

Министерство науки и высшего образования Российской Федерации Федеральное государственное бюджетное образовательное учреждение высшего образования

«Московский государственный технический университет имени Н.Э. Баумана

(национальный исследовательский университет)» (МГТУ им. Н.Э. Баумана)

ФАКУЛЬТЕТ «Информатика и системы управления» (ИУ)

КАФЕДРА «Информационная безопасность» (ИУ8)

Отчёт

по рубежному контролю № 3 по дисциплине «Методы оптимизации»

Тема: « Исследование генетических алгоритмов в задачах поиска экстремумов »

Вариант 10

Выполнил: Митрофанов Д.А., студент группы ИУ8-33

Проверил: Коннова Н. С., доцент каф. ИУ8

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1.1. Цель работы

Изучить основные принципы действия генетических алгоритмов на примере решения задач оптимизации функций двух переменных.

1.2. Постановка задачи

Найти максимум функции f(x,y) в области D с помощью простого (классического) генетического алгоритма. За исходную популяцию принять 4 случайных точки. Хромосома каждой особи состоит из двух генов: значений координат x, y. B качестве потомков следует выбирать результат скрещивания лучшего решения со вторым и третьим в порядке убывания значений функции приспособленности с последующей случайной мутацией обоих генов. B качестве критерия остановки эволюционного процесса задаться номером конечной популяции ($N\sim10^1...10^2$). Визуализировать результаты расчетов.

1.3. Условие варианта

Вид функции f(x,y)	Область допустимых значений D
$\frac{\sin^2(x)}{1+x^2+y^2}$	$(0,2) \times (-2,2)$

2. Расчёт с помощью программы

10 generations:

	genereation prefix	-	X		Y		FIT	max element	average
	0 p 0 p 0 p		0.4018 0.9955 1.445 1.283		-0.0001607 1.223 0.9934 -0.08465	 -	0.1317 0.2019 0.2416 0.3465	 0.3465	0.2304
ļ	1 p		1.283		-0.08465	 !	0.3465	 ! !	 !
	1 p 1 p 1 p	 	1.283 0.9955 0.9955		-0.0001607 -0.08465 -0.0001607	 -	0.3474 0.3523 0.3536	 	0.3499
	1 ig		1.283 1.283 1.283 1.283 1.283 1.283 0.9955 0.9955 0.9955 0.9955		-0.08465 -0.08465 -0.08465 -0.0001607 -0.0001607 -0.08465 -0.08465 -0.08465 -0.0001607 -0.0001607		0.3465 0.3465 0.3465 0.3474 0.3474 0.3474 0.3523 0.3523 0.3523 0.3523 0.3536 0.3536		0.3499
	2 p 2 p 2 p 2 p 2 p	 	0.9955 0.9955 0.9955 0.9955	 	-0.0001607 -0.0001607 -0.0001607 -0.0001607	 	0.3536 0.3536 0.3536 0.3536		0.3536

2		 0.9955				
2	ig ig	0.9955	-0.0001607	•	I I	I I
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2	ig	0.9955				
2	ig	0.9955	-0.0001607	•		
2	ig	0.9955 0.9955	-0.0001607 -0.0001607			
2	ig			•		
2	ig	0.9955	1 0.000 = 007	1 0.0000		
	ig	0.9955	-0.0001607	•		
2	ig	0.9955	-0.0001607		1 0 2526	1 0 2526
2 	ig 	0.9955 	-0.0001607	0.3536 	0.3536 	0.3536
3	p	0.9955	-0.0001607	0.3536	1	1
3	l p	0.9955	-0.0001607	•	i	i
3	l p	0.9955	-0.0001607		i	i
3	q	0.9955	-0.0001607	0.3536	0.3536	0.3536
3	ig	 0.9955	-0.0001607	 0.3536	 	
3	ig	0.9955	-0.0001607		1	1
3	ig	0.9955	-0.0001607	0.3536		
3	ig	0.9955	-0.0001607			1
3	ig	0.9955	-0.0001607	•		1
3	ig	0.9955	-0.0001607	0.3536	İ	İ
3	ig	0.9955	-0.0001607		i	i
3	ig	0.9955	•	0.3536	i	i
3	ig	0.9955	-0.0001607	•	i	i
3	ig	0.9955	-0.0001607	•	i	i
3	ig	0.9955	•	0.3536	İ	i i
3	ig	0.9955	-0.0001607	0.3536	0.3536	0.3536
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4 4 4 	p p p	0.9955 0.9955 0.9955 0.9955	-0.0001607 -0.0001607 -0.0001607 -0.0001607	0.3536 0.3536 0.3536 0.3536		
4 4 4 	p p p 	0.9955 0.9955 0.9955 0.9955	-0.0001607 -0.0001607 -0.0001607 -0.0001607	0.3536 0.3536 0.3536 0.3536 0.3536		
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4 4 4 	p p p ig ig ig ig ig	0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955	-0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607	0.3536 0.3536 0.3536 0.3536 0.3536 0.3536 0.3536 0.3536 0.3536 0.3536		
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4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 7 5 5 5 5	p	0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955	-0.0001607 -0.0001607	0.3536 0.3536	0.3536	0.3536
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 5 5 5 5 5	p	0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955 0.9955	-0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607 -0.0001607	0.3536 0.3536	0.3536	0.3536

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9	q q	0.9955 0.9955	-0.0001607 -0.0001607	0.3536 0.3536	l	1
9	p	0.9955	-0.0001607	0.3536		
9	l p	0.9955	-0.0001607		0.3536	0.3536
9	 ig	 0.9955	-0.0001607	0.3536	 I	
9	ig	0.9955	1 -0.0001607	0.3536		
9	ig	0.9955	-0.0001607	0.3536	i	İ
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9	ig ig	0.9955 0.9955	-0.0001607	0.3536 0.3536	1	1
9	l ig	0.9955	-0.0001607	0.3536		
9	ig	0.9955	-0.0001607	0.3536	i	İ
9	lig	0.9955	-0.0001607	0.3536	0.3536	0.3536
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			100 generation	ıs:		
enereati	lon prefix	X	Y	FIT	max element	average
0	 q	 0.4897	-1.732	0.05218		 I
0	p	1.51	-1.321	0.1983		
0	l p	0.9145	-0.5381	0.2953		
0	p	1.384	0.178	0.3276	0.3276	0.2183
 1		 1.51	0.178	0.3009		
1	q q	1.31	-0.5381	0.3009	 	1
1	P	1.384	0.178	0.3276	İ	i
1	l p	0.9145	0.178	0.336	0.336	0.3165
1	ig	1.51	-0.5381	0.2792	1	I
1	ig	0.9145	-0.5381	0.2953	j	I
1	ig	1.51	0.178	0.3009	1	1
1	ig	1.51	0.178	0.3009	1	I
1	ig	1.384	-0.5381	0.3013		
1	ig	1.384	0.178	0.3276	I	
1 1	ig ig	1.384 1.384	0.178 0.178	0.3276 0.3276	 	I I
1	ig	1.384	0.178	0.3276	! 	1
1	ig	1.384	0.178	0.3276	i	i
1	ig	0.9145	0.178	0.336	j	İ
1	ig	0.9145	0.178	0.336	0.336	0.3156
					== =====	
 2	 р	1.384	0.178	0.3276		
2	l p	0.9145	0.178	0.336	1	1
2	l p	0.9145	0.178	0.336	1	1
2	a l	0.9145	0.178	0.336	0.336	0.3339

| 0.3276 | 0.3276

2 2 2 2 2 2 2 2 2 2		1.384 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145	0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178	0.3276 0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336	 0.336	0.3339	
3 3 3 3	p p p	0.9145 0.9145 0.9145 0.9145	0.178 0.178 0.178 0.178	0.336 0.336 0.336 0.336	 0.336	 0.336	
3 3 3 3 3 3 3 3 3 3	ig ig ig ig ig	0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145	0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178	0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336	 0.336		
4 4 4 4	p p p	0.9145 0.9145 0.9145 0.9145	0.178 0.178 0.178 0.178	0.336 0.336 0.336 0.336	 0.336	 0.336	
4 4 4 4 4 4 4 4 4 4	ig ig ig ig ig ig ig ig	0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145	0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178	0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336	 0.336		
5 5 5 5	p p p	0.9145 0.9145 0.9145 0.9145	0.178 0.178 0.178 0.178	0.336 0.336 0.336 0.336	 0.336	 0.336	
5 5 5 5 5 5 5 5 5	ig ig ig ig ig ig ig ig	0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145 0.9145	0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178 0.178	0.336 0.336 0.336 0.336 0.336 0.336 0.336 0.336	 		

5	ig	0.9145	0.178	0.336			. !
5	ig	0.9145	0.178	0.336	1 0 226	1 0 226	
5	ig	0.9145	0.178	0.336	0.336	0.336	
6	l p	0.9145	0.178	0.336			!
6	l p	0.9145	0.178	0.336	!		!
6	l p	0.9145	0.178	0.336			
6	l p	0.9145	0.178	0.336	0.336	0.336	- 1
6	ig	0.9145	0.178	0.336	1		- 1
6	ig	0.9145	0.178	0.336			
6	ig	0.9145	0.178	0.336			
6	ig	0.9145	0.178	0.336			
6	ig	0.9145	0.178	0.336			
6	ig	0.9145	0.178	0.336			
6	ig	0.9145	0.178	0.336			- 1
6	ig	0.9145	0.178	0.336			- 1
6	ig	0.9145	0.178	0.336	i	i	i
6	iq	0.9145	0.178	0.336	i	İ	i
6	ig	0.9145	0.178	0.336	i		i
6	ig	0.9145	0.178	0.336	0.336	0.336	i
							'
7	1						,
7	l p	0.9145	0.178	0.336	!		!
7	l p	0.9145	0.178	0.336			
7	l p	0.9145	0.178	0.336			- 1
7	l þ	0.9145	0.178	0.336	0.336	0.336	
7	ig	0.9145	0.178	0.336	1		- 1
7	lig	0.9145	0.178	0.336	i	i	i
7	ig	0.9145	0.178	0.336	i		i
7	ig	0.9145	0.178	0.336			i
7	ig	0.9145	0.178	0.336	1	l I	
7	ig	0.9145	0.178	0.336	1	l I	
7	ig	0.9145	0.178	0.336	1	l I	
7	ig	0.9145	0.178	0.336	1	l I	
			·		1		
7	ig	0.9145	0.178	0.336			
7	ig	0.9145	0.178	0.336			
7	ig	0.9145	0.178	0.336		1 0 000	!
7	ig	0.9145	0.178	0.336	0.336	0.336	_
8	l p	0.9145	0.178	0.336	Į.	ļ	- 1
8	l p	0.9145	0.178	0.336			
8	l p	0.9145	0.178	0.336			
8	l p	0.9145	0.178	0.336	0.336	0.336	- 1
8	ig	0.9145	0.178	0.336			- 1
8	ig	0.9145	0.178	0.336	i	i	i
8	ig	0.9145	0.178	0.336	i	i	i
8	ig	0.9145	0.178	0.336	i	i	
8	ig	0.9145	0.178	0.336		! 	1
8	ig	0.9145	0.178	0.336	I I	! 	- 1
8				0.336	I I	I I	- 1
	ig	0.9145	0.178		I I	I	
8	ig	0.9145	0.178	0.336		1	- !
8	ig	0.9145	0.178	0.336			!
8	ig	0.9145	0.178	0.336	I	Į.	
8	ig	0.9145	0.178	0.336			
8	ig	0.9145	0.178	0.336	0.336	0.336	_
9	p	0.9145	0.178	0.336	1	1	- 1

