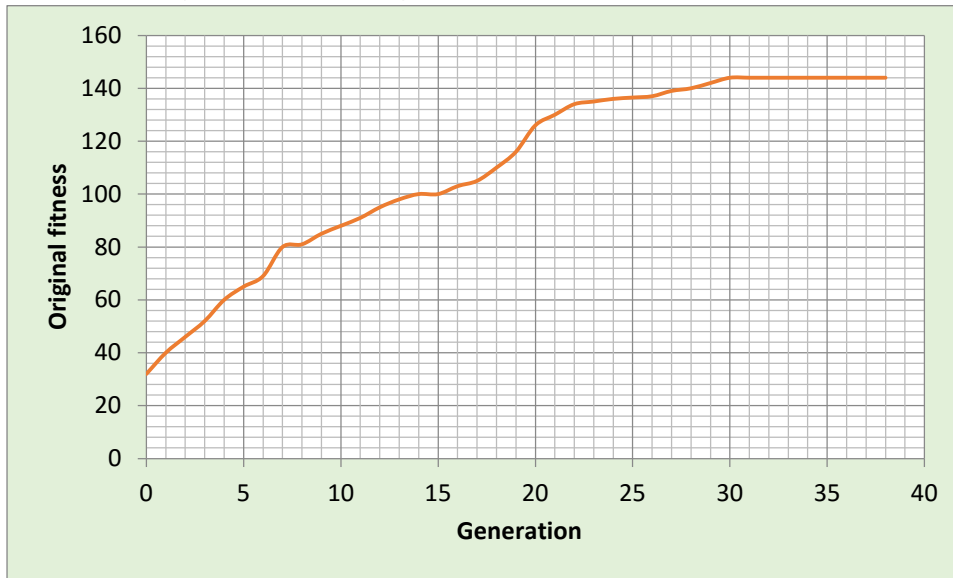# Modern intelligent IT
Lab 3 (22.04.2016)
Akira Imada
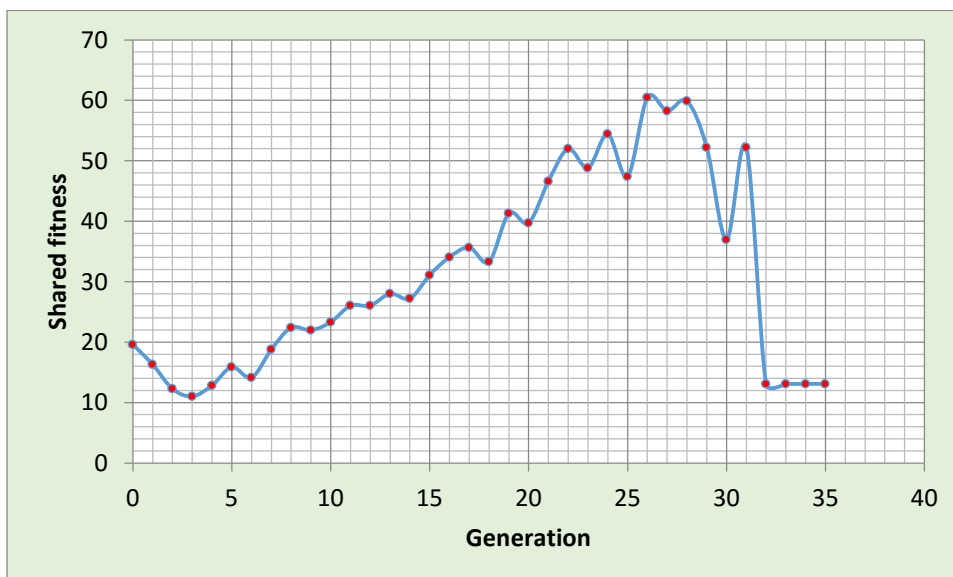## Student – Anton Marchenko(AC-36)

