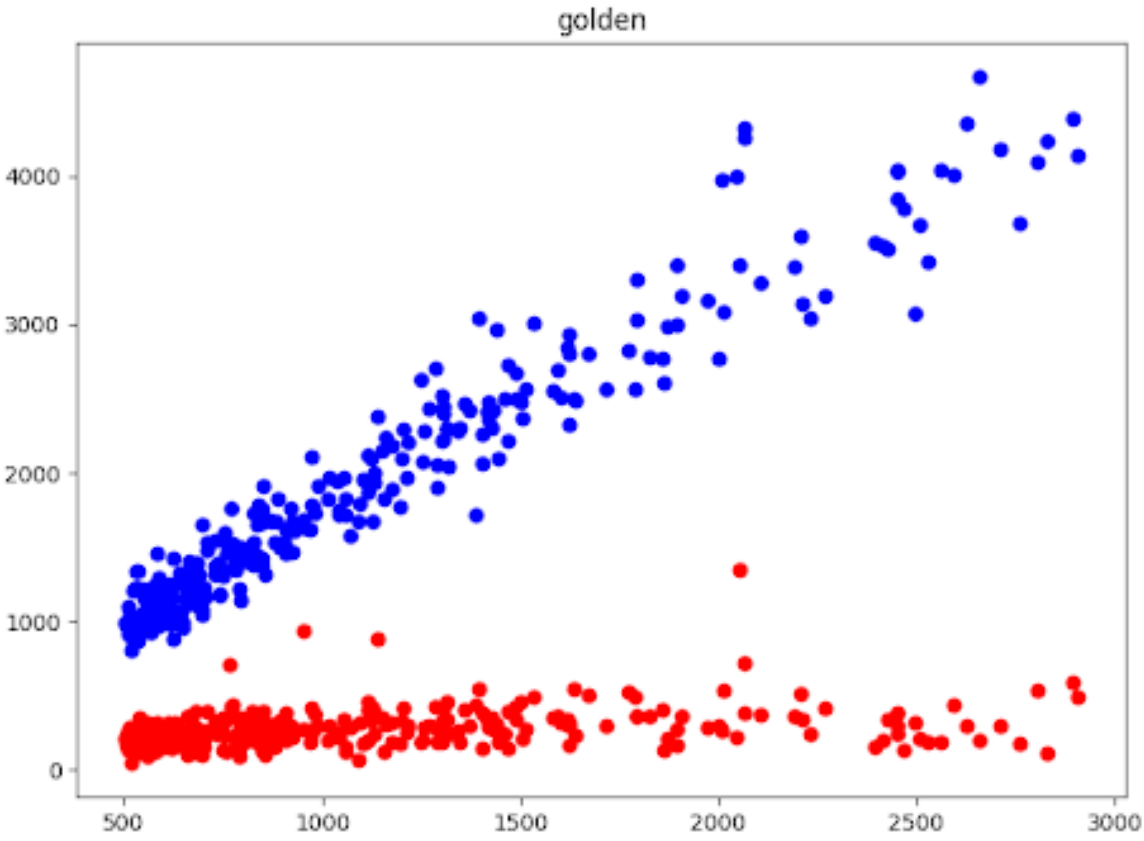

Figure 12: Размер задачи 10:

```
k=10.1 steps=31
k=1000.0010000000001 steps=857
k=100000000.0 steps=15
size: 3
k=2.9999999999999996 steps=11
k=10001.0001 steps=8485
k=10000499.98800075 steps=211
size: 4
k=4.0 steps=11
k=173.23394673100304 steps=150
k=17320.508364363905 steps=9640
k=141774.46951415477 steps=67565
size: 6
k=7.4301405355945205 steps=17
k=2012487.2896767037 steps=9574
k=18.55397531527947 steps=38
Method:break h0=0.5 eps=0.9 lambda=0.9
size: 2
k=10.1 steps=50
k=1000.0010000000001 steps=888
k=100000000.0 steps=58
size: 3
k=2.9999999999999996 steps=41
k=10001.0001 steps=3631
k=10000499.98800075 steps=234
size: 4
k=4.0 steps=42
k=173.23394673100304 steps=211
k=17320.508364363905 steps=4035
k=141774.46951415477 steps=28588
size: 6
k=7.4301405355945205 steps=47
k=2012487.2896767037 steps=846
k=18.55397531527947 steps=50
Method:golden
size: 2
k=10.1 steps=9
k=1000.0010000000001 steps=4
k=100000000.0 steps=2
size: 3
k=2.9999999999999996 steps=2
k=10001.0001 steps=9087
k=10000499.98800075 steps=7
size: 4
k=4.0 steps=2
k=173.23394673100304 steps=7
k=17320.508364363905 steps=5
k=141774.46951415477 steps=24225
size: 6
k=7.4301405355945205 steps=13
k=2012487.2896767037 steps=2058
k=18.55397531527947 steps=40
Method:fibonacci
```

```
size: 2
k=10.1 steps=9
k=1000.0010000000001 steps=6
k=100000000.0 steps=3
size: 3
k=2.9999999999999996 steps=2
k=10001.0001 steps=58
k=10000499.98800075 steps=136
size: 4
k=4.0 steps=2
k=173.23394673100304 steps=7
k=17320.508364363905 steps=11621
k=141774.46951415477 steps=53095
size: 6
k=7.4301405355945205 steps=13
k=2012487.2896767037 steps=1808
k=18.55397531527947 steps=40
```