Tournament Size Experiments

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Summary

In this document we show two plots for the GAModel and the GABBOB - a simple GA applied to the BBOB benchmark funtions - with tournize size (k) from 2 to 25, with the Uniform crossover operator (with 0.1 of independent probability of exchanging an gene) and Gaussian mutation operator with mu=0, sigma=1, 0.1 of independent probability.

Every plot it was calculated the mean, the standart deviation (std) and the confidence interval (C.I) of 40 runs of a configuration. Aa example of a configuration, giben by: evaluation function, tournament size, is GABBOB F1 with k = 2. For each configuration two plots are given. One, with the mean and the standart deviation and the other, with the mean and the CI. The graph shows the values of the mean minus and plus the std, whereas in the second plot, the graph shows mean and the CI, though the valeus are independent.

1. Number of generations: 500 (used to be 100).
2. Population size: 800 (used to be 500).

Comments

We did some experiments with 40 dimensions, now we are experimenting with 20 dimensions.

Standart Deviation: F20 (For k = 1...25) -> 0.3577385 1.4522482 0.3722891 0.3342789 0.3203987 0.3432203 0.3179952 0.3193463 15.7308372 0.2495824 0.4440507 0.6733610 1.7549915 9.6024268 10.8827583 0.2660707 0.3039624 0.2499267 0.3054992 0.2952024 2.2356739 0.4414154 0.2572610 0.3786557

More information

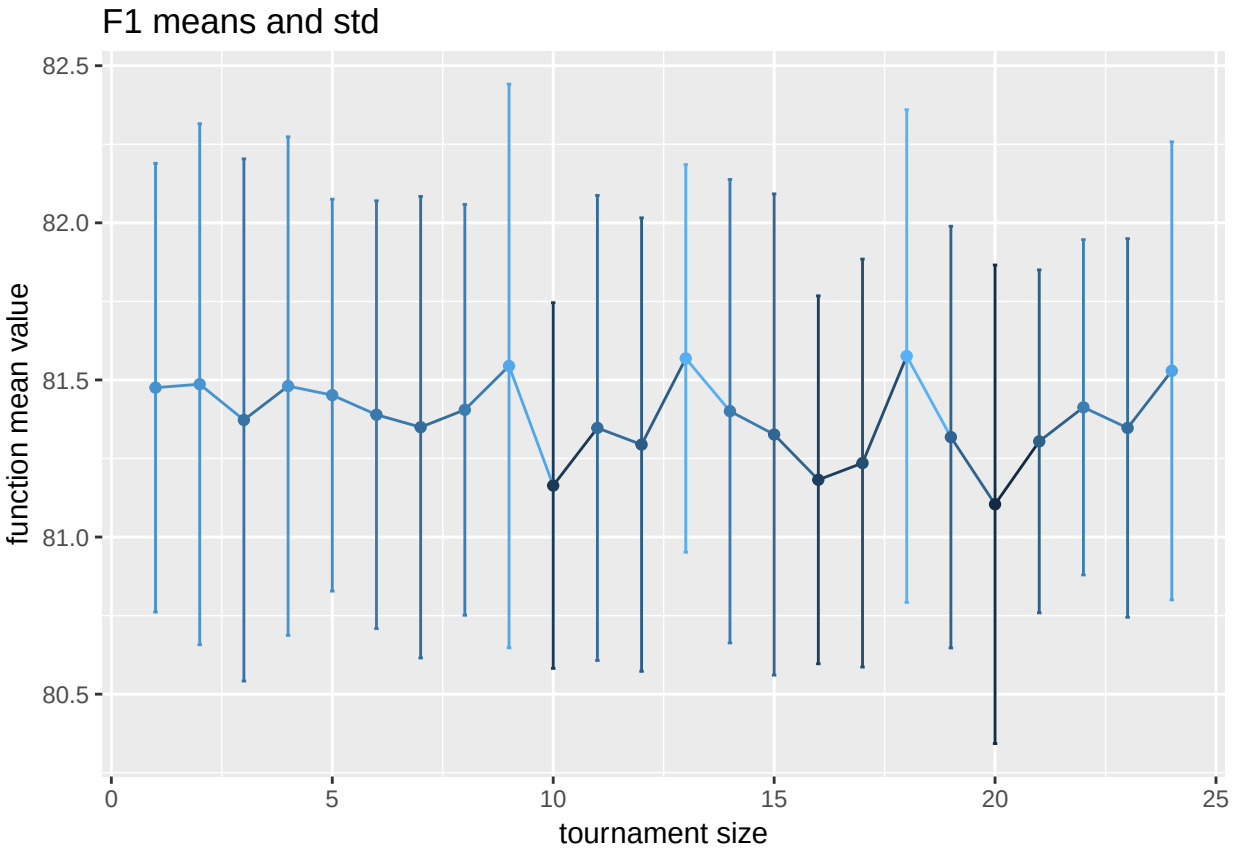
With more dimensions the harder it is for a GA to find precise solutions. I got the idea from Sawyerr et al (Check next paragraph), although they use a much more complex GA (a hybrid one).

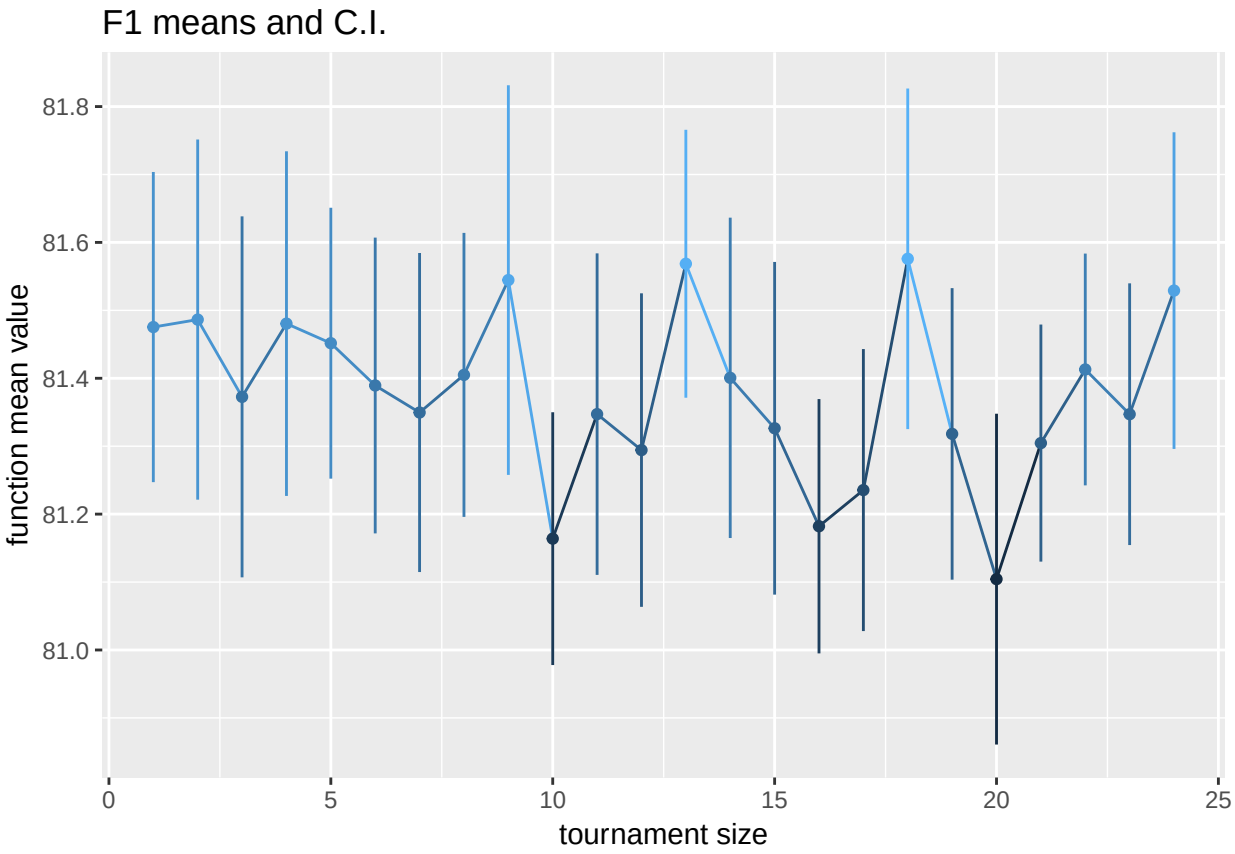
Sawyerr et al concluded that the RCGAu has excelled in solving the f1, f2, f3, f7 and f21, tough for the other functions it achieved avarage results. They also state that real value GA do not efficiently solve highly conditioned problems and studies have currently been carried out to find out why [1].

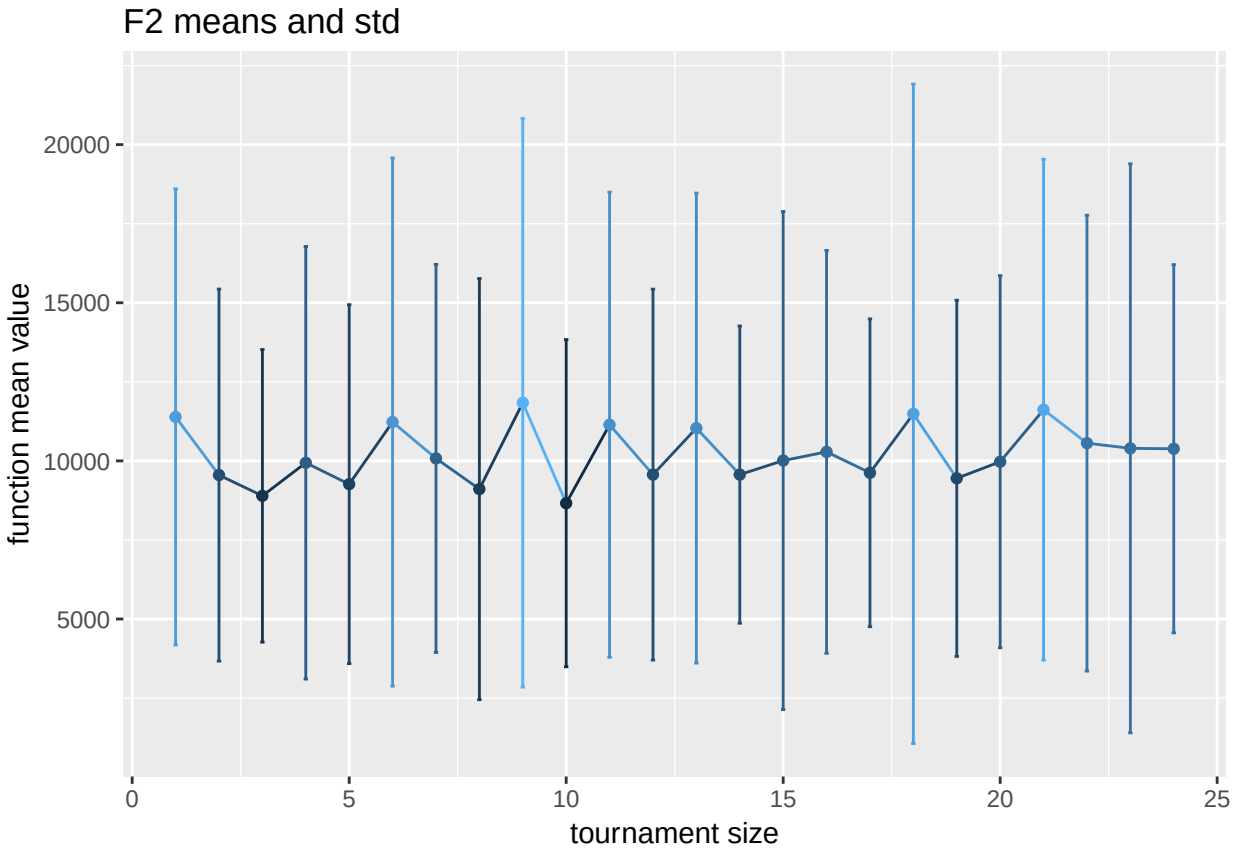
[1] Sawyerr, B.A., Adewumi, A.O., Ali, M.M.: Benchmarking rcgau on the noiseless bbob testbed. The Scientific World Journal 2015 (2015).

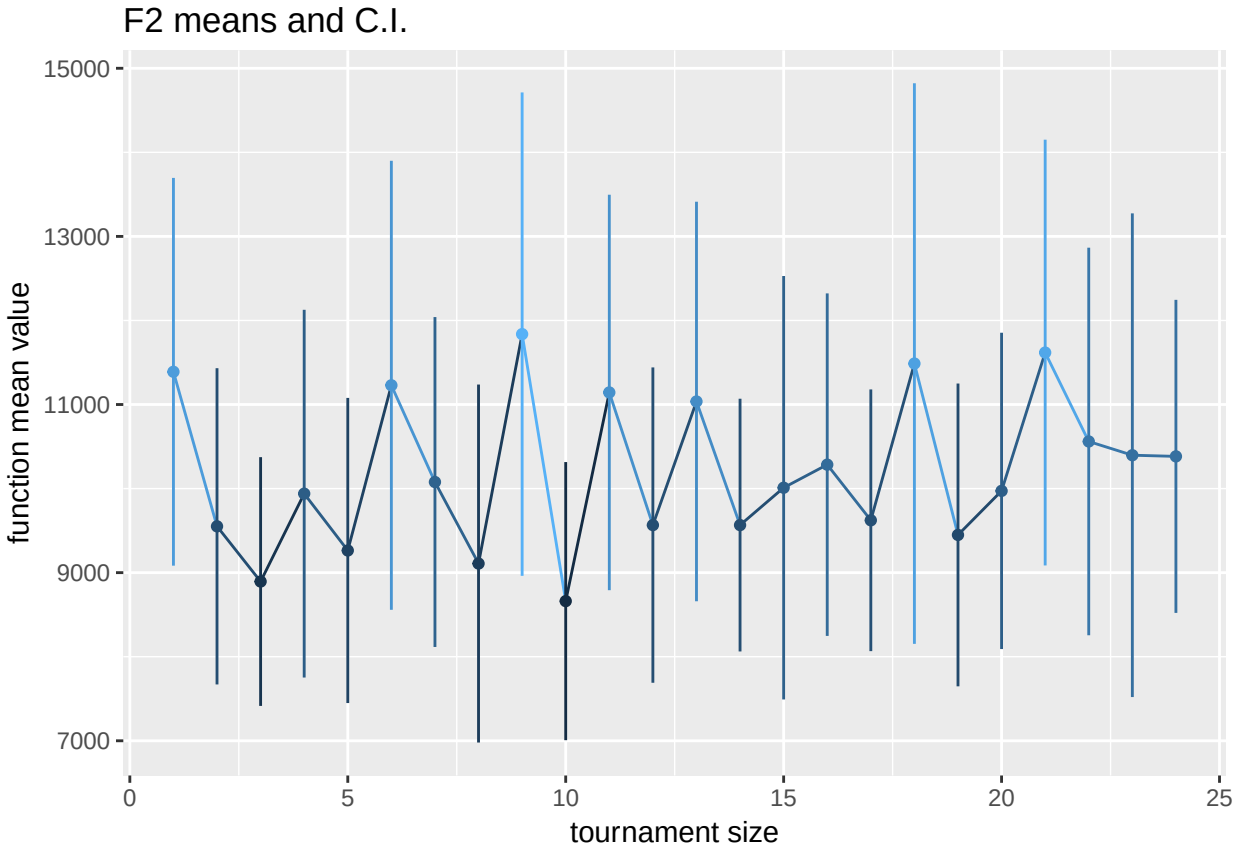
Plots

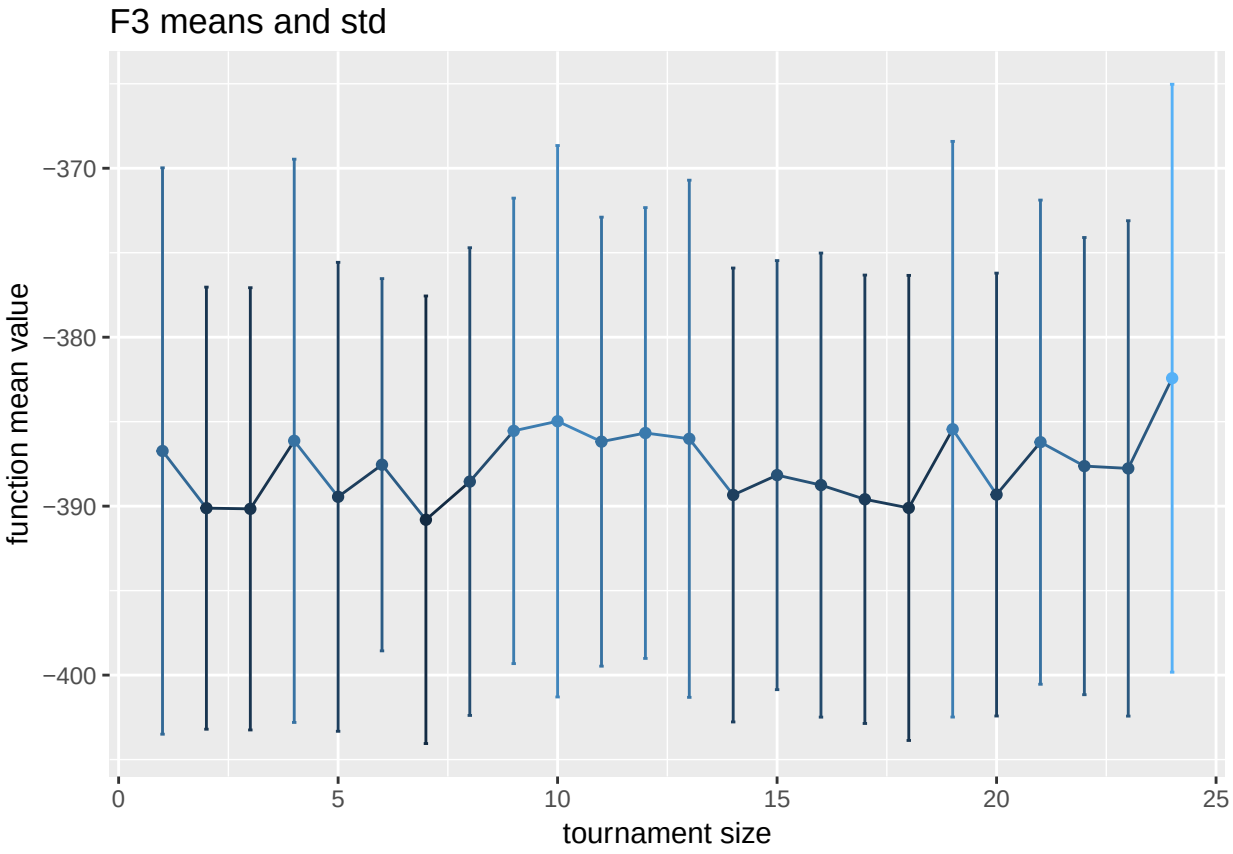
The order of the plots is: first we show the GAModel plots and the the BBOB benchmark functions, from F1 to F24.

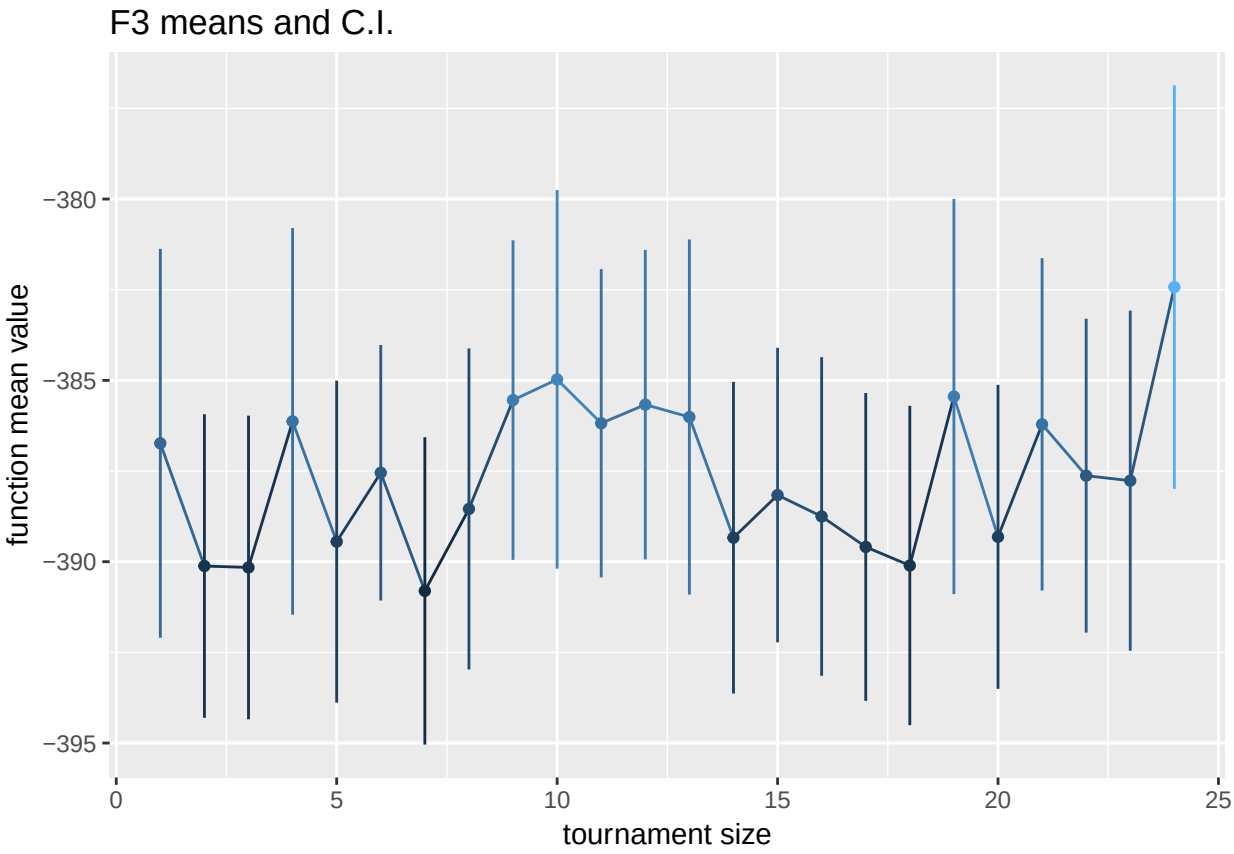

F1 means and std
82.5
82.0
81.5
81.0
80.5
function mean value
0
5
10
15
20
25
tournament size

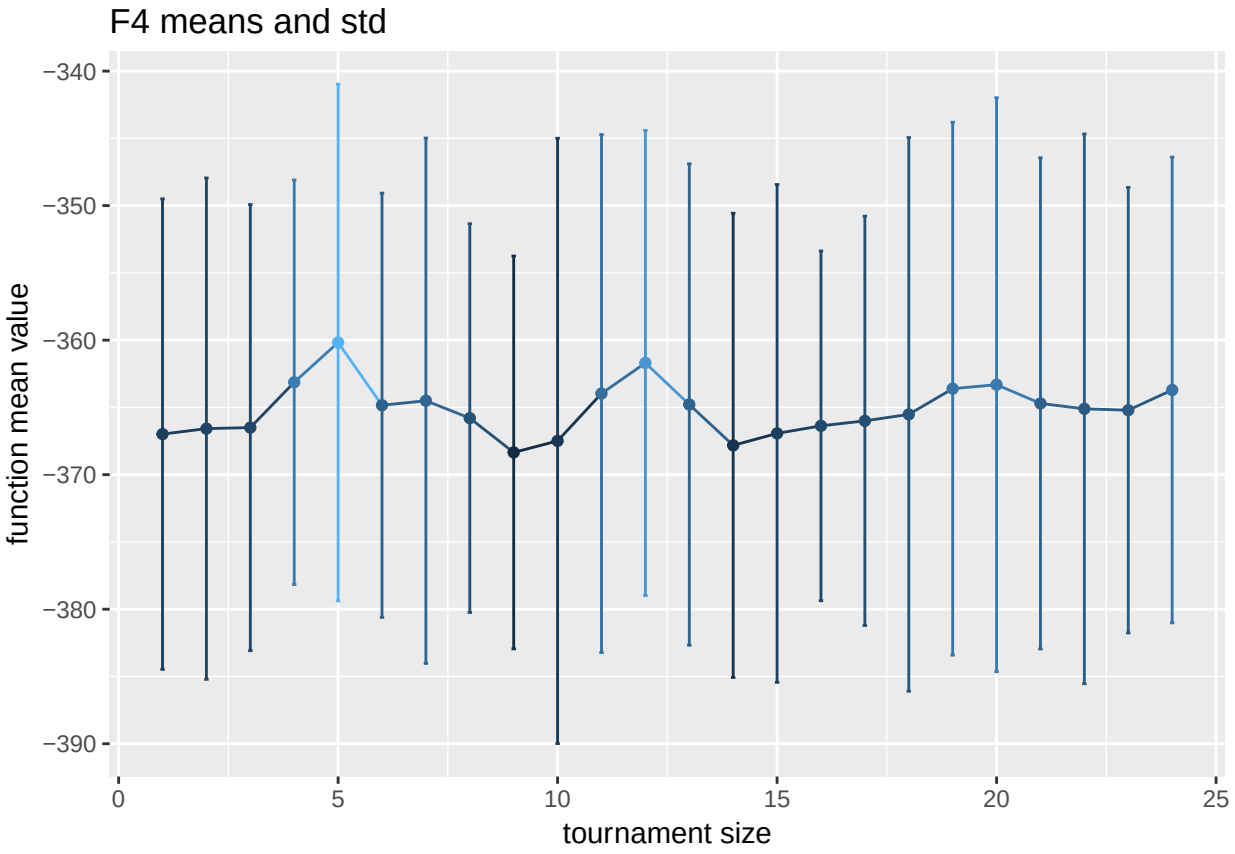

F1 means and C.I.
81.8
81.6
81.4
81.2
81.0
function mean value
0
5
10
15
20
25
tournament size

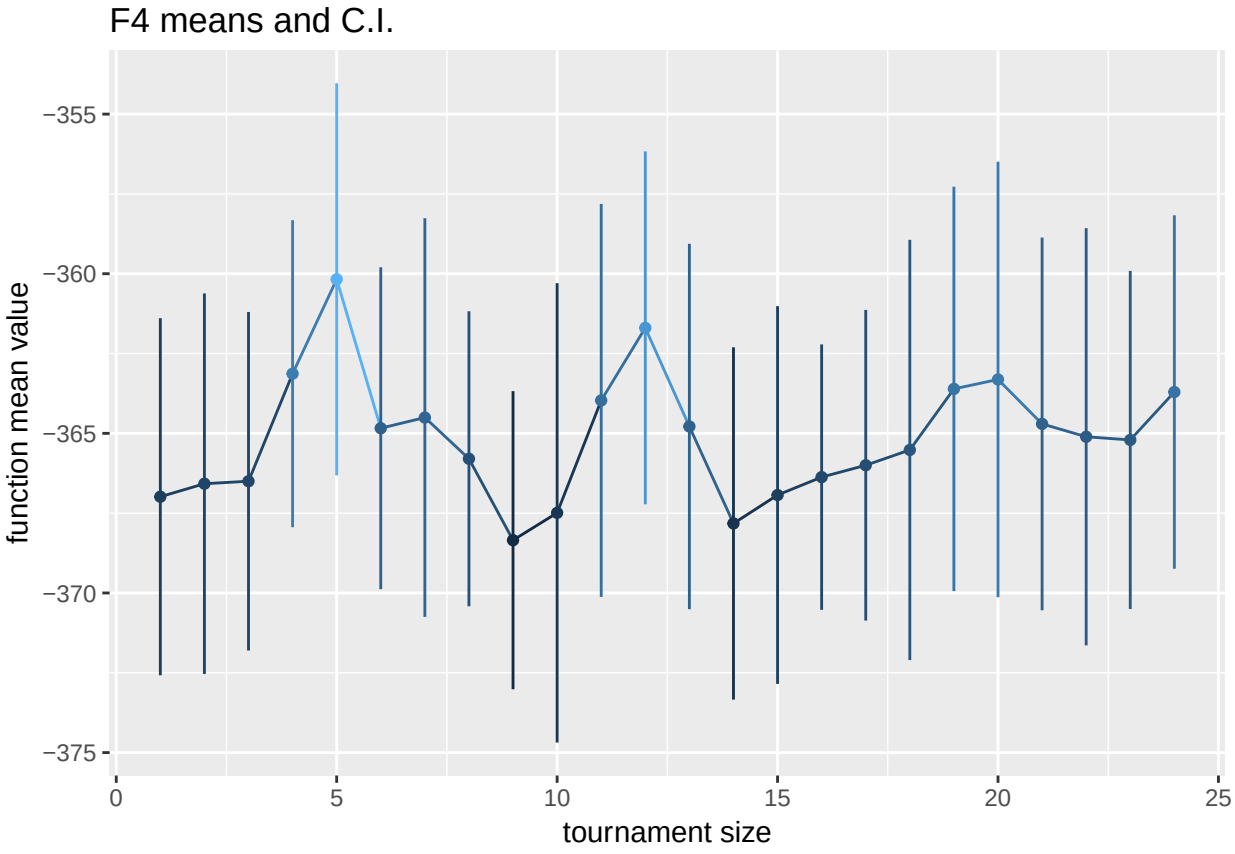

F2 means and std
function mean value
20000
15000
10000
5000
0
5
10
15
20
25
tournament size