Task №1

Lucky Dog Problem with Fithess Sharing Algorithm

1. Show the graph of fitness vs generation of 8 highest fitness dogs

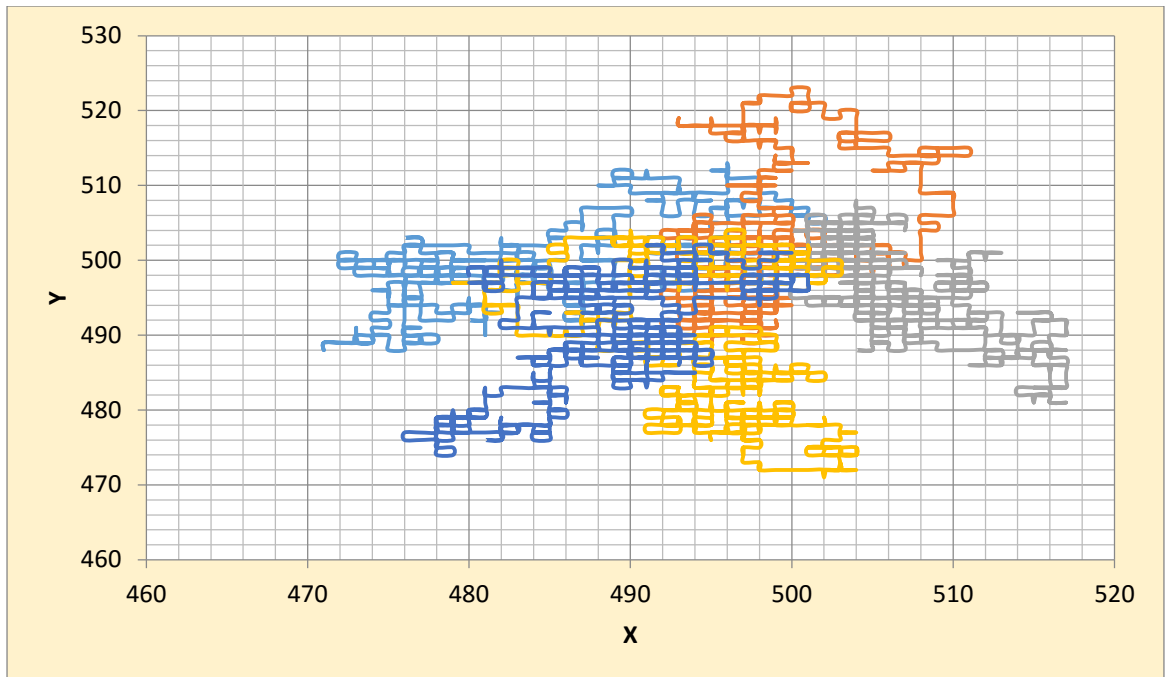Graph of original fitness vs generation.

Graph of shared fitness vs generation.

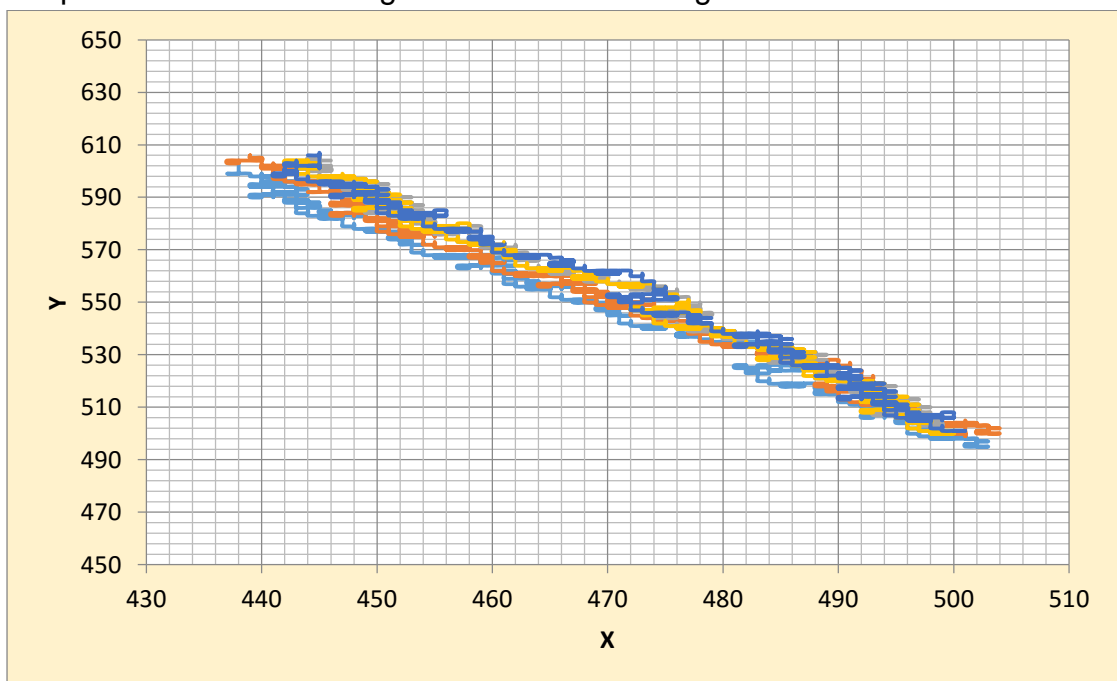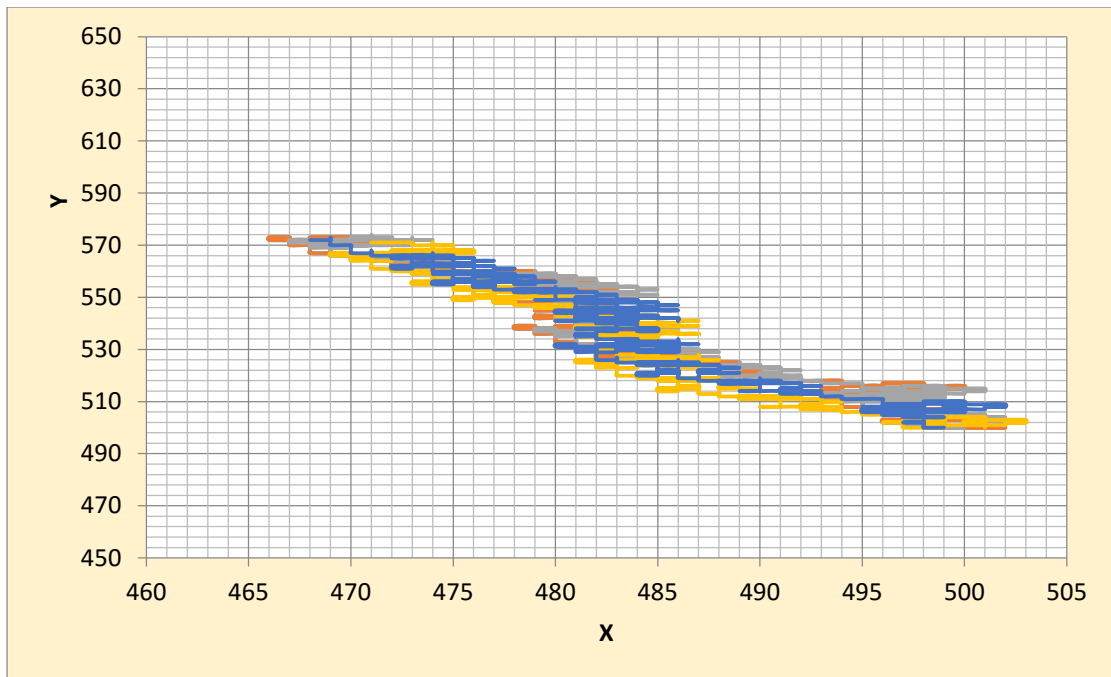2. Show the route of 8 highest fithess dogs in the 1st generations, two intermediate generations, and the final generation.

