COMP SCI 5401 FS2017 Assignment 1d

John Niemeyer
JJNB78@mst.edu

October 23, 2017

MOEA Explained

For my MOEA I decided that my Pareto Fronts would be based off the first objective fitness vs. the second objective fitness. Since we did not care about the lower fitness fronts, I was able to ignore any Pareto Fronts that were below P1 (the best Pareto Front so far). This means that i had to use a temp list when I found a new dominant Pareto Front due to having to remove the previous dominant Pareto Front "king," which i did by going through the current Pareto Front and seeing if the older values work with the newer dominant front. If it does I added it to the temp list (which already contained the newest dominant Pareto Front), when finished with going through the previous best Pareto Front I deepcopy the temp list to P1 and the temp list becomes the new Best Pareto Front.

Investigation

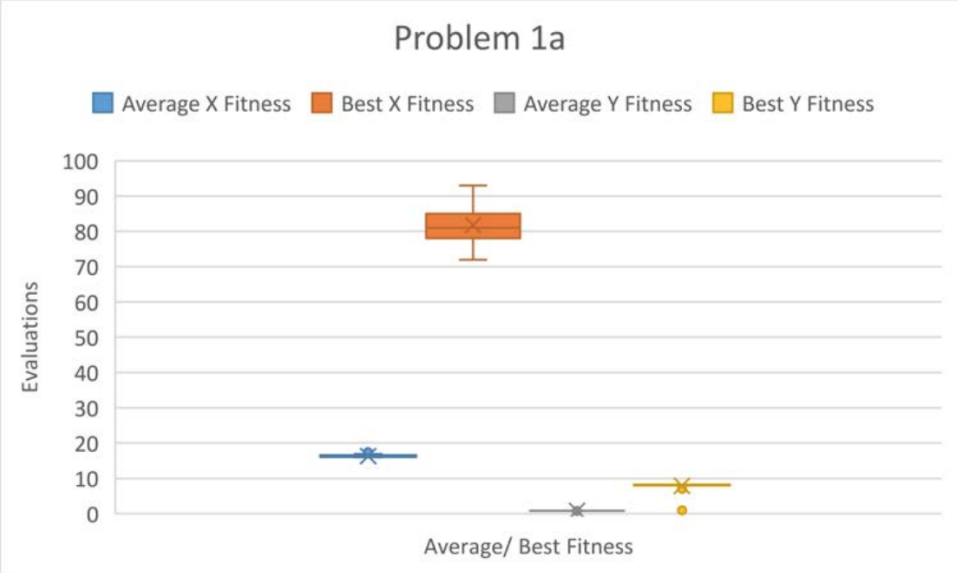
The trade-off between the best Pareto Front and the diversity of the obtained Pareto Front for all of my datasets would be that the generated solutions are extremely clustered... In fact, there are a lot of overlaps between the points within these Pareto Fronts. This is due to the extremely small change in the second objective fitness, which forces them to cluster closer together, even if the first objective fitness is extremely spread-out.

Overall my datasets for each problem were fairly close together in the end, meaning that the results were very loosely tied to the strategy parameters. There was no a clear winner throughout all of my datasets which means that I needed to change a parameter in order to get a better set of results and I failed to do so.

Experiment parameters and graphs

1 Problem 1a

1.1 Graphs



1.2 Result Tables

Problem 1a: final results

1	Problem 1a			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	18.14	79	0.81	9
4	17.46	89	0.8	9
5	16.98	80	0.82	8
6	16.82	85	0.81	1
7	16.68	84	0.83	8
8	16.42	83	0.82	8
9	16.55	84	0.81	9
10	16.63	83	0.82	9
11	16.64	92	0.83	8
12	16.39	93	0.82	9
13	16.26	82	0.83	8
14	16.4	75	0.83	8
15	16.28	83	0.83	8
16	16.28	78	0.81	8
17	16.21	72	0.83	8
18	16.21	77	0.85	8
19	16.1	80	0.82	8
20	16.14	74	0.84	8
21	16.03	78	0.82	7
22	16.08	80	0.82	8
23	16.08	77	0.83	8
24	16.03	74	0.84	8
25	15.92	89	0.82	8
26	15.93	84	0.82	8
27	16.04	90	0.83	9
28	15.94	78	0.83	7
29	15.98	79	0.82	8
30	16.04	86	0.86	8
31	15.91	85	0.81	9
32	15.94	79	0.84	8

1.3 Statistical Analysis

Problem 1a: Best Fitness				
subject #	Fitness 1c	fitness 1d	x-y	(x-y)^2
1	68	79	-11	121
2	77	89	-12	144
3	79	80	-1	1
4	75	85	-10	100
5	77	84	-7	49
6	69	83	-14	196
7	75	84	-9	81
8	71	83	-12	144
9	65	92	-27	729
10	69	93	-24	576
11	77	82	-5	25
12	73	75	-2	4
13	73	83	-10	100
14	80	78	2	4
15	76	72	4	16
16	73	77	-4	16
17	77	80	-3	9
18	73	74	-1	1
19	72	78	-6	36
20	74	80	-6	36
21	77	77	0	0
22	71	74	-3	9
23	74	89	-15	225
24	75	84	-9	81
25	65	90	-25	625
26	70	78	-8	64
27	66	79	-13	169
28	84	86	-2	4
29	72	85	-13	169
30	69	79	-10	100
SUM:			-256	3834
	t-value:	-0.21508		df: 29
	P-Value:	0.8312		t-value: 2.045

Problem 1a: Average Fitness				
subject #	Fitness 1c	fitness 1d	x-y	(x-y)^2
1	5.4	18.14	-12.74	162.3076
2	4.74	17.46	-12.72	161.7984
3	4.67	16.98	-12.31	151.5361
4	4.4	16.82	-12.42	154.2564
5	4.48	16.68	-12.2	148.84
6	4.23	16.42	-12.19	148.5961
7	4.36	16.55	-12.19	148.5961
8	4.19	16.63	-12.44	154.7536
9	4.16	16.64	-12.48	155.7504
10	4.13	16.39	-12.26	150.3076
11	4.03	16.26	-12.23	149.5729
12	4.11	16.4	-12.29	151.0441
13	4.32	16.28	-11.96	143.0416
14	4.15	16.28	-12.13	147.1369
15	4.02	16.21	-12.19	148.5961
16	4.21	16.21	-12	144
17	4.08	16.1	-12.02	144.4804
18	3.99	16.14	-12.15	147.6225
19	3.89	16.03	-12.14	147.3796
20	3.88	16.08	-12.2	148.84
21	3.84	16.08	-12.24	149.8176
22	3.82	16.03	-12.21	149.0841
23	4.02	15.92	-11.9	141.61
24	4.01	15.93	-11.92	142.0864
25	3.85	16.04	-12.19	148.5961
26	3.72	15.94	-12.22	149.3284
27	4.01	15.98	-11.97	143.2809
28	3.65	16.04	-12.39	153.5121
29	3.77	15.91	-12.14	147.3796
30	3.86	15.94	-12.08	145.9264
SUM:			-366.52	4479.078
	t-value:	-0.98697		df: 29
	P-Value:	0.3318		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of -0.21508 and the t-value of -0.98697, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