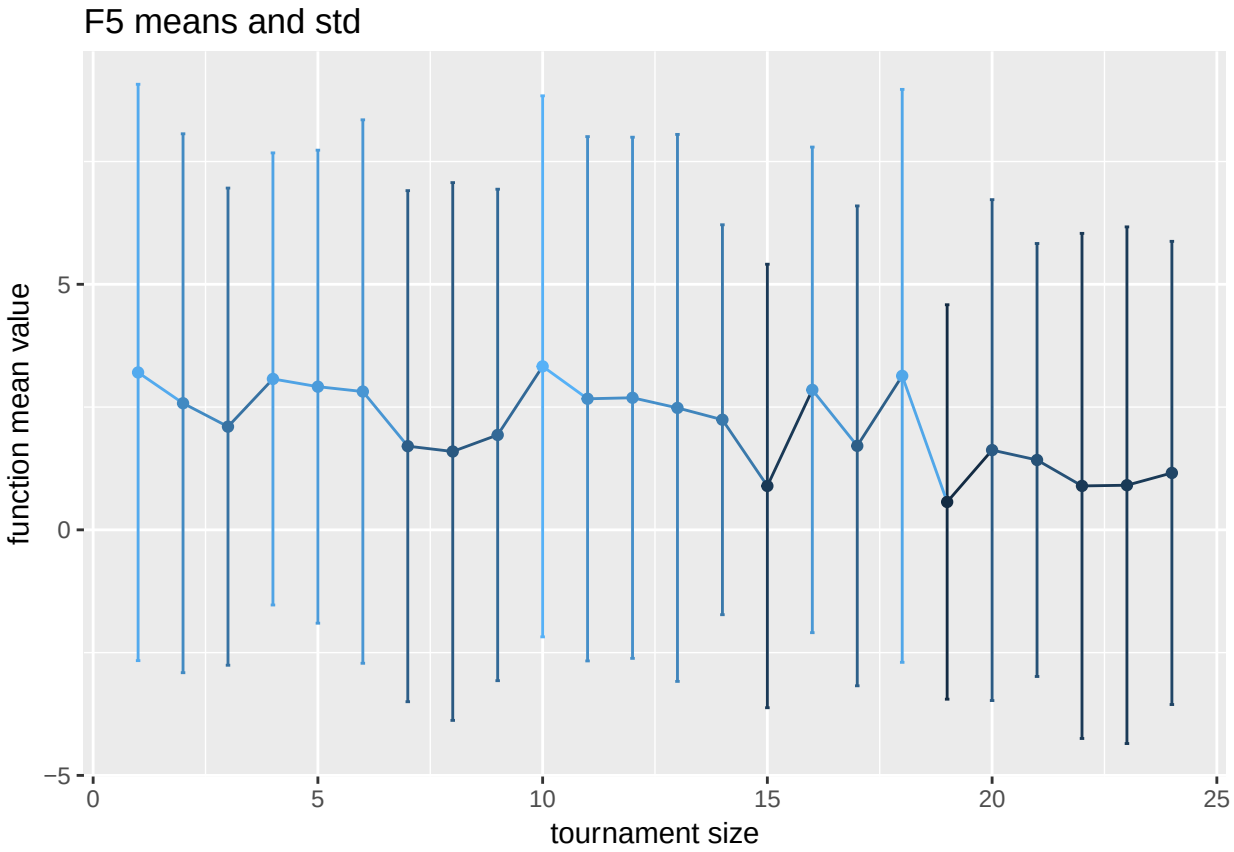

F2 means and C.I.
function mean value
15000
13000
11000
9000
7000
0
5
10
15
20
25
tournament size

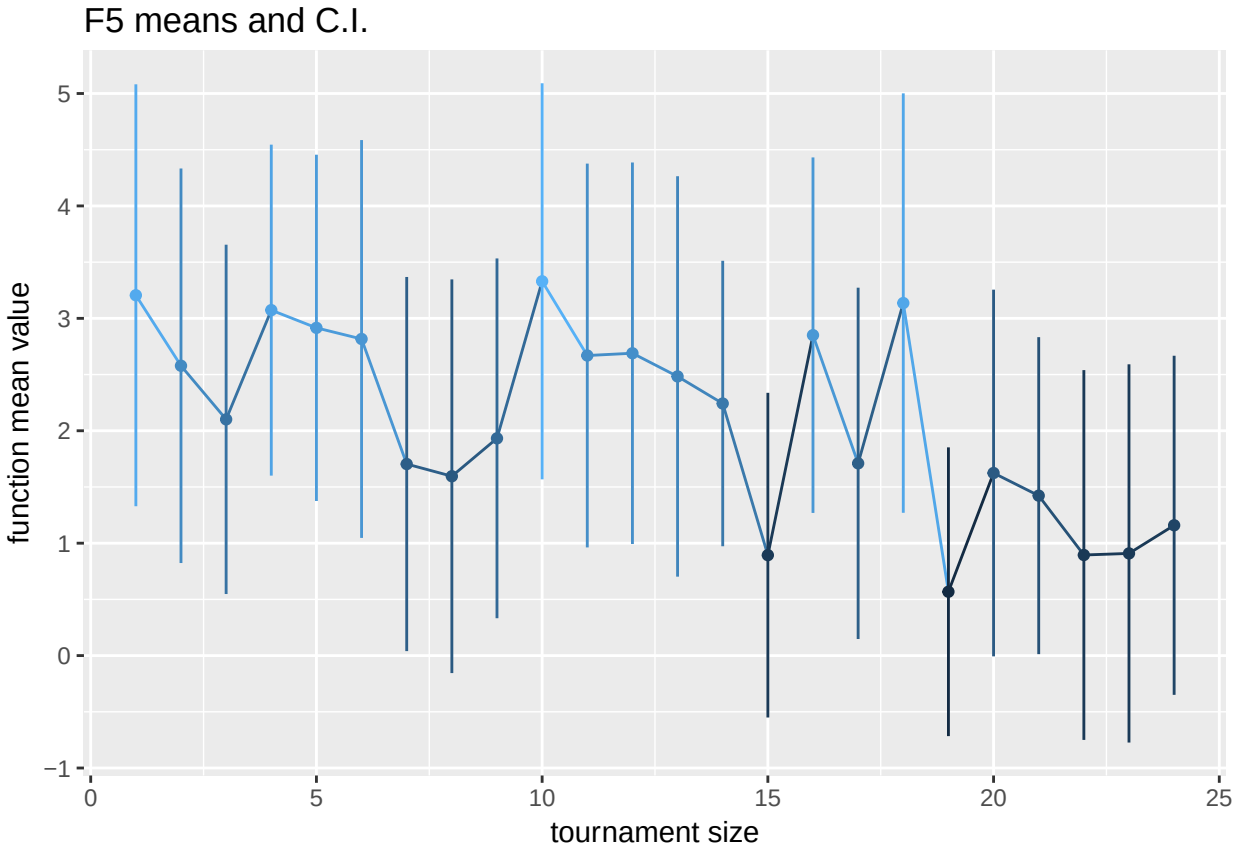

F3 means and std
function mean value
−370
−380
−390
−400
0
5
10
15
20
25
tournament size

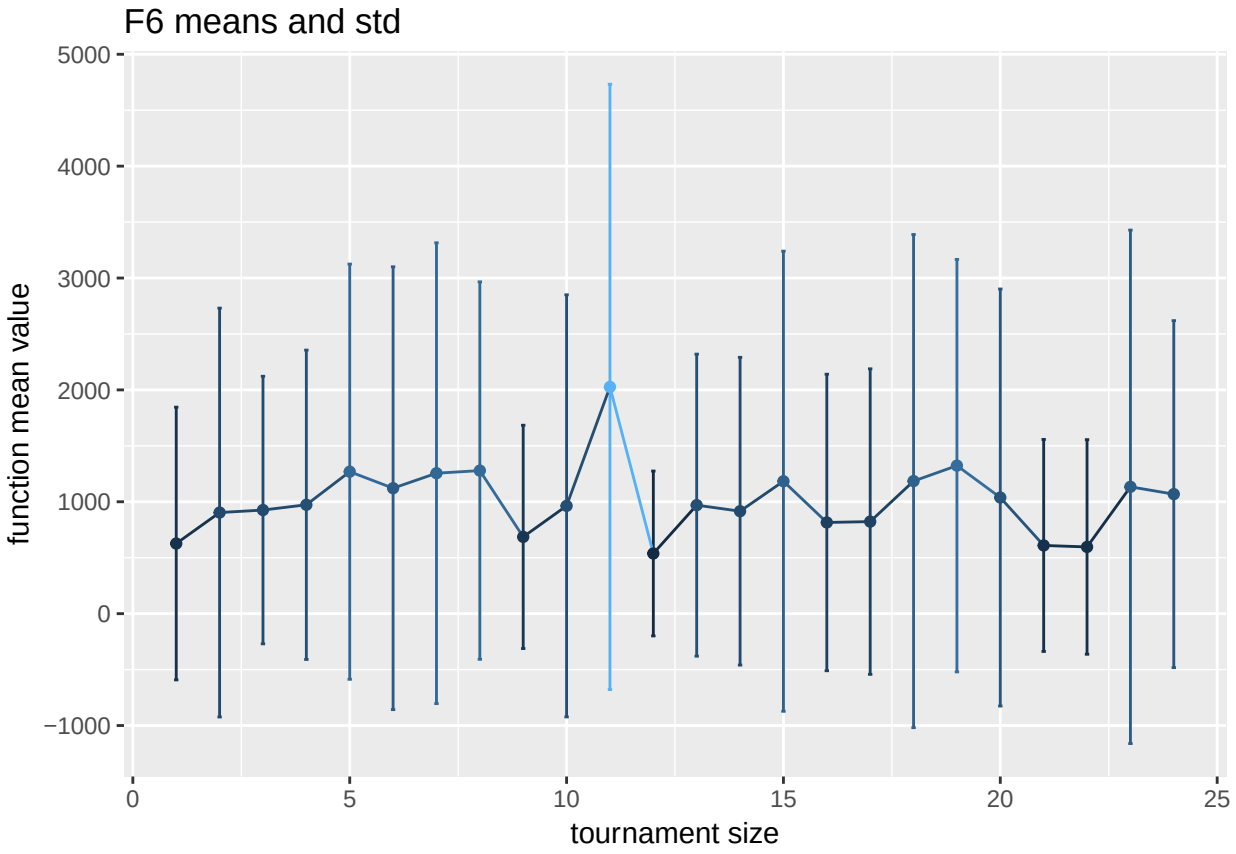

F3 means and C.I.
function mean value
−380
−385
−390
−395
0
5
10
15
20
25
tournament size

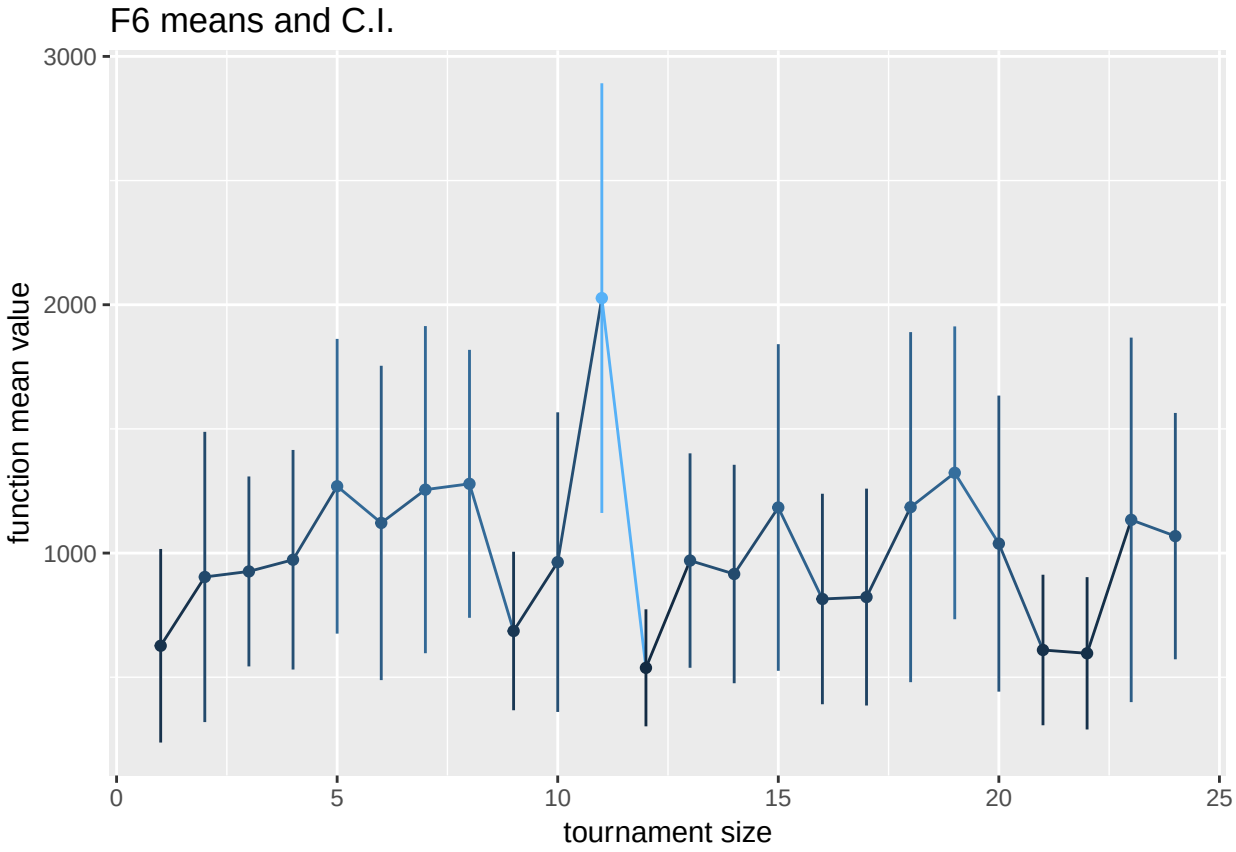

F4 means and std
function mean value
−340
−350
−360
−370
−380
−390
0
5
10
15
20
25
tournament size

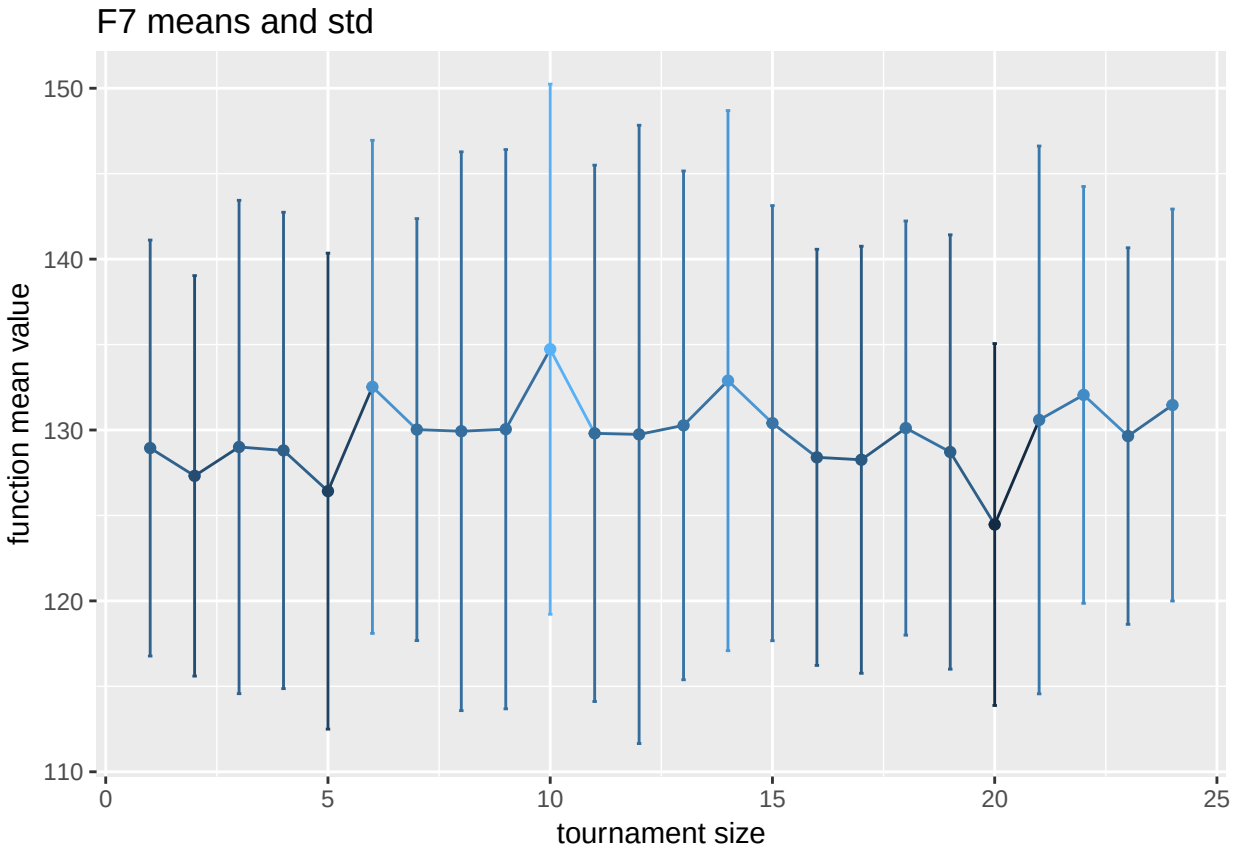

F4 means and C.I.
function mean value
−355
−360
−365
−370
−375
0
5
10
15
20
25
tournament size

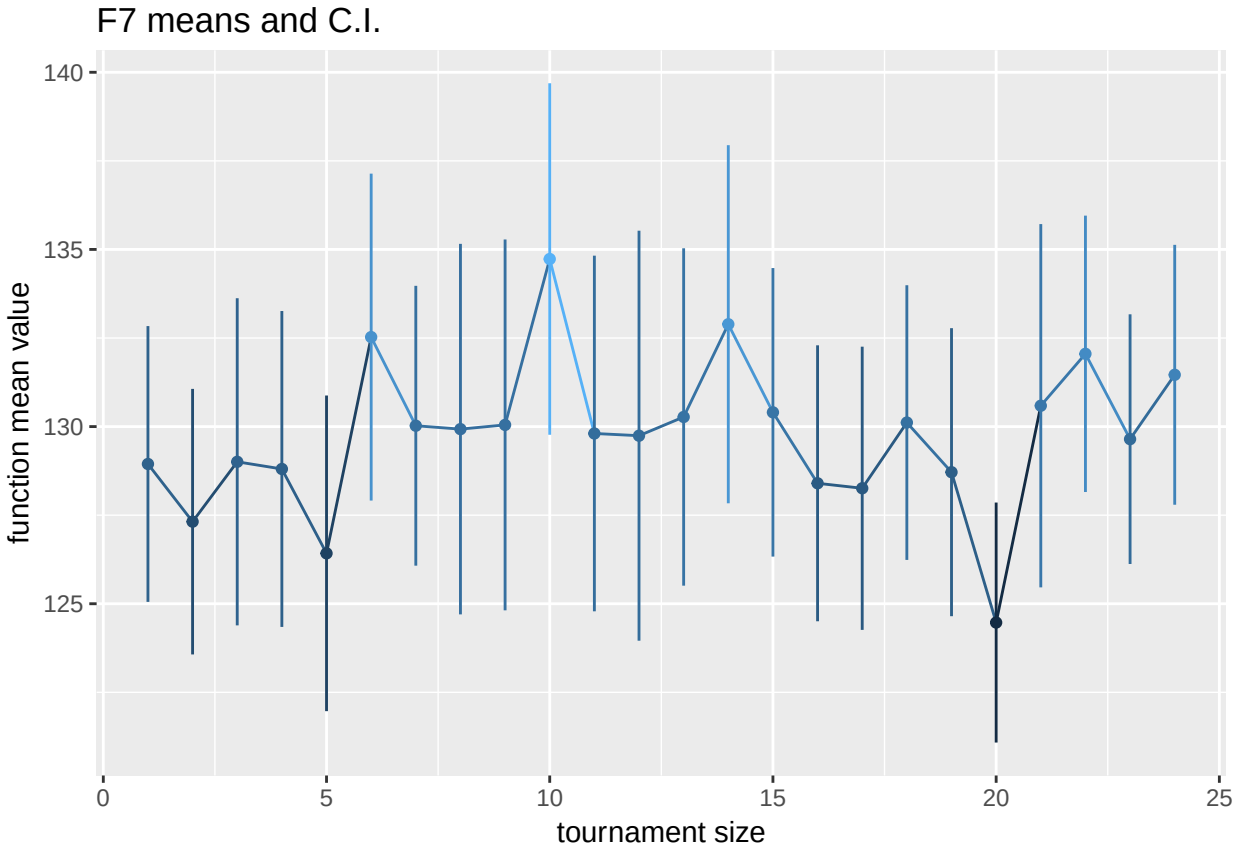

F5 means and std
function mean value
5
0
−5
0
5
10
15
20
25
tournament size

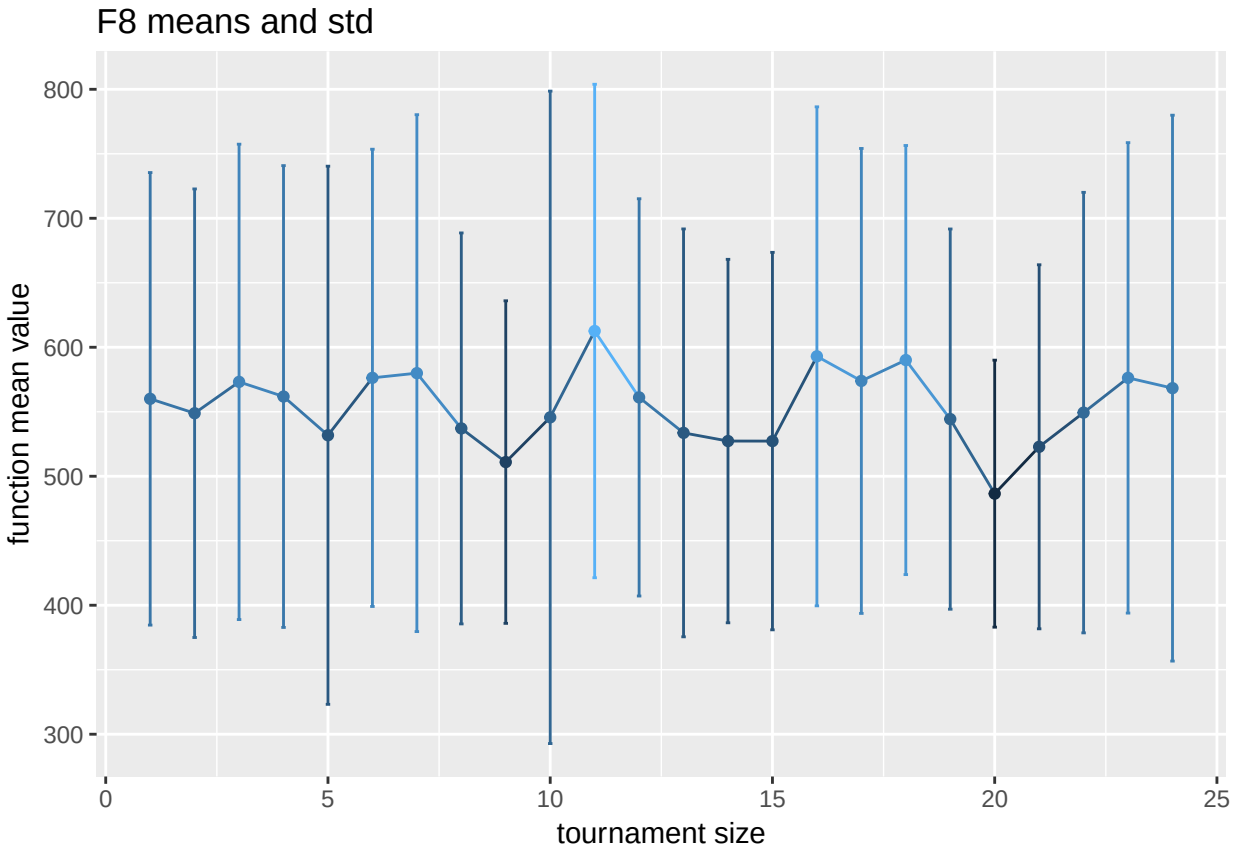

F5 means and C.I.
function mean value
5
4
3
2
1
0
−1
0
5
10
15
20
25
tournament size

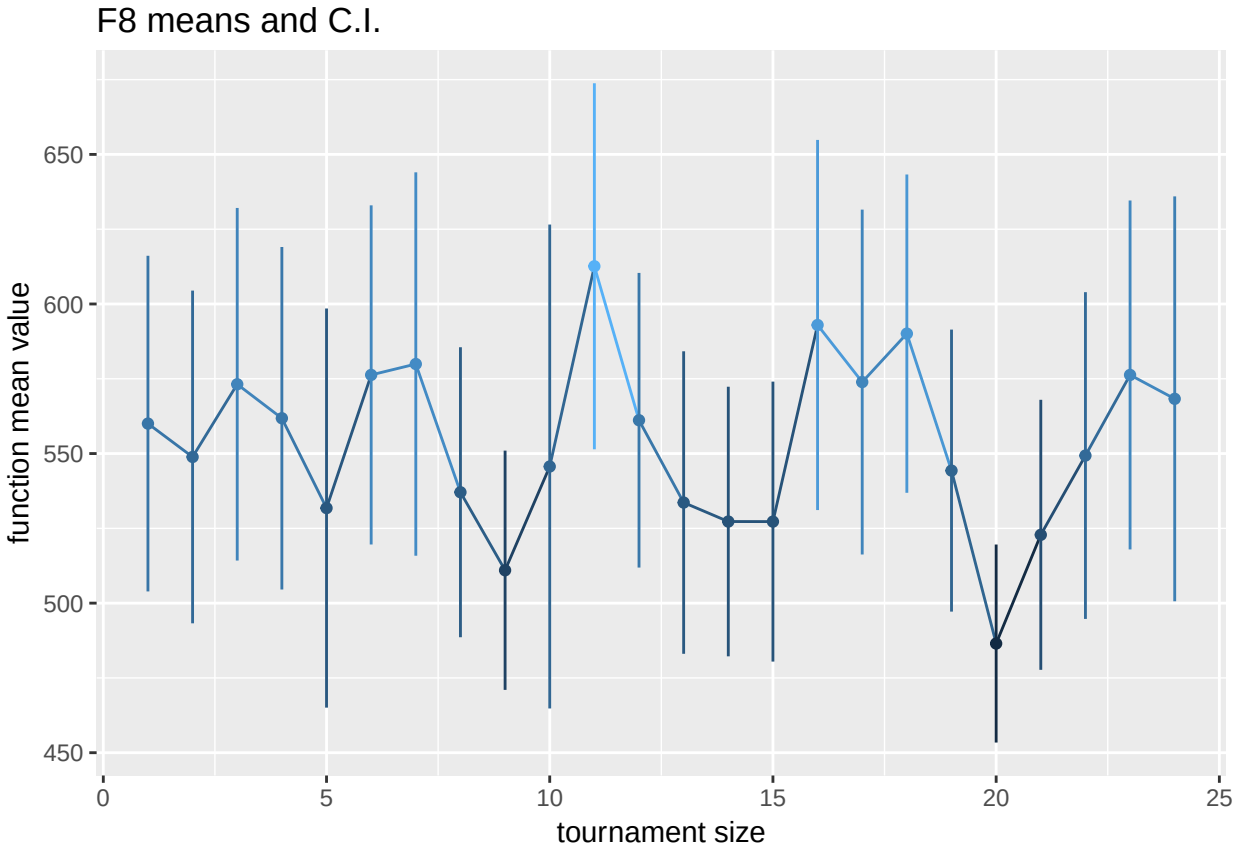

F6 means and std
function mean value
5000
4000
3000
2000
1000
0
−1000
0
5
10
15
20
25
tournament size