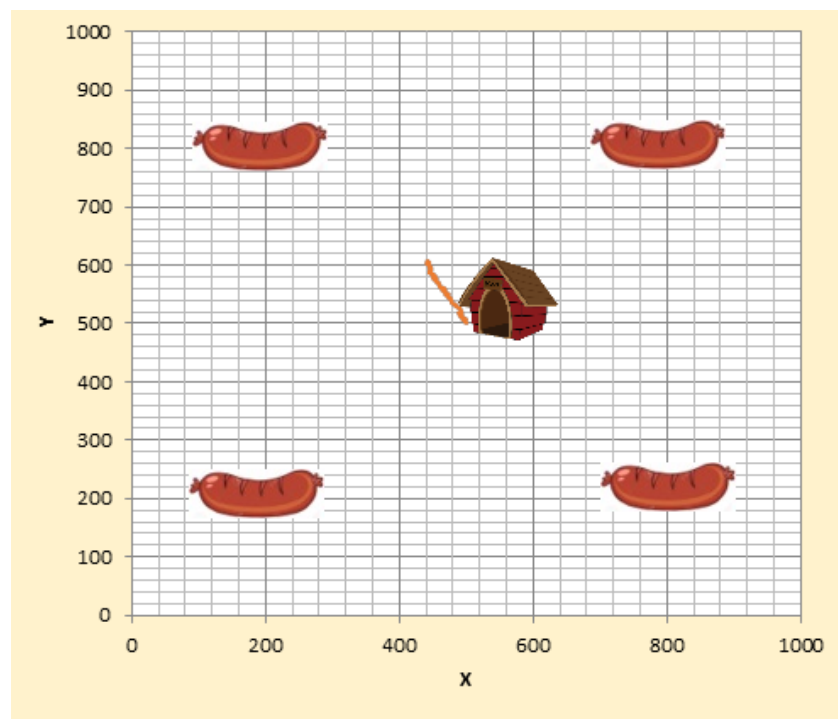Graphs of the routes of dogs in the 1st generation.

Graphs of the routes of dogs in the intermediate generation.

Routes in the final generation.

3. Show the table of original fitness and shared fitness for all the N chromosomes in the above 5 generations

First generation(N = 0)

Dogs	Position	#0 iteration	
		Original fitness	Shared fitness
#1	493,487	20	10
#2	472,522	50	25
#3	491,507	16	8
#4	447,487	66	33
#5	547,513	60	30
#6	522,506	28	14
#7	533,533	66	33
#8	489,479	32	16
#9	504,54	44	22
#10	503,507	10	5

Dogs	Position	#1 iteration	
		Original fitness	Shared fitness
#1	499,501	22	11
#2	476,492	32	16
#3	505,477	28	14
#4	517,513	30	15
#5	485,473	42	21
#6	513,501	14	7
#7	473,467	60	30
#8	529,509	38	19
#9	499,483	26	13.янв
#10	495,471	34	17

Intermediate generation (N = 20)