9	9	Ιp	0.9145	0.178	0.336			I
9 ig 0.9145 0.178 0.336	-	-				 0 336	 0 336	
9 ig 0.9145 0.178 0.336								'
9 ig 0.9145 0.178 0.336	a							
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9 10			0.9145	0.178	0.336	İ	į	i
9		_		·		1		Ţ
9	-	_		·		I I	 	
9 ig 0.9145 0.178 0.336						i	i	i
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9 1q						I I		
10		_				i	İ	i
10 p 0.9145 0.178 0.336	9	ig	0.9145	0.178	0.336	0.336	0.336	
10 p 0.9145 0.178 0.336								
10 p 0.9145 0.178 0.336 0.336 0.336 1 1 1 1 p 0.9145 0.178 0.336	10	 p	0.9145	0.178	0.336	 	l	
10		-				1	1	1
10						1 0 336	 0 336	
10								'
10	10	 ig	0.9145	0.178	0.336	 		
10		ig				1	1	- 1
10		_		·		1		
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10	10	ig	0.9145	0.178	0.336	İ	i	İ
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11			1 0.3143					'
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11 ig		ig	0.9145					
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11 ig	11	ig	0.9145	0.178	0.336	į.	į.	İ
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11 ig	11	ig	0.9145	0.178	0.336	į	i	İ
11 ig 0.9145 0.178 0.336								
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12 p						0.336	0.336	i
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12 p	12	 p	0.8731	0.3743	0.3087	 		
12 p 1.085 0.2404 0.3499 0.3499 0.3295	12	q l	0.8499	0.2147	0.3191	ļ.	1	İ
12 ig 0.6459 0.08588 0.2543						0 3400	0 3305	
		P	1 1.000	0.2704	U.J.J.	U.Jajj		'
	12					 		
	12				0.2548	1	1	-

12 12 12 12 12 12 12 12	ig ig ig ig ig ig ig	0.8682 1.015 1.199 0.9327 0.942 0.9686 1.201 1.14 1.1	0.1139 0.377 0.3364 -0.01976 -0.05961 0.00882 0.1403 0.1633 0.1489 0.02796	0.3297 0.3322 0.3403 0.3449 0.3459 0.3504 0.3531 0.3549 0.3558 0.3587	 0.3587	0.3312
13 13 13 13	p p	1.201 1.14 1.1 1.146	0.1403 0.1633 0.1489 0.02796	0.3531 0.3549 0.3558 0.3587	 0.3587	
13	ig ig ig ig ig ig ig ig	1.201 1.201 1.146 1.1 1.146 1.14 1.201 1.146 1.14 1.14	0.1633 0.1489 0.1633 0.1633 0.1489 0.1489 0.02796 0.1403 0.1403 0.1403 0.02796 0.02796	0.3521 0.3527 0.3548 0.3551 0.3554 0.3556 0.3558 0.3558 0.356 0.3562 0.3589 0.3593	 	
14 14 14 14	p b b	1.1 1.146 1.14	0.1403 0.02796 0.02796 0.02796	0.3562 0.3587 0.3589 0.3593	 0.3593	
14 14 14 14 14 14 14 14	ig ig ig ig ig ig ig ig	1.146 1.14 1.1 1.146 1.146 1.14 1.14 1.11 1.1	0.1403 0.1403 0.1403 0.02796 0.02796 0.02796 0.02796 0.02796 0.02796 0.02796 0.02796	0.3558 0.356 0.3562 0.3587 0.3587 0.3589 0.3593 0.3593 0.3593 0.3593 0.3593	 	
15 15 15 15	p p	1.1 1.1 1.1 1.1	0.02796 0.02796 0.02796 0.02796	0.3593 0.3593 0.3593 0.3593	 0.3593	 0.3593
15 15 15 15 15 15 15 15	ig ig ig ig ig ig ig ig	1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1	0.02796 0.02796 0.02796 0.02796 0.02796 0.02796 0.02796 0.02796 0.02796	0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593	 	

15 15	ig	1.1	0.02796 0.02796	0.3593			
15	ig	1.1	0.02796	0.3593	0.3593	0.3593	
16 16	q q	1.1	0.02796 0.02796	0.3593 0.3593	l	l	
1 16		1.1		0.3593			i
16		1.1	0.02796		0.3593	0.3593	
16	ig	1.1	0.02796	0.3593		 	
16	ig	1.1	0.02796	0.3593	1		
16	ig	1.1	•	0.3593	1		- 1
16	ig	1.1	0.02796	0.3593			
16 16	ig ig	1.1	0.02796 0.02796	0.3593 0.3593	l I	l I	
•	ig	1.1	·	0.3593			i
16	ig	1.1	0.02796	0.3593	i	i	i
16	ig	1.1	0.02796	0.3593			- 1
		1.1	0.02796	0.3593			- 1
16		1.1	0.02796	0.3593			- !
16	ig	1.1	0.02796	0.3593	0.3593	0.3593	
17	p	1.1	0.02796				
17 17	p	1.1	0.02796 0.02796	0.3593			-
1 17	p p	1.1	0.02796	0.3593	0.3593	0.3593	1
							'
17	ig	1.1	0.02796	0.3593			!
17 17	ig ig	1.1	0.02796 0.02796	0.3593 0.3593	1		
1 17	ig	1.1	1 0.02796	0.3593	1	l I	- 1
17	ig	1.1	0.02796	0.3593			i
17	ig	1.1	0.02796	0.3593	į	İ	Ĺ
17	ig	1.1	0.02796	0.3593			- 1
17	ig	1.1	0.02796	0.3593	!		- !
17 17		1.1		0.3593			-
1 17	ig ig	1.1	0.02796 0.02796	0.3593 0.3593	1	 	
1 17	ig	1.1	0.02796	0.3593	0.3593	0.3593	i
18	p	1.1	0.02796	0.3593			-
18	p	1.1	0.02796	0.3593		1	i
18	l p	1.1	0.02796	0.3593			
18	p	1.1	0.02796	0.3593	0.3593	0.3593	
18	ig	1.1	0.02796	0.3593	I	1	-
18	ig	1.1	0.02796	0.3593		1	
18	ig	1.1	0.02796	0.3593			
18	ig	1.1	0.02796	0.3593			
18 18	ig ig	1.1	0.02796 0.02796	0.3593 0.3593	I I	l I	
18	ig	1.1	0.02796	0.3593			
1 18	ig	1.1	0.02796	0.3593	i		i
18	ig	1.1	0.02796	0.3593		1	
18	ig	1.1	0.02796	0.3593	[1	
18	ig	1.1	0.02796	0.3593	0 3503	0 3503	
18	ig 	1.1	0.02796	0.3593	0.3593 	0.3593 	
19	l p	1.1	0.02796	0.3593	I	I	

	p p	1.1	0.02796 0.02796	0.3593 0.3593		
•		1.1	0.02796	0.3593	0.3593	0.3593
19 19	ig ig	1.1	0.02796 0.02796	0.3593 0.3593		
19	ig	1.1	0.02796	0.3593		
19	ig	1.1	0.02796	0.3593	1	!
19 19	ig ig	1.1	0.02796 0.02796	0.3593		
19	ig	1.1	0.02796	0.3593		
19 19			0.02796 0.02796	0.3593 0.3593		
		1.1	0.02796	0.3593		
19	ig	1.1	0.02796	0.3593		
19	ig 	1.1	0.02796 	0.3593	0.3593 	0.3593
	l p	1.1	0.02796	0.3593	1	
	p p	1.1 1.1	0.02796 0.02796	0.3593		
	l p	1.1	0.02796	0.3593	0.3593	0.3593
	ig	1.1	0.02796	0.3593	1	
20 20	ig	1.1 1.1	0.02796 0.02796	0.3593 0.3593		
20	ig ig	1.1	0.02796	0.3593		
20	ig	1.1	0.02796	0.3593	İ	i
			0.02796 0.02796	0.3593 0.3593		
20			0.02796	0.3593		
	ig	1.1	0.02796	0.3593		1
20 20	ig ig	1.1 1.1	0.02796 0.02796	0.3593 0.3593		
20	ig	1.1	0.02796	0.3593	0.3593	0.3593
21	 p	 1.1	 0.02796	0.3593		
21	l p	1.1	0.02796	0.3593		
	p p	1.1	0.02796	0.3593	0.3593	0.3593
21	ig	1.1	0.02796	0.3593	1	1
			0.02796	0.3593	1	
			0.02796 0.02796	0.3593 0.3593		
21	ig	1.1	0.02796	0.3593	!	1
21 21			0.02796 0.02796	0.3593	1	1
	ig	1.1	0.02796	0.3593		
21	ig		0.02796	0.3593	1	
21 21		1.1 1.1	0.02796 0.02796	0.3593 0.3593		
	ig 	i 1.1	0.02796	0.3593	0.3593	0.3593
			0.3001	0.331		1
	p p	0.8888	-0.1718 0.1513	0.3312		
			0.1313	0.3546	0.3546	0.3393
		0.817 1.37	-0.2483 0.3149	0.3074 0.3227		

22 22 22 22 22 22 22 22	_	0.8956 1.301 0.9813 1.159 1.283 1.047 1.073 1.169 1.11	-0.2085 0.2975 0.3238 0.3108 0.153 -0.2175 -0.1934 0.1587 0.1109 -0.03746	0.3301 0.3341 0.3341 0.3442 0.3444 0.3498 0.3527 0.3541 0.3575 0.3584	0.3584	
23 23 23 23 23	p p p	1.169 1.203 1.11 1.153	0.1587 0.09021 0.1109 -0.03746	0.3541 0.3546 0.3575 0.3584	 0.3584	
23 23 23 23 23 23 23 23	ig ig	1.203 1.203 1.153 1.11 1.203 1.169 1.153 1.153 1.153 1.151		0.3522 0.354 0.3548 0.3554 0.3556 0.3561 0.3567 0.3567 0.3574 0.3577 0.3581 0.3592	 	
24 24 24 24	p p p	1.169 1.11 1.153 1.11	-0.03746 0.09021 -0.03746 -0.03746	0.3577 0.3581 0.3584 0.3592	 0.3592	
24 24 24 24 24 24 24 24	ig ig ig ig ig	1.169 1.153 1.169 1.169 1.11 1.153 1.153 1.11 1.11 1.11	-0.03746 -0.03746 -0.03746	0.3567 0.3574 0.3577 0.3577 0.3581 0.3584 0.3592 0.3592 0.3592 0.3592 0.3592	 	
25 25 25 25 25	l p	1.11 1.11 1.11 1.11	-0.03746 -0.03746 -0.03746 -0.03746	0.3592	 0.3592	
25 25 25 25 25 25 25 25	ig ig ig ig ig ig	1.11 1.11 1.11 1.11 1.11 1.11 1.11 1.11	-0.03746 -0.03746 -0.03746	0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592		