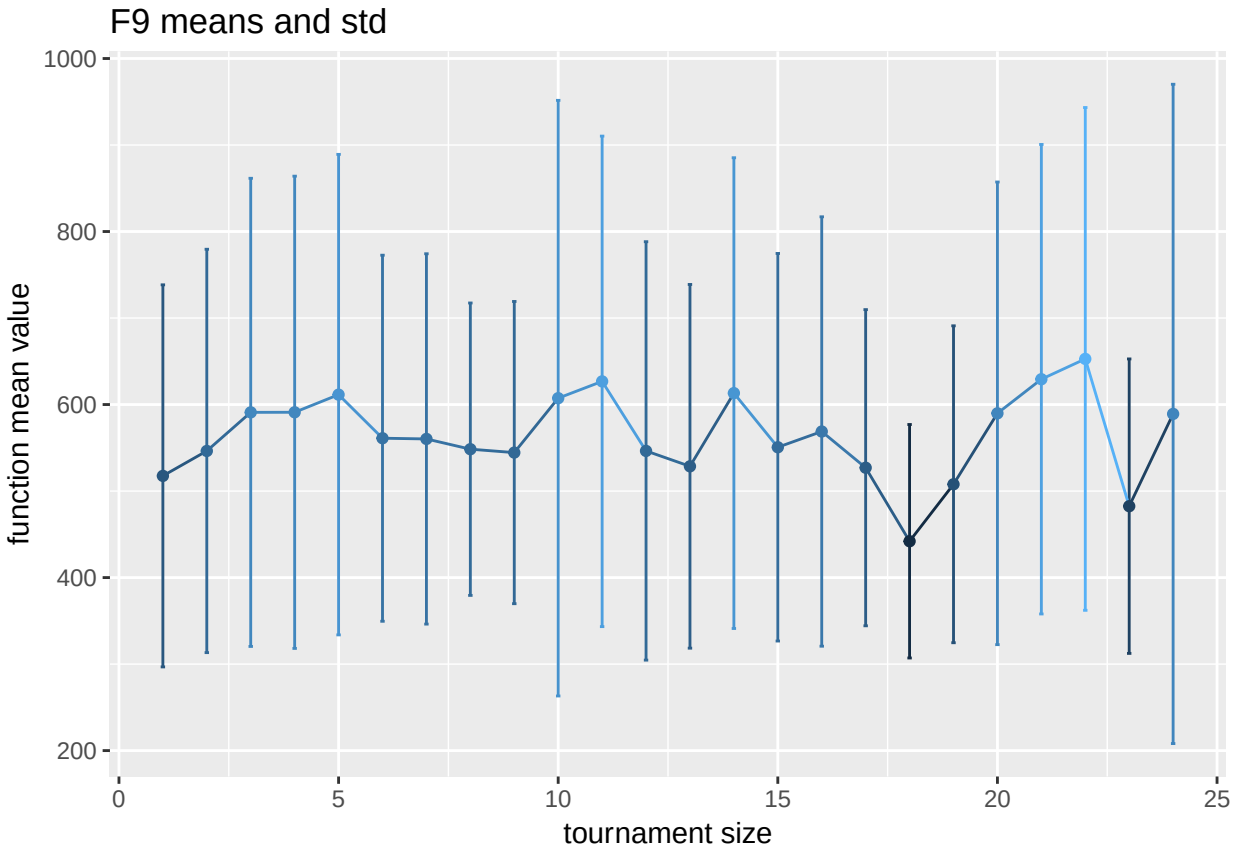

F6 means and C.I.
function mean value
3000
2000
1000
0
5
10
15
20
25
tournament size

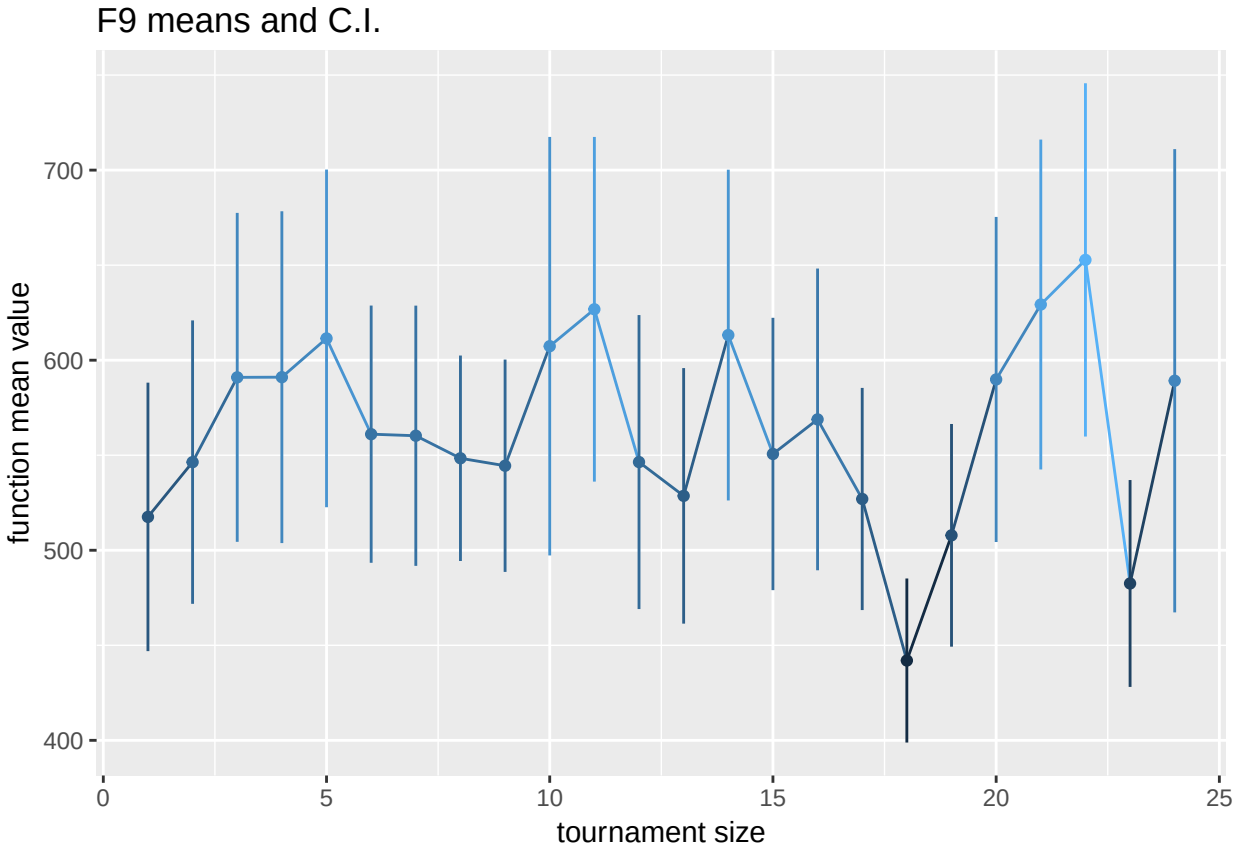

F7 means and std
function mean value
150
140
130
120
110
0
5
10
15
20
25
tournament size

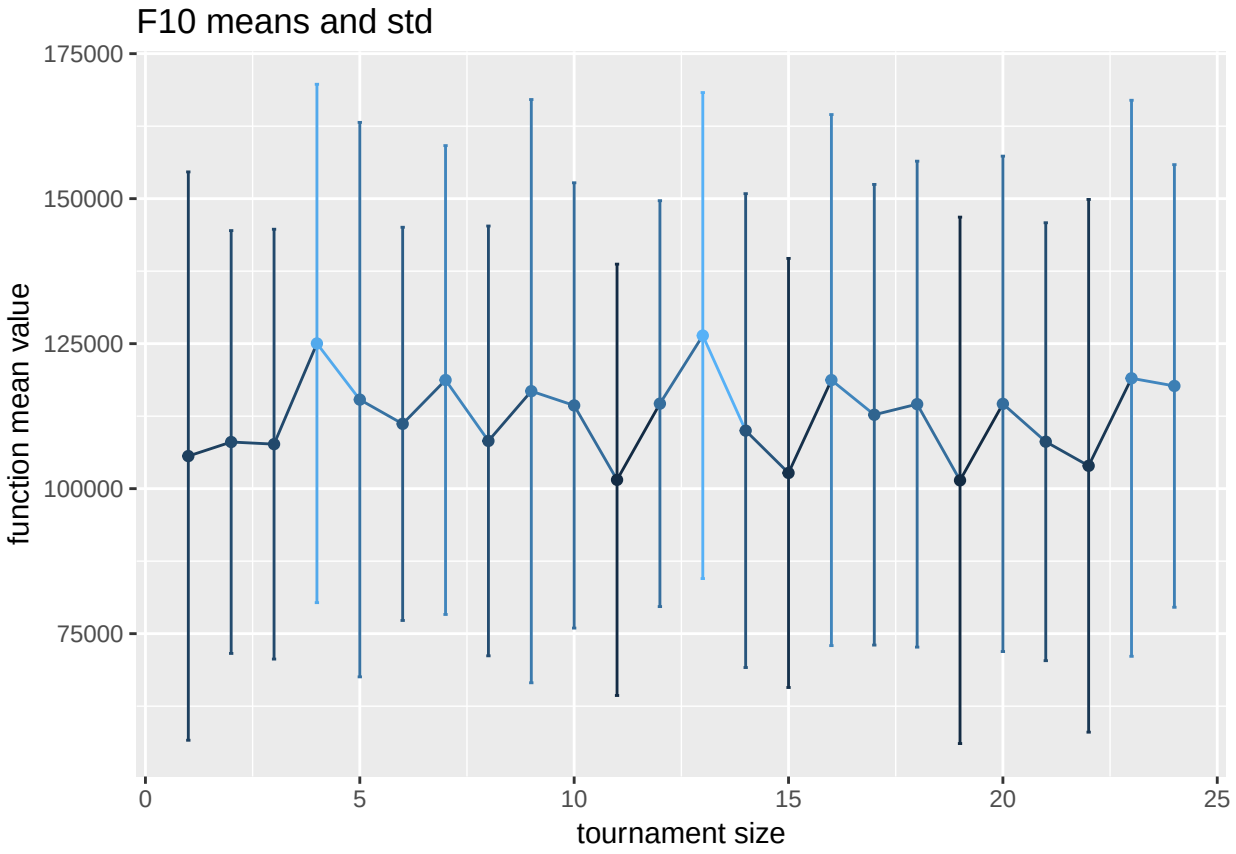

F7 means and C.I.
function mean value
140
135
130
125
0
5
10
15
20
25
tournament size

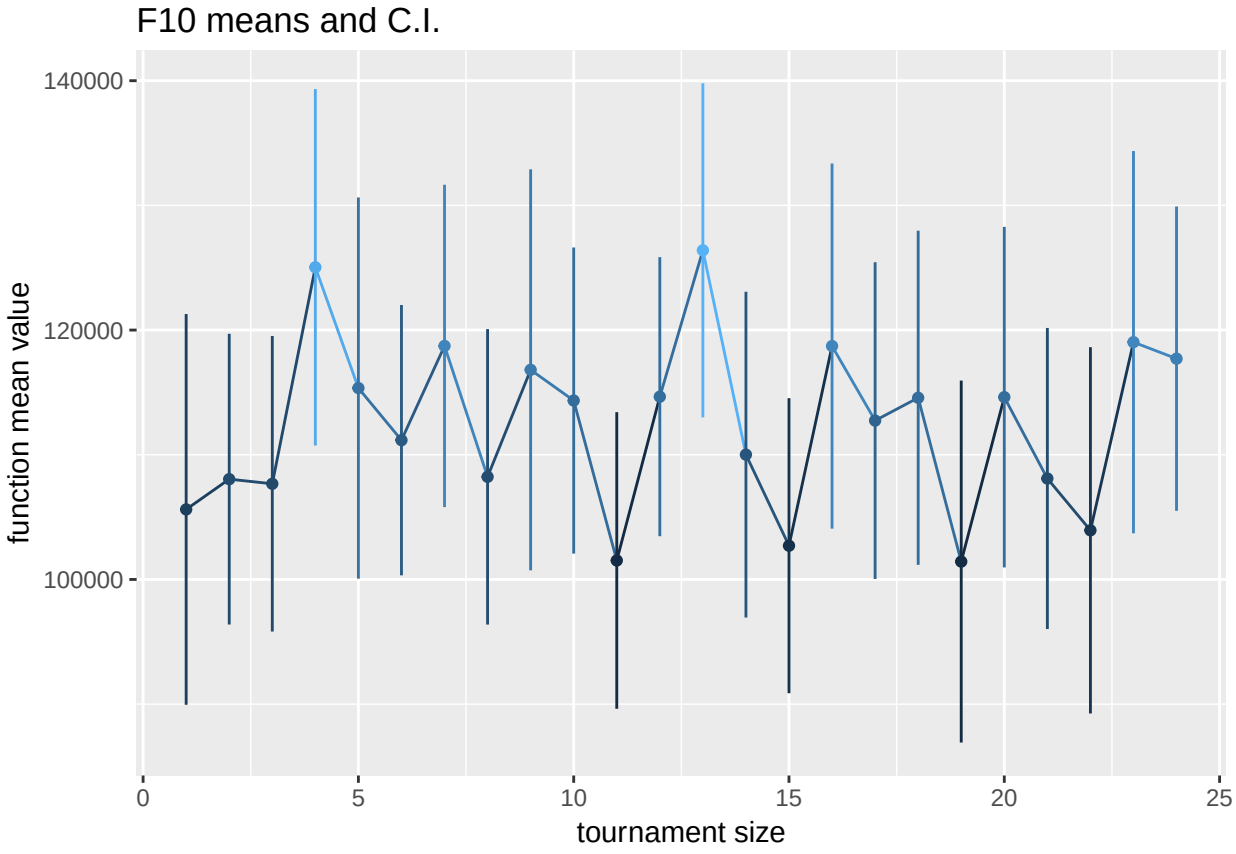

F8 means and std
function mean value
800
700
600
500
400
300
0
5
10
15
20
25
tournament size

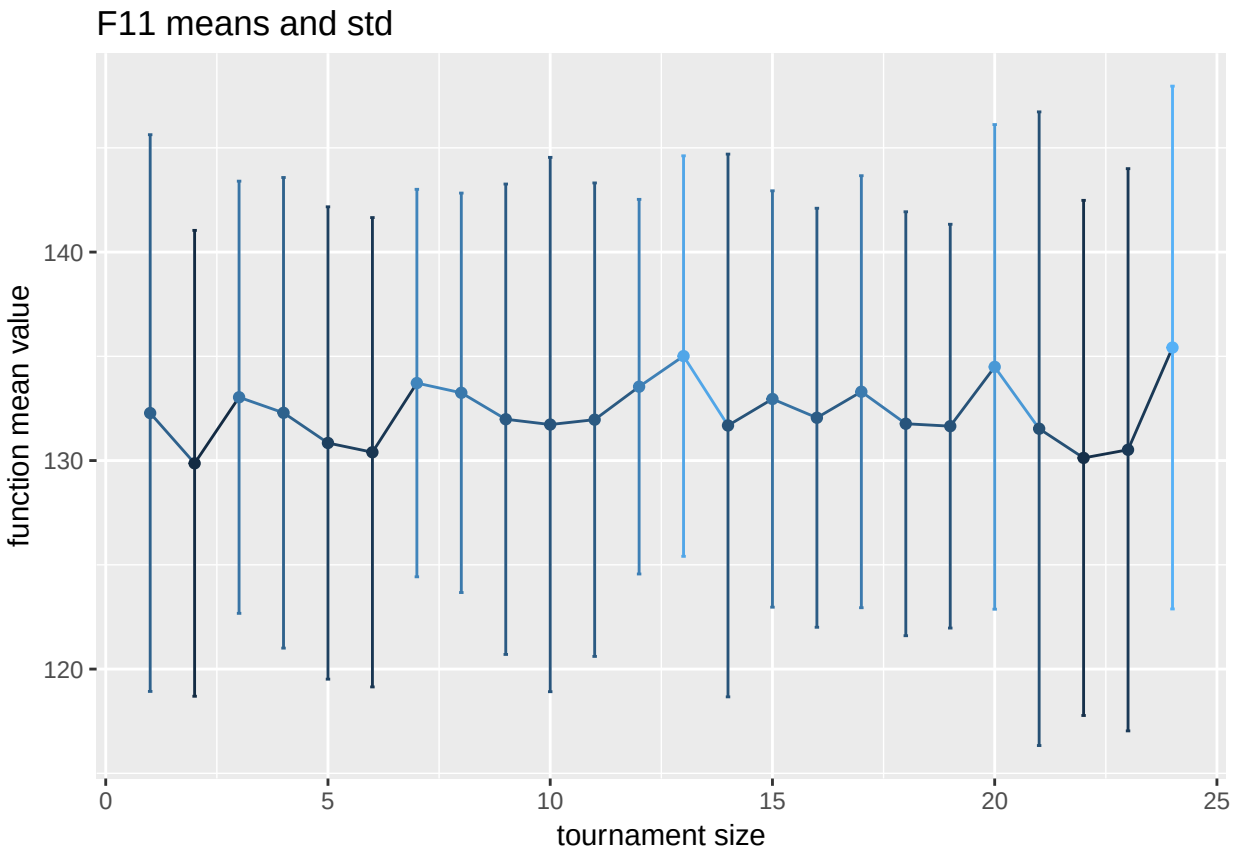

F8 means and C.I.
function mean value
650
600
550
500
450
0
5
10
15
20
25
tournament size

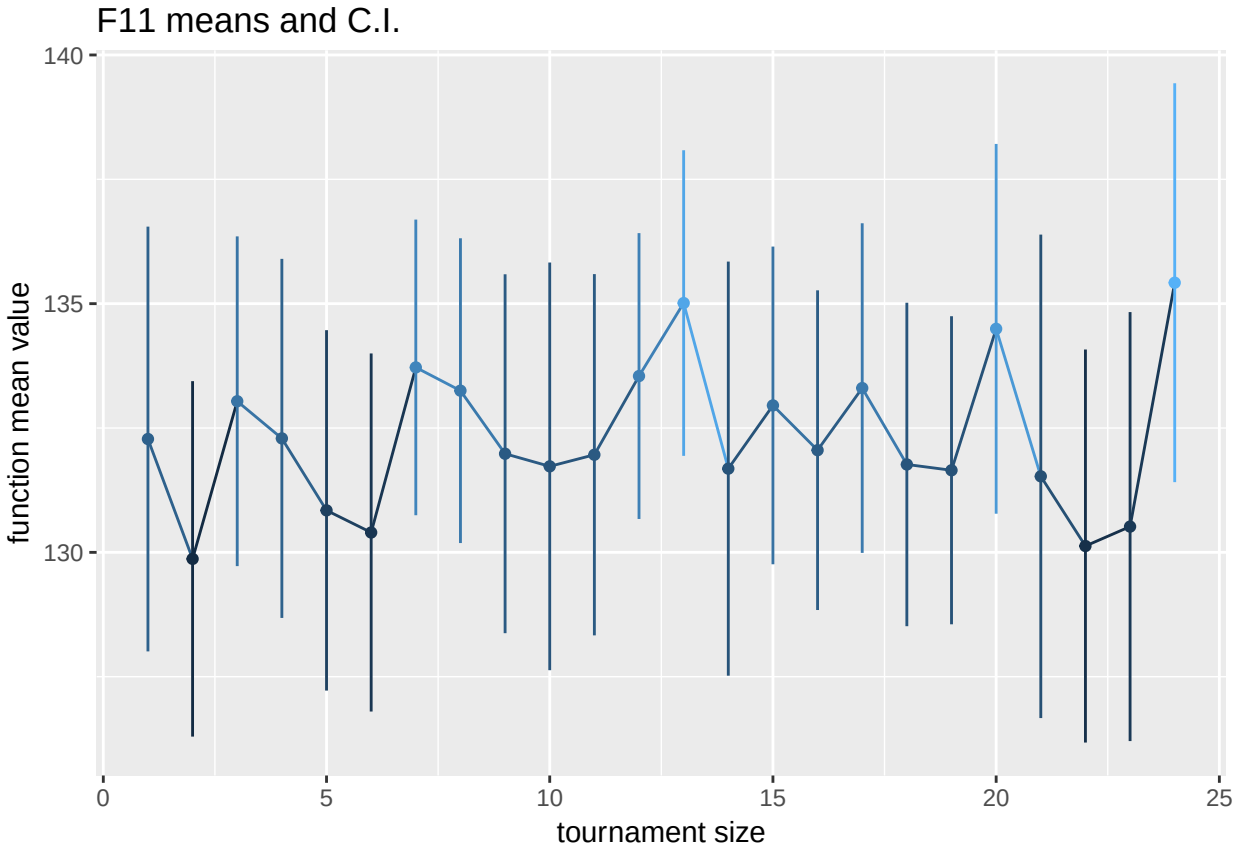

F9 means and std
function mean value
1000
800
600
400
200
0
5
10
15
20
25
tournament size

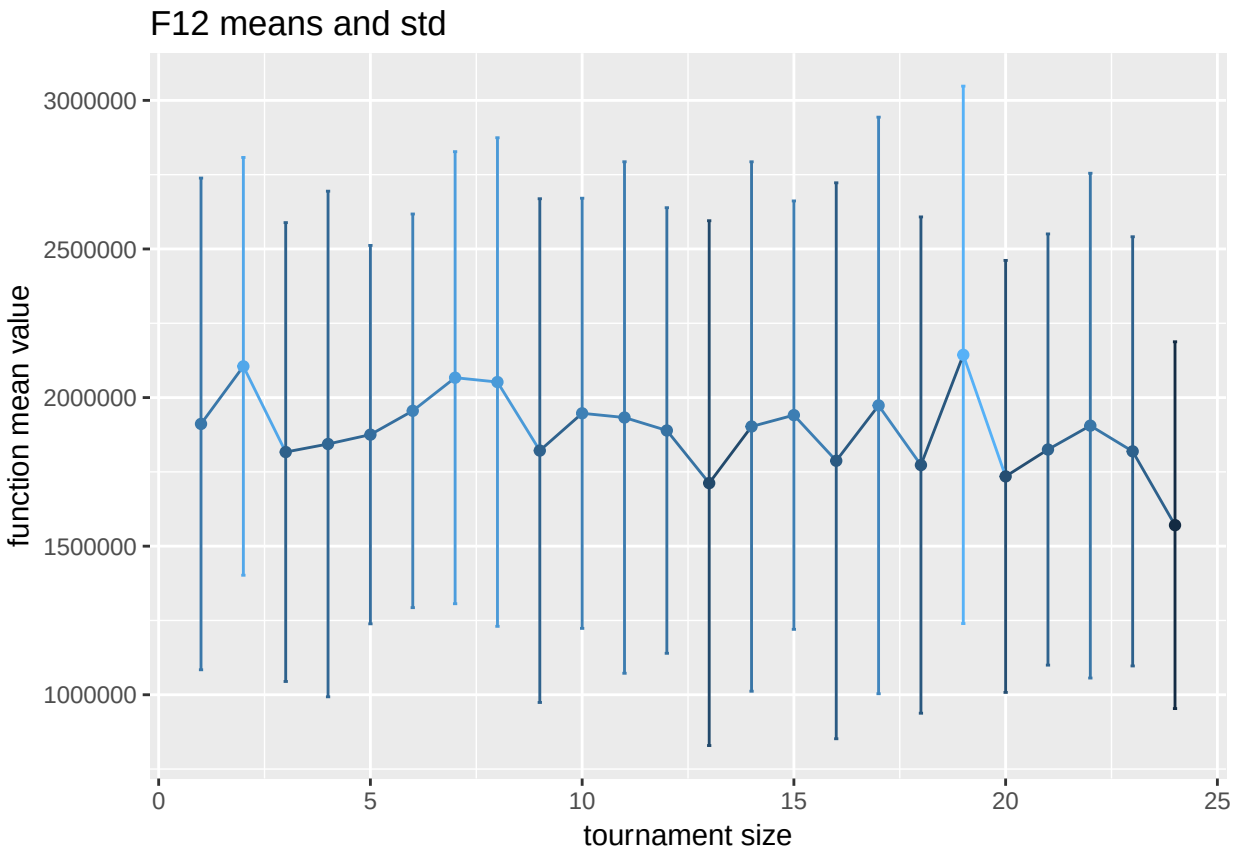

F9 means and C.I.
function mean value
700
600
500
400
0
5
10
15
20
25
tournament size

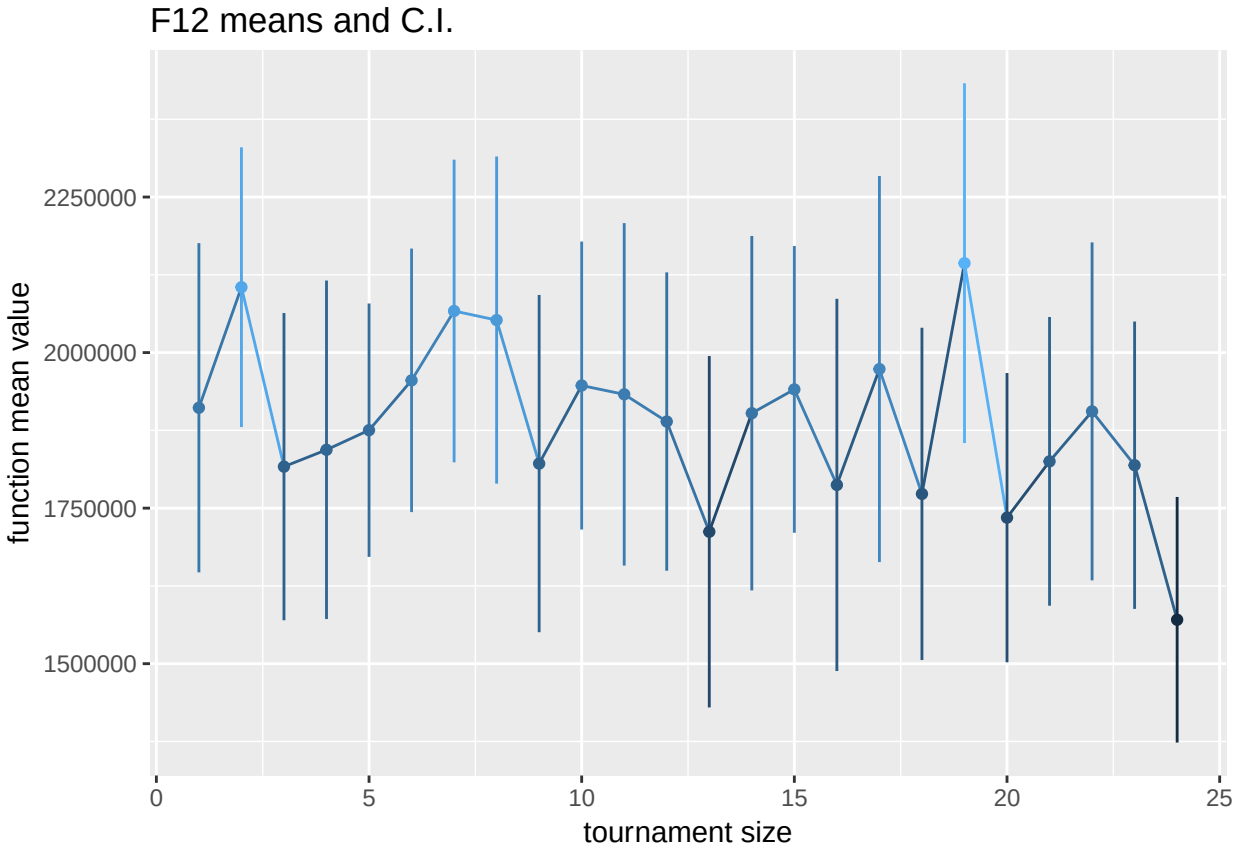

F10 means and std
function mean value
175000
150000
125000
100000
75000
0
5
10
15
20
25
tournament size