1.4 EA Configurations

If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config1a.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob1_random_log.txt
prob_log_EA: logs/prob1_EA_log_a.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob1_random_solution.txt
prob_solution_EA: solutions/prob1_EA_solution_a.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 1,
    Fitness_Proportional_Selection: 0, k-
    Tournament_Selection_with_replacement: 0

Survival_Strategy: plus: 1, comma: 0

Survival_Selection: Uniform_random_survival: 0, Truncation: 1, k-
    Tournament_Selection_without_replacement: 0

Termination: Number_of_evals: 0,
    no_change_in_average_population_fitness_for_n_generations: 1,
    no_change_in_best_fitness_in_population_for_n_generations: 0
```

2 Problem 1b

2.1 Graphs

2.2 Result Tables

Problem 1b: final results

1	Problem 1b			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	11.05	70	0.84	8
4	11.15	71	0.84	8
5	11.04	71	0.81	7
6	11.1	72	0.86	8
7	11.05	79	0.83	8
8	11.12	78	0.84	8
9	11.14	69	0.84	8
10	11.3	75	0.83	8
11	11.18	75	0.86	9
12	11.05	64	0.84	8
13	11.06	78	0.85	1
14	11.08	75	0.84	8
15	11.12	82	0.84	1
16	11.03	73	0.85	9
17	11.12	79	0.85	1
18	11.12	68	0.84	8
19	11.27	79	0.85	9
20	11.15	73	0.85	8
21	11.13	65	0.86	9
22	11.19	70	0.83	8
23	11.17	77	0.86	8
24	11.15	67	0.83	9
25	11.24	73	0.83	9
26	11.1	76	0.87	9
27	11.06	71	0.85	8
28	11.12	71	0.86	8
29	10.96	87	0.86	9
30	11.07	78	0.86	8
31	11.16	71	0.82	9
32	11.19	71	0.87	9

2.3 Statistical Analysis

Problem 1b: Best Fitness				
subject #	Fitness 1c	fitness 1d	x-y	(x-y)^2
1	68	70	-2	4
2	77	71	6	36
3	79	71	8	64
4	75	72	3	9
5	77	79	-2	4
6	69	78	-9	81
7	75	69	6	36
8	71	75	-4	16
9	65	75	-10	100
10	69	64	5	25
11	77	78	-1	1
12	73	75	-2	4
13	73	82	-9	81
14	80	73	7	49
15	76	79	-3	9
16	73	68	5	25
17	77	79	-2	4
18	73	73	0	0
19	72	65	7	49
20	74	70	4	16
21	77	77	0	0
22	71	67	4	16
23	74	73	1	1
24	75	76	-1	1
25	65	71	-6	36
26	70	71	-1	1
27	66	87	-21	441
28	84	78	6	36
29	72	71	1	1
30	69	71	-2	4
SUM:			-12	1150
	t-value:	-0.01182		df: 29
	P-Value:	0.9906		t-value: 2.045

Problem 1b: Average Fitness				
subject #	Fitness 1c	fitness 1d	x-y	(x-y)^2
1	5.4	11.05	-5.65	31.9225
2	4.74	11.15	-6.41	41.0881
3	4.67	11.04	-6.37	40.5769
4	4.4	11.1	-6.7	44.89
5	4.48	11.05	-6.57	43.1649
6	4.23	11.12	-6.89	47.4721
7	4.36	11.14	-6.78	45.9684
8	4.19	11.3	-7.11	50.5521
9	4.16	11.18	-7.02	49.2804
10	4.13	11.05	-6.92	47.8864
11	4.03	11.06	-7.03	49.4209
12	4.11	11.08	-6.97	48.5809
13	4.32	11.12	-6.8	46.24
14	4.15	11.03	-6.88	47.3344
15	4.02	11.12	-7.1	50.41
16	4.21	11.12	-6.91	47.7481
17	4.08	11.27	-7.19	51.6961
18	3.99	11.15	-7.16	51.2656
19	3.89	11.13	-7.24	52.4176
20	3.88	11.19	-7.31	53.4361
21	3.84	11.17	-7.33	53.7289
22	3.82	11.15	-7.33	53.7289
23	4.02	11.24	-7.22	52.1284
24	4.01	11.1	-7.09	50.2681
25	3.85	11.06	-7.21	51.9841
26	3.72	11.12	-7.4	54.76
27	4.01	10.96	-6.95	48.3025
28	3.65	11.07	-7.42	55.0564
29	3.77	11.16	-7.39	54.6121
30	3.86	11.19	-7.33	53.7289
SUM:			-209.68	1469.6498
	t-value:	-1.02597		df: 29
	P-Value:	0.3134		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of -0.01182 and the t-value of -1.02597, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

2.4 EA Configurations

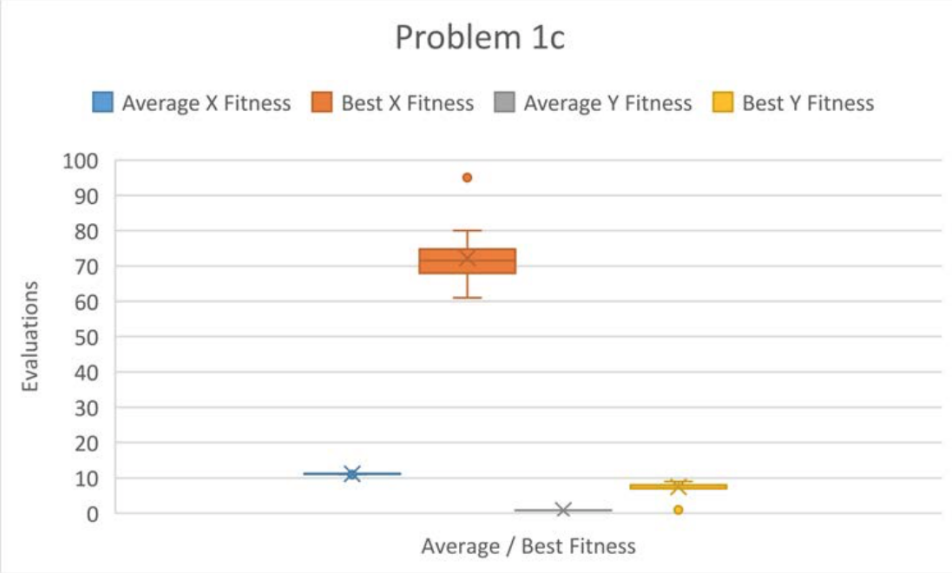
If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config1b.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob1_random_log.txt
prob_log_EA: logs/prob1_EA_log_c.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob1_random_solution.txt
prob_solution_EA: solutions/prob1_EA_solution_c.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 1,
    Fitness_Proportional_Selection: 0, k-
    Tournament_Selection_with_replacement: 1

Survival_Strategy: plus: 1, comma: 0

Survival_Selection: Uniform_random_survival: 0, Truncation: 1, k-
    Tournament_Selection_without_replacement: 0

Termination: Number_of_evals: 0,
    no_change_in_average_population_fitness_for_n_generations: 1,
    no_change_in_best_fitness_in_population_for_n_generations: 0
```