25	ig	1.11	-0.03746	0.3592	1	1 1
25	ig	1.11	-0.03746		i	i
25	ig	1.11	-0.03746	0.3592	0.3592	0.3592
26	 р	1.11	-0.03746	 0.3592		I
26	q	1.11	-0.03746	0.3592	i	i
26	q	1.11	·	0.3592	i	i
26	l p	1.11	-0.03746	0.3592	0.3592	0.3592
 26	 ig	1.11	-0.03746	0.3592		
26	ig	1.11	-0.03746	0.3592	ì	i
26	ig	1.11	-0.03746	0.3592	i	i
26	ig	1.11	-0.03746	0.3592	1	
26	ig	1.11	-0.03746	0.3592	1	
26	ig	1.11	-0.03746	0.3592	1	
26	ig	1.11	-0.03746	0.3592	1	
26	ig	1.11	-0.03746	0.3592	1	
26	ig	1.11	-0.03746	0.3592	1	
26	ig	1.11		0.3592	1	
26	ig	1.11	-0.03746	0.3592		
26	ig	1.11	-0.03746	0.3592	0.3592	0.3592
27	l p	1.11	-0.03746	0.3592		
27	p	1.11		0.3592	I	
27	p	1.11	-0.03746		1 0 2502	1 0.3592
27 	p		-0.03746	0.3592	0.3592	
 27		1.11	-0.03746	 0.3592		
27	ig ig	1.11	-0.03746	0.3592	I I	
27	ig	1.11	-0.03746	0.3592	I.	
27	ig	1.11	-0.03746	0.3592	I I	
27	ig	1.11	1 -0.03746	0.3592	i I	
27	ig	1.11	-0.03746	0.3592	i	
27	ig	1.11		0.3592	i	
27	ig	1.11	•	0.3592	i	
27	ig	1.11	-0.03746	0.3592	i	i
27	ig	1.11	-0.03746	0.3592	i	i
27	ig	1.11	-0.03746		i	i
27	ig	1.11	-0.03746		0.3592	0.3592
 28	 p	1.11	-0.03746	 0.3592		
28	l p	1.11	-0.03746		i I	
28	p	1.11	1 -0.03746		i	,
28	p	1.11	-0.03746	•	0.3592	0.3592
	·					
28	ig	1.11	-0.03746	0.3592	1	
28	ig	1.11	-0.03746	0.3592	1	İ
28	ig	1.11	-0.03746	0.3592		İ
28	ig	1.11	-0.03746	0.3592		
28	ig	1.11	-0.03746	0.3592	1	1
28	ig	1.11	-0.03746	0.3592	1	
28	ig	1.11	·	0.3592	1	1
28	ig	1.11	-0.03746	0.3592	1	1
28	ig	1.11	-0.03746	0.3592	1	1
28	ig	1.11		0.3592		
28	_	1.11	-0.03746	0.3592	1	1
28 	ig 	1.11	-0.03746	0.3592	0.3592	0.3592
 29	 р	1.11	-0.03746	0.3592		
		•		· · · · · · · · ·		, '
				4.0		

29 29	p	1.11	-0.03746 -0.03746	0.3592] 	
29	p	1.11	-0.03746	0.3592	0.3592	0.3592
	·					
29 29	ig ig	1.11 1.11	-0.03746 -0.03746	0.3592 0.3592	1	
29	ig	1.11		0.3592	i	Ì
29	ig	1.11		0.3592	1	1
29	ig	1.11		0.3592 0.3592	1	
29 29		1.11		0.3592	İ	
29		1.11	·	0.3592	i	i
29	ig	1.11		0.3592	Į.	Į.
29 29		1.11		0.3592	I I	l I
29	ig	1.11	-0.03746	0.3592	0.3592	0.3592
30	 q	0.8837	-0.2737	0.322		
30	p	0.8537	0.09882	0.3268	i	i
30	l b	1.253	· ·	0.3501		
30	p 	1.206	-0.1019	0.3541	0.3541	0.3382
30	ig ig	0.8248 0.8459	-0.07941 0.07566	0.3198 0.3256	I I	l I
30	ig	0.8962	0.2599	0.326	İ	
30	ig	1.401	-0.03646	0.3277	Ì	Ì
30	ig	0.9161	0.2483	0.331	1	1
30	ig ig	1.362 1.328	0.1316 -0.2447	0.3332 0.3337	l I	l I
30	ig	1.19		0.3447	i	i
30	ig	1.29		0.3466	1	1
30	ig ig	1.257 1.157	0.1736 0.1034	0.3466 0.3568		
30	ig	1.174	-0.01883	0.3576	0.3576	0.3374
31	 р	1.253	-0.08731	0.3501		
31	p	1.206	-0.1019	0.3541	1	1
31	p	1.157	0.1034	0.3568		0 3547
31	p 	1.174	-0.01883 	0.3576	0.3576	0.3547
31	 ig	1.253	 0.1034	 0.3497		
31	ig	1.253		0.3497	i	i
31	ig	1.253	-0.01883	0.3511	Ţ	ļ.
31	ig	1.206	0.1034 -0.08731	0.3541	I I	
31	ig ig	1.206 1.206	· ·	0.3545	i I	
31	ig	1.174	0.1034	0.3561	İ	i
31		1.174	-0.1019	0.3561	1	1
31 31	ig ig	1.174 1.157	-0.08731 -0.1019	0.3565 0.3569	I I	I
31	ig	1.157	-0.1019	0.3573		
31	ig	1.157	-0.01883	0.3584	0.3584	0.3547
						_
32	p	1.157	· ·	0.3569		
32	p	1.157		0.3573	1	1
32	p p	1.174 1.157	-0.01883 -0.01883	0.3576 0.3584	 0.3584	 0.3576
	·					
32	 ig	1.174	 -0.1019	0.3561	·	
32	ig	1.174	-0.08731	0.3565	1	1

32 32 32 32 32 32 32 32	ig ig ig ig ig ig ig	1.157 1.157 1.157 1.157 1.174 1.157 1.157 1.157 1.157	-0.1019 -0.1019 -0.08731 -0.08731 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883	0.3569 0.3569 0.3573 0.3573 0.3576 0.3584 0.3584 0.3584 0.3584	0.3584	0.3576
33 33 33 33	p p p	1.157 1.157 1.157 1.157	-0.01883 -0.01883 -0.01883 -0.01883	0.3584 0.3584 0.3584	 0.3584	
33 33 33 33 33 33 33 33	ig ig ig ig ig ig ig ig	1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157	-0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883	0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584	 	
34 34 34 34	p p p	1.157 1.157 1.157 1.157	-0.01883 -0.01883 -0.01883 -0.01883	0.3584 0.3584 0.3584 0.3584	 0.3584	
34 34 34 34 34 34 34 34	ig ig ig ig ig ig ig ig	1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157	-0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883	0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584	0.3584	
35 35 35 35	p p p	1.157 1.157 1.157 1.157	-0.01883 -0.01883 -0.01883 -0.01883		 0.3584	
35 35 35 35 35 35 35 35	ig ig ig ig ig ig ig	1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157 1.157	-0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883 -0.01883	0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584 0.3584		

35	ig	1.157	-0.01883	0.3584		1 1
35	ig	1.157	-0.01883	0.3584	1	
35 	ig 	1.157	-0.01883	0.3584	0.3584	0.3584
36	p	1.157	-0.01883	0.3584		
36	p	1.157	-0.01883	0.3584		
36	l p	1.157	-0.01883	0.3584		
36	p	1.157	-0.01883	0.3584	0.3584	0.3584
36	ig	1.157	-0.01883	0.3584	I	
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584		
36	ig	1.157	-0.01883	0.3584	0.3584	0.3584
27		. 1 1 5				
37	l p	1.157	-0.01883	0.3584		
37	l p	1.157	-0.01883	0.3584		
37	l p	1.157	-0.01883	0.3584	1 0 2504	
37 	p 	1.157	-0.01883	0.3584	0.3584	0.3584
37	ig	1.157	-0.01883	0.3584		
37	ig	1.157	-0.01883	0.3584	1	
37	ig	1.157	-0.01883	0.3584		
37	ig	1.157	-0.01883	0.3584		. !
37	ig	1.157	-0.01883	0.3584	1	
37	ig	1.157	-0.01883	0.3584	I .	
37	ig	1.157	-0.01883	0.3584		
37	ig	1.157	-0.01883	0.3584		
37	ig	1.157	-0.01883	0.3584		
37	ig	1.157	-0.01883	0.3584		
37	ig	1.157	-0.01883			
37 	ig 	1.157	-0.01883	0.3584	0.3584	0.3584
38	 р	1.157	-0.01883	0.3584	 _	==
38	l p	1.157	-0.01883			į
38	l p	1.157	-0.01883		1	İ
38	l p	1.157	-0.01883	0.3584	0.3584	0.3584
38	ig	1.157	-0.01883	0.3584	1	
38	ig	1.157	-0.01883	0.3584	1	
38	ig	1.157	-0.01883	0.3584	1	
38	ig	1.157	-0.01883	0.3584	1	
38	ig	1.157	-0.01883	0.3584		
38	ig	1.157	-0.01883	0.3584	1	
38	ig	1.157	·	0.3584		
38	ig	1.157	-0.01883	0.3584	1	
38	ig	1.157	-0.01883	0.3584	1	
38	ig	1.157	-0.01883	0.3584		İ
38	ig	1.157	-0.01883	0.3584		
38	ig	1.157	-0.01883	0.3584	0.3584	0.3584
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 39	 q	1.157	-0.01883	 0 3584		
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39	39 39	p	1.157 1.157	-0.01883 -0.01883	0.3584 0.3584		
39		-				0.3584	0.3584
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39							1
39							l I
39	39	ig	1.157	-0.01883	0.3584	i	i
39				•			
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39	39	ig	1.157		0.3584	İ	Ì
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40	39	ig	1.157	-0.01883	0.3584	0.3584	0.3584
40							
40	40	 р				 	
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40	•	_				 0.3564	 0.3497
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40	40	 ig	1.402	-0.2806	0.3191		
40		ig	1.41	0.08513	0.3252	į.	ļ.
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41	41	p 	1.191 	-0.04289 	0.3564 	0.3564 	0.3547
41			 1 003		 0 3471		
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41	41	ig	1.191	0.2042	0.3506	1	Į.
41							l I
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41		ig	1.207			!	Į.
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42							
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42 42 42 42 42 42 42 42	ig ig ig ig ig ig ig ig	1.191 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121	0.01384 -0.04289 -0.04289 -0.03463 -0.03463 0.01384 0.01384 0.01384 0.01384	0.3566 0.3591 0.3591 0.3592 0.3592 0.3593 0.3593 0.3593 0.3593 0.3593	0.3593	0.3586
43 43 43 43	p p p	1.121 1.121 1.121 1.121	0.01384 0.01384 0.01384 0.01384	0.3593 0.3593 0.3593 0.3593	 0.3593	 0.3593
43 43 43 43 43 43 43 43	ig ig ig ig ig ig ig ig	1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121	0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384	0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593	0.3593	0.3593
44 44 44 44	p p p	1.121 1.121 1.121 1.121	0.01384 0.01384 0.01384 0.01384	0.3593 0.3593 0.3593 0.3593	 0.3593	
44 44 44 44 44 44 44 44	ig ig ig ig ig ig ig ig	1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121	0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384	0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593	 	
45 45 45 45	p p p	1.121 1.121 1.121 1.121	0.01384 0.01384 0.01384 0.01384	0.3593 0.3593 0.3593 0.3593	 0.3593	
45 45 45 45 45 45 45 45 	ig ig ig ig ig ig ig ig	1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121 1.121	0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384 0.01384	0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593		