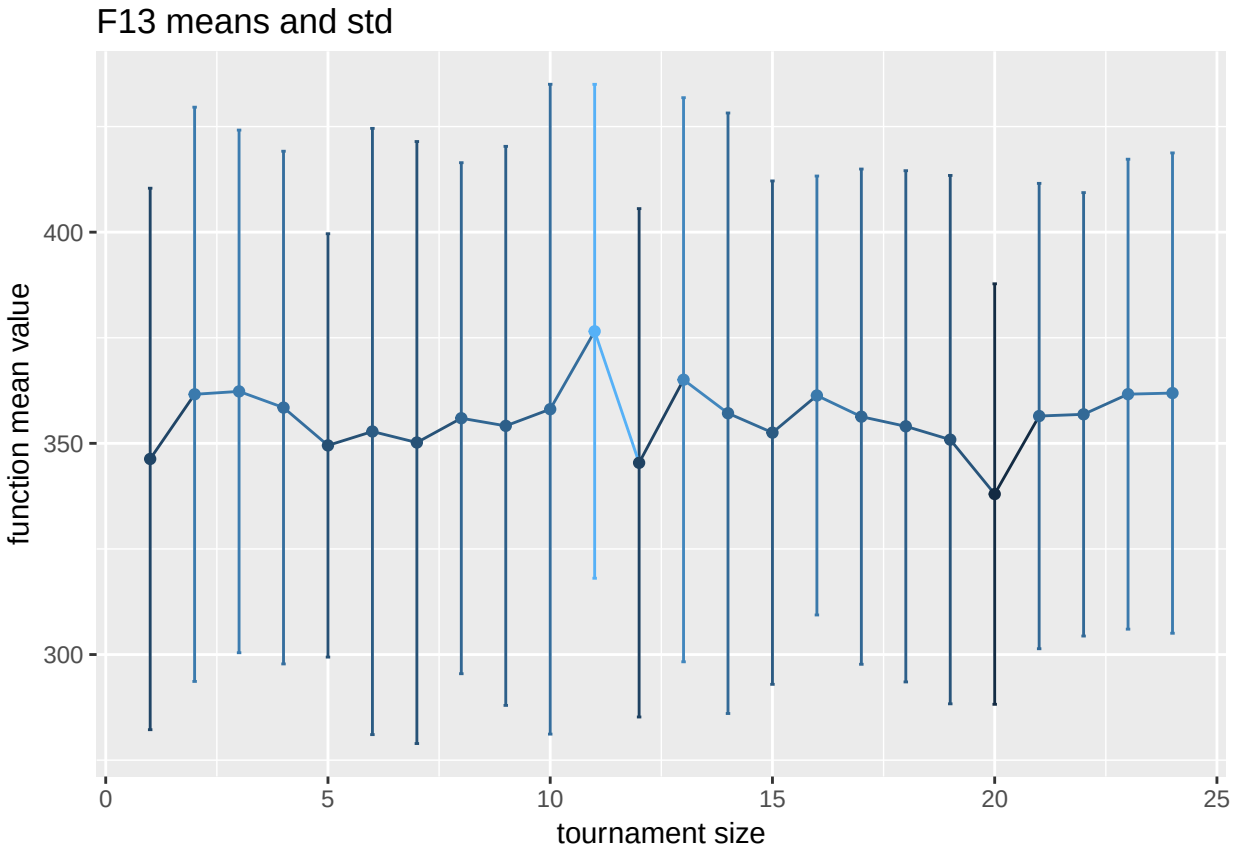

F10 means and C.I.
function mean value
140000
120000
100000
0
5
10
15
20
25
tournament size

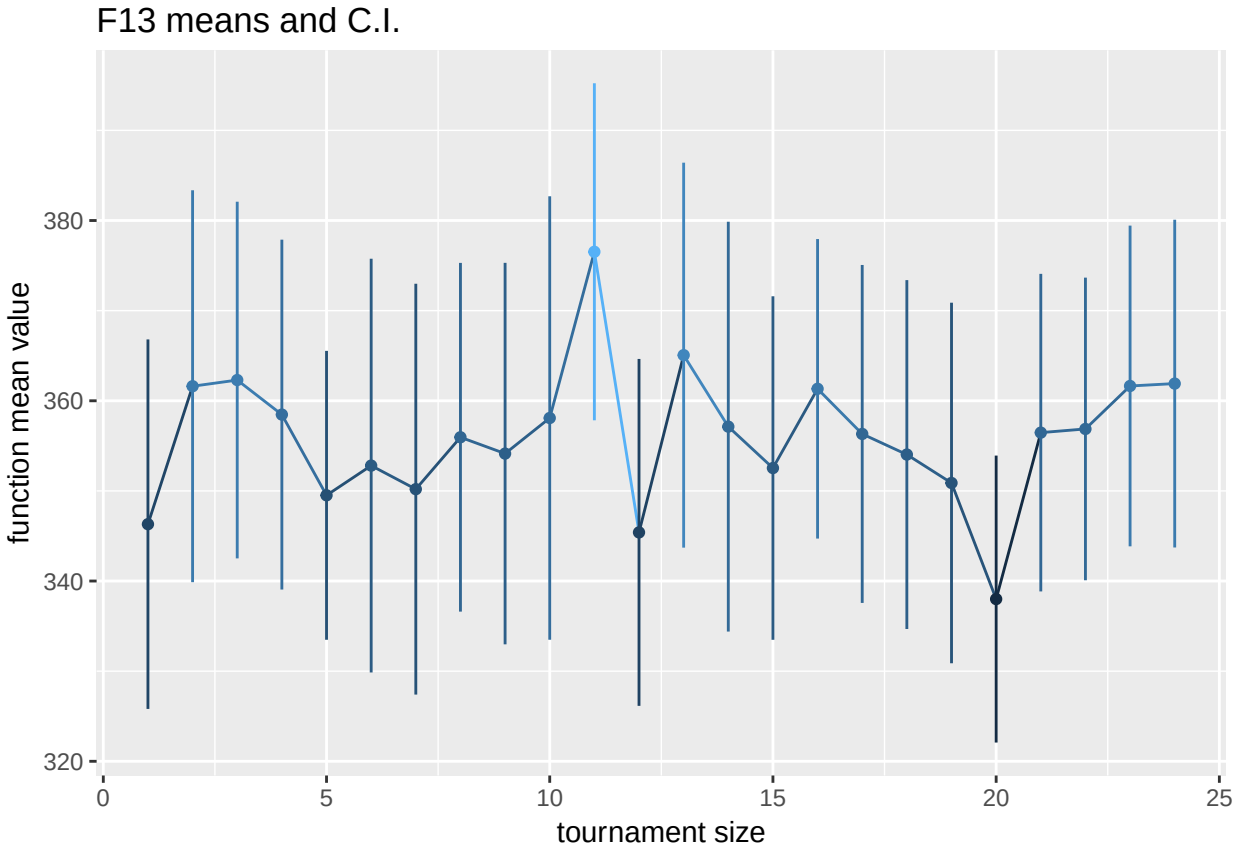

F11 means and std
function mean value
140
130
120
0
5
10
15
20
25
tournament size

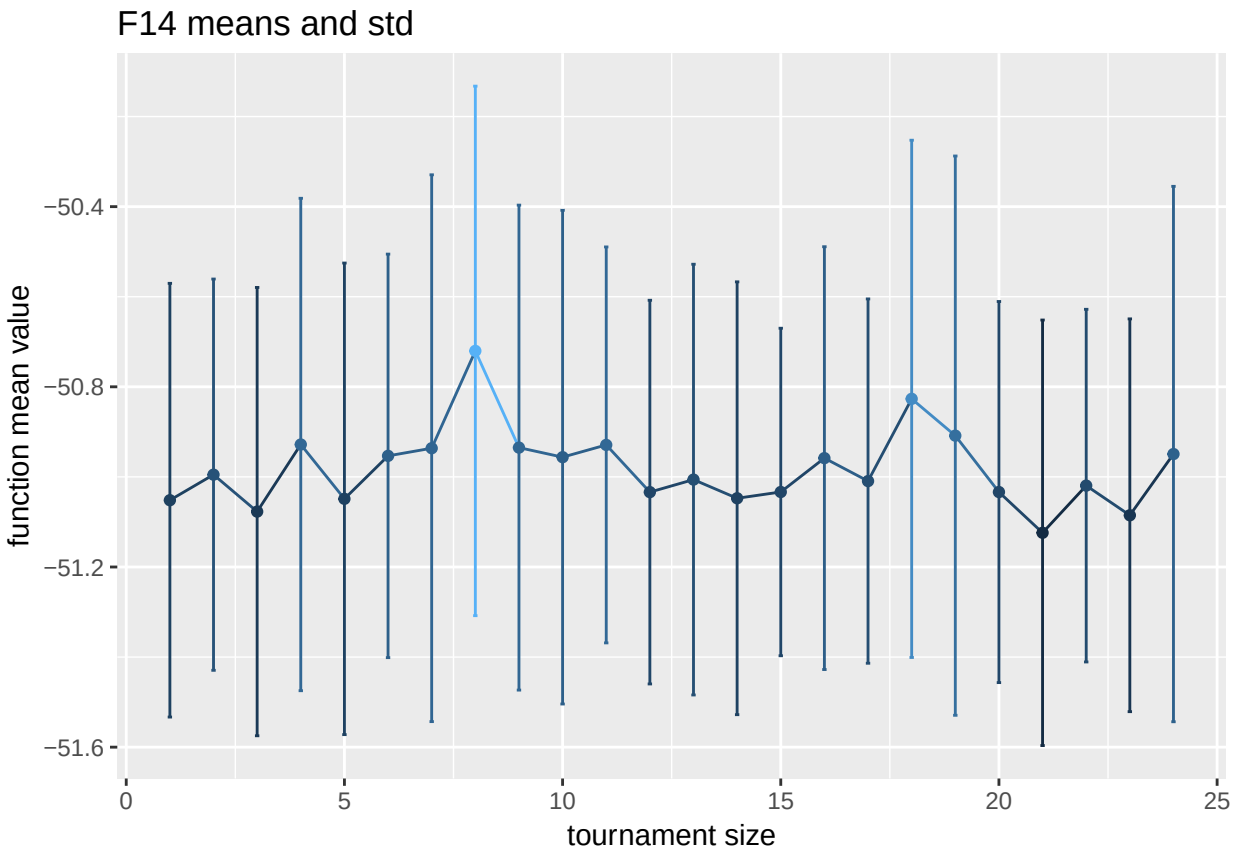

F11 means and C.I.
function mean value
140
135
130
0
5
10
15
20
25
tournament size

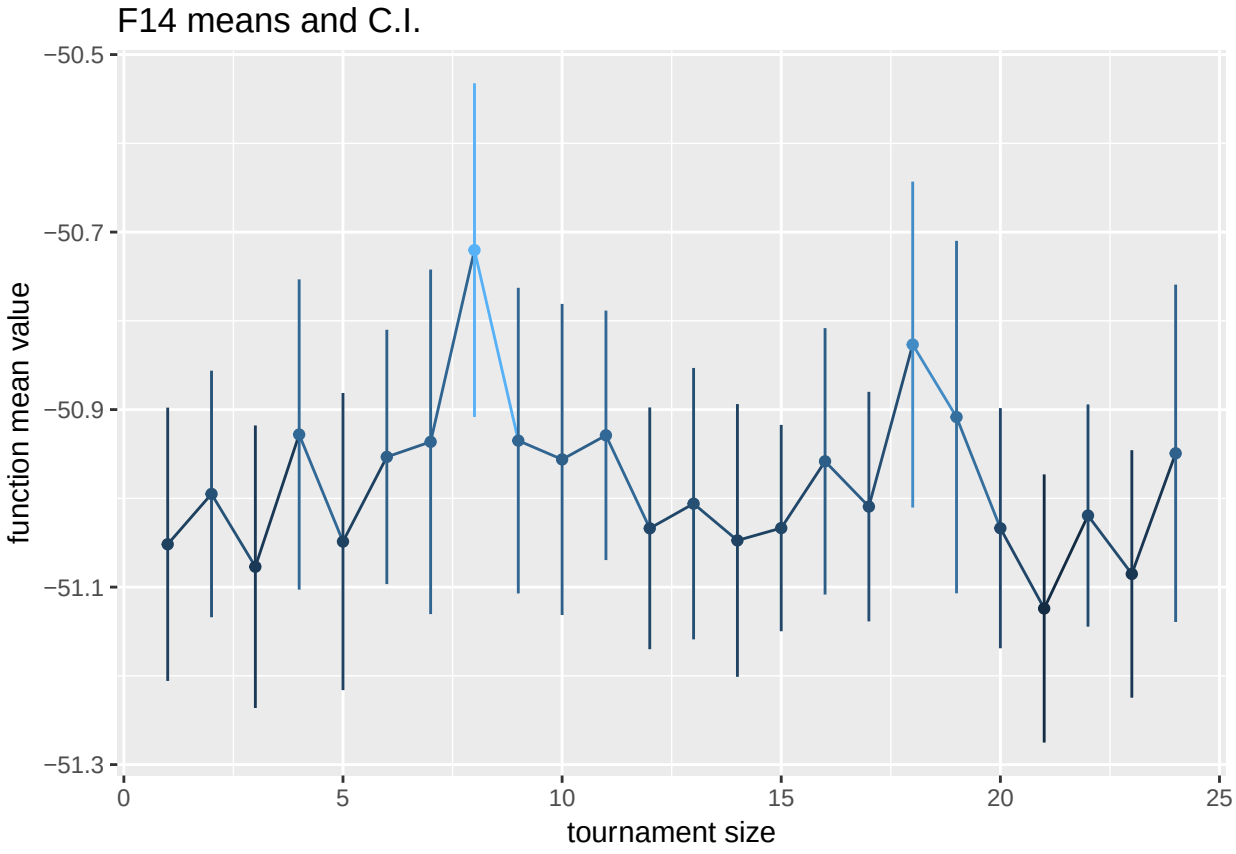

F12 means and std
function mean value
3000000
2500000
2000000
1500000
1000000
0
5
10
15
20
25
tournament size

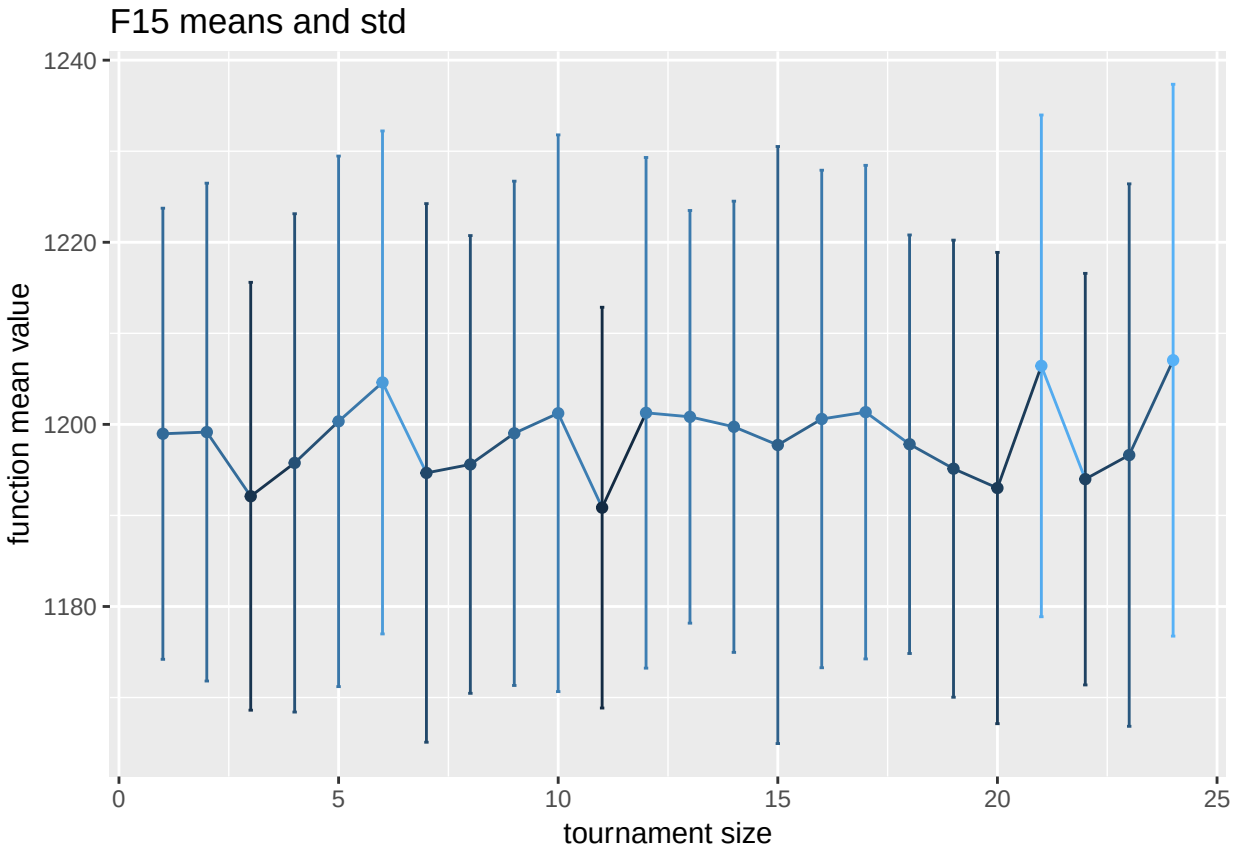

F12 means and C.I.
function mean value
2250000
2000000
1750000
1500000
0
5
10
15
20
25
tournament size

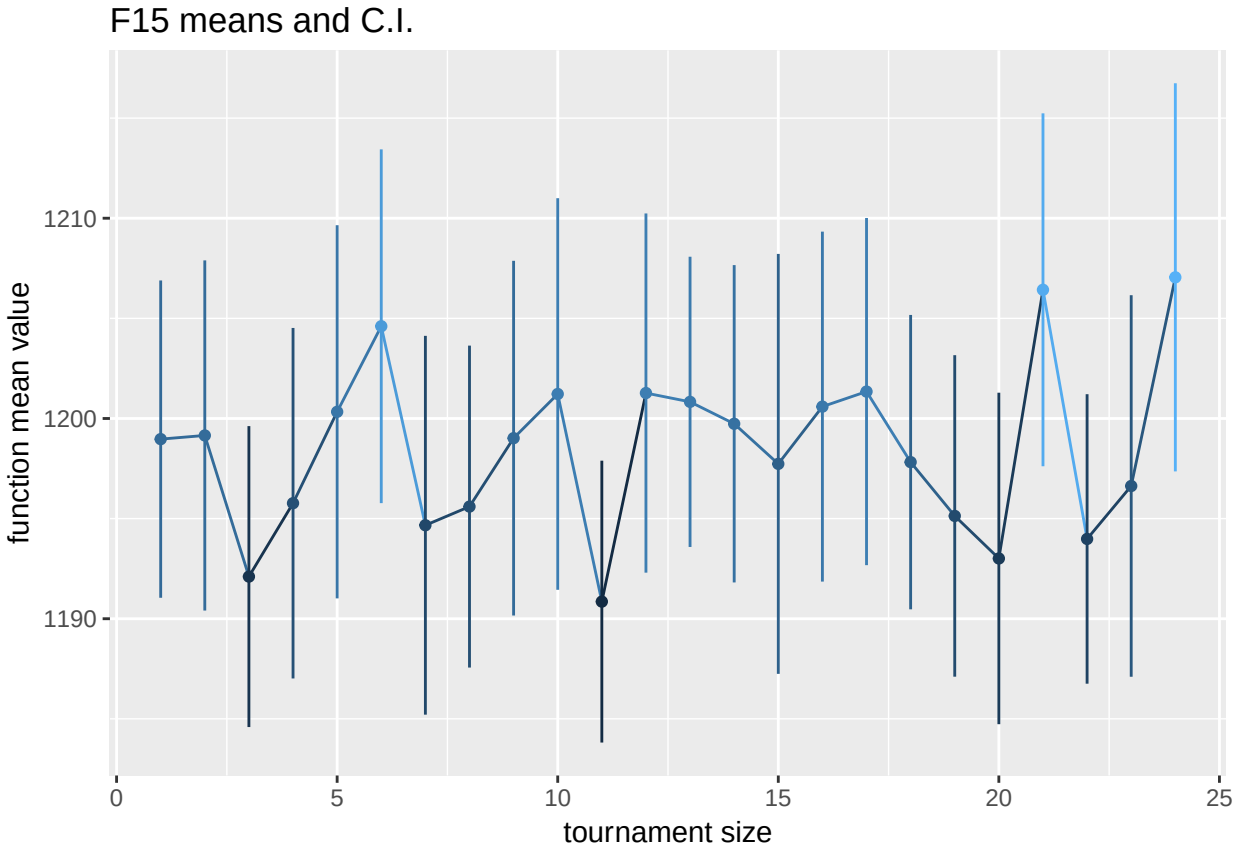

F13 means and std
function mean value
400
350
300
0
5
10
15
20
25
tournament size

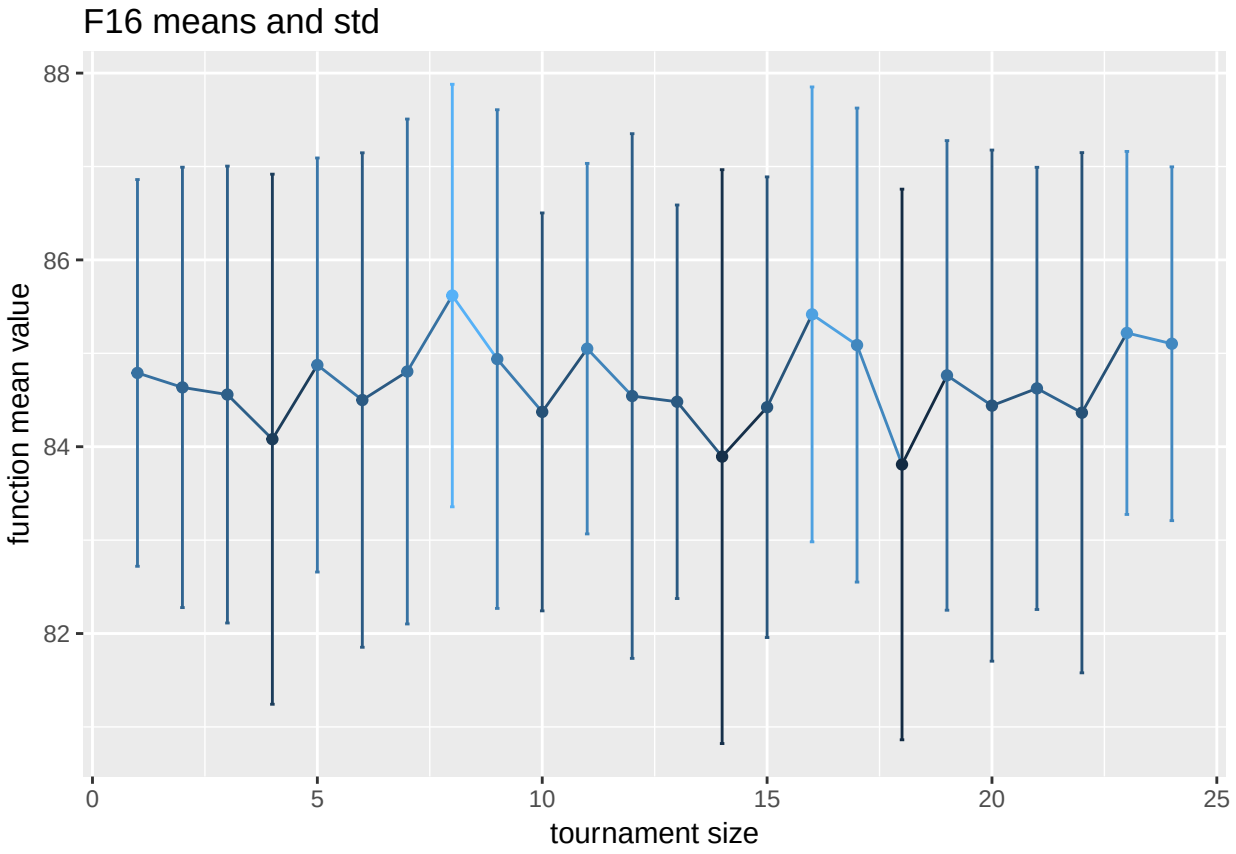

F13 means and C.I.
function mean value
380
360
340
320
0
5
10
15
20
25
tournament size

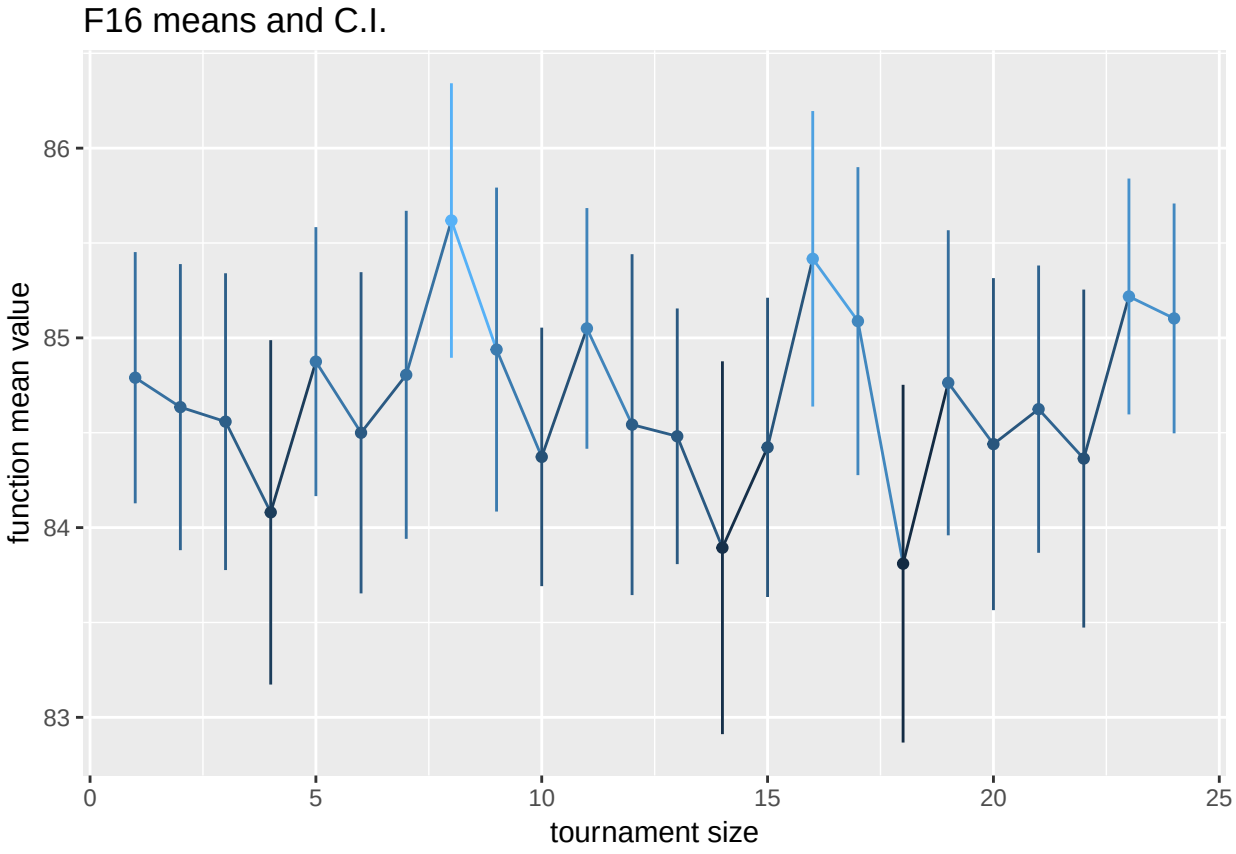

F14 means and std
function mean value
−50.4
−50.8
−51.2
−51.6
0
5
10
15
20
25
tournament size