3 Problem 1c

3.1 Graphs



3.2 Result Tables

Problem 1c: final results

1	Problem 1c			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	11.22	67	0.85	7
4	11.16	74	0.8	1
5	10.99	79	0.85	7
6	11.16	71	0.82	8
7	11.23	68	0.85	8
8	11.15	74	0.86	7
9	10.96	77	0.86	8
10	11.19	68	0.84	8
11	11.2	74	0.84	8
12	11.1	95	0.85	8
13	11.06	80	0.82	8
14	11.2	74	0.86	7
15	11.13	69	0.83	8
16	11.05	71	0.85	9
17	10.88	68	0.81	9
18	11.11	69	0.83	9
19	11.02	80	0.83	8
20	11.26	66	0.85	8
21	11.18	78	0.86	8
22	11.21	70	0.84	9
23	11.08	62	0.84	8
24	11.21	74	0.83	7
25	11.28	72	0.84	7
26	11.25	74	0.84	8
27	11.14	72	0.84	9
28	11.11	66	0.86	7
29	11.04	61	0.84	8
30	11.1	71	0.86	7
31	11.09	66	0.86	1
32	11.14	77	0.86	9

3.3 Statistical Analysis

Problem 1c: Best Fitness				
subject #	Fitness 1c	fitness 1d	x-y	(x-y)^2
1	68	67	1	1
2	77	74	3	9
3	79	79	0	0
4	75	71	4	16
5	77	68	9	81
6	69	74	-5	25
7	75	77	-2	4
8	71	68	3	9
9	65	74	-9	81
10	69	95	-26	676
11	77	80	-3	9
12	73	74	-1	1
13	73	69	4	16
14	80	71	9	81
15	76	68	8	64
16	73	69	4	16
17	77	80	-3	9
18	73	66	7	49
19	72	78	-6	36
20	74	70	4	16
21	77	62	15	225
22	71	74	-3	9
23	74	72	2	4
24	75	74	1	1
25	65	72	-7	49
26	70	66	4	16
27	66	61	5	25
28	84	71	13	169
29	72	66	6	36
30	69	77	-8	64
SUM:			29	1797
	t-value:	0.02299		df: 29
	P-Value:	0.9818		t-value: 2.045

Problem 1c: Average Fitness				
subject #	Fitness 1c	fitness 1d	x-y	(x-y)^2
1	5.4	11.22	-5.82	33.8724
2	4.74	11.16	-6.42	41.2164
3	4.67	10.99	-6.32	39.9424
4	4.4	11.16	-6.76	45.6976
5	4.48	11.23	-6.75	45.5625
6	4.23	11.15	-6.92	47.8864
7	4.36	10.96	-6.6	43.56
8	4.19	11.19	-7	49
9	4.16	11.2	-7.04	49.5616
10	4.13	11.1	-6.97	48.5809
11	4.03	11.06	-7.03	49.4209
12	4.11	11.2	-7.09	50.2681
13	4.32	11.13	-6.81	46.3761
14	4.15	11.05	-6.9	47.61
15	4.02	10.88	-6.86	47.0596
16	4.21	11.11	-6.9	47.61
17	4.08	11.02	-6.94	48.1636
18	3.99	11.26	-7.27	52.8529
19	3.89	11.18	-7.29	53.1441
20	3.88	11.21	-7.33	53.7289
21	3.84	11.08	-7.24	52.4176
22	3.82	11.21	-7.39	54.6121
23	4.02	11.28	-7.26	52.7076
24	4.01	11.25	-7.24	52.4176
25	3.85	11.14	-7.29	53.1441
26	3.72	11.11	-7.39	54.6121
27	4.01	11.04	-7.03	49.4209
28	3.65	11.1	-7.45	55.5025
29	3.77	11.09	-7.32	53.5824
30	3.86	11.14	-7.28	52.9984
SUM:			-209.91	1472.5297
	t-value:	-1.02218		df: 29
	P-Value:	0.3151		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of 0.02299 and the t-value of -1.02218, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

3.4 EA Configurations

If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config1c.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob1_random_log.txt
prob_log_EA: logs/prob1_EA_log_c.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob1_random_solution.txt
prob_solution_EA: solutions/prob1_EA_solution_c.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 0,
    Fitness_Proportional_Selection: 0, k-
    Tournament_Selection_with_replacement: 1

Survival_Strategy: plus: 0, comma: 1

Survival_Selection: Uniform_random_survival: 1, Truncation: 0, k-
    Tournament_Selection_without_replacement: 0