45	ig	1.121		0.3593	ļ	1
45 45	ig	1.121 1.121	0.01384 0.01384	0.3593	1 0.3593	1 0.3593
45 	ig 	1.121	0.01384	0.3593	0.3593 	U.3593
46	 p	1.121	0.01384	0.3593		
46	p	1.121	0.01384	0.3593	1	
46	p	1.121	0.01384	0.3593		
46	l p	1.121	0.01384	0.3593	0.3593	0.3593
46 46	ig ig	1.121 1.121	0.01384 0.01384	0.3593 0.3593	Į	
46	ig	1.121	·	0.3593	I I	l I
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46	ig	1.121	0.01384	0.3593	l l	
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46	ig	1.121	0.01384	0.3593		
46	ig	1.121	0.01384	0.3593	ļ	
46	ig	1.121	0.01384	0.3593	ļ	
46	ig	1.121	0.01384		ļ	
46		1.121		0.3593	1 0 2502	1 0 2502
46 	ig 	1.121	0.01384 	0.3593	0.3593	0.3593
47	 р	1.121	0.01384	0.3593		
47	l p	1.121	0.01384		i	i
47	q	1.121		0.3593	i	i
47	q	1.121	0.01384	0.3593	0.3593	0.3593
47	 ig	1.121	0.01384	0.3593		
47	ig	1.121	0.01384	0.3593	i	i
47	ig	1.121	0.01384	0.3593	i	i
47	ig	1.121	0.01384	0.3593	i	
47	lig	1.121	0.01384	0.3593	i	İ
47	ig	1.121	0.01384	0.3593	i	İ
47	ig	1.121	0.01384	0.3593	i	
47	ig	1.121	0.01384	0.3593		
47	ig	1.121	0.01384	0.3593	i	
47	l iq	1.121	0.01384	0.3593	i	
47	ig	1.121	0.01384	0.3593	i	
47	ig	1.121	0.01384	0.3593	0.3593	0.3593
10		. 1 101	0.01384	1 0 2502		
48 48	l p	1.121 1.121	0.01384	0.3593 0.3593	1	I
	l p	•	0.01384	0.3593	1	I
48 48	p p	1.121 1.121	0.01384		0.3593	0.3593
40 						
48	 ig	1.121	 0.01384	 0.3593		
48	ig	1.121	0.01384	0.3593	1	I I
48	19 ig	1.121	0.01384	0.3593	1 1	I
48	_	1.121	0.01384	0.3593	1 1	I
48	ig ig		0.01384	0.3593	1 1	I
48	ig	1.121 1.121	0.01384	0.3593	1 	I I
48	ig	1.121	0.01384	0.3593	1 1	I I
48	ig	1.121	0.01384	0.3593	1	I
	_		·		I I	I
48	ig	1.121	0.01384	0.3593	1	I
48 48	ig	1.121	0.01384 0.01384	0.3593 0.3593	1	I
48 48	ig ig	1.121 1.121	0.01384	0.3593	0.3593	1 0.3593
	· ±9	1 1.161	1 0.01304			
49	p	1.121	0.01384	0.3593	1	
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49	p	1.121	0.01384 0.01384 0.01384	0.3593		
49 	p 	1.121		0.3593	0.3593	0.3593
49 49	 ig ig	1.121 1.121	0.01384 0.01384	0.3593 0.3593	 	
49	ig	1.121	0.01384	0.3593		
49 49	ig	1.121 1.121	0.01384	0.3593 0.3593		
49	ig ig	1.121	0.01384	0.3593		
49	ig	1.121	0.01384	0.3593	1]
49 49		1.121 1.121	0.01384 0.01384	0.3593 0.3593		
49	ig	1.121	0.01384	0.3593	i	
49 49	ig ig	1.121 1.121	0.01384	0.3593 0.3593	 0.3593	 0.3593
50	p	1.121	0.01384	0.3593		
50 50	p p	1.121 1.121	0.01384	0.3593 0.3593		
50	p	1.121	0.01384	0.3593	0.3593	0.3593
50	ig	1.121	0.01384	0.3593	1	
50 50	ig ig	1.121 1.121	0.01384	0.3593 0.3593		
50	ig	1.121	0.01384	0.3593		
50	ig	1.121	0.01384	0.3593	1	
50 50		1.121 1.121	0.01384	0.3593 0.3593		
50	ig	1.121	0.01384	0.3593	į	
50 50	ig ig	1.121 1.121	0.01384	0.3593 0.3593		
50	ig	1.121	0.01384	0.3593		
50	ig 	1.121	0.01384	0.3593 	0.3593	0.3593
51	l p	0.8859	0.2745	0.3225	1	1
51 51	p p	1.348 0.8975	-0.1815 -0.126	0.3338 0.3356		
51	p	1.17	0.07722	0.357	0.357	0.3372
51	ig	1.378	0.2998	0.3223	Ţ	1
51 51	_	1.395 0.9798	-0.137 0.2878	0.327 0.3375		
51	ig	1.22	-0.2815	0.3373	İ	
51		1.306	-0.03513	0.3441		
51 51	ig ig	1.296 1.242	0.08919 0.2213	0.3446 0.3456		
51	ig	1.01	-0.2201	0.3466	İ	Ì
51 51		1.24 1.212	0.1364 -0.04924	0.35 0.3548		
51	ig	1.049	-0.1271	0.3551	İ	İ
51	ig 	1.094	-0.124	0.3568	0.3568	0.344
52	l p	1.212	-0.04924	0.3548	I	1
52 52	q q	1.049 1.094	-0.1271 -0.124	0.3551 0.3568		
52	q p	1.17	0.07722	0.3568	0.357	0.3559
52	ig	1.212	-0.1271	0.3528	!	!
52	ig	1.212	-0.124	0.3529		

52 52 52 52 52 52 52 52	ig ig ig ig ig ig	1.212 1.049 1.17 1.17 1.094 1.049 1.049 1.17 1.094 1.094		0.3543 0.3552 0.3554 0.3556 0.3567 0.3568 0.3574 0.3575 0.3584 0.3589	 0.3589	
53 53 53 53	p	1.049 1.17 1.094 1.094	-0.04924 -0.04924 0.07722 -0.04924	0.3574 0.3575 0.3584 0.3589	 0.3589	 0.358
53 53 53 53 53 53 53 53	ig ig ig ig ig ig ig	1.049 1.17 1.049 1.049 1.17 1.17 1.17 1.094 1.094 1.094 1.094 1.094	-0.04924 -0.04924 -0.04924 0.07722 -0.04924 -0.04924	0.3568 0.357 0.3574 0.3574 0.3575 0.3575 0.3584 0.3589 0.3589 0.3589 0.3589	 	
54 54 54 54	_	1.094 1.094 1.094 1.094	-0.04924	0.3589 0.3589 0.3589 0.3589	 0.3589	 0.3589
54 54 54 54 54 54 54 54	ig ig ig ig ig ig ig ig	1.094 1.094 1.094 1.094 1.094 1.094 1.094 1.094 1.094 1.094 1.094	-0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924	0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589	0.3589	
55 55 55 55	p	1.094 1.094 1.094 1.094	·	0.3589 0.3589 0.3589 0.3589	 0.3589	 0.3589
55 55 55 55 55 55 55 55	ig ig ig ig ig ig	1.094 1.094 1.094 1.094 1.094 1.094 1.094 1.094 1.094	-0.04924 -0.04924	0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589		

55	_	1.094			ļ	!!!!
55 55		1.094 1.094		0.3589	1 0.3589	I I 0.3589
 56	 q	1.094	-0.04924	 0.3589		
56	p	1.094	-0.04924		i	j
56	p	1.094		0.3589		
56 	p 	1.094	-0.04924	0.3589 	0.3589	0.3589
 56	 ig	1.094	 -0.04924	 0.3589		
56	ig	1.094	-0.04924	0.3589	i	j
56	ig	1.094	-0.04924	0.3589		
56	ig	1.094	·	0.3589		
56	ig	1.094	-0.04924	0.3589	!	[
56	ig	1.094	·	0.3589		
56 56	ig ig	1.094 1.094		0.3589 0.3589	1	I
56	ig	1.094	-0.04924	0.3589	l I	!
56	_	1.094	·	0.3589		
56		1.094		0.3589	i	İ
56	ig	1.094	-0.04924	0.3589	0.3589	0.3589
57		1.094		1 0 3500		
5 <i>7</i>	q q	1.094	-0.04924		l I	I I
57	p	1.094	-0.04924			
57	p	1.094	-0.04924	0.3589	0.3589	0.3589
		. <u></u>	·			
57	ig	1.094	-0.04924	0.3589	1	
57	ig	1.094		0.3589		
57	ig	1.094	·	0.3589	1	
57	ig	1.094	-0.04924	0.3589		
57 57	ig ig	1.094 1.094		0.3589 0.3589		
57	ig	1.094	•	0.3589	1	
57	ig	1.094	-0.04924	0.3589		i I
57	ig	1.094		0.3589	i	
57	ig	1.094	-0.04924	0.3589		
57	ig	1.094	-0.04924	0.3589		
57 	ig 	1.094	-0.04924	0.3589 	0.3589	0.3589
58	l p	1.094	-0.04924	0.3589		
58	p	1.094	-0.04924	0.3589	1	
58	l p	1.094	-0.04924	0.3589		
58 	р 	1.094	-0.04924	0.3589 	0.3589	0.3589
 58	 ig	1.094	-0.04924	 0.3589		
58	ig	1.094	1 -0.04924	0.3589		!
58	ig	1.094	-0.04924	0.3589	i	
58	l ig	1.094	-0.04924	0.3589	į	
58	ig	1.094	-0.04924	0.3589		
58	ig	1.094	-0.04924	0.3589		
58	ig	1.094	-0.04924	0.3589	!	
58	ig	1.094	-0.04924	0.3589		
58 58	ig	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589		I
58	ig ig	1.094	-0.04924	0.3589	 	I
58	ig	1.094	-0.04924	0.3589	0.3589	0.3589
 59	 q	1.094	-0.04924	 0.3589		
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59 59	p	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589		
59	p	1.094	-0.04924	0.3589	0.3589	0.3589
59	ig	1.094	-0.04924	0.3589		
59	ig	1.094	-0.04924	0.3589		
59 59	ig ig	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589		l
59	ig	1.094	-0.04924	0.3589		
59	ig	1.094	-0.04924	0.3589	1	
59 59	ig ig	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589		
59	ig	1.094	-0.04924	0.3589		
59	ig	1.094	-0.04924	0.3589	i	İ
59	ig	1.094	-0.04924	0.3589		
59 	ig 	1.094	-0.04924 	0.3589 	0.3589 	0.3589
60	 р	1.094	-0.04924	0.3589		
60	l b	1.094	-0.04924	0.3589	1	
60 60	p	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589	 0.3589	 0.3589
	p	·	1 0.04 <i>3</i> 24			1 0.3303
 I 60	 ig	1.094	 -0.04924	 0.3589		
1 60	ig	1.094	-0.04924	0.3589		
60	ig	1.094	-0.04924	0.3589	i	
60	ig	1.094	-0.04924	0.3589	1	
60 60	ig ig	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589		
60	ig	1.094	-0.04924	1 0.3589		
60	ig	1.094	-0.04924	0.3589	j	İ
60	ig	1.094	-0.04924	0.3589	1	
60 60	ig ig	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589		
60	ig	1.094	-0.04924	0.3589	0.3589	0.3589
		 1.094				
61 61	p p	1.094	-0.04924 -0.04924	0.3589 0.3589	l	l
61	p	1.094	-0.04924	0.3589		
61	p	1.094	-0.04924	0.3589	0.3589	0.3589
61	ig	1.094	-0.04924	0.3589		
61 61	ig ig	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589	I	I
61	ig	1.094	-0.04924	0.3589		
61	ig	1.094	-0.04924	0.3589	1	
61	ig	1.094	-0.04924	0.3589		
61 61	ig ig	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589	I	
61	ig	1.094	-0.04924	0.3589	i	
61	ig	1.094	-0.04924	0.3589	1	
61 61	ig ig	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589	 0.3589	 0.3589
. OT	ı ±9	. ⊥•∪⊅4 	0.04324 	. U.JJOJ	1 0.3303	1 0.3309
62	p	1.094	-0.04924	0.3589	1	
62	p	1.094	-0.04924	0.3589		
62 62	p p	1.094 1.094	-0.04924 -0.04924	0.3589 0.3589	0.3589	0.3589
62	 ig	1.094	 -0.04924	0.3589	 	
62	ig	1.094	-0.04924	0.3589	1	