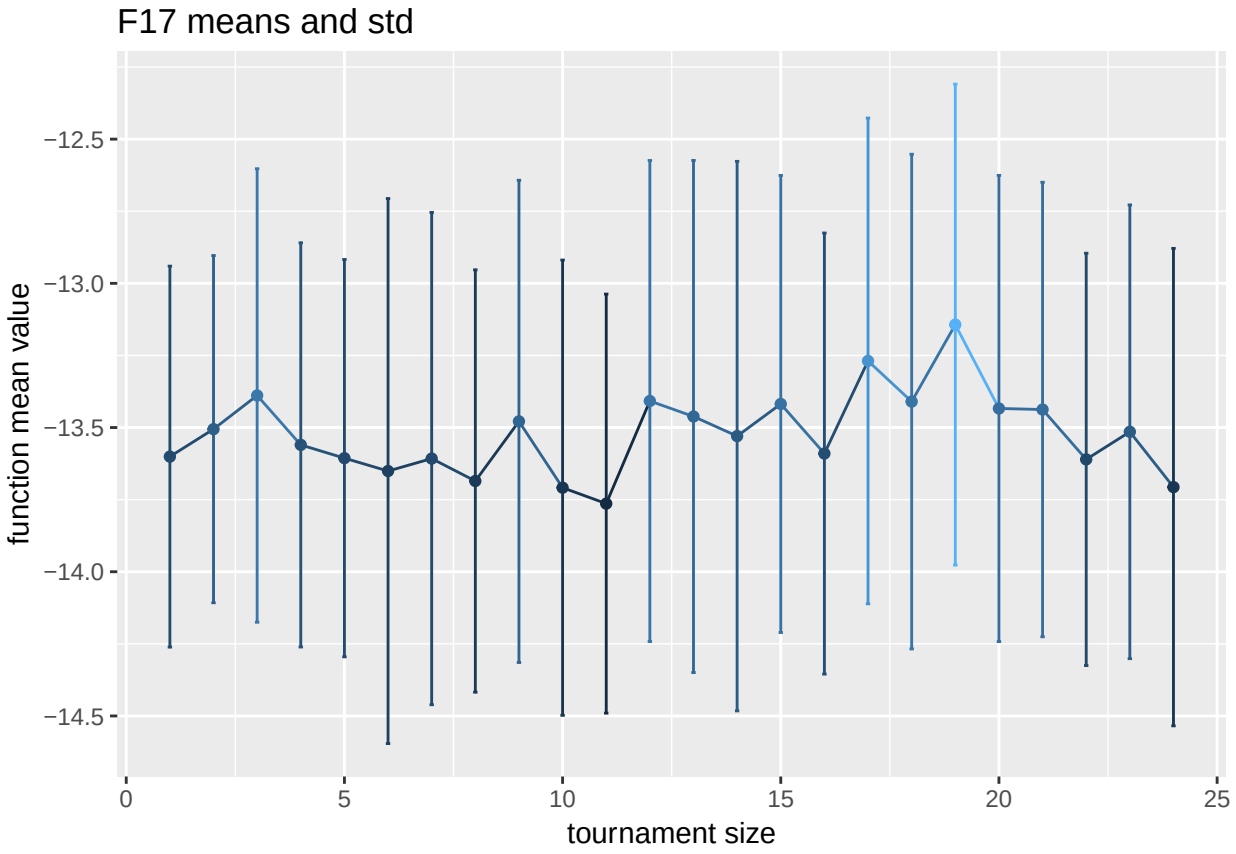

F14 means and C.I.
function mean value
−50.5
−50.7
−50.9
−51.1
−51.3
0
5
10
15
20
25
tournament size

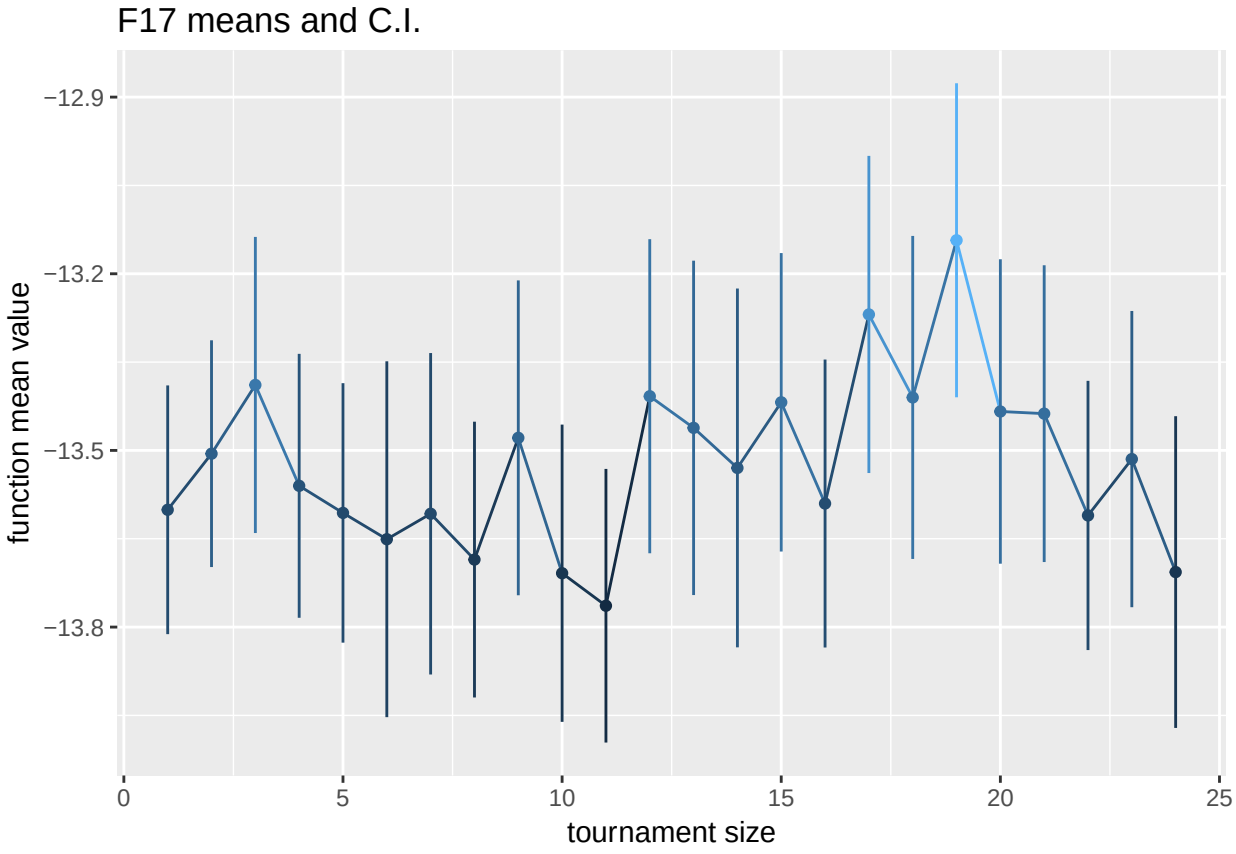

F15 means and std
1240
1220
1200
1180
function mean value
0
5
10
15
20
25
tournament size

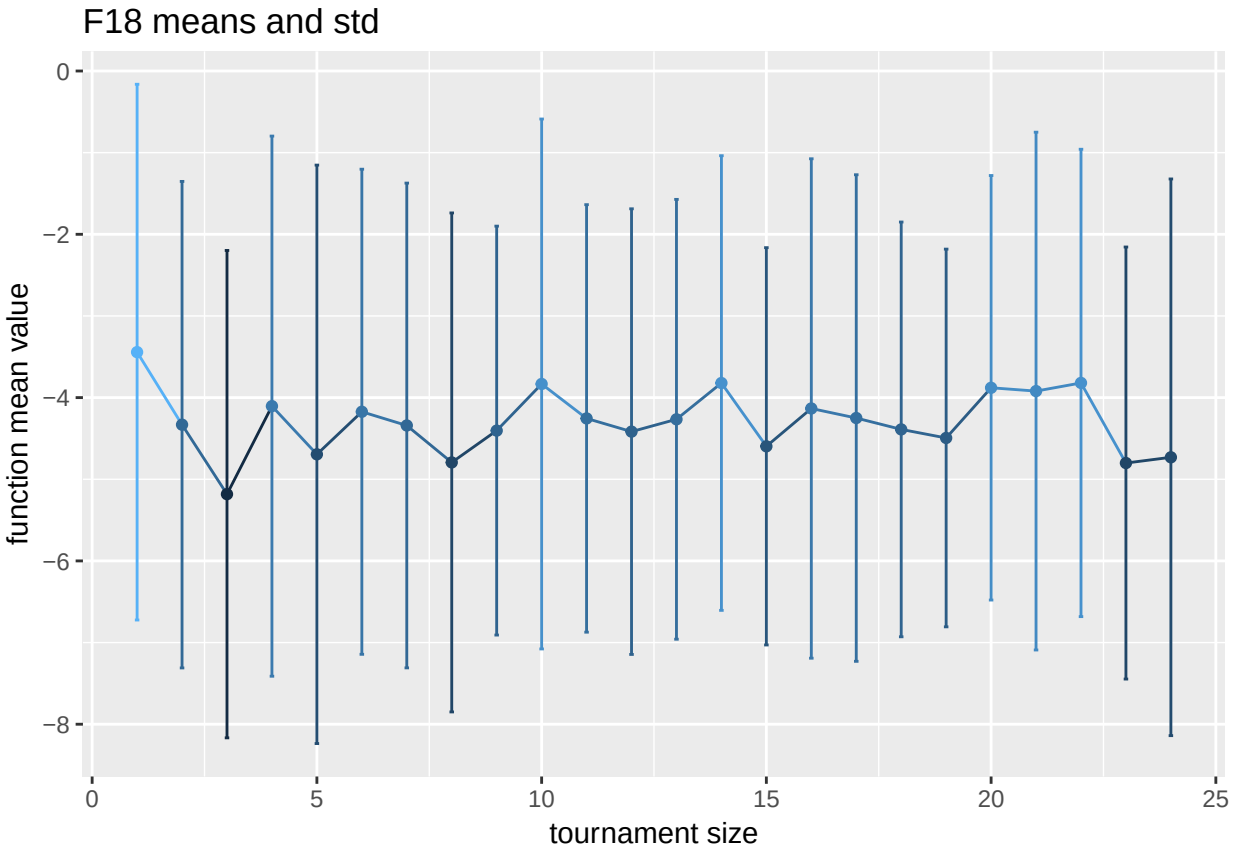

F15 means and C.I.
1210
1200
1190
function mean value
0
5
10
15
20
25
tournament size

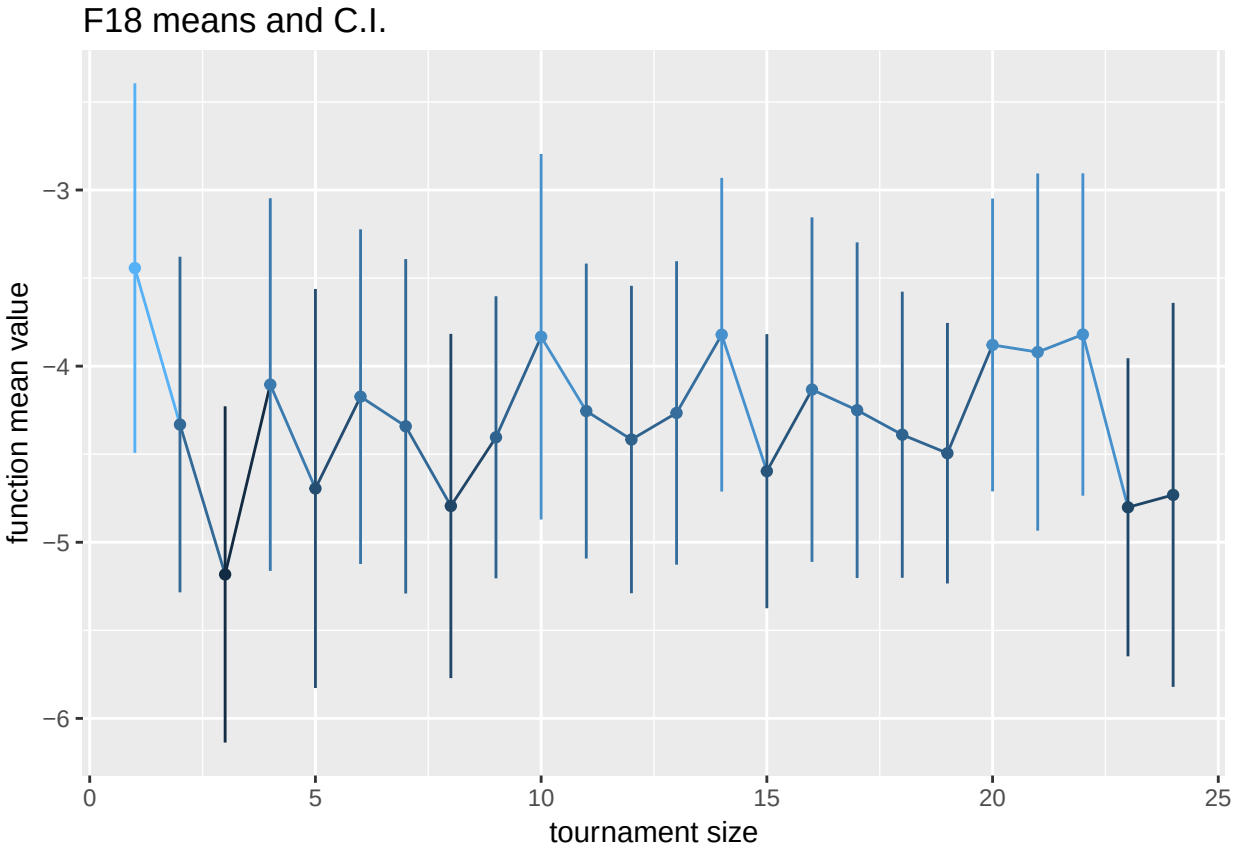

F16 means and std
function mean value
88
86
84
82
0
5
10
15
20
25
tournament size

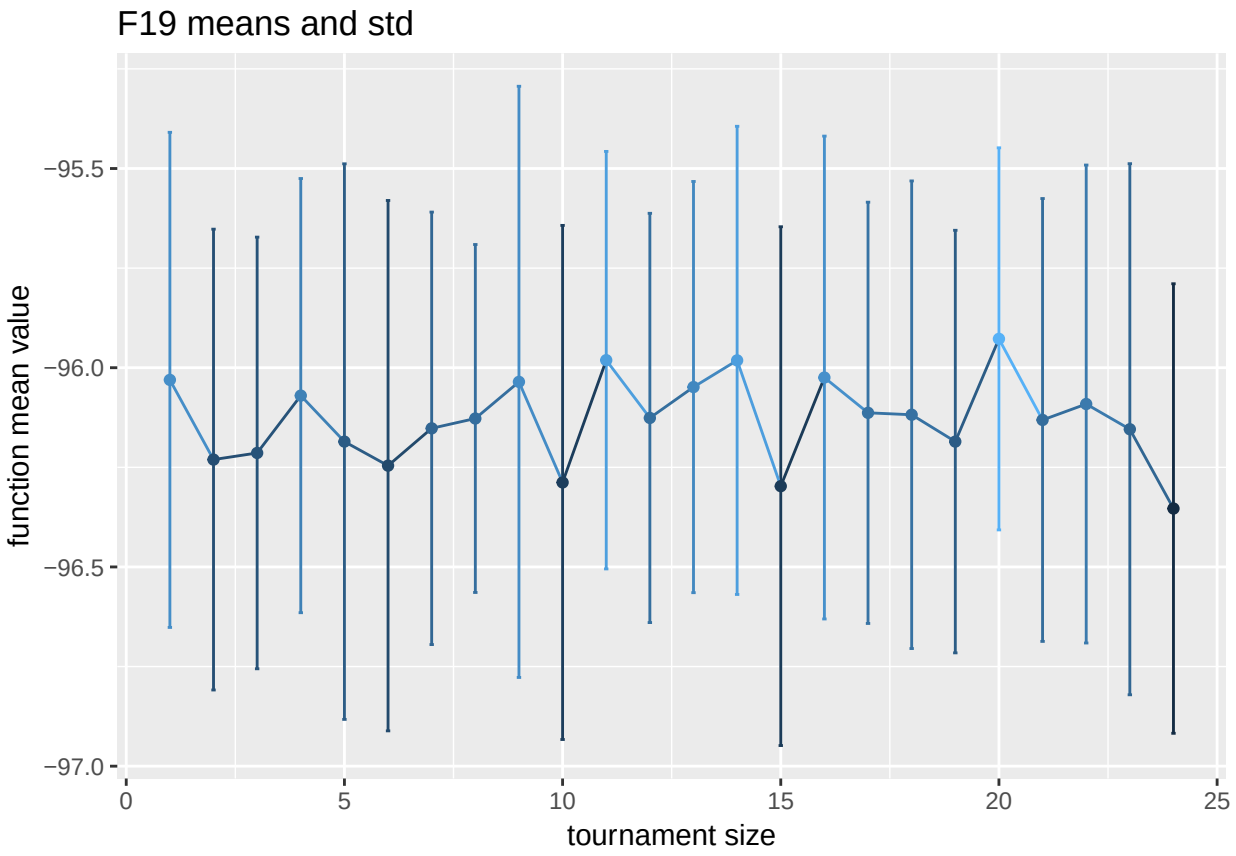

F16 means and C.I.
function mean value
86
85
84
83
0
5
10
15
20
25
tournament size

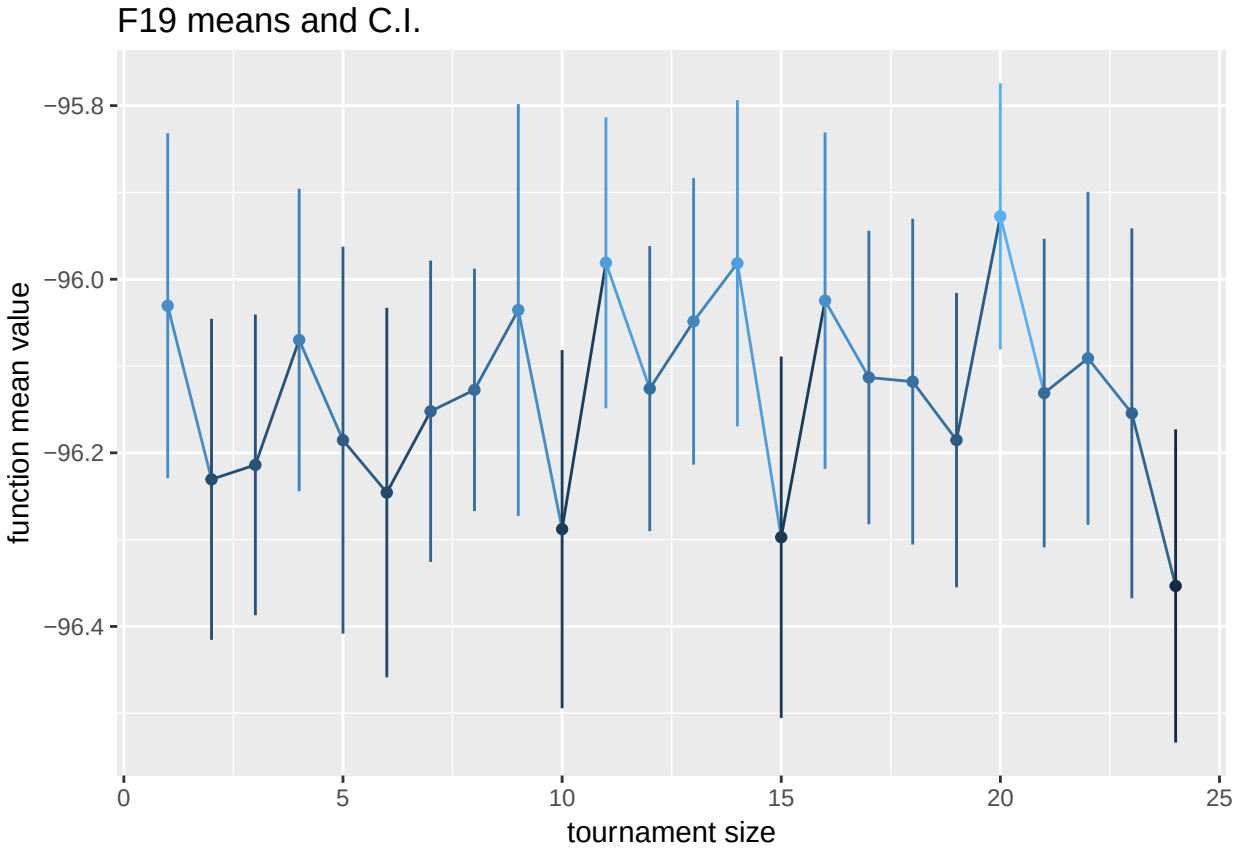

F17 means and std
function mean value
−12.5
−13.0
−13.5
−14.0
−14.5
0
5
10
15
20
25
tournament size

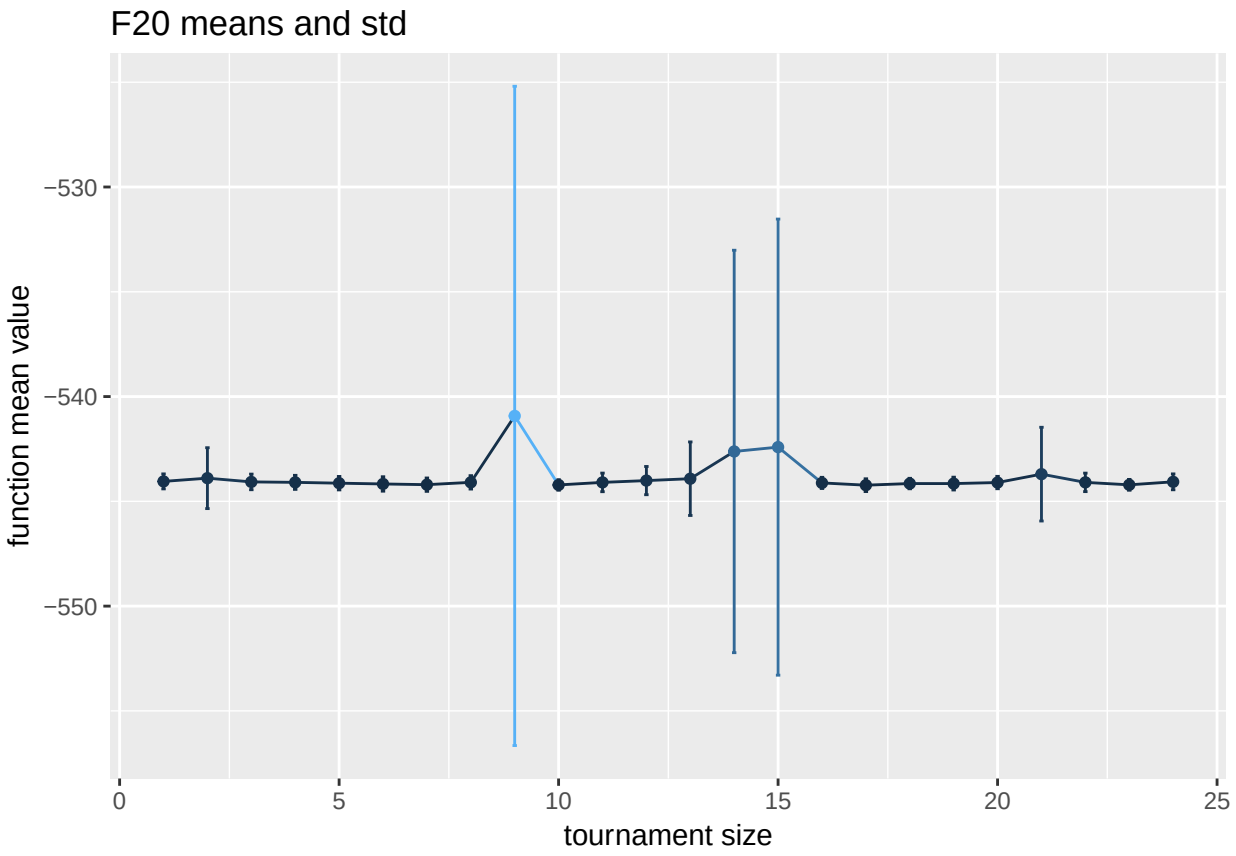

F17 means and C.I.
function mean value
−12.9
−13.2
−13.5
−13.8
0
5
10
15
20
25
tournament size

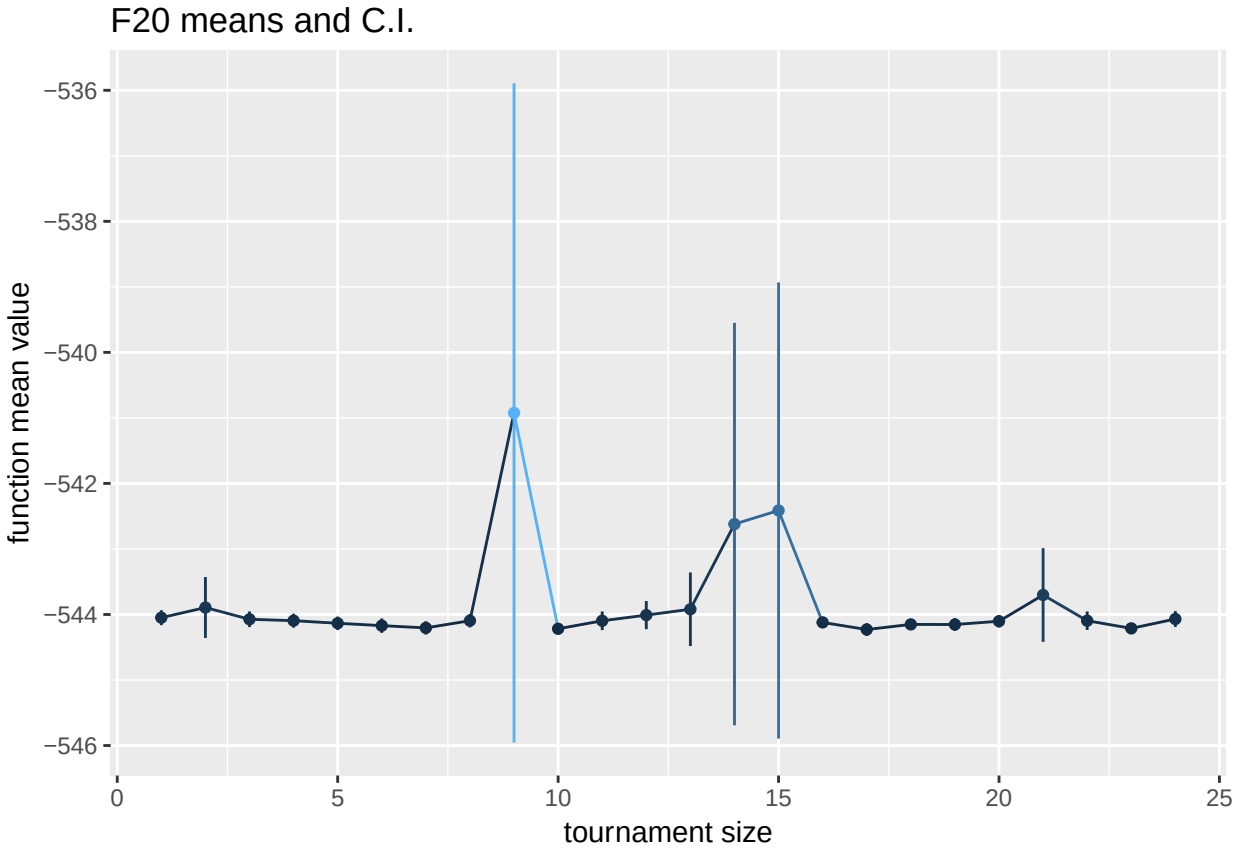

F18 means and std
function mean value
0
−2
−4
−6
−8
0
5
10
15
20
25
tournament size