Termination: Number_of_evals: 1,
    no_change_in_average_population_fitness_for_n_generations: 0,
    no_change_in_best_fitness_in_population_for_n_generations: 0
```

4 Problem 2a

4.1 Graphs

4.2 Result Tables

Problem 2a: final results

1	Problem 2a			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	10.52	72	0.04	4
4	10.69	81	0.04	4
5	10.69	73	0.04	4
6	10.73	77	0.03	4
7	10.95	88	0.03	3
8	10.4	93	0.04	4
9	10.73	72	0.03	4
10	10.77	80	0.04	4
11	10.8	85	0.03	3
12	10.8	90	0.03	3
13	10.63	83	0.03	4
14	10.57	88	0.03	3
15	10.87	71	0.03	3
16	10.86	86	0.04	3
17	10.83	80	0.03	4
18	10.41	71	0.04	4
19	10.81	78	0.03	4
20	10.81	81	0.03	3
21	10.72	85	0.03	4
22	10.64	75	0.03	4
23	10.58	73	0.03	3
24	10.65	67	0.03	4
25	10.85	68	0.03	4
26	10.92	86	0.03	3
27	10.63	75	0.03	4
28	10.62	73	0.03	3
29	10.87	85	0.03	4
30	10.62	76	0.03	3
31	10.81	82	0.04	3
32	10.87	73	0.03	3

4.3 Statistical Analysis

Problem 2a: Best Fitness				
subject #	Fitness 2c	fitness 2d	x-y	(x-y)^2
1	68	72	-4	16
2	77	81	-4	16
3	79	73	6	36
4	75	77	-2	4
5	77	88	-11	121
6	69	93	-24	576
7	75	72	3	9
8	71	80	-9	81
9	65	85	-20	400
10	69	90	-21	441
11	77	83	-6	36
12	73	88	-15	225
13	73	71	2	4
14	80	86	-6	36
15	76	80	-4	16
16	73	71	2	4
17	77	78	-1	1
18	73	81	-8	64
19	72	85	-13	169
20	74	75	-1	1
21	77	73	4	16
22	71	67	4	16
23	74	68	6	36
24	75	86	-11	121
25	65	75	-10	100
26	70	73	-3	9
27	66	85	-19	361
28	84	76	8	64
29	72	82	-10	100
30	69	73	-4	16
SUM:			-171	3095
	t-value:	-0.12478		df: 29
	P-Value:	0.9016		t-value: 2.045

Problem 2a: Average Fitness				
subject #	Fitness 2c	fitness 2d	x-y	(x-y)^2
1	2.96	10.52	-7.56	57.1536
2	1.57	10.69	-9.12	83.1744
3	1.3	10.69	-9.39	88.1721
4	0.83	10.73	-9.9	98.01
5	0.47	10.95	-10.48	109.8304
6	0.63	10.4	-9.77	95.4529
7	1.02	10.73	-9.71	94.2841
8	0.12	10.77	-10.65	113.4225
9	0.57	10.8	-10.23	104.6529
10	0.34	10.8	-10.46	109.4116
11	0.36	10.63	-10.27	105.4729
12	0.06	10.57	-10.51	110.4601
13	0.36	10.87	-10.51	110.4601
14	0.28	10.86	-10.58	111.9364
15	0.08	10.83	-10.75	115.5625
16	0.18	10.41	-10.23	104.6529
17	-0.15	10.81	-10.96	120.1216
18	-0.04	10.81	-10.85	117.7225
19	0	10.72	-10.72	114.9184
20	0.1	10.64	-10.54	111.0916
21	0.04	10.58	-10.54	111.0916
22	0.02	10.65	-10.63	112.9969
23	-0.25	10.85	-11.1	123.21
24	-0.25	10.92	-11.17	124.7689
25	-0.07	10.63	-10.7	114.49
26	-0.03	10.62	-10.65	113.4225
27	0.03	10.87	-10.84	117.5056
28	-0.17	10.62	-10.79	116.4241
29	-0.12	10.81	-10.93	119.4649
30	-0.32	10.87	-11.19	125.2161
SUM:			-311.73	3254.5541
	t-value:	-1.05872		df: 29
	P-Value:	0.2985		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of -0.12478 and the t-value of -1.05872, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

4.4 EA Configurations

If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config2a.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob2_random_log.txt
prob_log_EA: logs/prob2_EA_log_a.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob2_random_solution.txt
prob_solution_EA: solutions/prob2_EA_solution_a.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 0,
    Fitness_Proportional_Selection: 0, k-
    Tournament_Selection_with_replacement: 1

Survival_Strategy: plus: 0, comma: 1

Survival_Selection: Uniform_random_survival: 0, Truncation: 1, k-
    Tournament_Selection_without_replacement: 0

Termination: Number_of_evals: 0,
    no_change_in_average_population_fitness_for_n_generations: 0,
    no_change_in_best_fitness_in_population_for_n_generations: 1
```

5 Problem 2b

5.1 Graphs

5.2 Result Tables

Problem 2b: final results

1	Problem 2b			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	10.7	75	0.07	3
4	10.5	78	0.06	3
5	10.79	89	0.06	4
6	10.72	81	0.05	5
7	10.61	74	0.06	3
8	10.81	68	0.07	4
9	11.03	69	0.06	3
10	10.43	84	0.06	3
11	11.07	70	0.06	4
12	10.56	75	0.06	3
13	10.86	69	0.07	4
14	10.44	79	0.06	3
15	10.91	78	0.05	4
16	10.78	82	0.06	3
17	10.8	78	0.06	4
18	10.99	76	0.05	3
19	10.73	70	0.05	4
20	10.92	72	0.06	3
21	10.66	65	0.06	4
22	10.75	75	0.06	3
23	10.53	77	0.05	4
24	10.69	78	0.06	3
25	10.77	68	0.06	3
26	10.78	88	0.06	3
27	10.86	72	0.06	3
28	10.54	82	0.05	3
29	10.81	78	0.04	4
30	10.6	82	0.06	3
31	10.72	66	0.06	3
32	10.8	83	0.06	3

5.3 Statistical Analysis

Problem 2b: Best Fitness				
subject #	Fitness 2c	fitness 2d	x-y	(x-y)^2
1	68	75	-7	49
2	77	78	-1	1
3	79	89	-10	100
4	75	81	-6	36
5	77	74	3	9
6	69	68	1	1
7	75	69	6	36
8	71	84	-13	169
9	65	70	-5	25
10	69	75	-6	36
11	77	69	8	64
12	73	79	-6	36
13	73	78	-5	25
14	80	82	-2	4
15	76	78	-2	4
16	73	76	-3	9
17	77	70	7	49
18	73	72	1	1
19	72	65	7	49
20	74	75	-1	1
21	77	77	0	0
22	71	78	-7	49
23	74	68	6	36
24	75	88	-13	169
25	65	72	-7	49
26	70	82	-12	144
27	66	78	-12	144
28	84	82	2	4
29	72	66	6	36
30	69	83	-14	196
SUM:			-85	1531
	t-value:	-0.07914		df: 29
	P-Value:	0.9375		t-value: 2.045

Problem 2b: Average Fitness				
subject #	Fitness 2c	fitness 2d	x-y	(x-y)^2
1	2.96	10.7	-7.74	59.9076
2	1.57	10.5	-8.93	79.7449
3	1.3	10.79	-9.49	90.0601
4	0.83	10.72	-9.89	97.8121
5	0.47	10.61	-10.14	102.8196
6	0.63	10.81	-10.18	103.6324
7	1.02	11.03	-10.01	100.2001
8	0.12	10.43	-10.31	106.2961
9	0.57	11.07	-10.5	110.25
10	0.34	10.56	-10.22	104.4484
11	0.36	10.86	-10.5	110.25
12	0.06	10.44	-10.38	107.7444
13	0.36	10.91	-10.55	111.3025
14	0.28	10.78	-10.5	110.25
15	0.08	10.8	-10.72	114.9184
16	0.18	10.99	-10.81	116.8561
17	-0.15	10.73	-10.88	118.3744
18	-0.04	10.92	-10.96	120.1216
19	0	10.66	-10.66	113.6356
20	0.1	10.75	-10.65	113.4225
21	0.04	10.53	-10.49	110.0401
22	0.02	10.69	-10.67	113.8489
23	-0.25	10.77	-11.02	121.4404
24	-0.25	10.78	-11.03	121.6609
25	-0.07	10.86	-10.93	119.4649
26	-0.03	10.54	-10.57	111.7249
27	0.03	10.81	-10.78	116.2084
28	-0.17	10.6	-10.77	115.9929
29	-0.12	10.72	-10.84	117.5056
30	-0.32	10.8	-11.12	123.6544
SUM:			-312.24	3263.5882
	t-value:	-1.04993		df: 29
	P-Value:	0.3024		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of -0.07914 and the t-value of -1.04993, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