62 62 62 62 62 62 62 62	ig ig ig ig ig ig ig ig	1.094 1.094 1.094 1.094 1.094 1.094 1.094 1.094 1.094	-0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924 -0.04924	0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589 0.3589	0.3589	0.3589
63 63 63 63	p p p	0.8117 0.8567 1.014 1.045	-0.1273 -0.0657 -0.3378 -0.268	0.3142 0.3285 0.3365 0.3457	 0.3457	
63 63 63 63 63 63 63 63	ig ig ig ig ig ig ig ig	0.8726 1.381 0.8909 1.282 1.285 0.9557 1.244 1.258 1.236 1.061 1.207 1.125	-0.2805 -0.2719 -0.1626 -0.3409 -0.2988 -0.1749 0.164 -0.04802 0.07917 -0.1902 -0.1033 0.08361	0.3189 0.3235 0.3322 0.3329 0.3359 0.3431 0.3484 0.3502 0.352 0.3524 0.3539 0.3582	 	
64 64 64 64	p p p	1.236 1.061 1.207 1.125	0.07917 -0.1902 -0.1033 0.08361	0.352 0.3524 0.3539 0.3582	 0.3582	
64 64 64 64 64 64 64 64	ig ig ig ig ig ig ig ig	1.236 1.207 1.236 1.236 1.125 1.207 1.207 1.061 1.061 1.061 1.125 1.125	-0.1902 -0.1902 -0.1033 0.08361 -0.1902 0.08361 0.07917 -0.1033 0.08361 0.07917 -0.1033 0.07917	0.3479 0.3503 0.3514 0.3519 0.3537 0.3545 0.3546 0.3566 0.3572 0.3574 0.3576 0.3583	0.3583	0.3543
65 65 65 65	p p p	1.061 1.125 1.125 1.125	0.07917 -0.1033 0.08361 0.07917	0.3574 0.3576 0.3582 0.3583	 0.3583	
65 65 65 65 65 65 65 65	ig ig ig ig ig ig ig ig	1.061 1.061 1.061 1.125 1.125 1.125 1.125 1.125	-0.1033 0.08361 0.07917 -0.1033 -0.1033 0.08361 0.08361 0.07917	0.3566 0.3572 0.3574 0.3576 0.3576 0.3582 0.3582 0.3583 0.3583		

	1	. 1 105	. 0 07017	. 0 2502			
65 65	ig	1.125	0.07917	0.3583			
1 65	ig	1.125 1.125	0.07917 0.07917	0.3583 0.3583	0.3583	0.3579	
65	ig 	1 1.123			0.3363		'
66	l p	1.125	0.07917	0.3583	1		
66	l p	1.125	0.07917	0.3583			
66	l p	1.125	0.07917	0.3583			
66	l p	1.125	0.07917	0.3583	0.3583	0.3583	
 I 66	ig	1.125	0.07917	0.3583			
66	ig	1.125	0.07917	0.3583	i i		i
66	ig	1.125	0.07917	0.3583	i		i
66	ig	1.125	0.07917	0.3583	i		i
66	ig	1.125	0.07917	0.3583	i		i
66	ig	1.125	0.07917	0.3583	i	İ	i
66	ig	1.125	0.07917	0.3583	i	i	i
66	ig	1.125	0.07917	0.3583	i	i	i
66	ig	1.125	0.07917	0.3583	İ		İ
66	ig	1.125	0.07917	0.3583	İ		İ
66	ig	1.125	0.07917	0.3583			- 1
66	ig	1.125	0.07917	0.3583	0.3583	0.3583	
 67	l n	1.125	0.07917	0.3583			
67	p p	1.125	0.07917	0.3583	i I	 	l I
67	l p	1.125	0.07917	0.3583	l I		
67	p	1.125	0.07917	0.3583	0.3583	0.3583	
	·						'
67	ig	1.125	0.07917	0.3583			
67	ig	1.125	0.07917	0.3583			
67	ig	1.125	0.07917	0.3583			
67	ig	1.125	0.07917	0.3583			- 1
67	ig	1.125	0.07917	0.3583			- 1
67	ig	1.125	0.07917	0.3583			
67	ig	1.125	0.07917	0.3583			!
67	ig	1.125	0.07917	0.3583			!
67	ig	1.125	0.07917	0.3583			!
67	ig	1.125	0.07917	0.3583			
67 67	ig	1.125 1.125	0.07917 0.07917	0.3583 0.3583	0.3583	1 0.3583	
	ig 	1.125					'
68	l p	1.125	0.07917	0.3583			
68	l p	1.125	0.07917	0.3583	1		
68	l p	1.125	0.07917	0.3583	1	1	
68	l p	1.125	0.07917	0.3583	0.3583	0.3583	
68	 ig	1.125	0.07917	0.3583			
68	ig	1.125	0.07917	0.3583	1 	1 	l I
68	ig	1.125	0.07917	0.3583			l I
68	ig	1.125	0.07917	0.3583			
68	ig	1.125	0.07917	0.3583			
68	ig	1.125	0.07917	0.3583	i	i	i
68	ig	1.125	0.07917	0.3583	i	i	i
68	ig	1.125	0.07917	0.3583	i	i	i
68	ig	1.125	0.07917	0.3583	i	i	i
68	ig	1.125	0.07917	0.3583	i	i	i
68	ig	1.125	0.07917	0.3583	1		i
68	ig	1.125	0.07917	0.3583	0.3583	0.3583	İ
		I 1 10F		1 0 2502			
69	p	1.125	0.07917	0.3583	I	I	I

69 69 69	p p p	1.125 1.125 1.125	0.07917 0.07917 0.07917	0.3583 0.3583 0.3583	 0.3583	 0.3583
69 69	 ig ig	1.125 1.125	0.07917 0.07917	0.3583 0.3583		
69 69 69	ig ig ig	1.125 1.125 1.125	0.07917 0.07917 0.07917	0.3583 0.3583 0.3583		
69 69	ig ig	1.125 1.125	0.07917	0.3583 0.3583	İ	
69	ig	1.125 1.125	0.07917 0.07917 0.07917	0.3583	 	
		1.125 1.125 1.125	0.07917	0.3583 0.3583 0.3583	 0.3583	 0.3583
70		1.125	0.07917	0.3583	 !	 !
70	-	1.125	0.07917	0.3583		
70 	p	1.125	0.07917	0.3583	0.3583	0.3583
	 ig	1.125	0.07917	0.3583		
70 70	ig ig	1.125 1.125	0.07917 0.07917	0.3583 0.3583		
70 70	ig ig	1.125 1.125	0.07917 0.07917	0.3583 0.3583		
70 70	ig ig	1.125 1.125	0.07917 0.07917	0.3583 0.3583		
70 70	ig ig	1.125 1.125	0.07917 0.07917	0.3583 0.3583		1
70		1.125 1.125	0.07917	0.3583		i
	ig	1.125	0.07917	0.3583	0.3583	0.3583
71 71	p p	1.125 1.125	0.07917 0.07917	0.3583 0.3583		
71	l p	1.125	0.07917	0.3583	1 0 3503	0 3503
	p 	1.125	0.07917	0.3583	0.3583	0.3583
71	ig	1.125	0.07917	0.3583		
71		1.125	0.07917	0.3583		
71 71	ig		0.07917 0.07917	0.3583 0.3583		
71 71	ig ig	1.125 1.125	0.07917 0.07917	0.3583 0.3583		
71 71			0.07917 0.07917	0.3583 0.3583		
71 71	ig	1.125 1.125	0.07917	0.3583	İ	i I
71	ig	1.125	0.07917	0.3583	0.3583	0.3583
	p p	0.8414 0.9691	0.267 -0.08189	0.3124 0.3493	1	1
72	_	1.229	-0.08949 -0.118	0.3524	 0.3552	0.3423
	۱ ۲	T.TOT	1 0.110		0.3332	1 0.3423

72 72 72 72 72 72 72 72	ig ig ig ig ig ig ig ig	1.375 1.334 0.9594 0.9897 0.9549 1.129 1.023 1.181 1.026	-0.159 -0.1768 0.183 -0.2185 -0.1358 0.2178 0.09588 -0.135 -0.03101 -0.01244	0.33 0.3362 0.3432 0.3446 0.3452 0.3519 0.3545 0.3546 0.3561 0.3594	0.3594	
73 73 73 73	p p	1.181 1.181 1.026 1.114	-0.135 -0.118 -0.03101 -0.01244	0.3546 0.3552 0.3561 0.3594	 0.3594	
73 73 73 73 73 73 73 73	ig ig ig ig ig ig	1.026 1.026 1.181 1.181 1.026 1.114 1.181 1.181 1.181 1.181 1.181	-0.135 -0.118 -0.135 -0.118 -0.01244 -0.135 -0.03101 -0.03101 -0.118 -0.01244 -0.01244 -0.03101	0.3532 0.3539 0.3546 0.3552 0.3563 0.3565 0.3571 0.3571 0.3572 0.3572 0.3572	0.3593	
74 74 74 74	p p p	1.181 1.181 1.114 1.114	-0.01244 -0.01244 -0.03101 -0.01244	0.3572 0.3572 0.3593 0.3594	 0.3594	
74 74 74 74 74 74 74 74	ig ig ig ig ig ig ig ig	1.181 1.181 1.181 1.181 1.181 1.181 1.114 1.114 1.114 1.114	-0.01244	0.3571 0.3571 0.3572 0.3572 0.3572 0.3572 0.3593 0.3594 0.3594 0.3594 0.3594	0.3594	
75 75 75 75	p p p	1.114 1.114 1.114 1.114	-0.01244 -0.01244	0.3594 0.3594 0.3594 0.3594	 0.3594	
75 75 75 75 75 75 75 75	ig ig ig ig ig ig ig ig	1.114 1.114 1.114 1.114 1.114 1.114 1.114 1.114	-0.01244 -0.01244 -0.01244 -0.01244 -0.01244	0.3594 0.3594 0.3594 0.3594 0.3594 0.3594 0.3594 0.3594 0.3594		

75	ig	1.114	-0.01244	0.3594	I	1
75 75	ig	1.114	-0.01244 -0.01244	0.3594 0.3594	 0.3594	
/5	ig 	1.114				0.3594
 I 76	 p	1.114	-0.01244	0.3594		
76	q	1.114	-0.01244	0.3594		
76	l p	1.114	-0.01244	0.3594	İ	i i
76	l p	1.114	-0.01244	0.3594	0.3594	0.3594
76	 ig	1.114	-0.01244	0.3594		
76	ig	1.114	-0.01244	0.3594		1
76	ig	1.114	-0.01244	0.3594		
76	ig	1.114	-0.01244	0.3594		
76	ig	1.114	-0.01244	0.3594		
76 76	ig ig	1.114 1.114	-0.01244 -0.01244	0.3594 0.3594		
1 76 1 76	ig	1.114		0.3594	l I	! ! ! ! !
76	ig	1.114		0.3594		
76	ig	1.114		0.3594	i	i
76	ig	1.114		0.3594	İ	i i
76	ig	1.114	-0.01244	0.3594	0.3594	0.3594
77	l p	1.114	-0.01244	0.3594		1
77	l p	1.114		0.3594		
77	l p	1.114	-0.01244		1 0 2504	
77 	p 	1.114	-0.01244	0.3594	0.3594	0.3594
77	ig	1.114		0.3594		
77 77	ig	1.114 1.114	-0.01244 -0.01244	0.3594		
1 77	ig ig	1.114	-0.01244	0.3594	l I	
77	ig	1.114	-0.01244	0.3594		
77	lig	1.114	-0.01244	0.3594	i	i i
77	ig	1.114	-0.01244	0.3594		1
77	ig	1.114		0.3594		1
77	ig	1.114	-0.01244	0.3594		
77	ig	1.114	-0.01244	0.3594		
77 77	ig ig	1.114 1.114	-0.01244 -0.01244		1 0.3594	0.3594
 78	 р	1.114	-0.01244	0.3594	1	
78	l p	1.114	-0.01244		1	i i
78	l p	1.114	-0.01244			
78 	p 	1.114	-0.01244	0.3594	0.3594	0.3594
78	ig	1.114	-0.01244	0.3594	Ţ	<u> </u>
78	ig	1.114	-0.01244			
78 78	ig ig	1.114 1.114	-0.01244 -0.01244	0.3594 0.3594	I I	
70 78	ig	1.114	•	0.3594		
78	ig	1.114	-0.01244	0.3594		
78	ig	1.114	· ·	0.3594	İ	i
78	ig	1.114	-0.01244	0.3594		İ
78	ig	1.114	-0.01244	0.3594		1
78	ig	1.114	-0.01244		Ţ	<u> </u>
78 78		1.114	-0.01244 -0.01244	0.3594 0.3594	 0.3594	
	ig 	1.114	-U.UIZ44 	U.3394 	U.3394 	0.3394
1 79	p	1 1.114	=U.U.Z.44	1 0.5394	I	