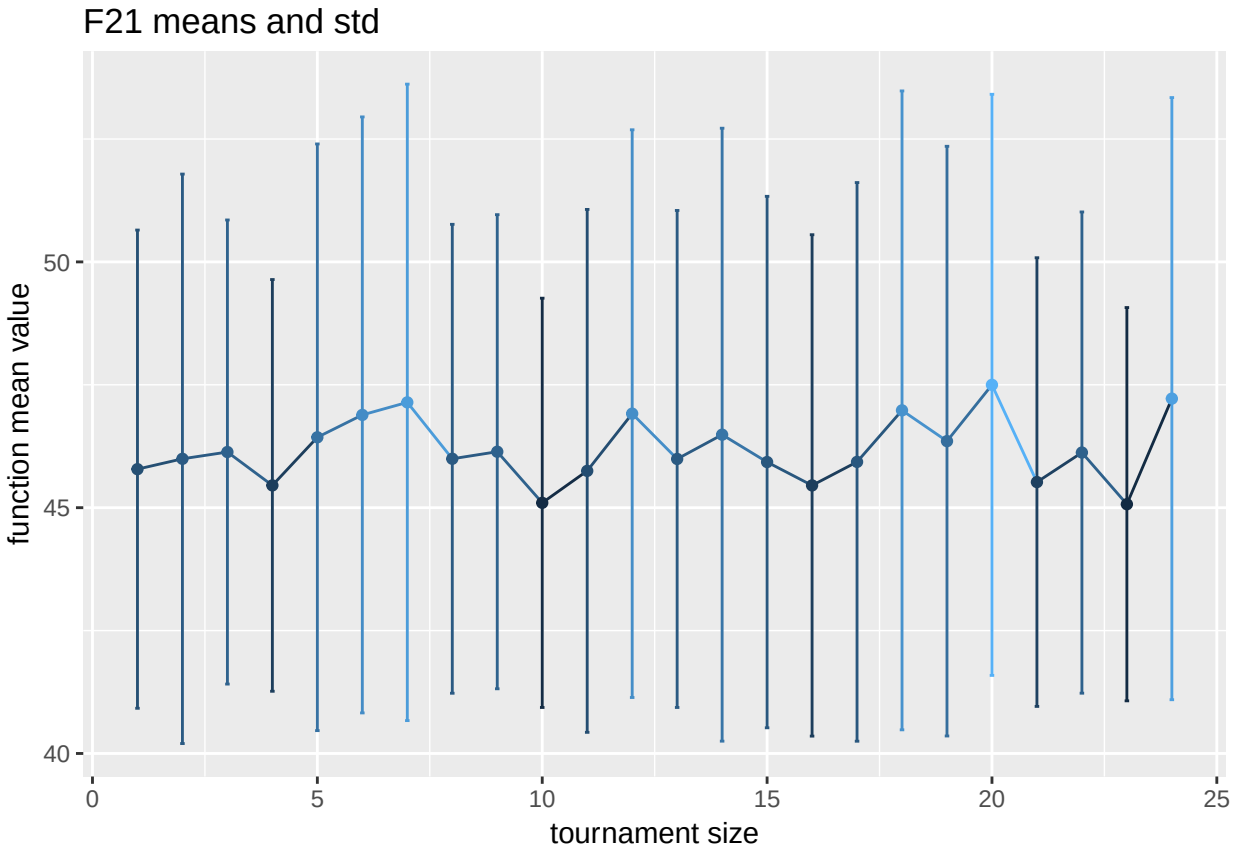

F18 means and C.I.
function mean value
−3
−4
−5
−6
0
5
10
15
20
25
tournament size

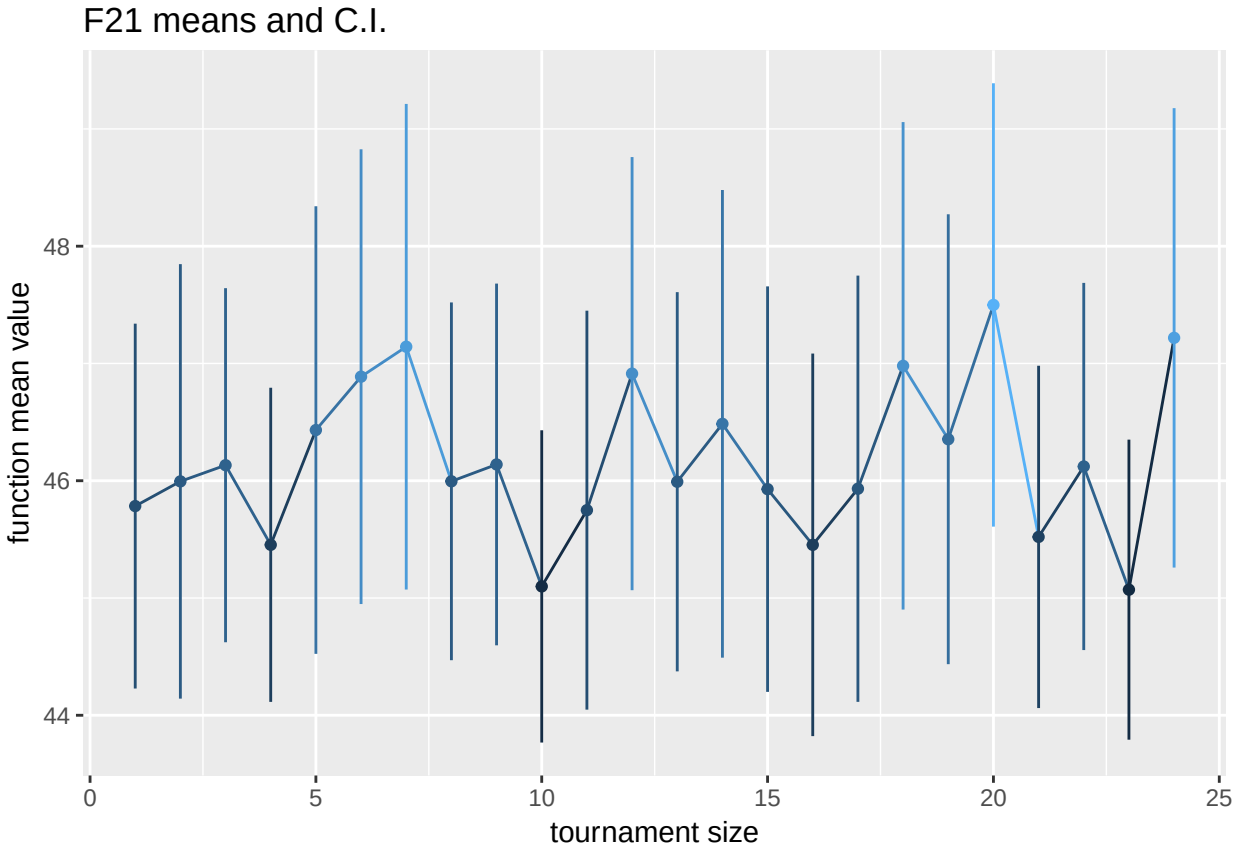

F19 means and std
function mean value
−95.5
−96.0
−96.5
−97.0
0
5
10
15
20
25
tournament size

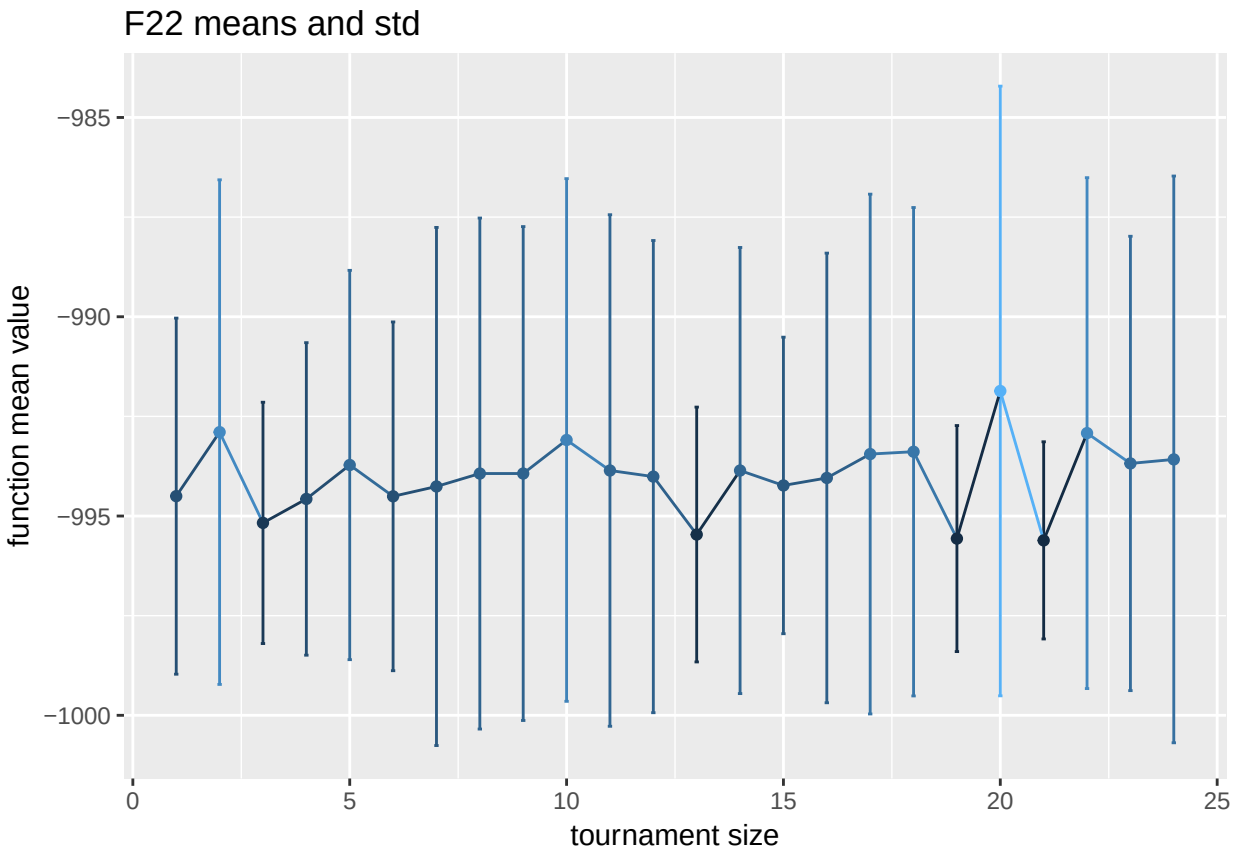

F19 means and C.I.
function mean value
−95.8
−96.0
−96.2
−96.4
0
5
10
15
20
25
tournament size

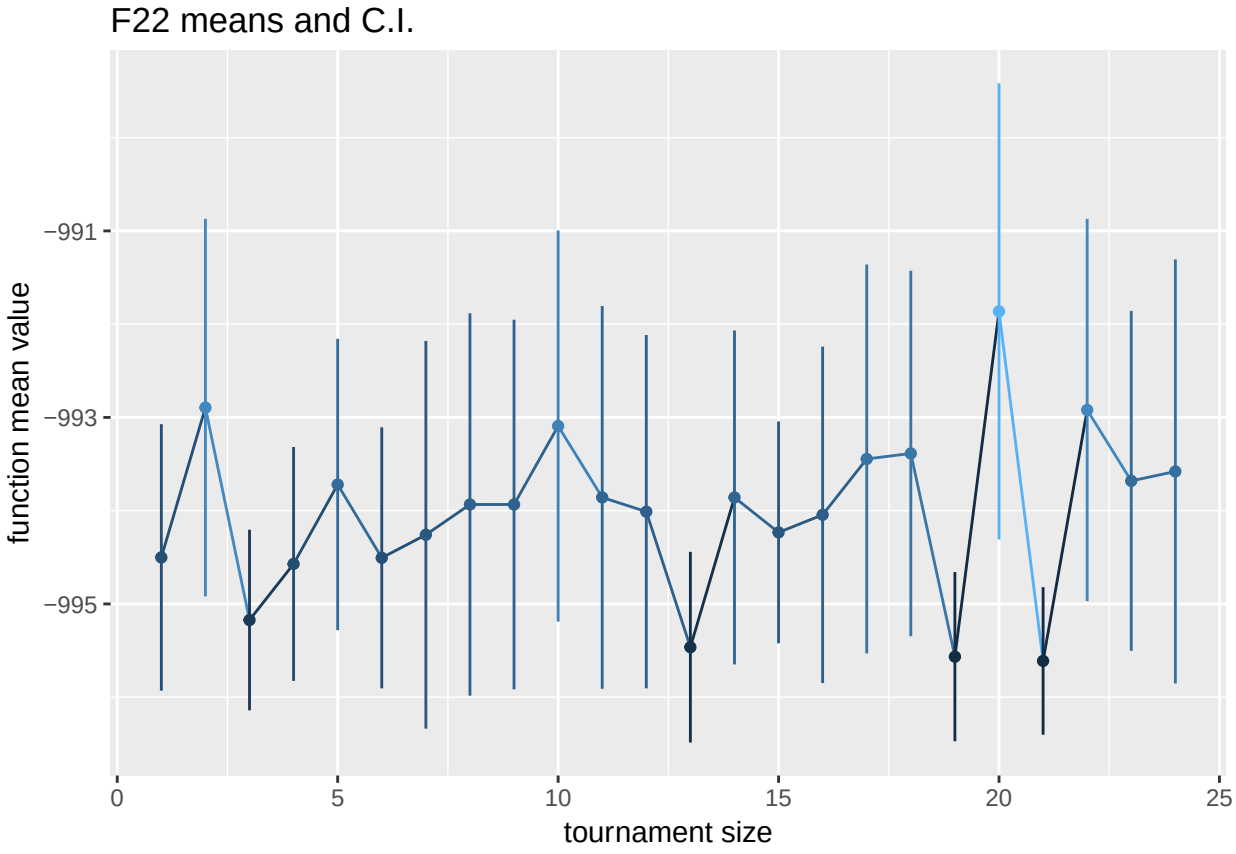

F20 means and std
function mean value
−530
−540
−550
0
5
10
15
20
25
tournament size

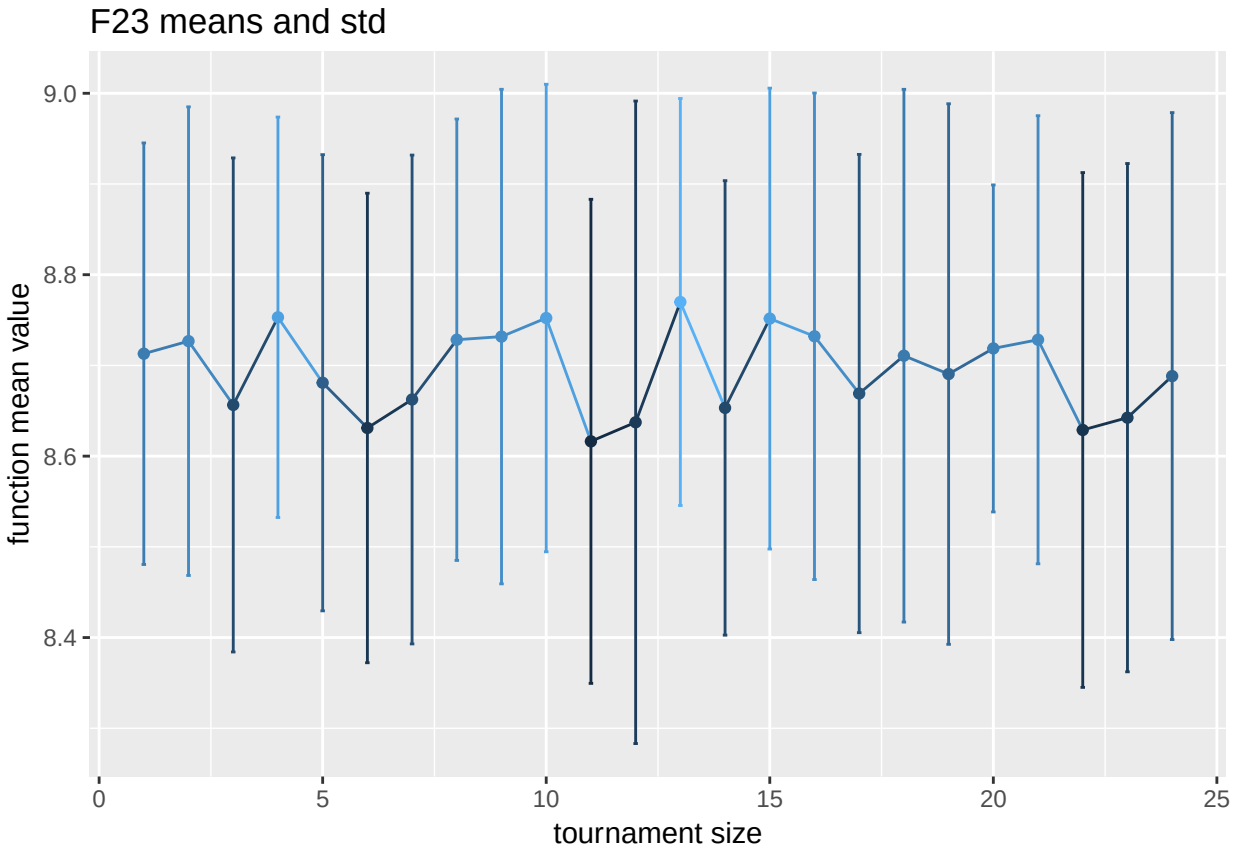

F20 means and C.I.
function mean value
−536
−538
−540
−542
−544
−546
0
5
10
15
20
25
tournament size

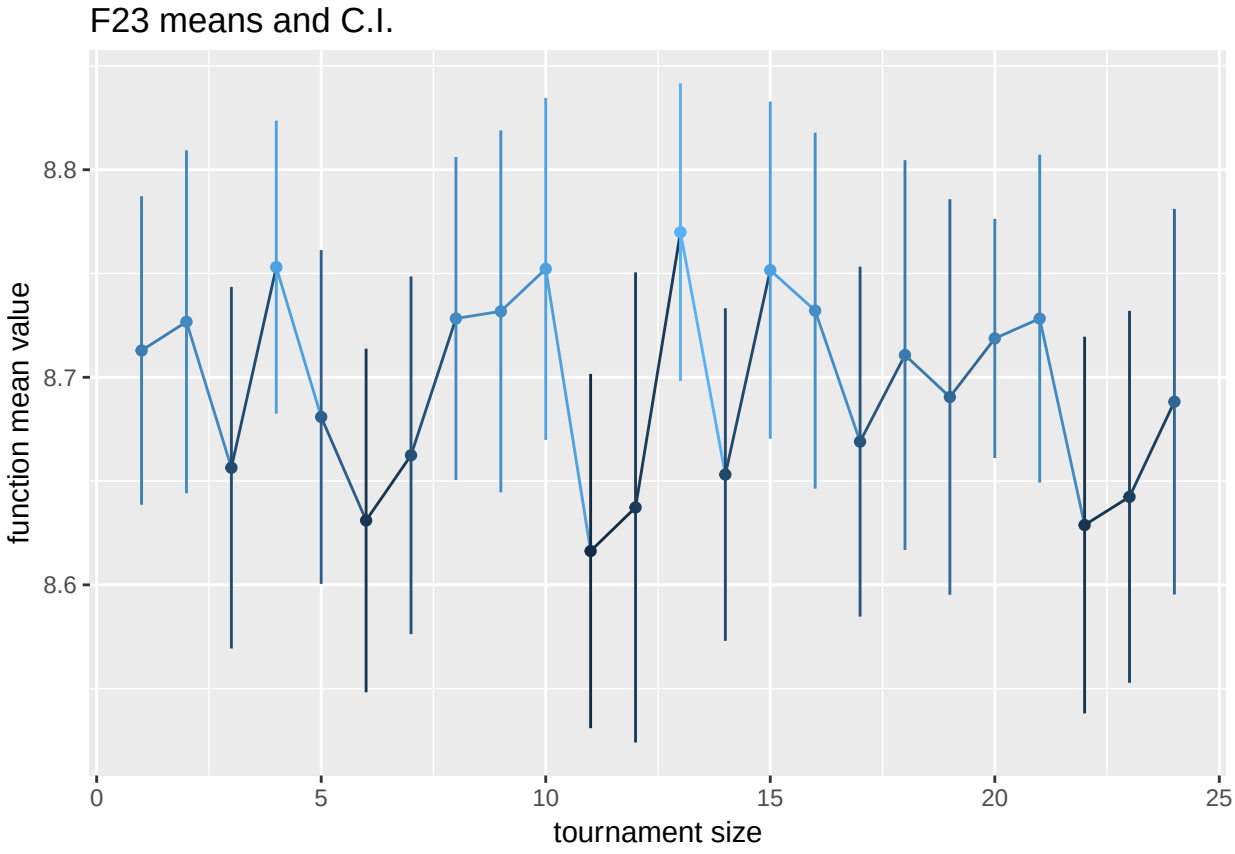

F21 means and std
function mean value
50
45
40
0
5
10
15
20
25
tournament size

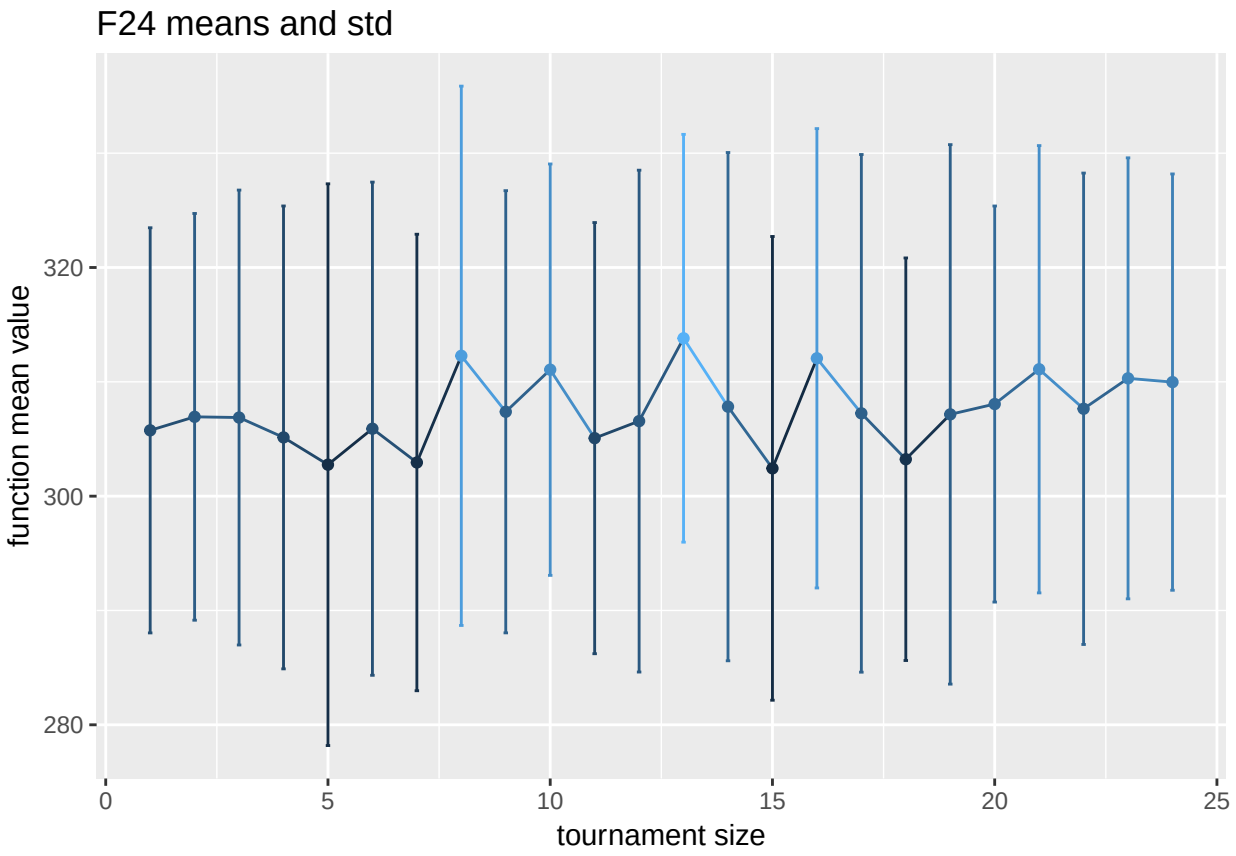

F21 means and C.I.
function mean value
48
46
44
0
5
10
15
20
25
tournament size

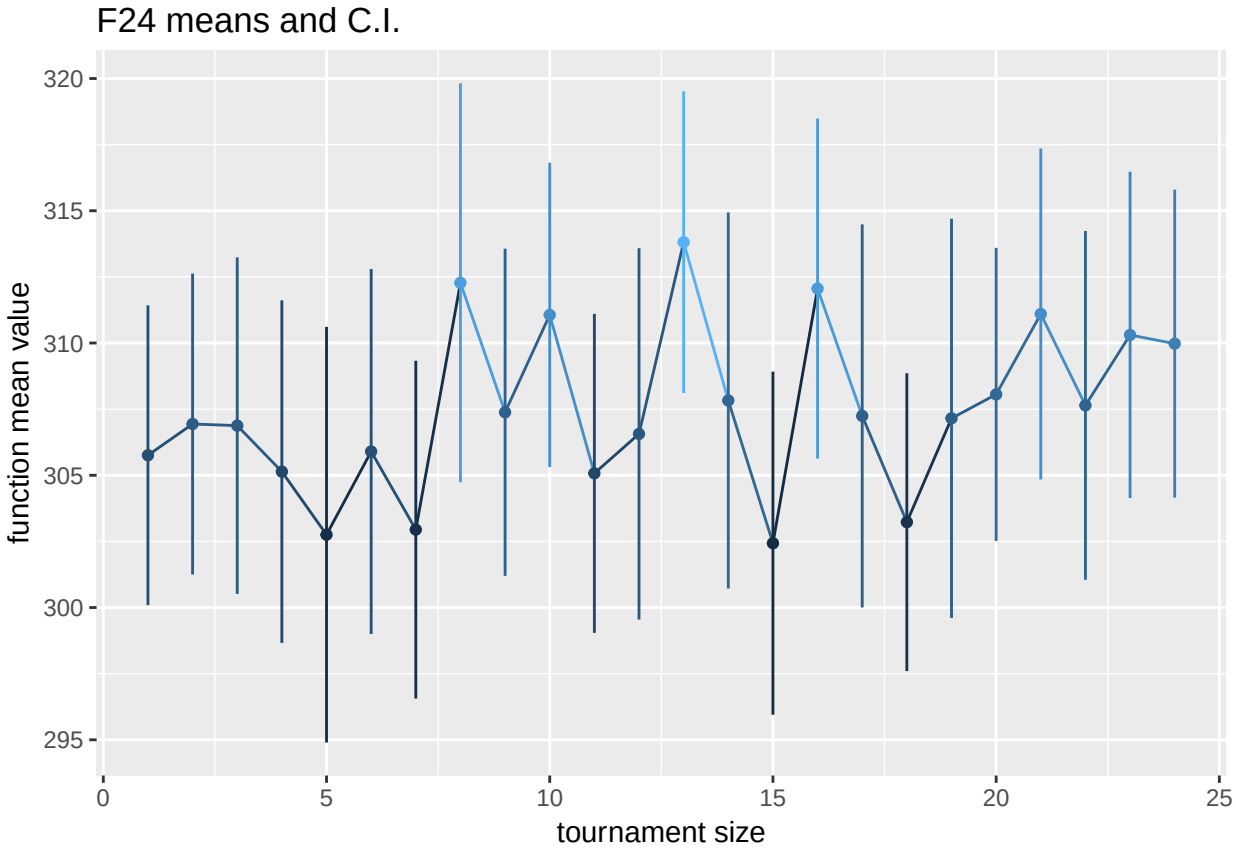

F22 means and std
function mean value
−985
−990
−995
−1000
0
5
10
15
20
25
tournament size


F22 means and C.I.
function mean value
−991
−993
−995
0
5
10
15
20
25
tournament size


F23 means and std
function mean value
9.0
8.8
8.6
8.4
0
5
10
15
20
25
tournament size

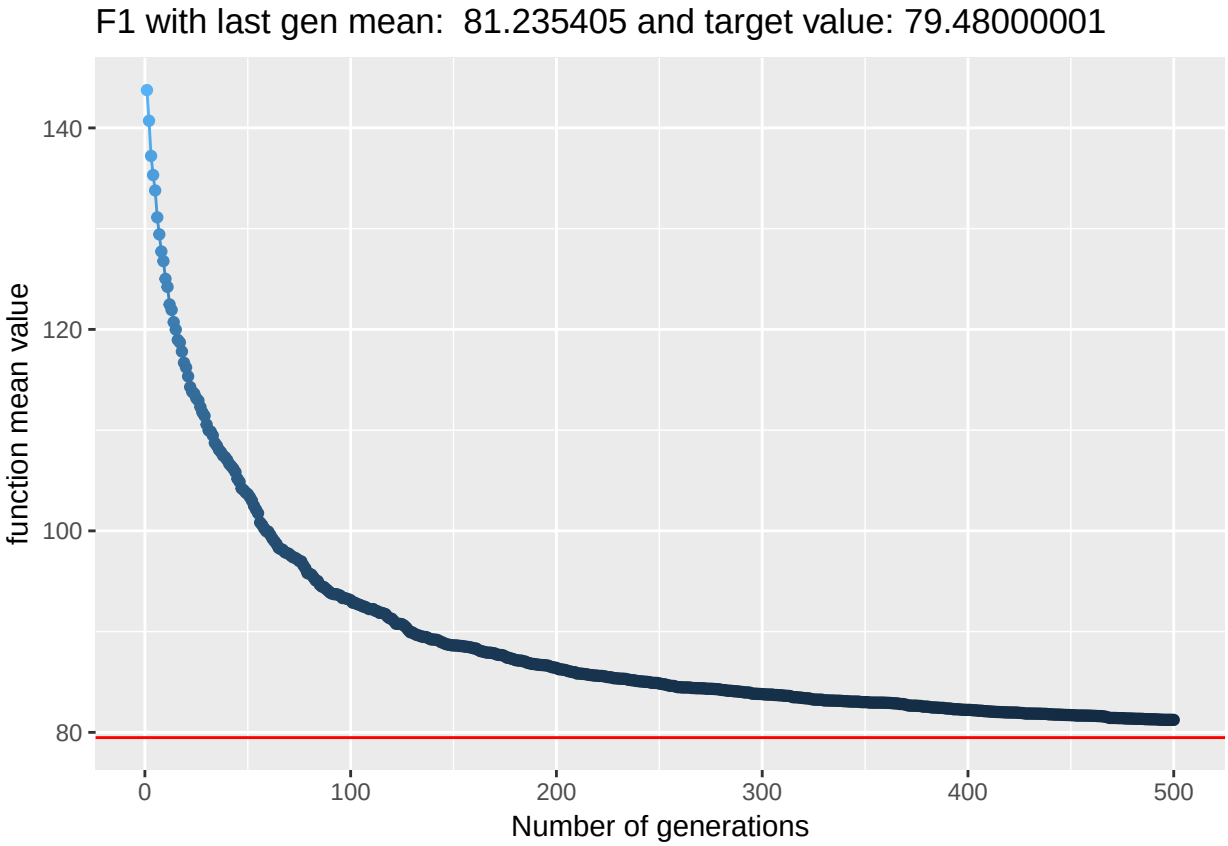

F23 means and C.I.
function mean value
8.8
8.7
8.6
0
5
10
15
20
25
tournament size