5.4 EA Configurations

If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config2b.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob2_random_log.txt
prob_log_EA: logs/prob2_EA_log_b.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob2_random_solution.txt
prob_solution_EA: solutions/prob2_EA_solution_b.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 1,
    Fitness_Proportional_Selection: 0, k-
    Tournament_Selection_with_replacement: 0

Survival_Strategy: plus: 0, comma: 1

Survival_Selection: Uniform_random_survival: 1, Truncation: 0, k-
    Tournament_Selection_without_replacement: 0

Termination: Number_of_evals: 0,
    no_change_in_average_population_fitness_for_n_generations: 0,
    no_change_in_best_fitness_in_population_for_n_generations: 1
```

6 Problem 2c

6.1 Graphs

6.2 Result Tables

Problem 2c: final results

1	Problem 2c			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	10.61	92	0.05	3
4	10.39	73	0.05	3
5	10.81	71	0.05	3
6	10.92	91	0.05	5
7	10.84	84	0.03	3
8	10.75	73	0.03	3
9	10.86	67	0.03	4
10	10.69	72	0.03	3
11	10.75	84	0.04	4
12	10.79	82	0.04	3
13	10.96	72	0.04	4
14	10.58	65	0.03	3
15	10.76	83	0.03	3
16	10.58	69	0.04	3
17	10.85	73	0.03	4
18	10.96	69	0.03	3
19	10.6	75	0.04	3
20	10.72	83	0.03	4
21	10.62	82	0.03	4
22	10.79	86	0.04	4
23	10.68	69	0.04	4
24	10.77	68	0.04	4
25	10.63	70	0.03	3
26	10.74	65	0.03	3
27	10.66	88	0.03	3
28	10.67	97	0.03	3
29	10.8	85	0.03	4
30	10.84	81	0.04	3
31	10.9	69	0.03	3
32	10.8	83	0.03	4

6.3 Statistical Analysis

Problem 2c: Best Fitness				
subject #	Fitness 2c	fitness 2d	x-y	(x-y)^2
1	68	92	-24	576
2	77	73	4	16
3	79	71	8	64
4	75	91	-16	256
5	77	84	-7	49
6	69	73	-4	16
7	75	67	8	64
8	71	72	-1	1
9	65	84	-19	361
10	69	82	-13	169
11	77	72	5	25
12	73	65	8	64
13	73	83	-10	100
14	80	69	11	121
15	76	73	3	9
16	73	69	4	16
17	77	75	2	4
18	73	83	-10	100
19	72	82	-10	100
20	74	86	-12	144
21	77	69	8	64
22	71	68	3	9
23	74	70	4	16
24	75	65	10	100
25	65	88	-23	529
26	70	97	-27	729
27	66	85	-19	361
28	84	81	3	9
29	72	69	3	9
30	69	83	-14	196
SUM:			-125	4277
	t-value:	-0.06815		df: 29
	P-Value:	0.9461		t-value: 2.045

Problem 2c: Average Fitness				
subject #	Fitness 2c	fitness 2d	x-y	(x-y)^2
1	2.96	10.61	-7.65	58.5225
2	1.57	10.39	-8.82	77.7924
3	1.3	10.81	-9.51	90.4401
4	0.83	10.92	-10.09	101.8081
5	0.47	10.84	-10.37	107.5369
6	0.63	10.75	-10.12	102.4144
7	1.02	10.86	-9.84	96.8256
8	0.12	10.69	-10.57	111.7249
9	0.57	10.75	-10.18	103.6324
10	0.34	10.79	-10.45	109.2025
11	0.36	10.96	-10.6	112.36
12	0.06	10.58	-10.52	110.6704
13	0.36	10.76	-10.4	108.16
14	0.28	10.58	-10.3	106.09
15	0.08	10.85	-10.77	115.9929
16	0.18	10.96	-10.78	116.2084
17	-0.15	10.6	-10.75	115.5625
18	-0.04	10.72	-10.76	115.7776
19	0	10.62	-10.62	112.7844
20	0.1	10.79	-10.69	114.2761
21	0.04	10.68	-10.64	113.2096
22	0.02	10.77	-10.75	115.5625
23	-0.25	10.63	-10.88	118.3744
24	-0.25	10.74	-10.99	120.7801
25	-0.07	10.66	-10.73	115.1329
26	-0.03	10.67	-10.7	114.49
27	0.03	10.8	-10.77	115.9929
28	-0.17	10.84	-11.01	121.2201
29	-0.12	10.9	-11.02	121.4404
30	-0.32	10.8	-11.12	123.6544
SUM:			-312.4	3267.6394
	t-value:	-1.05372		df: 29
	P-Value:	0.3007		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of -0.06815 and the t-value of -1.05372, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

6.4 EA Configurations

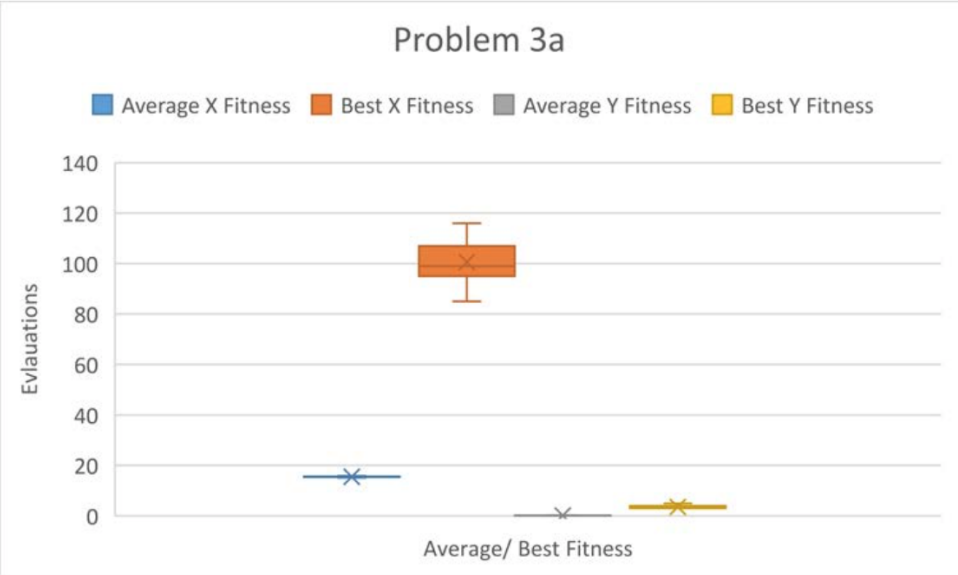
If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config2c.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob2_random_log.txt
prob_log_EA: logs/prob2_EA_log_b.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob2_random_solution.txt
prob_solution_EA: solutions/prob2_EA_solution_b.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 0,
    Fitness_Proportional_Selection: 0, k-
    Tournament_Selection_with_replacement: 1

Survival_Strategy: plus: 1, comma: 0

Survival_Selection: Uniform_random_survival: 0, Truncation: 0, k-
    Tournament_Selection_without_replacement: 1

Termination: Number_of_evals: 0,
    no_change_in_average_population_fitness_for_n_generations: 0,
    no_change_in_best_fitness_in_population_for_n_generations: 1
```