Dogs	Position	#19 generation	
		Original fitness	Shared fitness
#1	501,551	92	46
#2	497,553	88	44
#3	489,553	70	35
#4	487,581	94	47
#5	501,561	88	44
#6	481,561	80	36,3636364
#7	484,566	82	41
#8	492,546	90	45
#9	484,56	76	34,5454545
#10	502,57	80	40

Dogs	#20 iteration		
	Position	Original fitness	Shared fitness
#1	495,567	78	39
#2	487,559	84	38,1818182
#3	490,572	82	37,2727273
#4	481,561	82	37,2727273
#5	497,561	98	49
#6	489,569	80	36,3636364
#7	489,549	90	40,9090909
#8	484,56	82	34,1666667
#9	479,571	92	46
#10	488,552	86	39,0909091

Dogs	#21 iteration		
	Position	Original fitness	Shared fitness
#1	483,583	100	50
#2	491,557	98	49
#3	486,56	90	45
#4	487,575	88	44
#5	496,57	90	45
#6	477,579	102	51
#7	476,574	98	49
#8	482,59	108	41,5384615
#9	497,561	100	50
#10	481,589	108	41,5384615

Intermediate generation(N = 25)

Dogs	#24 iteration		
	Position	Original fitness	Shared fitness
#1	473,589	120	42,8571429
#2	486,59	184	92
#3	462,606	144	31,3043478
#4	462,606	144	31,3043478
#5	481,587	156	78
#6	472,586	120	50
#7	472,59	118	42,1428571
#8	462,606	144	31,3043478
#9	491,581	172	86
#10	462,604	142	37,3684211

| Dogs | Position | #25 iteration | |
		Original fitness	Shared fitness
#1	481,585	106	40,76923077
#2	463,581	118	53,63636364
#3	466,58	114	43,84615385
#4	466,576	116	48,33333333
#5	472,574	108	49,09090909
#6	478,588	118	53,63636364
#7	481,593	116	58
#8	472,578	106	44,16666667
#9	479,585	106	37,85714286
#10	468,578	116	44,61538462

| Dogs | Position | #26 iteration | |
		Original fitness	Shared fitness
#1	477,579	110	55
#2	481,599	118	59
#3	472,578	114	57
#4	466,58	114	57
#5	469,555	144	72
#6	468,6	132	66
#7	459,597	138	62,72727273
#8	468,574	106	53
#9	463,597	134	60,90909091
#10	474,598	124	62

Final generation (N = 32)

| Dogs | Position | #32 iteration | |
		Original fitnes	Shared fitness
#1	462,606	144	13,09
#2	462,606	144	13,09
#3	462,606	144	13,09
#4	462,606	144	13,09
#5	462,606	144	13,09
#6	462,606	144	13,09
#7	462,606	144	13,09
#8	462,606	144	13,09
#9	462,606	144	13,09
#10	462,606	144	13,09

| Dogs | Position | #32 iteration | |
		Original fitnes	Shared fitness
#1	462,606	144	13,09
#2	462,606	144	13,09
#3	462,606	144	13,09
#4	462,606	144	13,09
#5	462,606	144	13,09
#6	462,606	144	13,09
#7	462,606	144	13,09
#8	462,606	144	13,09
#9	462,606	144	13,09
#10	462,606	144	13,09