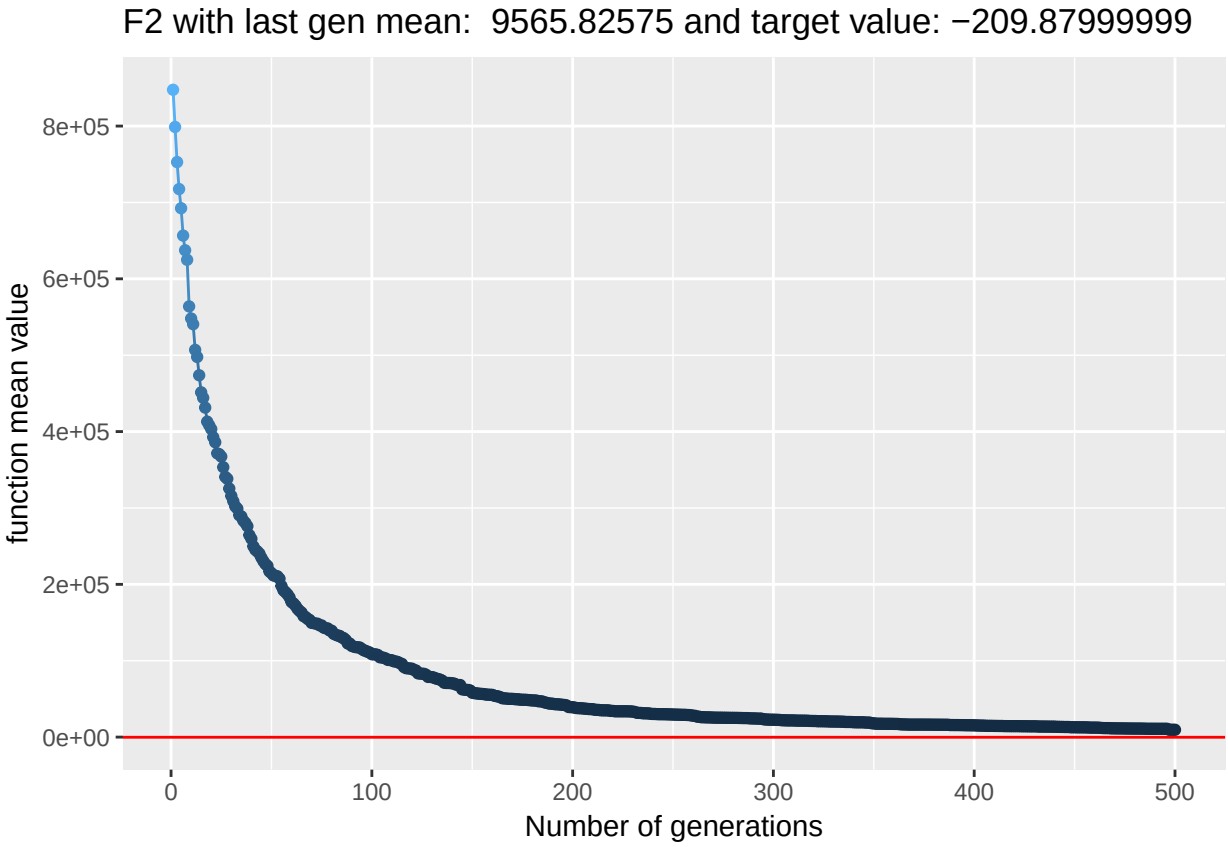

F24 means and std
function mean value
320
300
280
0
5
10
15
20
25
tournament size

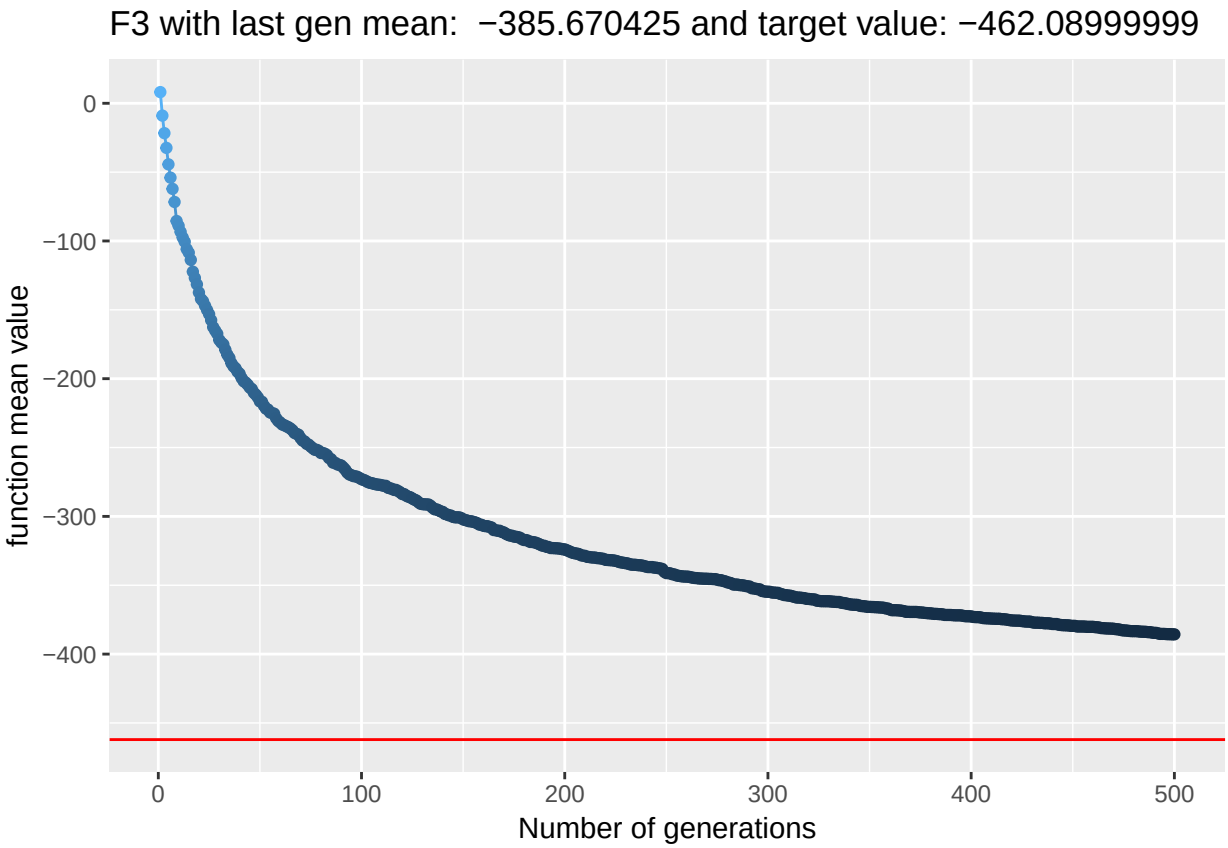

F24 means and C.I.
function mean value
320
315
310
305
300
295
0
5
10
15
20
25
tournament size

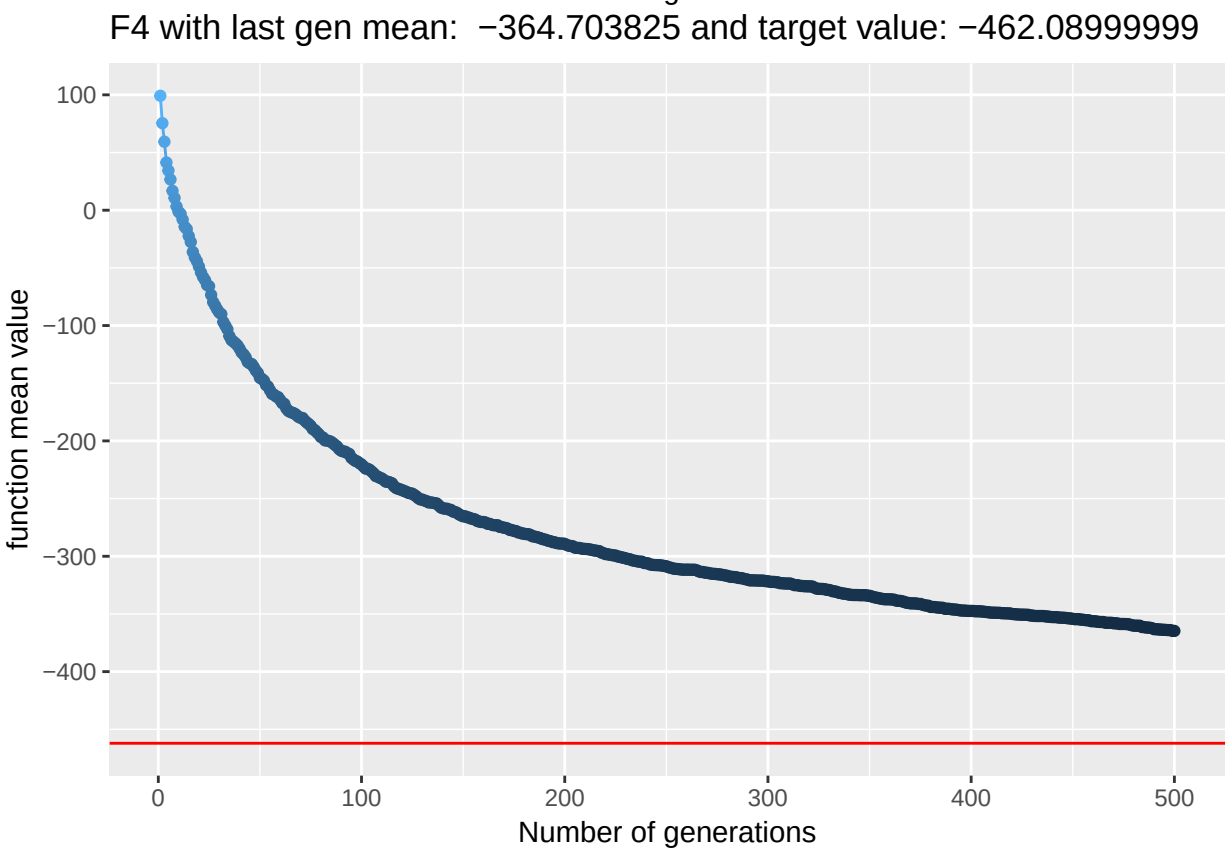
Convergency Plots

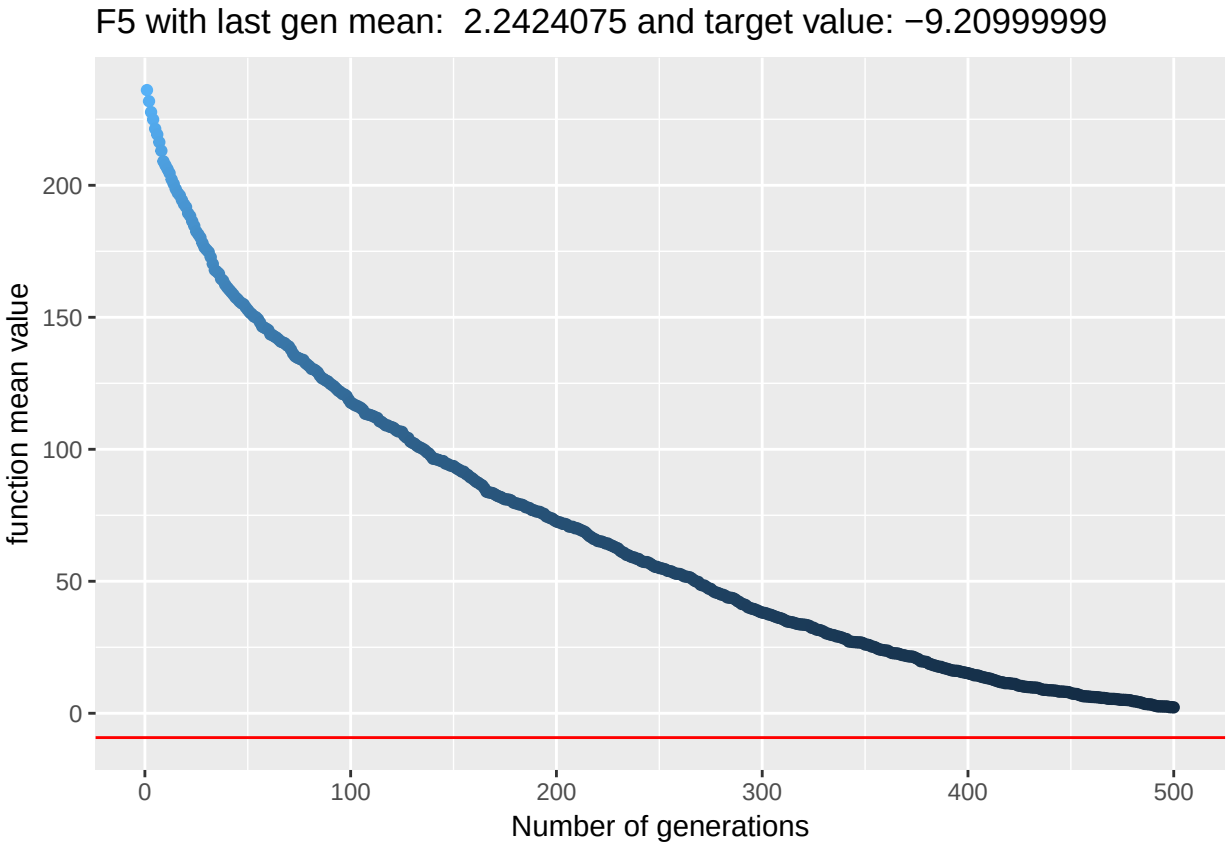
Based on the best values for K, from plots of the last section, we made the convergency plots. Not all k values are represented because the plot are basically the same. Also the std was omitted, because in some plots the difference betwen the std and the mean is very big. In those cases, it was difficult to see any convergency (the line was almost a straight line).

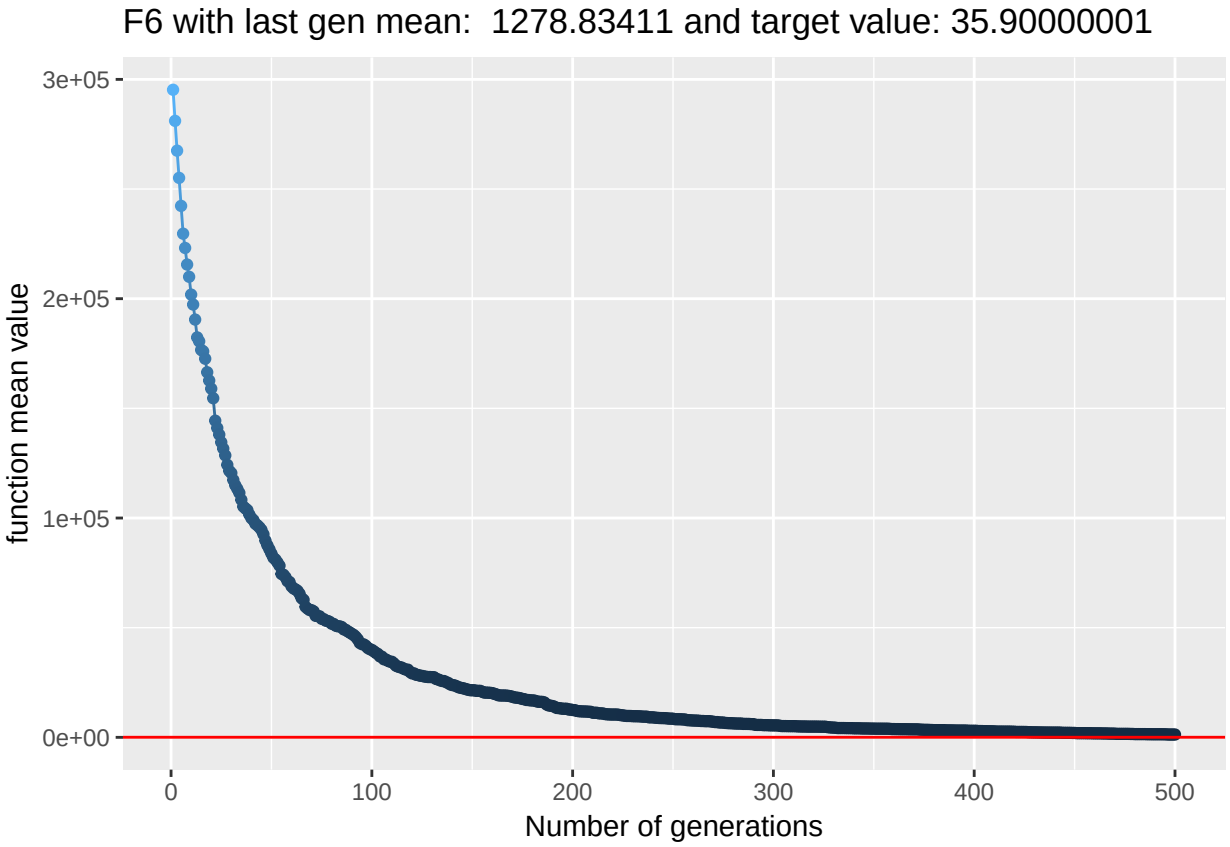

F1 with last gen mean: 81.235405 and target value: 79.48000001
function mean value
140
120
100
80
0
100
200
300
400
500
Number of generations

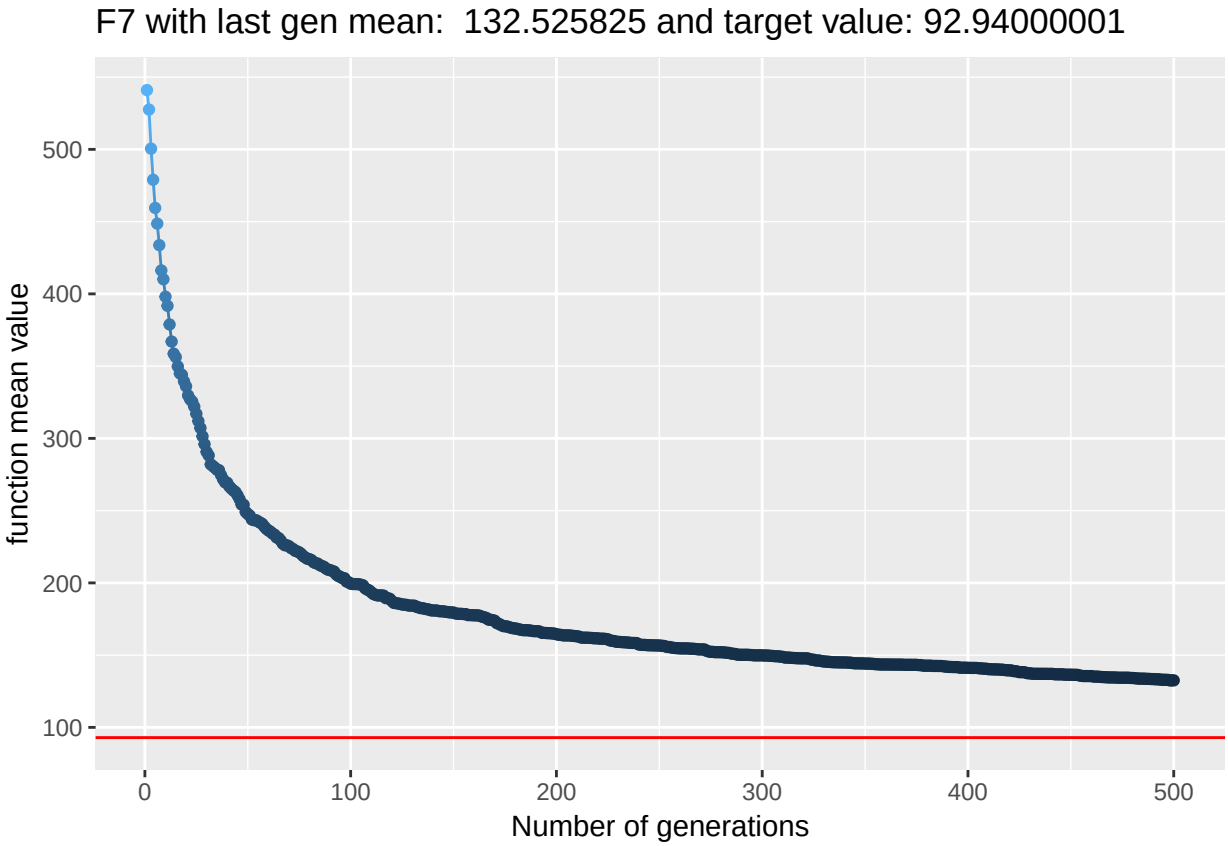

F2 with last gen mean: 9565.82575 and target value: −209.87999999
function mean value
8e+05
6e+05
4e+05
2e+05
0e+00
0
100
200
300
400
500
Number of generations

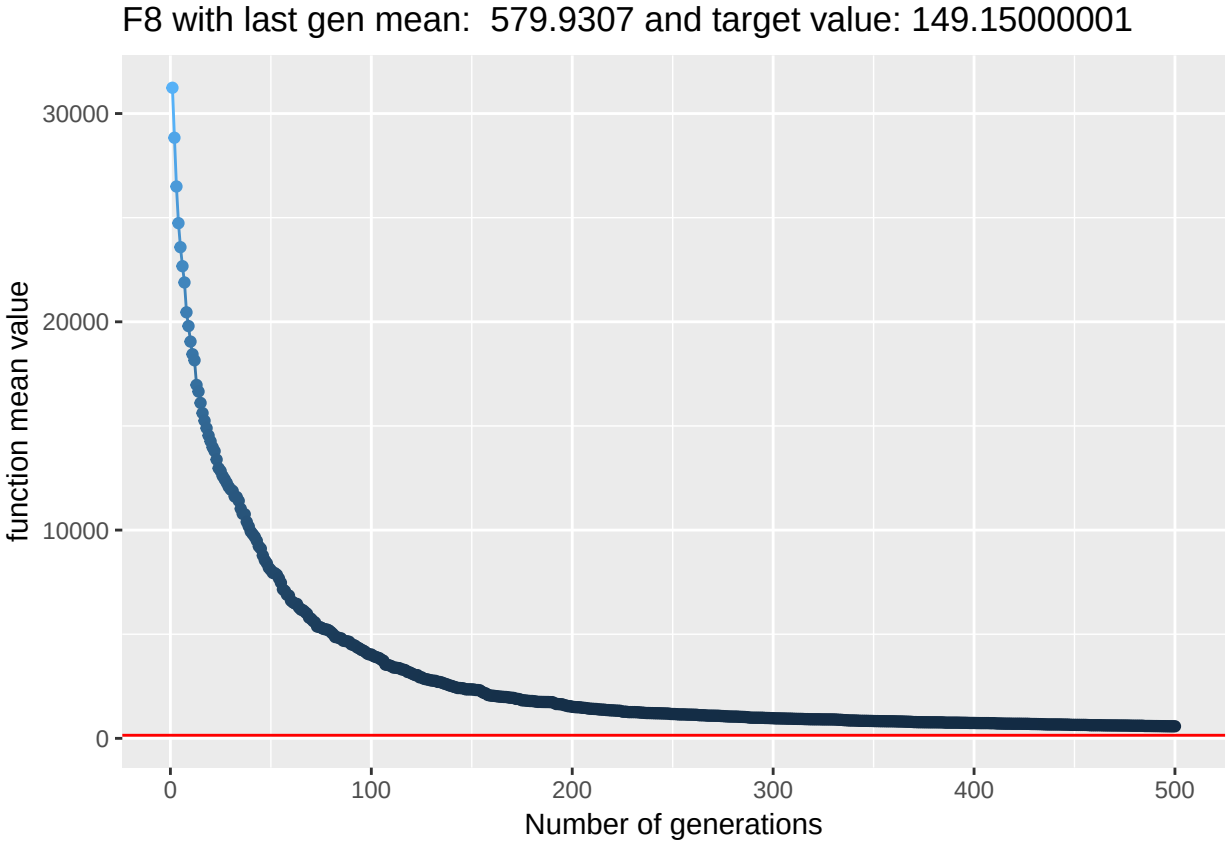

F3 with last gen mean: −385.670425 and target value: −462.08999999
function mean value
0
−100
−200
−300
−400
0
100
200
300
400
500
Number of generations

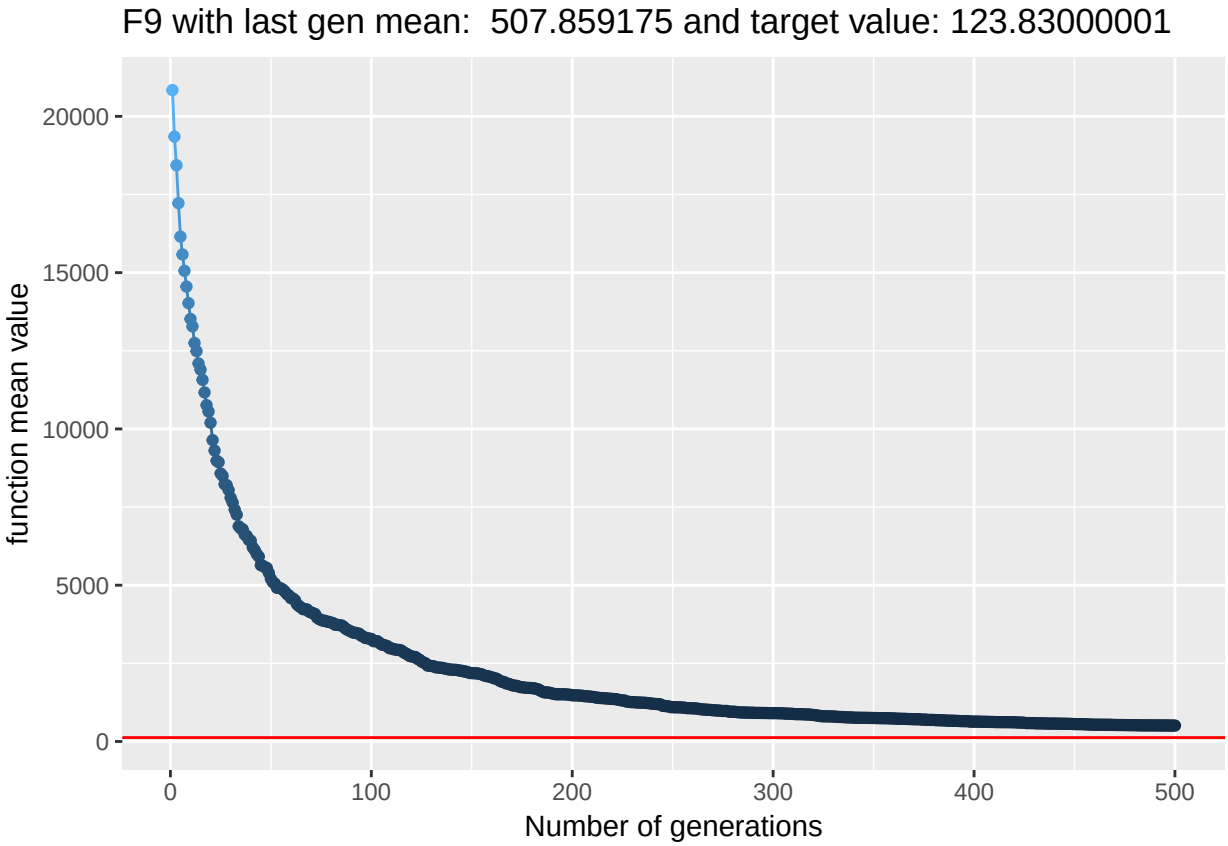

F4 with last gen mean: −364.703825 and target value: −462.08999999
function mean value
100
0
−100
−200
−300
−400
0
100
200
300
400
500
Number of generations