79 79	p	1.114	-0.01244	0.3594		
79	p	1.114 1.114	-0.01244 -0.01244	0.3594	0.3594	0.3594
79 79	ig ig	1.114 1.114	-0.01244 -0.01244	0.3594 0.3594		
1 79	ig	1.114		0.3594	l I	
79	ig	1.114	-0.01244	0.3594		İ
79	ig	1.114	-0.01244	0.3594	1	1
79 79	ig ig	1.114 1.114	-0.01244 -0.01244	0.3594 0.3594		
1 79		1.114		0.3594		!
79	ig	1.114	-0.01244	0.3594	i	i
79	ig	1.114		0.3594		1
79 79	ig ig	1.114 1.114	-0.01244 -0.01244	0.3594 0.3594	 0.3594	 0.3594
	. <u>1</u> 9					
80	p	1.114	-0.01244	0.3594	1	1
80	l p	1.114		0.3594	Į.	1
80 80	q q	1.114 1.114	-0.01244 -0.01244	0.3594 0.3594	 0.3594	 0.3594
	· P		. 0.01244			
 80	 ig	1.114	 -0.01244	0.3594		·
80	ig	1.114	-0.01244	0.3594		
80	ig	1.114	-0.01244	0.3594	İ	ĺ
80	ig	1.114	-0.01244	0.3594		ļ
80	ig ig	1.114 1.114	-0.01244 -0.01244	0.3594 0.3594		1
80		1.114		0.3594	İ	1
80	ig	1.114		0.3594	1	1
80	ig	1.114		0.3594		1
80 80	ig ig	1.114 1.114	-0.01244 -0.01244	0.3594 0.3594		1
80	ig	1.114	-0.01244	0.3594	0.3594	0.3594
81	 р	1.329	-0.2285	0.3345		·
81	p	0.9956	-0.2684	0.3412		İ
81	l p	1.296	0.01628	0.3457	1	1
81	p	1.016 	0.147 	0.3518	0.3518 	0.3433
81 81	ig ig	0.8289 0.8173	0.1804 0.06417	0.316 0.3181	I I	I I
81	ig	0.9072	0.09116	0.3389	i	i
81	ig	0.9131	0.05738	0.3409	1	!
81	ig	0.9269	0.107	0.3419 0.3477	I	
81 81	ig ig	1.208 1.261	0.2332	0.3477	I I	
81		0.9701	·	0.3503	i	İ
81	ig	0.9886	-0.08807	0.3514	1	1
81	ig	1.198	-0.1319	0.3537	1	1
81 81	ig ig	1.124 1.094	0.09032 -0.003841	0.358	0.3593	0.3437
82	 р	 1.016	 0.147	0.3518	 	
82	p	1.198	-0.1319	0.3537	İ	İ
82	l p	1.124	0.09032	0.358		
82	p 	1.094	-0.003841	0.3593	0.3593	0.3557
82	 ig	1.016	 -0.1319	0.3525		
82	ig	1.198	0.147	0.3523	İ	

82 82 82 82 82 82 82 82	ig ig ig ig ig ig ig	1.016 1.198 1.016 1.094 1.124 1.198 1.094 1.124 1.094 1.124	0.09032 0.09032 -0.003841 0.147 0.147 -0.003841 -0.1319 -0.1319 0.09032 -0.003841	0.3541 0.355 0.3555 0.3558 0.3559 0.3562 0.3565 0.3566 0.358 0.3593	 0.3593	
83 83 83 83	p p	1.094 1.124 1.094 1.124	· ·	0.358 0.358 0.3593 0.3593	 0.3593	
83 83 83 83 83 83 83 83	ig ig	1.094 1.094 1.094 1.124 1.124 1.124 1.094 1.094 1.094 1.124 1.124	-0.003841 -0.003841	0.358 0.358 0.358 0.358 0.358 0.358 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593	0.3593	0.3587
84 84 84 84	p p p	1.124 1.124 1.124 1.124	-0.003841 -0.003841 -0.003841 -0.003841	0.3593 0.3593 0.3593 0.3593	 0.3593	
84 84 84 84 84 84 84 84 84 84 84 84	ig ig ig ig ig ig ig ig	1.124 1.124 1.124 1.124 1.124 1.124 1.124 1.124 1.124 1.124 1.124	-0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841	0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593	0.3593	0.3593
85 85 85 85	p p p	1.124 1.124 1.124 1.124	-0.003841 -0.003841 -0.003841 -0.003841	0.3593 0.3593 0.3593 0.3593	 0.3593	 0.3593
85 85 85 85 85 85 85 85	ig ig ig ig ig ig ig ig	1.124 1.124 1.124 1.124 1.124 1.124 1.124 1.124 1.124 1.124	-0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841 -0.003841	0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593 0.3593		

85 85	ig ig	1.124 1.124	-0.003841 -0.003841	0.3593 0.3593	į.	
85	ig	1.124		0.3593	0.3593	0.3593
 86	 р	1.124	-0.003841	0.3593	 	
86	l p	1.124	-0.003841	0.3593	Į.]
86	l p	1.124	-0.003841			
86 	p 	1.124	-0.003841	0.3593 	0.3593 	0.3593
 86	 ig	1.124	 -0.003841	0.3593	 	
86	ig	1.124	-0.003841	0.3593	ĺ	
86	ig	1.124	-0.003841	0.3593		
86	ig	1.124	-0.003841			
86	ig	1.124	-0.003841			
86	ig	1.124	-0.003841			
86 86	ig ig	1.124 1.124	-0.003841 -0.003841		l I	
86	ig	1.124	-0.003841		l I	
86	ig	1.124	-0.003841		i	
86	l ig	1.124	-0.003841		i	j
86	ig	1.124	-0.003841		0.3593	0.3593
 87	 p	 1.124	 -0.003841	 0.3593		
87	p	1.124	-0.003841	0.3593		i I
87	q	1.124	-0.003841		i	
87	p	1.124	-0.003841	0.3593	0.3593	0.3593
87	ig	1.124	-0.003841	0.3593	1	
87	ig	1.124	-0.003841	0.3593	ļ.	
87	ig	1.124	-0.003841	0.3593		
87 87	ig ig	1.124 1.124	-0.003841 -0.003841	0.3593	l I	
87	ig	1.124	-0.003841		l I	
87	ig	1.124	-0.003841		İ	
87	l ig	1.124	-0.003841		i	j
87	ig	1.124	-0.003841	0.3593	1	
87	ig	1.124	-0.003841	0.3593		
87	ig	1.124		0.3593		
87 	ig 	1.124	-0.003841	0.3593	0.3593 	0.3593
88	l p	1.124	-0.003841	0.3593	1	1
88	l p	1.124	-0.003841	0.3593	1	
88	p	1.124	-0.003841	0.3593	0 3503	0 2502
88 	p 	1.124	-0.003841	0.3593	0.3593 	0.3593
88	ig	1.124	-0.003841	0.3593	 	
88	ig	1.124	-0.003841	0.3593	1	1
88	ig	1.124	-0.003841	0.3593	1	1
88	ig	1.124	-0.003841	0.3593	1	
88	ig	1.124	-0.003841	0.3593		
88	ig	1.124	-0.003841	0.3593	I	I
88 88	ig ig	1.124 1.124	-0.003841 -0.003841	0.3593 0.3593	I I	
88	ig	1.124	-0.003841	0.3593		!
88	ig	1.124	-0.003841	0.3593		İ
88	ig	1.124	-0.003841	0.3593	i	i
88	lig	1.124	-0.003841	0.3593	0.3593	0.3593
 89	 p	1.124	-0.003841	 0.3593	 I	
<u> </u>	۲ ۲	1	, 3.000011	, 0.0000	1	1
				2.1		

89 89	p	1.124 1.124	-0.003841 -0.003841	0.3593	 	
89	p	1.124	-0.003841	0.3593	0.3593	0.3593
89	ig	1.124 1.124	-0.003841	0.3593	1	1
89 89	ig ig	1.124	-0.003841 -0.003841	0.3593 0.3593		l I
89	ig	1.124	-0.003841	0.3593	İ	i
89 89	ig ig	1.124 1.124	-0.003841 -0.003841	0.3593		
89	ig	1.124	-0.003841	0.3593	I I	
89	ig	1.124	-0.003841	0.3593	Ì	Ì
89 89	ig ig	1.124 1.124	-0.003841 -0.003841	0.3593 0.3593		
89	ig	1.124	-0.003841	0.3593		
89	ig	1.124	-0.003841	0.3593	0.3593	0.3593
90	p	1.124	-0.003841	0.3593	 	
90	l p	1.124	-0.003841	0.3593		1
90 90	q q	1.124 1.124	-0.003841 -0.003841	0.3593 0.3593	0.3593	 0.3593
90	 ig	1.124	 -0.003841	0.3593		
90	ig	1.124	-0.003841	0.3593	i	i
90	ig	1.124 1.124	-0.003841 -0.003841	0.3593 0.3593		
90	ig ig	1.124	-0.003841	0.3593	I I	I I
90	ig	1.124	-0.003841	0.3593	i	i
90	ig	1.124	-0.003841 -0.003841	0.3593 0.3593		
1 90	ig ig	1.124 1.124	-0.003841	0.3593		
90	ig	1.124	-0.003841	0.3593	Ì	Ì
90	ig ig	1.124 1.124	-0.003841 -0.003841	0.3593	 0.3593	 0.3593
91		1.124	 -0.003841	0.3593		
1 91	p p	1.124	-0.003841	0.3593	I I	I I
91	p	1.124	-0.003841	0.3593	i	i
91	p 	1.124	-0.003841 	0.3593	0.3593 	0.3593
91			 -0.003841	0.3593		
91	ig ig	1.124 1.124	-0.003841	0.3593		
91	ig	1.124	-0.003841	0.3593	Ţ	Į.
91 91	ig ig	1.124 1.124	-0.003841 -0.003841	0.3593 0.3593	ļ.	ļ
91	ig	1.124	-0.003841	0.3593		
91	ig	1.124	-0.003841	0.3593	į.	ļ.
91 91	ig ig	1.124 1.124	-0.003841 -0.003841	0.3593	I	l I
91	ig	1.124	-0.003841	0.3593		
91	ig	1.124	-0.003841	0.3593	1	1
91	ig 	1.124	-0.003841 	0.3593	0.3593	0.3593
92	l p	1.397	0.1751	0.3254	Į.	ļ.
92	q q	1.383 1.179	0.06953 -0.2905	0.3307	I I	I I
92	p	0.9736	-0.2903	0.3508	0.3508	0.338
92	ig	1.416	-0.08996	0.3241	1	1
92	ig	1.385	-0.2114	0.326		I

92 92 92 92 92 92 92 92	ig ig ig ig ig ig ig	0.8539 1.34 1.328 1.296 0.9441 1.236 0.9681 1.262 1.105 1.181	0.06848 0.2622 -0.2039 0.1955 -0.107 -0.223 0.1196 -0.07811 -0.1809 -0.09039	0.3278 0.3308 0.3359 0.3408 0.3448 0.3461 0.3478 0.3492 0.3542 0.3561	0.3561	0.3403
93 93 93 93	p p p	1.262 0.9736 1.105 1.181	-0.07811 -0.03464 -0.1809 -0.09039	0.3492 0.3508 0.3542 0.3561	 0.3561	
93 93 93 93 93 93 93 93	ig ig ig ig ig ig ig ig	0.9736 1.262 1.262 0.9736 1.262 0.9736 1.181 1.181 1.181 1.105 1.105	-0.1809 -0.1809 -0.09039 -0.09039 -0.03464 -0.07811 -0.1809 -0.07811 -0.03464 -0.09039 -0.07811 -0.03464	0.3452 0.3457 0.3489 0.3496 0.3499 0.3525 0.3564 0.3571 0.3581 0.3584 0.3592	 	
94 94 94 94	p p p	1.181 1.105 1.105 1.105	-0.03464 -0.09039 -0.07811 -0.03464	0.3571 0.3581 0.3584 0.3592	 0.3592	
94 94 94 94 94 94 94 94	ig	1.181 1.181 1.181 1.105 1.105 1.105 1.105 1.105 1.105 1.105	· ·	0.3561 0.3564 0.3571 0.3581 0.3581 0.3584 0.3584 0.3592 0.3592 0.3592 0.3592 0.3592	0.3592	0.3582
95 95 95 95 95	p p	1.105 1.105 1.105 1.105	-0.03464	0.3592 0.3592 0.3592 0.3592	 0.3592	
95 95 95 95 95 95 95 95	ig ig ig ig ig ig ig ig	1.105 1.105 1.105 1.105 1.105 1.105 1.105 1.105	-0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464	0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592		