Task №2
A maximization of 3D function with Crowding Algorithm

1. Show the graph of fitness vs generation, repeating evolution until fitness becomes stable.
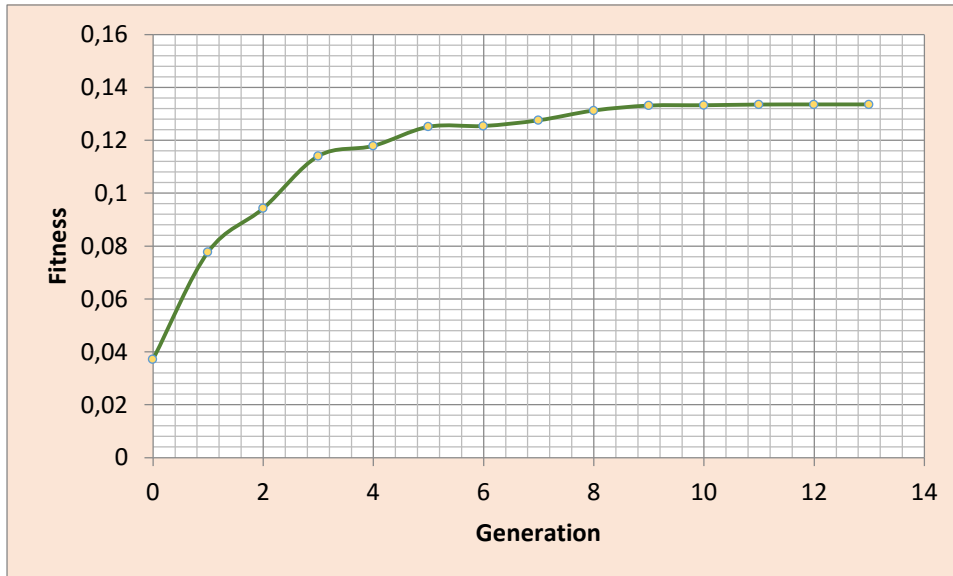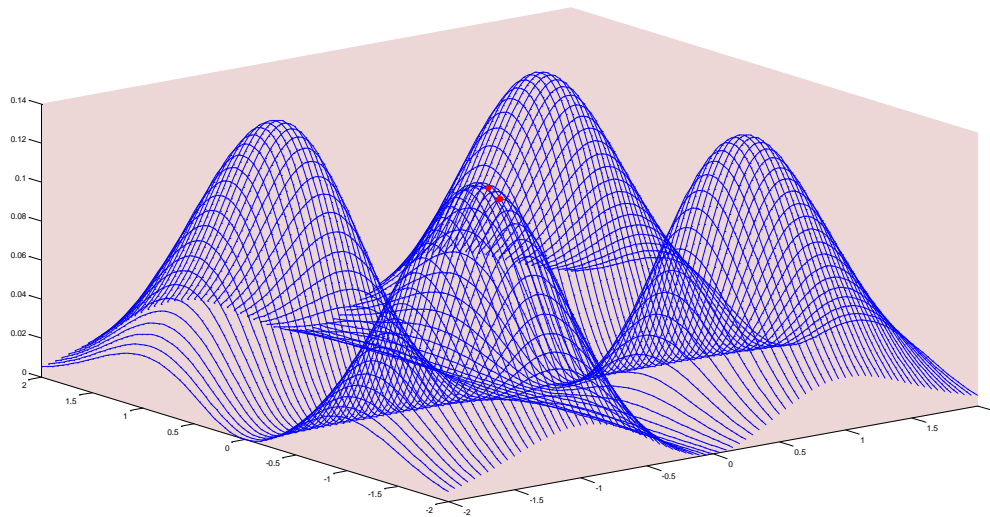

2. Show the 3D graph including 10 points on the surface in the 1st generations, two intermediate generations, and the final generation.
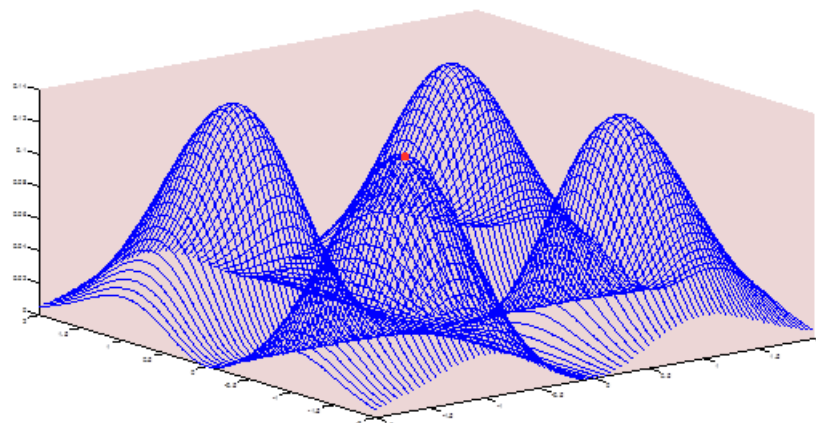
3D graph including 10 points on the surface in the 1st generations:
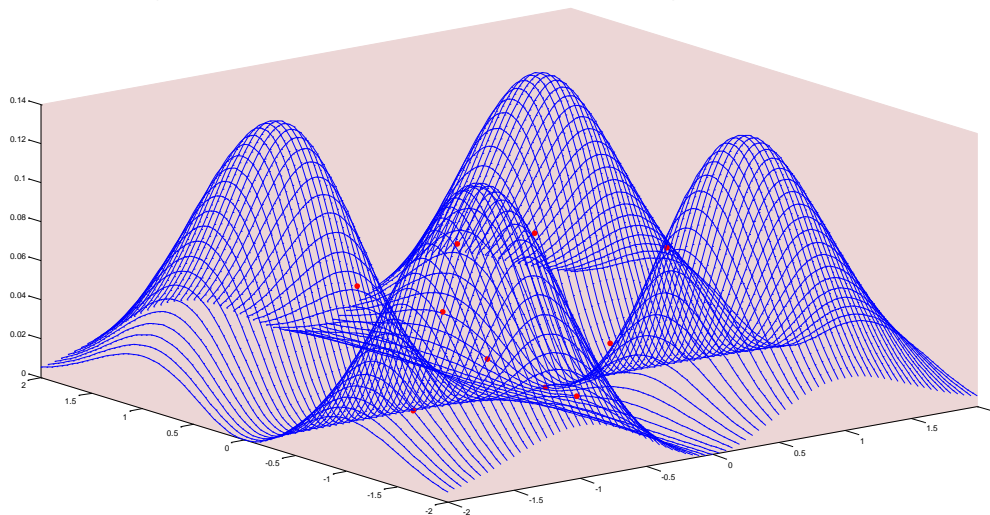
3D graph including 10 points on the surface in the two intermediate generations:
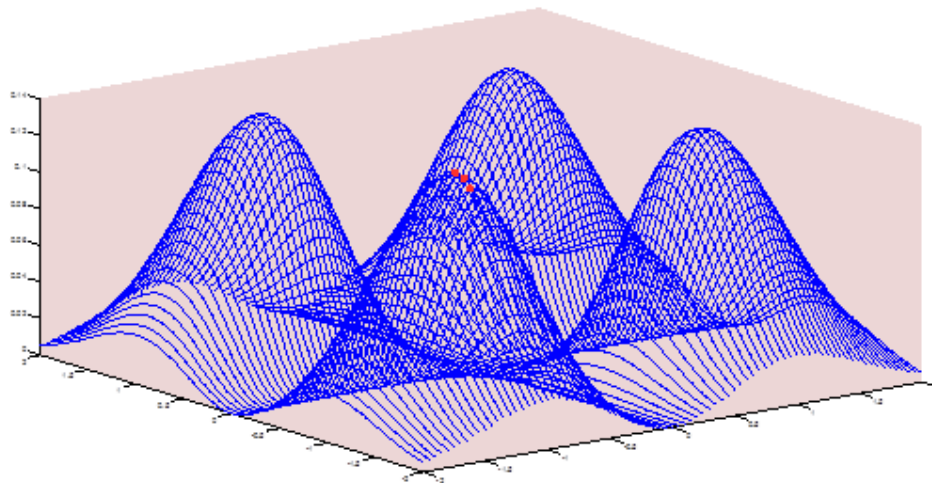
3D graph including 10 points on the surface in the final generation:

3. Show the table such as shown in the next page in the above 5 generations.

Show the table on 1st generation N = 1;
Generation N - 1 = 0

		Generation 0			
	selected parents & fitness	created children & fitness	$d(p_1,c_1)$ + $d(p_2,c_2)$	$d(p_1;c_2)$ + $d(p_2;c_1)$	new chromosomes
#0	p1: (110100001111001010010) = (0,6325;0,5806) z=0,0645 p2: (101000000111111110111) = (0,2532;0,9922) z=0,0221	c1: (110100001111001110111) = (0,6325;0,6168) z=0,0697 c2: (101000000111111010010) = (0,2532;0,9560) z=0,0220	0,0723	1,0672	110100001111001010010 110100001111001110111
#1	p1: (110100001111001010010) = (0,6325;0,5806) z=0,0645 p2: (000110110000111011010) = (-0,2111;-0,9326) z=0,0155	c1: (110100001111000111010) = (0,6325;0,5572) z=0,0610 c2: (000110110000111010010) = (-0,2111;-0,9560) z=0,0156	0,0469	3,4650	110100001111001010010 110100001111000111010
#2	p1: (011001101011011010011) = (-0,8025;0,4565) z=0,0572 p2: (000110110000111011010) = (-0,2111;-0,9326) z=0,0155	c1: (011001110000111011010) = (-0,8055;-0,9326) z=0,1236 c2: (000110101011011010011) = (-0,2082;0,4565) z=0,0070	2,7781	1,1887	011001110000111011010 000110110000111011010
#3	p1: (111100100101001011000) = (0,8935;0,1799) z=0,0113 p2: (011100011000101000110) = (-0,8876;-0,6383) z=0,0971	c1: (111100100101001011101) = (0,8935;0,1848) z=0,0119 c2:(011100011000101000100) = (-0,8876;-0,6334) z=0,0963	0,0098	3,9200	011100011000101000100 011100011000101000110
#4	p1: (011001101011011010011) = (-0,8025;0,4565) z=0,0572 p2: (011100011000101000110) = (-0,8876;-0,6383) z=0,0971	c1: (011000011000101000110) = (-0,7625;-0,6383) z=0,0881 c2: (011101101011011010011) = (-0,9277;0,4565) z=0,0616	2,1911	0,2502	011000011000101000110 011100011000101000110