7 Problem 3a

7.1 Graphs



7.2 Result Tables

Problem 3a: final results

1	Problem 3a			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	15.29	85	0.19	4
4	15.8	104	0.1	4
5	15.21	116	0.1	4
6	15.54	109	0.1	5
7	15.63	99	0.19	4
8	15.68	98	0.2	3
9	15.61	107	0.1	3
10	15.59	101	0.1	3
11	15.42	88	0.2	3
12	15.52	104	0.1	3
13	15.25	93	0.2	3
14	15.18	98	0.19	3
15	15.5	94	0.18	4
16	15.57	103	0.1	4
17	15.57	109	0.1	3
18	15.51	99	0.19	4
19	15.57	91	0.17	3
20	15.52	94	0.19	3
21	15.44	97	0.19	4
22	15.32	110	0.1	4
23	15.14	104	0.1	3
24	15.87	107	0.1	4
25	15.4	99	0.17	3
26	15.69	95	0.17	4
27	15.45	95	0.18	4
28	15.46	107	0.1	4
29	15.48	110	0.1	3
30	15.17	98	0.19	4
31	15.34	105	0.1	4
32	15.43	99	0.18	3

7.3 Statistical Analysis

Problem 3a: Best Fitness				
subject #	Fitness 3c	Fitness 3d	x-y	(x-y)^2
1	68	85	-17	289
2	77	104	-27	729
3	79	116	-37	1369
4	75	109	-34	1156
5	77	99	-22	484
6	69	98	-29	841
7	75	107	-32	1024
8	71	101	-30	900
9	65	88	-23	529
10	69	104	-35	1225
11	77	93	-16	256
12	73	98	-25	625
13	73	94	-21	441
14	80	103	-23	529
15	76	109	-33	1089
16	73	99	-26	676
17	77	91	-14	196
18	73	94	-21	441
19	72	97	-25	625
20	74	110	-36	1296
21	77	104	-27	729
22	71	107	-36	1296
23	74	99	-25	625
24	75	95	-20	400
25	65	95	-30	900
26	70	107	-37	1369
27	66	110	-44	1936
28	84	98	-14	196
29	72	105	-33	1089
30	69	99	-30	900
SUM:			-822	24160
	t-value:	-0.93403		df: 29
	P-Value:	0.358		t-value: 2.045

Problem 3a: Average Fitness				
subject #	Fitness 3c	Fitness 3d	x-y	(x-y)^2
1	7.42	15.29	-7.87	61.9369
2	6.66	15.8	-9.14	83.5396
3	5.69	15.21	-9.52	90.6304
4	6.1	15.54	-9.44	89.1136
5	5.59	15.63	-10.04	100.8016
6	5.64	15.68	-10.04	100.8016
7	5.3	15.61	-10.31	106.2961
8	5.42	15.59	-10.17	103.4289
9	5.23	15.42	-10.19	103.8361
10	5.48	15.52	-10.04	100.8016
11	4.51	15.25	-10.74	115.3476
12	4.54	15.18	-10.64	113.2096
13	4.75	15.5	-10.75	115.5625
14	5.04	15.57	-10.53	110.8809
15	5.19	15.57	-10.38	107.7444
16	5.04	15.51	-10.47	109.6209
17	4.64	15.57	-10.93	119.4649
18	5.41	15.52	-10.11	102.2121
19	4.18	15.44	-11.26	126.7876
20	4.41	15.32	-10.91	119.0281
21	4.71	15.14	-10.43	108.7849
22	5.01	15.87	-10.86	117.9396
23	4.76	15.4	-10.64	113.2096
24	5.06	15.69	-10.63	112.9969
25	4.58	15.45	-10.87	118.1569
26	4.45	15.46	-11.01	121.2201
27	4.54	15.48	-10.94	119.6836
28	4.67	15.17	-10.5	110.25
29	4.49	15.34	-10.85	117.7225
30	4.39	15.43	-11.04	121.8816
SUM:			-311.25	3242.8907
	t-value:	-1.04975		df: 29
	P-Value:	0.3025		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of -0.93403 and the t-value of -1.04975, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

7.4 EA Configurations

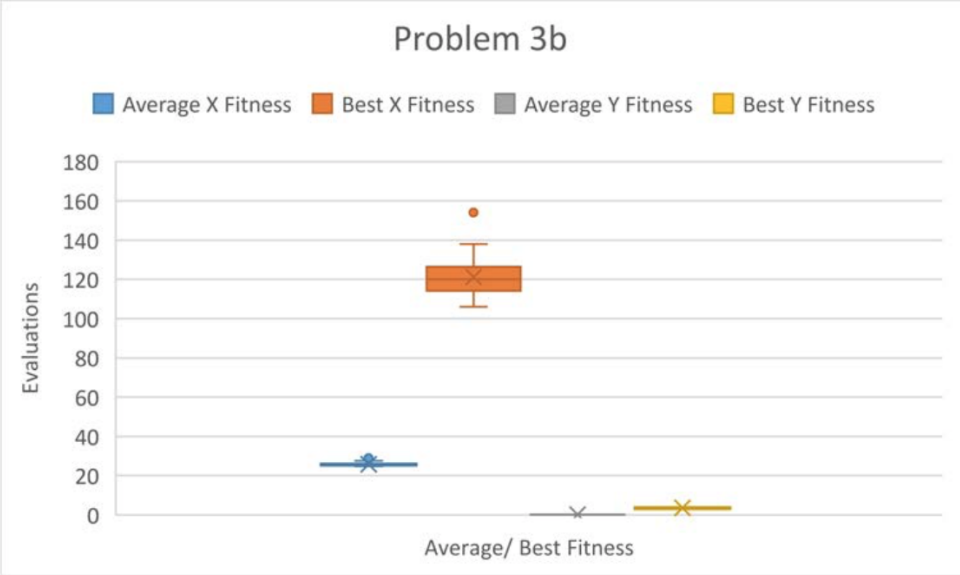
If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config3a.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob3_random_log.txt
prob_log_EA: logs/prob3_EA_log_a.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob3_random_solution.txt
prob_solution_EA: solutions/prob3_EA_solution_a.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 1,
    Fitness_Proportional_Selection: 0, k-
    Tournament_Selection_with_replacement: 0