95	ig	1.105	-0.03464	0.3592	ļ	!!!!
95 95	ig ig	1.105 1.105	-0.03464 -0.03464	0.3592 0.3592	 0.3592	0.3592
96	 p	1.105	-0.03464	0.3592		
96	l p	1.105	-0.03464	0.3592	1	1
96	l p	1.105	-0.03464	0.3592		
96 	p 	1.105	-0.03464	0.3592	0.3592	0.3592
96	 ig	1.105	-0.03464	0.3592	 	
96	ig	1.105	-0.03464	0.3592		
96	ig	1.105	-0.03464	0.3592		
96	l ig	1.105	-0.03464	0.3592	ļ.	<u> </u>
96	ig	1.105	-0.03464	0.3592		
96 96	ig ig	1.105 1.105	-0.03464 -0.03464	0.3592 0.3592	l I	
96	ig	1.105	-0.03464	0.3592	i	
96	ig	1.105	-0.03464	0.3592	i	i
96	ig	1.105	-0.03464	0.3592	İ	j
96	ig	1.105	-0.03464	0.3592		
96 	ig 	1.105	-0.03464 	0.3592	0.3592	0.3592
97	p	1.105	-0.03464	0.3592	1	
97	p	1.105	-0.03464	0.3592	į	i
97	l p	1.105	-0.03464	0.3592		
97 	p	1.105	-0.03464	0.3592	0.3592	0.3592
97	 ig	1.105	-0.03464	 0.3592	 I	
97	ig	1.105	-0.03464	0.3592	i	i
97	ig	1.105	-0.03464	0.3592	İ	j
97	ig	1.105	-0.03464	0.3592		
97	ig	1.105	-0.03464	0.3592	1	
97	ig	1.105	-0.03464	0.3592		
97 97	ig	1.105 1.105	-0.03464 -0.03464	0.3592 0.3592		
97	ig ig	1.105	-0.03464	0.3592	l I	
97	ig	1.105	-0.03464	0.3592		
97	ig	1.105	-0.03464	0.3592	i	iiiii
97 	ig	1.105	-0.03464	0.3592	0.3592	0.3592
98	l p	1.105	-0.03464	0.3592	1	1
98	l p	1.105	-0.03464		1	1
98	l p	1.105	-0.03464	0.3592		
98 	p	1.105	-0.03464	0.3592	0.3592	0.3592
98	 ig	1.105	-0.03464	0.3592		
98	ig	1.105	-0.03464	0.3592	1	l
98	ig	1.105	-0.03464	0.3592	<u> </u>	<u> </u>
98	ig	1.105	-0.03464	0.3592		
98	ig	1.105	-0.03464	0.3592		
98 98	ig ig	1.105 1.105	-0.03464 -0.03464	0.3592 0.3592	I I	
98	ig	1.105	-0.03464	0.3592	1	ı
98	ig	1.105	-0.03464	0.3592	i	
98	ig	1.105	-0.03464	0.3592	i	i
98	ig	1.105	-0.03464	0.3592	1	1
98 	ig 	1.105	-0.03464	0.3592	0.3592	0.3592
99	l p	1.105	-0.03464	0.3592	1	1 1

	99 99 99	p p	1.105 1.105 1.105	-0.03464 -0.03464 -0.03464	0.3592 0.3592 0.3592	 0.3592	 0.3592	
	99 99 99 99 99 99 99 99 99	ig	1.105 1.105 1.105 1.105 1.105 1.105 1.105 1.105 1.105 1.105 1.105 1.105 1.105	-0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464 -0.03464	0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592 0.3592	 	 0.3592	
 	100 100 100 100	result result result result	1.105 1.105 1.105 1.105	-0.03464 -0.03464 -0.03464 -0.03464	0.3592 0.3592 0.3592 0.3592	 0.3592	 0.3592	

Значение префиксов:

- 1) p parent 2) ig intermediate generation 3) result результат

Код программы приведён в Приложении.