Generation N = 1

		Generation 1			
	selected parents & fitness	created children & fitness	$d(p_1,c_1)$ + $d(p_2,c_2)$	$d(p_1;c_2)$ + $d(p_2;c_1)$	new chromosomes
#0	p1: (011001110000111011010) = (-0,8055;-0,9326) z=0,1236 p2: (011000011000101000110) = (-0,7625;-0,6383) z=0,0881	c1: (011001110000101000110) = (-0,8055;-0,6383) z=0,0919 c2: (011000011000111011010) = (-0,7625;-0,9326) z=0,1185	0,5885	0,0860	011001110000111011010 011000011000111011010
#1	p1: (110100001111001010010) = (0,6325;0,5806) z=0,0645 p2: (110100001111000111010) = (0,6325;0,5572) z=0,0610	c1: (110100001111000111010) = (0,6325;0,5572) z=0,0610 c2: (110100001111001010010) = (0,6325;0,5806) z=0,0645	0,0469	0,0000	110100001111001010010 110100001111001010010
#2	p1: (110100001111001010010) = (0,6325;0,5806) z=0,0645 p2: (011000011000101000110) = (-0,7625;-0,6383) z=0,0881	c1: (110100011000101000110) = (0,6373;-0,6383) z=0,0734 c2: (011000001111001010010) = (-0,7576;0,5806) z=0,0778	2,4379	2,7898	011000001111001010010 011000011000101000110
#3	p1: (011001110000111011010) = (-0,8055;-0,9326) z=0,1236 p2: (110100001111001110111) = (0,6325;0,6168) z=0,0697	c1: (011001110000100111011) = (-0,8055;-0,6168) z=0,0882 c2: (110100001111110110110) = (0,6325;0,9326) z=0,0977	0,6315	4,2496	011001110000111011010 011001110000100111011
#4	p1: (011100011000101000110) = (-0,8876;-0,6383) z=0,0971 p2: (000110110000111011010) = (-0,2111;-0,9326) z=0,0155	c1: (011100011000101000100) = (-0,8876;-0,6354) z=0,0966 c2: (000110110000111011101) = (-0,2111;-0,9355) z=0,0156	0,0059	1,4777	011100011000101000110 011100011000101000010

Generation N + 1 = 2

	selected parents & fitness	created children & fitness	d(p1,c1) + d(p2,c2)	d(p1;c2) + d(p2;c1)	new chromosomes
#0	p1: (011000001111001010010) = (-0,7576;0,5806) z=0,0778 p2: (011001110000110111010) = (-0,8055;-0,9326) z=0,1236	c1: (011000001111110111010) = (-0,7576;0,9326) z=0,1178 c2: (011001110000100101010010) = (-0,8055;-0,5806) z=0,0816	0,7038	3,0280	011001110000100101010010 011001110000110111010
#1	p1: (011001110000110111010) = (-0,8055;-0,9326) z=0,1236 p2: (011000011000110111010) = (-0,7625;-0,9326) z=0,1185	c1: (011001110000110111010) = (-0,8055;-0,9326) z=0,1236 c2: (011000011000110111010) = (-0,7625;-0,9326) z=0,1185	0,0000	0,0860	011001110000110111010 011001110000110111010
#2	p1: (011001110000110111010) = (-0,8055;-0,9326) z=0,1236 p2: (011100011000101000101) = (-0,8876;-0,6383) z=0,0971	c1: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237 c2: (011100011000101000101010) = (-0,8876;-0,6354) z=0,0966	0,0059	0,6166	011001110000110111010 011001110000110111101
#3	p1: (011000001111001010010) = (-0,7576;0,5806) z=0,0778 p2: (011001110000110111010) = (-0,8055;-0,9326) z=0,1236	c1: (011000001111001011010) = (-0,7576;0,5885) z=0,0792 c2: (011001110000110110010) = (-0,8055;-0,9247) z=0,1233	0,0156	3,0279	011001110000110110010 011001110000110111010
#4	p1: (011100011000101000101) = (-0,8876;-0,6383) z=0,0971 p2: (110100001111001010010) = (0,6325;0,5806) z=0,0645	c1: (011100011000101000101010) = (-0,8876;-0,6354) z=0,0966 c2: (110100001111001010101) = (0,6325;0,5836) z=0,0650	0,0059	3,8969	011100011000101000101 011100011000101000101010

Show table data on intermediate generation N = 7;

Generation N - 1 = 6

	selected parents & fitness	created children & fitness	d(p1,c1) + d(p2,c2)	d(p1;c2) + d(p2;c1)	new chromosomes
#0	p1: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237 p2: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237	c1: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237 c2: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237	0,0000	0,0000	011001110000110111101 011001110000110111101
#1	p1: (011001110000111010010) = (-0,8055;-0,9560) z=0,1243 p2: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237	c1: (011001110000111010101) = (-0,8055;-0,9589) z=0,1243 c2: (011001110000110111010) = (-0,8055;-0,9326) z=0,1236	0,0059	0,0469	011001110000111010010 011001110000111010101
#2	p1: (011101110000110111101) = (-0,9306;-0,9355) z=0,1329 p2: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237	c1: (011101110000110111101) = (-0,9306;-0,9355) z=0,1329 c2: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237	0,0000	0,2502	011101110000110111101 011101110000110111101
#3	p1: (011001110000111010010) = (-0,8055;-0,9560) z=0,1243 p2: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237	c1: (011001110000110111101) = (-0,8055;-0,9355) z=0,1237 c2: (011001110000111010010) = (-0,8055;-0,9560) z=0,1243	0,0411	0,0000	011001110000111010010 011001110000111010010
#4	p1: (011101110000110111101) = (-0,9306;-0,9355) z=0,1329 p2: (011001110000111010010) = (-0,8055;-0,9560) z=0,1243	c1: (011101110000110110010) = (-0,9306;-0,9247) z=0,1325 c2: (011001110000111011101) = (-0,8055;-0,9668) z=0,1245	0,0215	0,2579	011101110000110111101 011101110000110110010