Survival_Strategy: plus: 0, comma: 1

Survival_Selection: Uniform_random_survival: 1, Truncation: 0, k-
    Tournament_Selection_without_replacement: 0

Termination: Number_of_evals: 0,
    no_change_in_average_population_fitness_for_n_generations: 0,
    no_change_in_best_fitness_in_population_for_n_generations: 1
```

8 Problem 3b

8.1 Graphs



8.2 Result Tables

Problem 3b: final results

1	Problem 3b			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	28.91	126	0.1	4
4	27.65	120	0.1	4
5	26.96	128	0.1	4
6	26.68	115	0.1	3
7	26.54	118	0.1	4
8	26.48	154	0.1	3
9	26.24	120	0.1	4
10	26.17	120	0.1	3
11	25.86	111	0.1	4
12	25.79	112	0.1	4
13	25.98	115	0.1	4
14	25.69	112	0.1	3
15	25.36	107	0.1	4
16	25.49	119	0.1	4
17	25.57	120	0.1	4
18	25.14	138	0.1	4
19	25.32	119	0.1	3
20	25.47	116	0.1	4
21	25.53	125	0.1	4
22	24.88	135	0.1	3
23	25.14	115	0.1	3
24	25.26	125	0.1	4
25	25.29	125	0.1	3
26	25.19	111	0.1	4
27	24.94	132	0.1	3
28	25.04	107	0.1	3
29	25.23	124	0.1	3
30	24.87	106	0.1	3
31	25.14	129	0.1	4
32	25.38	131	0.1	4

8.3 Statistical Analysis

Problem 3b: Best Fitness				
subject #	Fitness 3c	Fitness 3d	x-y	(x-y)^2
1	68	126	-58	3364
2	77	120	-43	1849
3	79	128	-49	2401
4	75	115	-40	1600
5	77	118	-41	1681
6	69	154	-85	7225
7	75	120	-45	2025
8	71	120	-49	2401
9	65	111	-46	2116
10	69	112	-43	1849
11	77	115	-38	1444
12	73	112	-39	1521
13	73	107	-34	1156
14	80	119	-39	1521
15	76	120	-44	1936
16	73	138	-65	4225
17	77	119	-42	1764
18	73	116	-43	1849
19	72	125	-53	2809
20	74	135	-61	3721
21	77	115	-38	1444
22	71	125	-54	2916
23	74	125	-51	2601
24	75	111	-36	1296
25	65	132	-67	4489
26	70	107	-37	1369
27	66	124	-58	3364
28	84	106	-22	484
29	72	129	-57	3249
30	69	131	-62	3844
SUM:			-1439	73513
	t-value:	-1.04453		df: 29
	P-Value:	0.3049		t-value: 2.045

Problem 3b: Average Fitness				
subject #	Fitness 3c	Fitness 3d	x-y	(x-y)^2
1	7.42	28.91	-21.49	461.8201
2	6.66	27.65	-20.99	440.5801
3	5.69	26.96	-21.27	452.4129
4	6.1	26.68	-20.58	423.5364
5	5.59	26.54	-20.95	438.9025
6	5.64	26.48	-20.84	434.3056
7	5.3	26.24	-20.94	438.4836
8	5.42	26.17	-20.75	430.5625
9	5.23	25.86	-20.63	425.5969
10	5.48	25.79	-20.31	412.4961
11	4.51	25.98	-21.47	460.9609
12	4.54	25.69	-21.15	447.3225
13	4.75	25.36	-20.61	424.7721
14	5.04	25.49	-20.45	418.2025
15	5.19	25.57	-20.38	415.3444
16	5.04	25.14	-20.1	404.01
17	4.64	25.32	-20.68	427.6624
18	5.41	25.47	-20.06	402.4036
19	4.18	25.53	-21.35	455.8225
20	4.41	24.88	-20.47	419.0209
21	4.71	25.14	-20.43	417.3849
22	5.01	25.26	-20.25	410.0625
23	4.76	25.29	-20.53	421.4809
24	5.06	25.19	-20.13	405.2169
25	4.58	24.94	-20.36	414.5296
26	4.45	25.04	-20.59	423.9481
27	4.54	25.23	-20.69	428.0761
28	4.67	24.87	-20.2	408.04
29	4.49	25.14	-20.65	426.4225
30	4.39	25.38	-20.99	440.5801
SUM:			-620.29	12829.9601
	t-value:	-0.98839		df: 29
	P-Value:	0.3311		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of -1.04453 and the t-value of -0.98839, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

8.4 EA Configurations

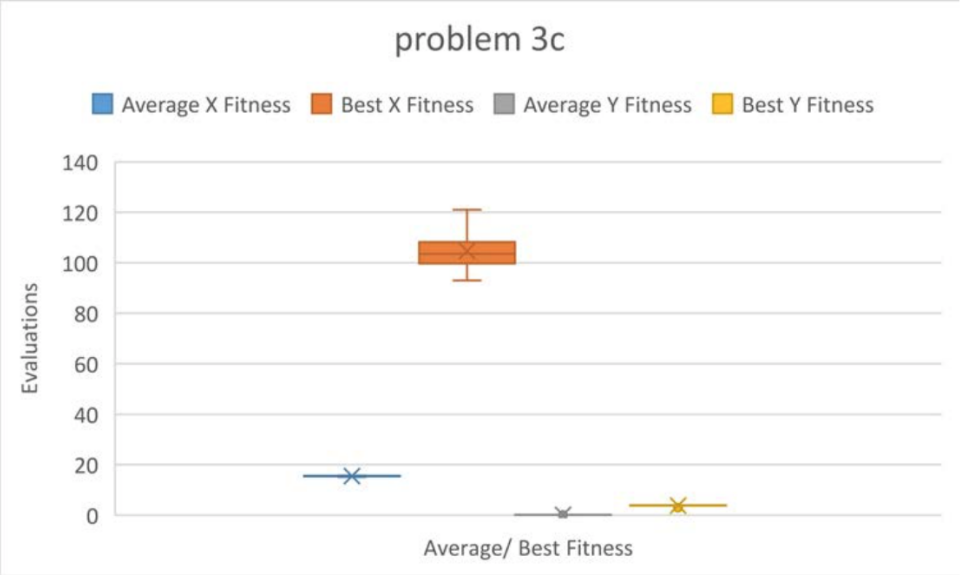
If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config3b.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob3_random_log.txt
prob_log_EA: logs/prob3_EA_log_c.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob3_random_solution.txt
prob_solution_EA: solutions/prob3_EA_solution_c.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 0,
    Fitness_Proportional_Selection: 1, k-
    Tournament_Selection_with_replacement: 0

Survival_Strategy: plus: 1, comma: 0

Survival_Selection: Uniform_random_survival: 0, Truncation: 1, k-
    Tournament_Selection_without_replacement: 0

Termination: Number_of_evals: 1,
    no_change_in_average_population_fitness_for_n_generations: 0,
    no_change_in_best_fitness_in_population_for_n_generations: 0
```