3. Графическая часть

1) Для 10 поколений

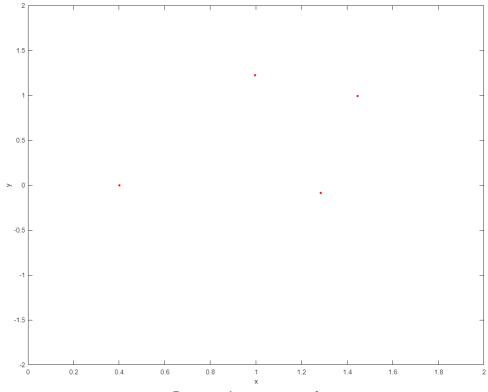


Рисунок 1 – поколение 0

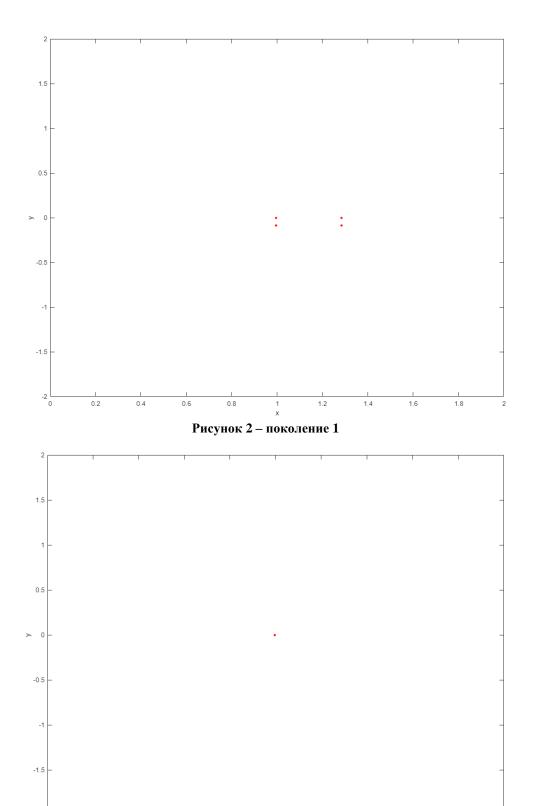


Рисунок 3 - поколения 2-10

1.4

0.4

2) Для 100 поколений

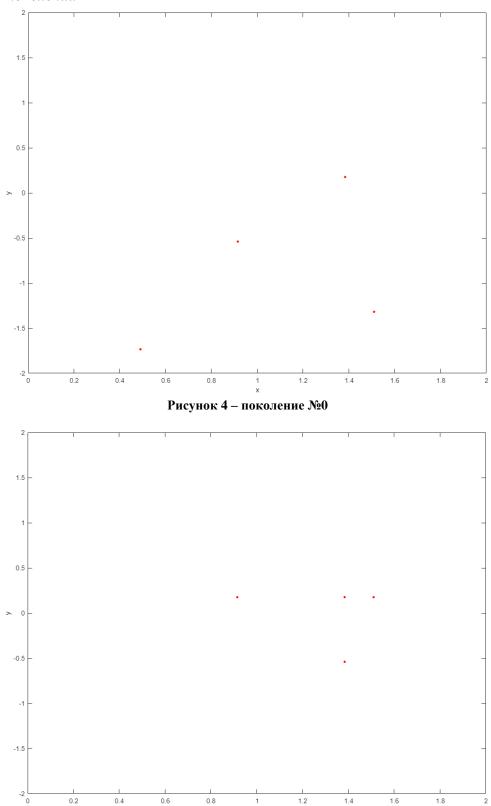


Рисунок 5 - поколение №1

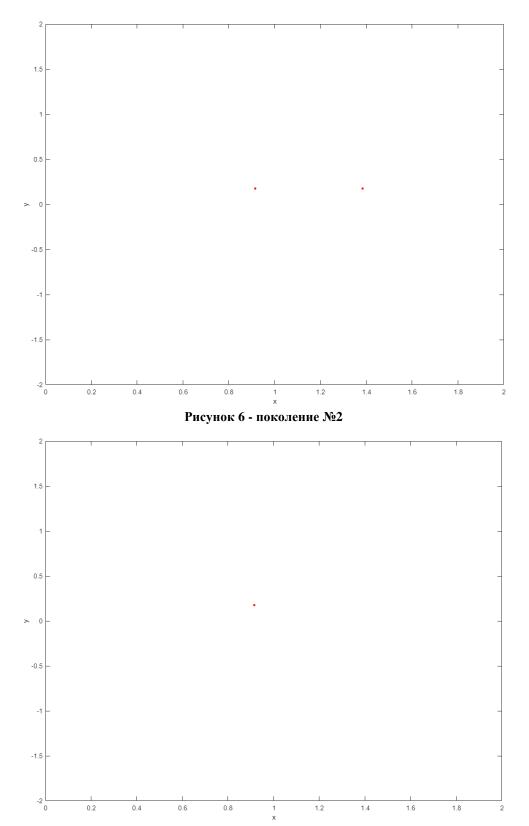


Рисунок 7 поколения №3-11

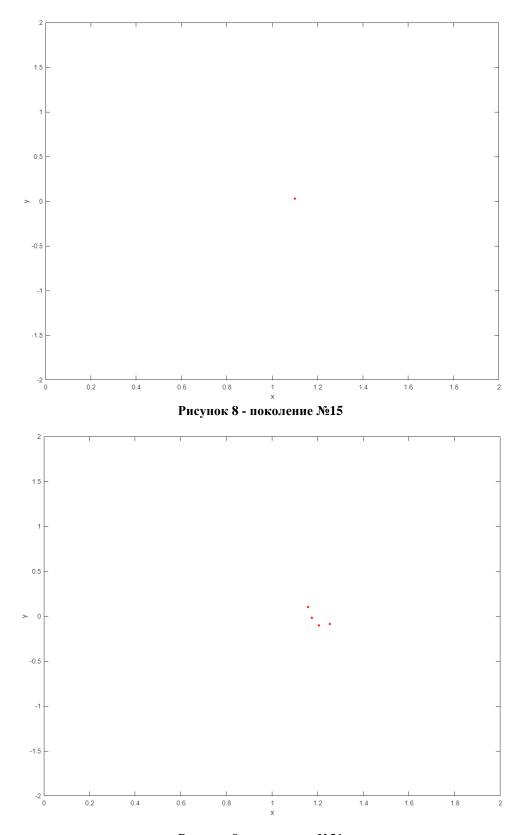


Рисунок 9 - поколение №31

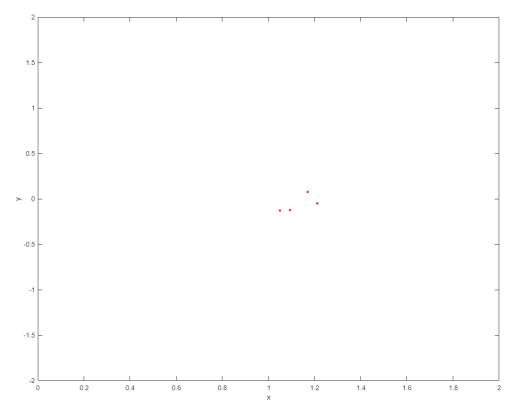


Рисунок 10 - поколение №52

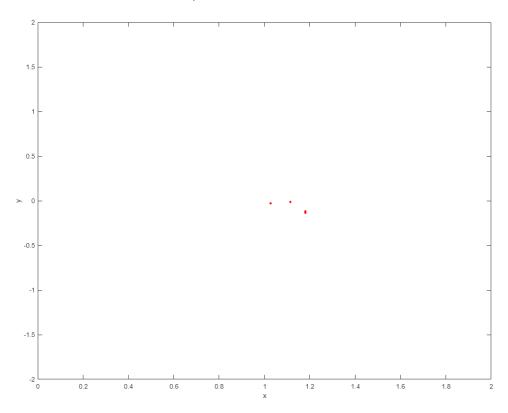


Рисунок 11 - поколение №73

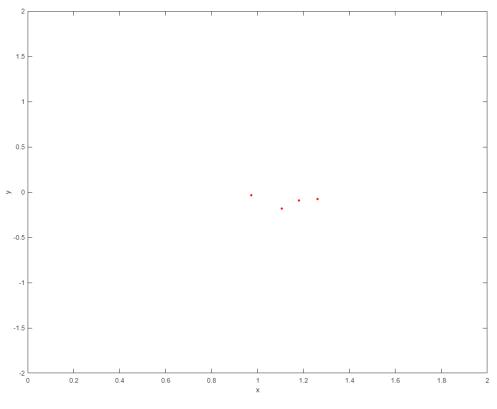


Рисунок 12 - поколение №93

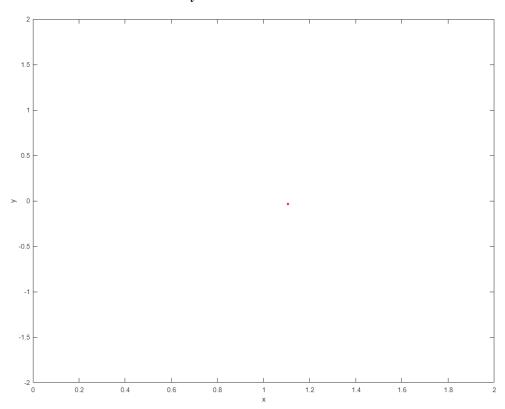


Рисунок 13 - поколение №100

4. Выводы

B процессе выполнения рубежного контроля я изучил метод поиска экстремума функции с помощью генетического алгоритма. B ходе работы мною был использован

алгоритм генерации промежуточной популяции, опирающийся на генетику, рулеточной селекции и мутации, в основе которой лежит случайное изменение генов. Значения полученные в ходе выполнения программы совпадают с графическими, что говорит о корректном ходе её работы.

Приложение

Файл main.cpp

Файл GeneticAlg.h

```
#pragma once
#include <map>
#include <random>
#include <iostream>
#include <iomanip>
#include <string>
struct point
       {
              double x; // Координата х
              double y; // Координата у
              double z; // Координата z
              point()
                     {
                            x = 0.0;
                            y = 0.0;
                            z = 0.0;
              point(double xval,double yval,double zval = 0.0)
                     {
                            x = xval; y = yval; z=zval;
                     }
              bool operator!=( point point 2 )
                     {
                            if ((x != point_2.x) && (y != point_2.y))
                                          return true;
                            return false;
                     }
              bool operator==( point point_2 )
                            if ((x == point_2.x) && (y == point_2.y))
                                          return true;
```

```
return false;
                     }
       };
struct borders
       {
              double a;
                           // Нижняя граница
              double b;
                            // Верхняя граница
              borders()
                            a = 0.0;
                            b = 0.0;
              borders(double a2,double b2)
                            a=a2;
                            b=b2;
                     }
       };
class GeneticAlgorithm
       {
              protected:
                     Область поиска для координат х и у
              std::pair<borders, borders> border{{0.0,2.0},{-2.0,2.0}};
              *
                     Родители
              */
              std::multimap<double,point> parents;
                     Промежуточная популяция
              */
              std::multimap<double,point> intermidiate generation;
                     Максимальное количество поколений
              */
              size_t max_generations;
              public:
              GeneticAlgorithm(size_t generations = 100u,std::pair<borders,borders>
input_border = \{\{0.0,2.0\},\{-2.0,2.0\}\}\}
                            max_generations = generations;
                            border = input_border;
                     }
              * @brief Функция используется для полного прохождения генетического алгоритма
              */
              void pass();
              * @brief Функция используется для создания 0 генерации
              * @param[in] count_of_parents Количество родителей
              */
              void init_gen(size_t count_of_parents = 4u);
              * @brief Функция, описывающая селекцию
```

```
*/
              void selection();
              /**
              * @brief Функция, описывающая мутацию
              void mutation();
              * @brief Функция, описывающая селекцию
              */
              void reduction();
              * @brief Функция для печати multimap
              * @param[in] multimap Контейнер std::multimap<double,point>
              * @param[in] prefix Префикс перед строкой
              * @param[in] up_border Рисует границу сверху и снизу, если значение true
              */
              void print(size_t genereation, std::multimap<double,point> multimap,
std::string prefix = "", bool border = true);
        };
                                      Файл GeneticAlg.cpp
       #include"GeneticAlg.h"
#include "Function.h"
#include <iterator>
#include <algorithm>
std::random device rd;
std::mt19937 gen(rd());
void draw hat()
       {
       std::cout<<std::left<<std::setprecision(4)<<"|"<<std::setw(9)<<"genereation"<<"|"<<st</pre>
d::setw(6)<<"prefix"<<" | "<<std::setw(10)<<"X"<<" | "<<std::setw(10)<<"Y"<<" |
"<<std::setw(10)<<"FIT"<<" | "<<std::setw(10)<<"max element"<<" |
"<<std::setw(9)<<"average"<<" |\n";
       }
void GeneticAlgorithm::init_gen(size_t count_of_parents)
       {
              std::uniform_real_distribution<double> x_border
(border.first.a,border.first.b);
              std::uniform_real_distribution<double> y_border
(border.second.a,border.second.b);
              parents.clear();
              point temp_point;
              for (size_t count = 0u;count < count_of_parents;++count)</pre>
                     {
                            temp_point.x = x_border(gen);
                            temp_point.y = y_border(gen);
                            temp_point.z = F(temp_point.x,temp_point.y);
```

```
parents.insert({temp_point.z,temp_point});
                     }
       }
void GeneticAlgorithm::selection()
       {
              intermidiate_generation.clear();
              point temp_point;
              for(auto index = parents.begin();index != parents.end();++index)
                                   Так как потомок может иметь что-то от каждого из
радителей, то я сделал следующее:
                                   у 2 родителей могут быть 2 потомка с координитами
(x1,y2,f(x1,y2)) и (x2,y1,f(x2,y1)),
                                   где (х1,у1) - координаты 1 родителя, (х2,у2) - координаты
2 родителя.
                            for(auto index_2 = std::next(index);index_2 !=
parents.end();++index_2)
                                   {
                                          // 1)
                                          temp_point.x = index->second.x;
                                          temp_point.y = index_2->second.y;
                                          temp_point.z = F(temp_point.x,temp_point.y);
       intermidiate_generation.insert({temp_point.z,temp_point});
                                          // 2)
                                          temp_point.x = index_2->second.x;
                                          temp_point.y = index->second.y;
                                          temp_point.z = F(temp_point.x,temp_point.y);
       intermidiate_generation.insert({temp_point.z,temp_point});
                     }
       }
void GeneticAlgorithm::reduction()
              for (auto temp : intermidiate_generation)
                     {
                            parents.insert(temp);
              intermidiate_generation.clear();
              size_t temp = parents.size() - 4;
              for (size_t index = 0u;index < temp;++index)</pre>
                            parents.erase(parents.begin());
                     }
              std::cout<<"";</pre>
       }
void GeneticAlgorithm::mutation()
       {
                     Заметка:
                     Мутация в данной реализации генного алгоритма выглядит следующим
образом:
```

```
координатой.
              std::uniform_real_distribution<double> delta(-0.3,0.3);
              std::multimap<double, point> temp_multimap;
              for (auto parent = parents.begin();parent != parents.end();++parent)
                     {
                            parent->second.x += delta(gen);
                            parent->second.y += delta(gen);
                            if (parent->second.x < border.first.a)</pre>
                                          parent->second.x = border.first.a;
                            else if (parent->second.x > border.first.b)
                                          parent->second.x = border.first.b;
                            if (parent->second.y < border.second.a)</pre>
                                          parent->second.y = border.second.a;
                            else if (parent->second.y > border.second.b)
                                          parent->second.y = border.second.b;
                            parent->second.z = F(parent->second.x,parent->second.y);
                            temp_multimap.insert({parent->second.z,parent->second});
              parents = temp_multimap;
              temp_multimap.clear();
              for (auto child = intermidiate_generation.begin();child !=
intermidiate_generation.end();++child)
                     {
                            child->second.x += delta(gen);
                            child->second.y += delta(gen);
                            if (child->second.x < border.first.a)</pre>
                                   {
                                          child->second.x = border.first.a;
                            else if (child->second.x > border.first.b)
                                          child->second.x = border.first.b;
                            if (child->second.y < border.second.a)</pre>
                                          child->second.y = border.second.a;
                            else if (child->second.y > border.second.b)
                                          child->second.y = border.second.b;
                            child->second.z = F(child->second.x,child->second.y);
                            temp_multimap.insert({child->second.z,child->second});
              intermidiate_generation = temp_multimap;
              temp_multimap.clear();
       }
void GeneticAlgorithm::pass()
```

берется координата точки х и рандомно сдвигается и также с у

```
double P = 0.0;
              std::uniform_real_distribution<double> Probability(0.0,0.1);
              draw_hat();
              init gen();
              print(0u,parents,"p");
              selection();
              reduction();
              std::cout<<"\n";</pre>
              for (size t iteration = 1u;iteration <= max generations - 1u ;++iteration)</pre>
                             P += Probability(gen);
                             // std::cout<<P<<"\n"; // Debug
                             selection();
                             if (P > 0.5)
                                    {
                                           mutation();
                                           P = 0.0;
                             print(iteration, parents, "p");
                             print(iteration, intermidiate_generation, "ig",true);
                             reduction();
                             std::cout<<"\n";</pre>
              print(max_generations,parents,"result");
       }
void GeneticAlgorithm::print(size_t genereation,std::multimap<double,point> multimap,
std::string prefix,bool border)
       {
              if (border)
                     {
                             std::cout<<" ";</pre>
                             for (int index = 1;index < 85;++index)</pre>
                                            std::cout<<"-";</pre>
                             std::cout<<"\n";</pre>
                      }
              double average = 0.0;
              for (auto tochka: multimap)
                      {
                             average +=tochka.second.z;
                      }
              average=average/multimap.size();
              auto max_element = std::max_element(multimap.begin(),multimap.end(),
[](std::pair<double,point> var1,std::pair<double,point> var2)
                                                                                         {
       return var1.first < var2.first;</pre>
                                                                                         }
              );
              for (auto tochka = multimap.begin();tochka != multimap.end();++tochka)
                     {
                             std::cout<<std::left<<std::setprecision(4)<<"</pre>
"<<std::setw(9)<<genereation<<"|"<<std::setw(6)<<' '+prefix<<" | "<<std::setw(10)<<tochka-
>second.x<<"\int "<<std::setw(10)<<tochka->second.y<<" | "<<std::setw(10)<<tochka->second.z;
```

```
if (tochka == std::prev(multimap.end()))
                                              std::cout<<" | "<<std::setw(10)<<max_element-</pre>
>first<<" | "<<std::setw(10)<<average<<" |";</pre>
                                      {
                                              std::cout<<" | "<<std::setw(10)<<"
                                                                                              "<<"
"<<std::setw(10)<<"
                                      }
                               std::cout<<"\n";</pre>
                       }
               if (border)
                       {
                               std::cout<<" ";</pre>
                               for (int index = 1;index < 85;++index)</pre>
                                              std::cout<<"-";</pre>
                               std::cout<<"\n";</pre>
                       }
         }
```