Generation N = 7

	selected parents & fitness	created children & fitness	$d(p_1,c_1)$ + $d(p_2,c_2)$	$d(p_1;c_2)$ + $d(p_2;c_1)$	new chromosomes
#0	p1: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243 p2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	c1: (0110011100001110111101) = (-0,8055;-0,9355) z=0,1237 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0411	0,2502	0111011100001111010010 0111011100001110111101
#1	p1: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243 p2: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243	c1: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243 c2: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243	0,0000	0,0000	0110011100001111010010 0110011100001111010010
#2	p1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 p2: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243	c1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 c2: (0110011100001110111101) = (-0,8055;-0,9355) z=0,1237	0,0411	0,2502	0111011100001110111101 0111011100001111010010
#3	p1: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243 p2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	c1: (0110011100001111010101) = (-0,8055;-0,9589) z=0,1243 c2: (0111011100001110111010) = (-0,9306;-0,9326) z=0,1328	0,0059	0,2546	0111011100001110111010 0111011100001110111101
#4	p1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 p2: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243	c1: (0111011100001110111010) = (-0,9306;-0,9326) z=0,1328 c2: (0110011100001111010101) = (-0,8055;-0,9589) z=0,1243	0,0059	0,2546	0111011100001110111101 0111011100001110111010

Generation N + 1 = 8

	selected parents & fitness	created children & fitness	$d(p_1,c_1)$ + $d(p_2,c_2)$	$d(p_1;c_2)$ + $d(p_2;c_1)$	new chromosomes
#0	p1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 p2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	c1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 c2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	0,0000	0,0000	0111011100001110111101 0111011100001110111101
#1	p1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 p2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	c1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 c2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	0,0411	0,0000	0111011100001111010010 0111011100001111010010
#2	p1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 p2: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243	c1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 c2: (0110011100001110111101) = (-0,8055;-0,9355) z=0,1237	0,0411	0,2502	0111011100001110111101 0111011100001111010010
#3	p1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 p2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	c1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 c2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	0,0000	0,0000	0111011100001110111101 0111011100001110111101
#4	p1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 p2: (0110011100001111010010) = (-0,8055;-0,9560) z=0,1243	c1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 c2: (0110011100001110111101) = (-0,8055;-0,9355) z=0,1237	0,0411	0,2502	0111011100001110111101 0111011100001111010010

Show table data on Last generations N = 11;

Generation N - 1 = 10

			d(p1,c1) + d(p2,c2)	d(p1;c2) + d(p2;c1)	
	selected parents & fitness	created children & fitness			new chromosomes
#0	p1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 p2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	c1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 c2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	0,0411	0,0000	0111011100001111010010 0111011100001111010010
#1	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329	c1: (0111011100001110111101) = (-0,9306;-0,9355) z=0,1329 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0411	0,0000	0111011100001111010010 0111011100001111010010
#2	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	c1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0000	0,0000	0111011100001111010010 0111011100001111010010
#3	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0059	0,0000	0111011100001111010101 0111011100001111010101
#4	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0059	0,0000	0111011100001111010101 0111011100001111010101

Generation N = 11

			d(p1,c1) + d(p2,c2)	d(p1;c2) + d(p2;c1)	
	selected parents & fitness	created children & fitness			new chromosomes
#0	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0059	0,0000	0111011100001111010101 0111011100001111010101
#1	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0059	0,0000	0111011100001111010101 0111011100001111010101
#2	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0059	0,0000	0111011100001111010101 0111011100001111010101
#3	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010011) = (-0,9306;-0,9570) z=0,1335 c2: (0111011100001111010100) = (-0,9306;-0,9580) z=0,1335	0,0020	0,0039	0111011100001111010100 0111011100001111010101
#4	p1: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010010) = (-0,9306;-0,9560) z=0,1335	0,0059	0,0000	0111011100001111010101 0111011100001111010101

Generation N + 1 = 12

	Generation 12				
	selected parents & fitness	created children & fitness	$d(p_1,c_1)$ + $d(p_2,c_2)$	$d(p_1;c_2)$ + $d(p_2;c_1)$	new chromosomes
#0	p1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	0,0000	0,0000	0111011100001111010101 0111011100001111010101
#1	p1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 p2: (0111011100001111010100) = (-0,9306;-0,9580) z=0,1335	c1: (0111011100001111010100) = (-0,9306;-0,9580) z=0,1335 c2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	0,0020	0,0000	0111011100001111010101 0111011100001111010101
#2	p1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	0,0000	0,0000	0111011100001111010101 0111011100001111010101
#3	p1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	0,0000	0,0000	0111011100001111010101 0111011100001111010101
#4	p1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 p2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	c1: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335 c2: (0111011100001111010101) = (-0,9306;-0,9589) z=0,1335	0,0000	0,0000	0111011100001111010101 0111011100001111010101