9 Problem 3c

9.1 Graphs



9.2 Result Tables

Problem 3c: final results

1	Problem 3c			
2	Average X Fitness	Best X Fitness	Average Y Fitness	Best Y Fitness
3	15.39	119	0.1	3
4	15.13	118	0.1	4
5	15.27	101	0.1	4
6	15.58	103	0.1	4
7	15.7	101	0.1	3
8	15.2	94	0.13	4
9	15.52	100	0.1	3
10	15.68	109	0.1	4
11	15.6	105	0.1	4
12	15.28	110	0.1	4
13	15.53	106	0.1	4
14	15.55	104	0.1	4
15	15.33	118	0.1	4
16	15.38	101	0.1	3
17	15.28	104	0.1	3
18	15.53	104	0.1	4
19	15.7	119	0.1	4
20	15.59	93	0.15	4
21	15.29	105	0.1	4
22	15.45	101	0.1	4
23	15.43	103	0.1	4
24	15.65	108	0.1	4
25	15.5	93	0.14	5
26	15.56	121	0.1	3
27	15.37	96	0.14	4
28	15.27	98	0.15	4
29	15.47	105	0.1	4
30	15.79	99	0.15	4
31	15.66	98	0.14	3
32	15.42	103	0.1	5

9.3 Statistical Analysis

Problem 3c: Best Fitness				
subject #	Fitness 3c	Fitness 3d	x-y	(x-y)^2
1	68	119	-51	2601
2	77	118	-41	1681
3	79	101	-22	484
4	75	103	-28	784
5	77	101	-24	576
6	69	94	-25	625
7	75	100	-25	625
8	71	109	-38	1444
9	65	105	-40	1600
10	69	110	-41	1681
11	77	106	-29	841
12	73	104	-31	961
13	73	118	-45	2025
14	80	101	-21	441
15	76	104	-28	784
16	73	104	-31	961
17	77	119	-42	1764
18	73	93	-20	400
19	72	105	-33	1089
20	74	101	-27	729
21	77	103	-26	676
22	71	108	-37	1369
23	74	93	-19	361
24	75	121	-46	2116
25	65	96	-31	961
26	70	98	-28	784
27	66	105	-39	1521
28	84	99	-15	225
29	72	98	-26	676
30	69	103	-34	1156
SUM:			-943	31941
	t-value:	-0.87954		df: 29
	P-Value:	0.3863		t-value: 2.045

Problem 3c: Average Fitness				
subject #	Fitness 3c	Fitness 3d	x-y	(x-y)^2
1	7.42	15.39	-7.97	63.5209
2	6.66	15.13	-8.47	71.7409
3	5.69	15.27	-9.58	91.7764
4	6.1	15.58	-9.48	89.8704
5	5.59	15.7	-10.11	102.2121
6	5.64	15.2	-9.56	91.3936
7	5.3	15.52	-10.22	104.4484
8	5.42	15.68	-10.26	105.2676
9	5.23	15.6	-10.37	107.5369
10	5.48	15.28	-9.8	96.04
11	4.51	15.53	-11.02	121.4404
12	4.54	15.55	-11.01	121.2201
13	4.75	15.33	-10.58	111.9364
14	5.04	15.38	-10.34	106.9156
15	5.19	15.28	-10.09	101.8081
16	5.04	15.53	-10.49	110.0401
17	4.64	15.7	-11.06	122.3236
18	5.41	15.59	-10.18	103.6324
19	4.18	15.29	-11.11	123.4321
20	4.41	15.45	-11.04	121.8816
21	4.71	15.43	-10.72	114.9184
22	5.01	15.65	-10.64	113.2096
23	4.76	15.5	-10.74	115.3476
24	5.06	15.56	-10.5	110.25
25	4.58	15.37	-10.79	116.4241
26	4.45	15.27	-10.82	117.0724
27	4.54	15.47	-10.93	119.4649
28	4.67	15.79	-11.12	123.6544
29	4.49	15.66	-11.17	124.7689
30	4.39	15.42	-11.03	121.6609
SUM:			-311.2	3245.2088
	t-value:	-1.06829		df: 29
	P-Value:	0.2942		t-value: 2.045

So according to the statistical analysis (shown above) the p-value for both best fitness and average fitness is not low enough to say that the results are statistically significant. That means that the t-value of -0.87954 and the t-value of -1.06829, computed using the tables given, were not far enough apart from the t-value given of 2.045 to make the difference in the fitness values statistically significant.

9.4 EA Configurations

If you want to get the same results you have to change the newSeed variable to 0 (Zero) in the configuration file in order to use the previous seed.

USING config3c.txt

```
Random = 0
EA = 1
newSeed = 1

mu: 20
lambda: 10
runs: 30
mutation_rate: 0.01
fitness_evaluations: 10000
prob_log_random: logs/prob3_random_log.txt
prob_log_EA: logs/prob3_EA_log_c.txt
number_of_evals_till_termination: 5
tournament_size_for_parent_selection: 10
tournament_size_for_survival_selection: 10
n_for_termination_convergence_criterion: 5
prob_solution_random: solutions/prob3_random_solution.txt
prob_solution_EA: solutions/prob3_EA_solution_c.txt
seed: time.time()

selfAdaptive: adaptMutation: 1

Initialization: Uniform_Random: 1

Parent_Selection: Uniform_random_parent: 0,
    Fitness_Proportional_Selection: 0, k-
    Tournament_Selection_with_replacement: 1

Survival_Strategy: plus: 0, comma: 1

Survival_Selection: Uniform_random_survival: 0, Truncation: 0, k-
    Tournament_Selection_without_replacement: 1

Termination: Number_of_evals: 0,
    no_change_in_average_population_fitness_for_n_generations: 0,
    no_change_in_best_fitness_in_population_for_n_generations: 1
```