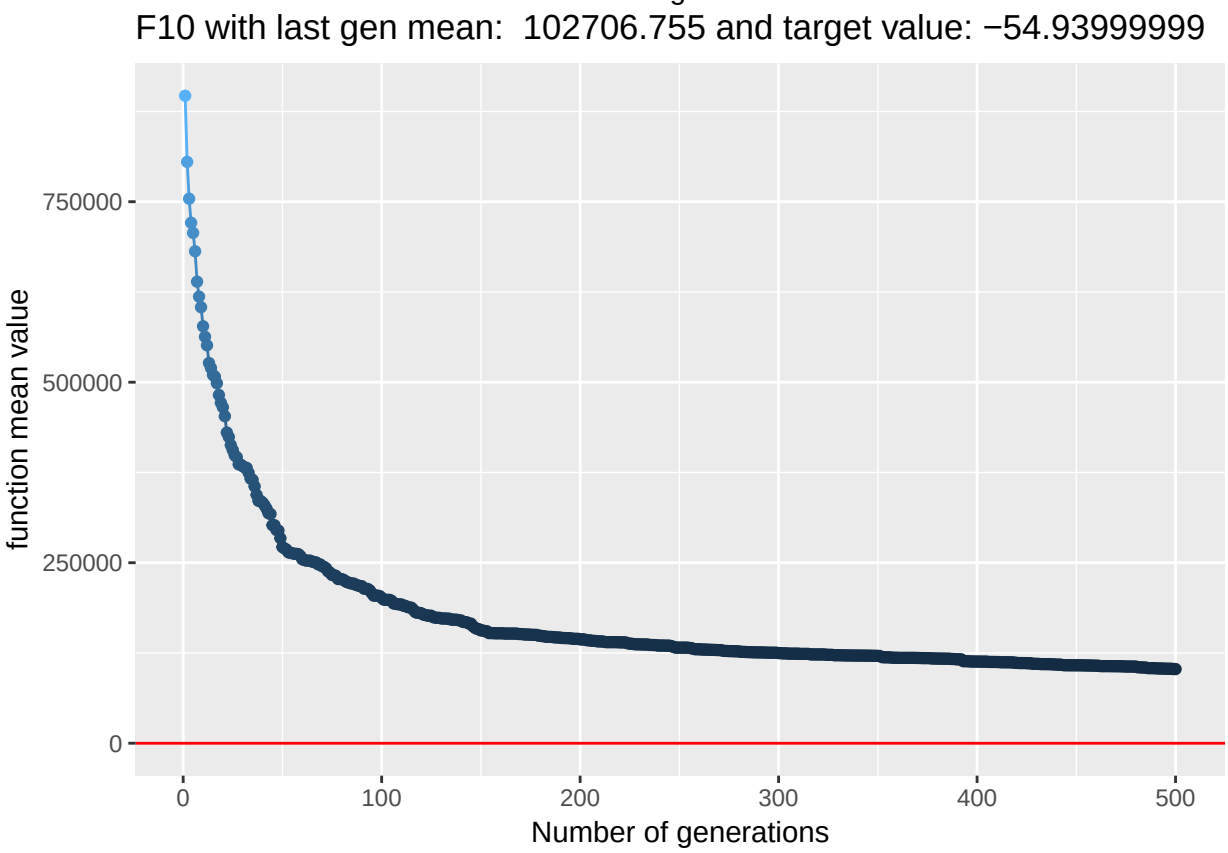

F5 with last gen mean: 2.2424075 and target value: −9.20999999
function mean value
200
150
100
50
0
0
100
200
300
400
500
Number of generations

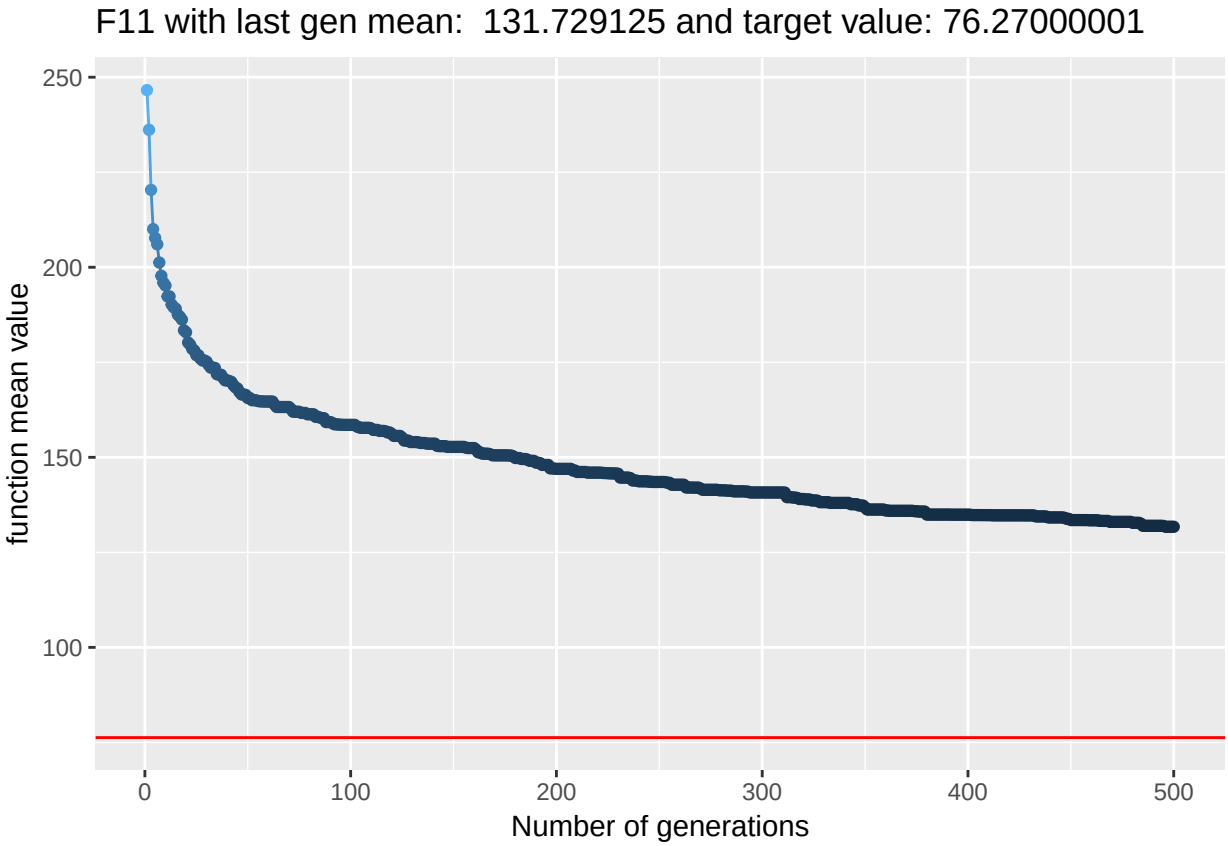

F6 with last gen mean: 1278.83411 and target value: 35.90000001
function mean value
3e+05
2e+05
1e+05
0e+00
0
100
200
300
400
500
Number of generations

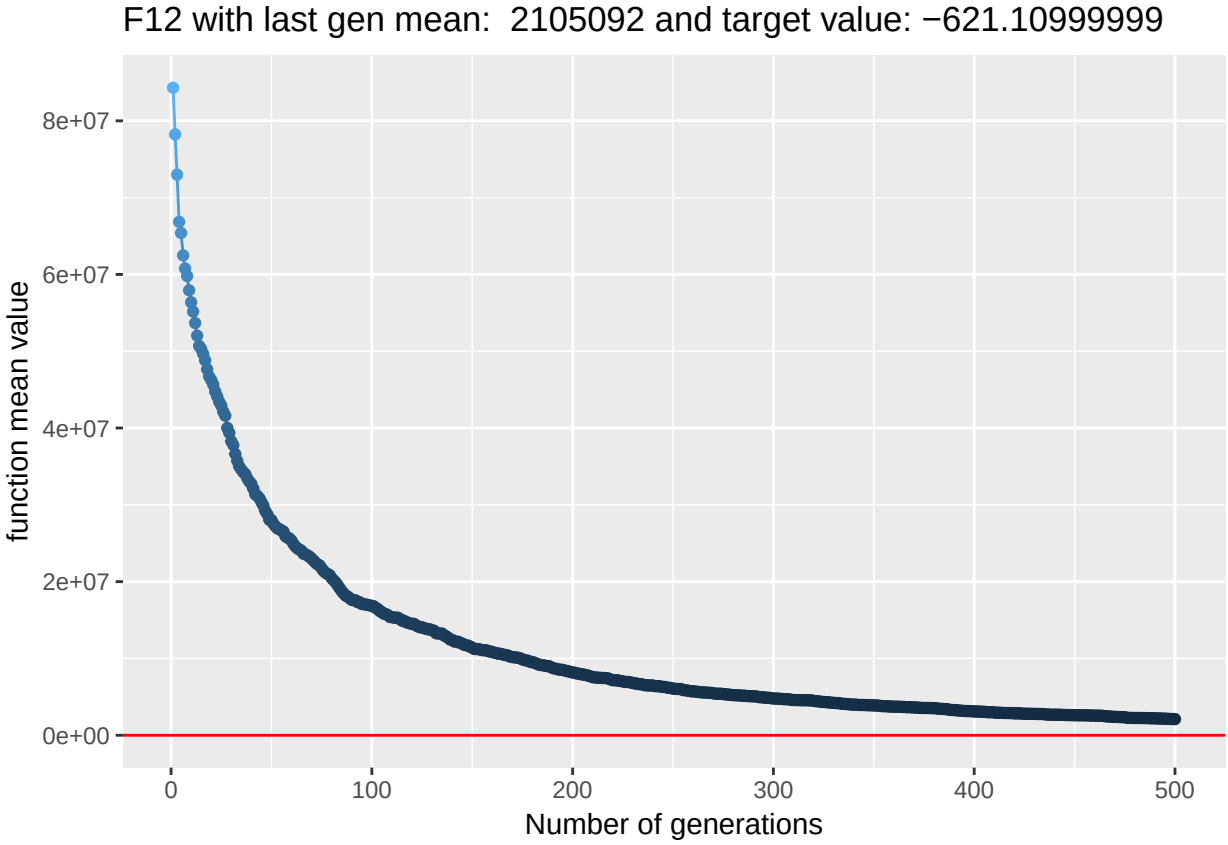

F7 with last gen mean: 132.525825 and target value: 92.94000001
function mean value
500
400
300
200
100
0
100
200
300
400
500
Number of generations

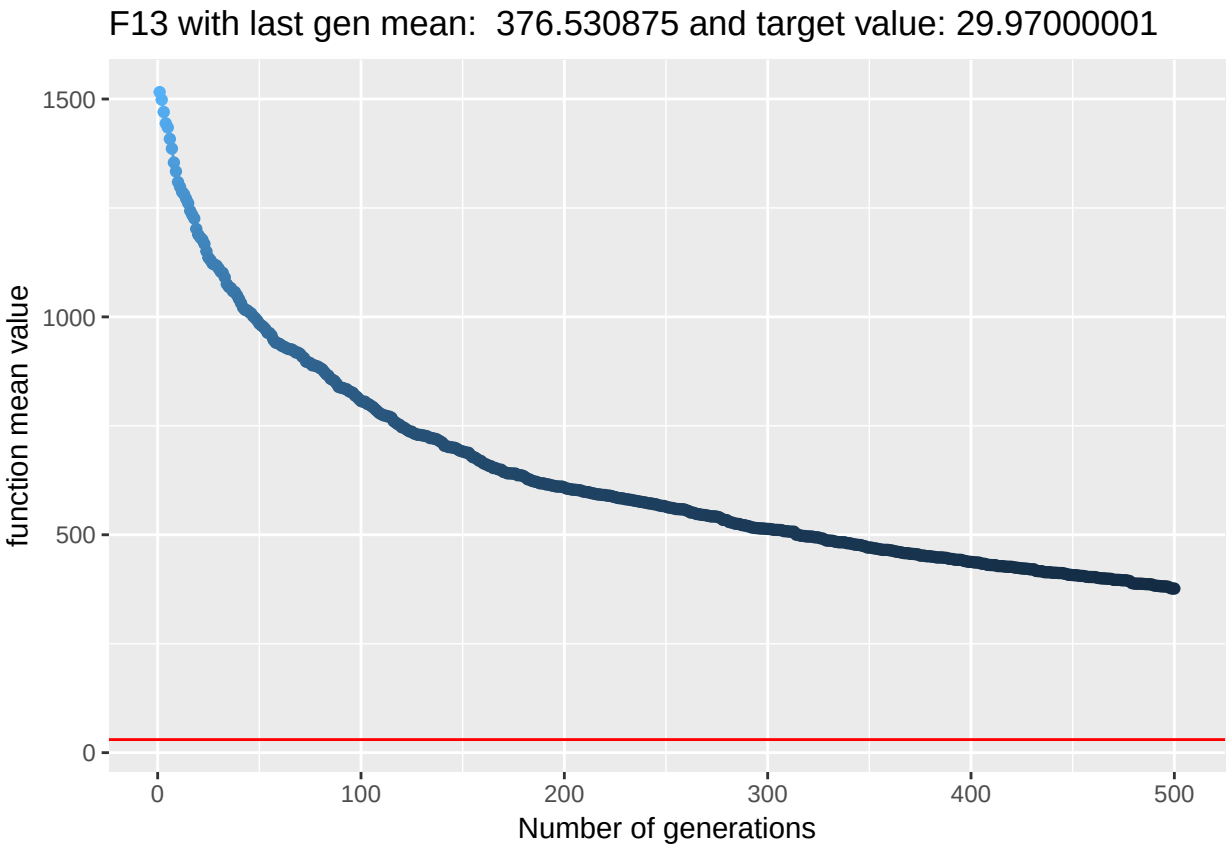

F8 with last gen mean: 579.9307 and target value: 149.15000001
function mean value
30000
20000
10000
0
0
100
200
300
400
500
Number of generations

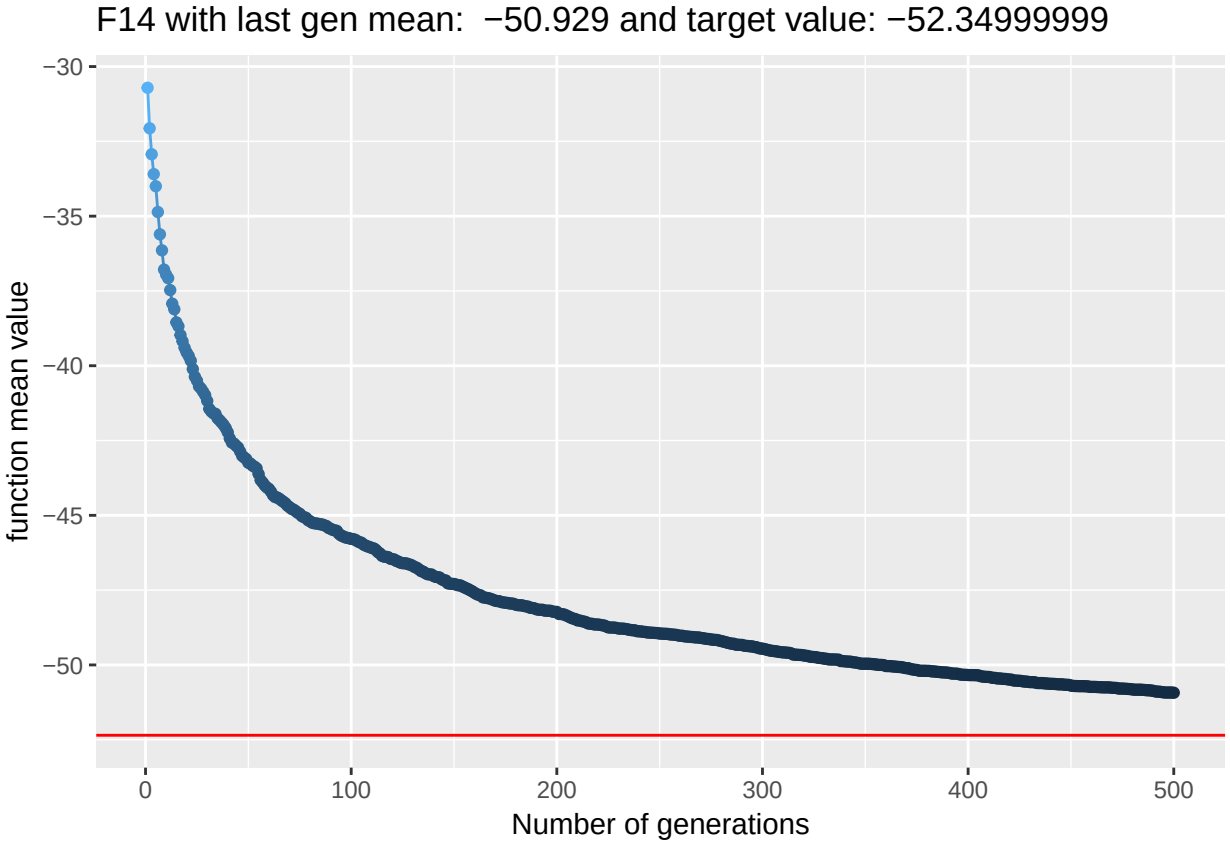

F9 with last gen mean: 507.859175 and target value: 123.83000001
function mean value
20000
15000
10000
5000
0
0
100
200
300
400
500
Number of generations

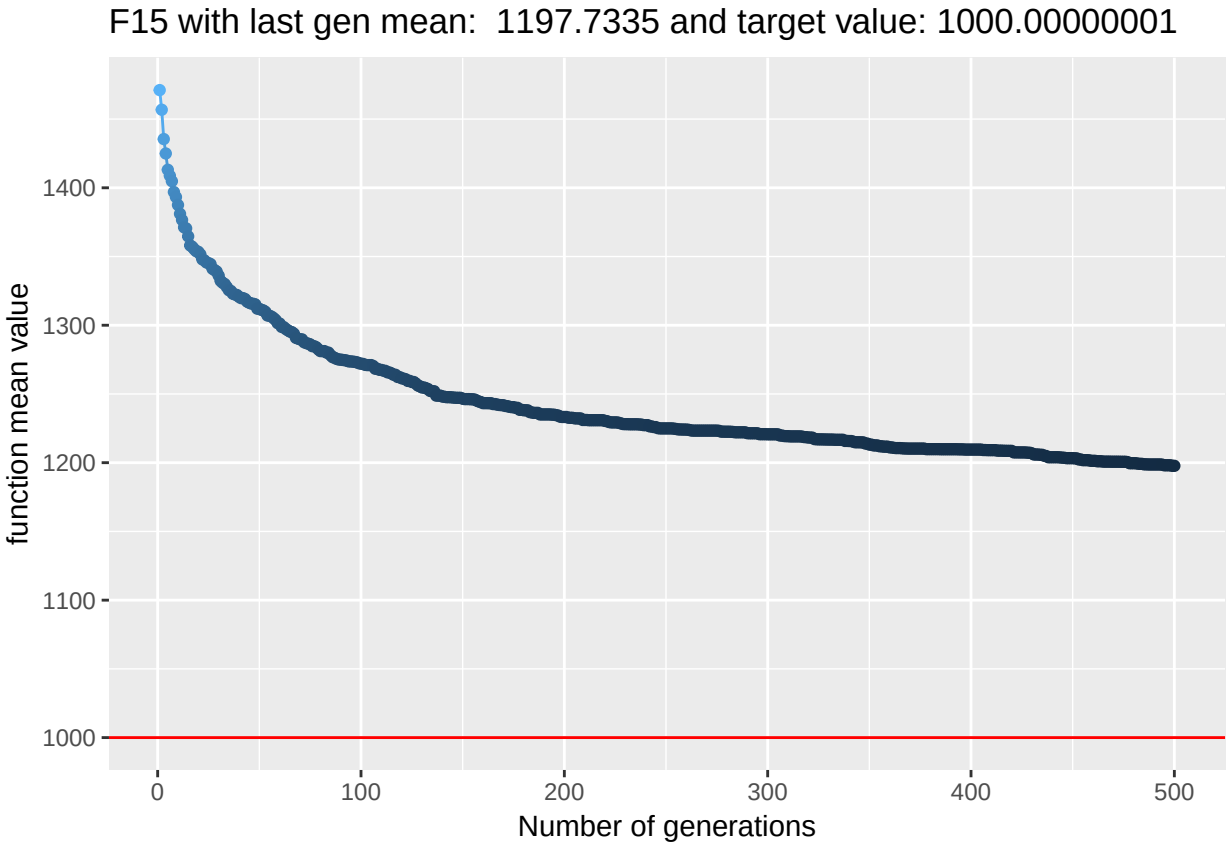

F10 with last gen mean: 102706.755 and target value: −54.93999999
function mean value
750000
500000
250000
0
0
100
200
300
400
500
Number of generations

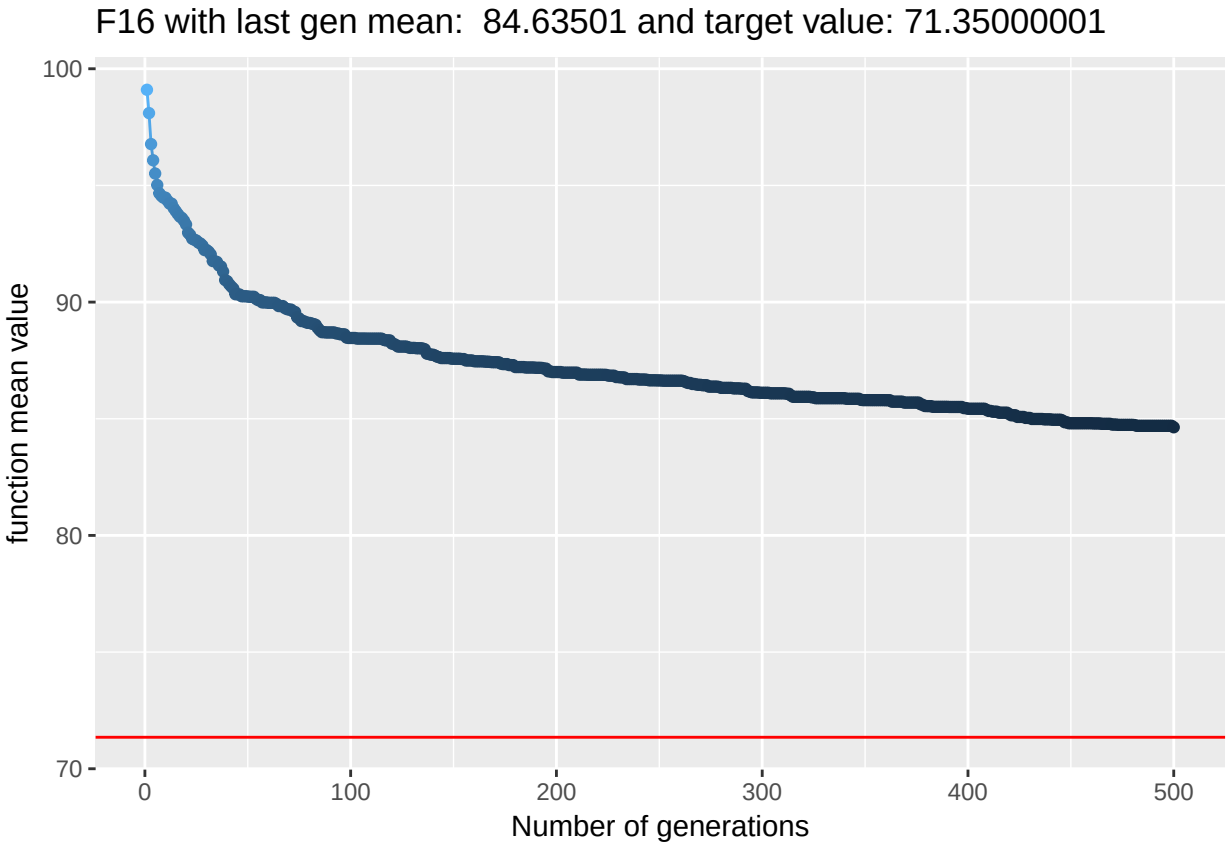

F11 with last gen mean: 131.729125 and target value: 76.27000001
250
200
150
100
function mean value
0
100
200
300
400
500
Number of generations


F12 with last gen mean: 2105092 and target value: −621.10999999
8e+07
6e+07
4e+07
2e+07
0e+00
function mean value
0
100
200
300
400
500
Number of generations

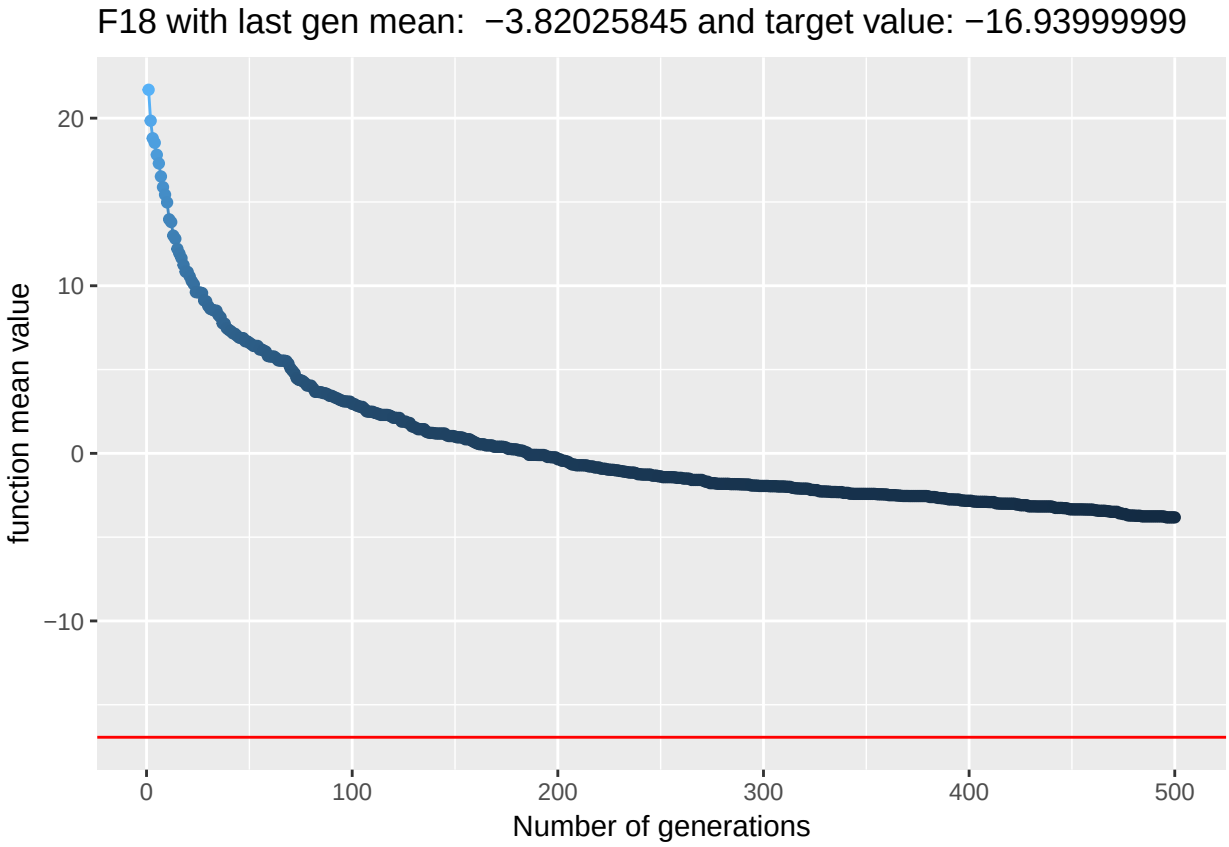

F13 with last gen mean: 376.530875 and target value: 29.97000001
function mean value
1500
1000
500
0
0
100
200
300
400
500
Number of generations

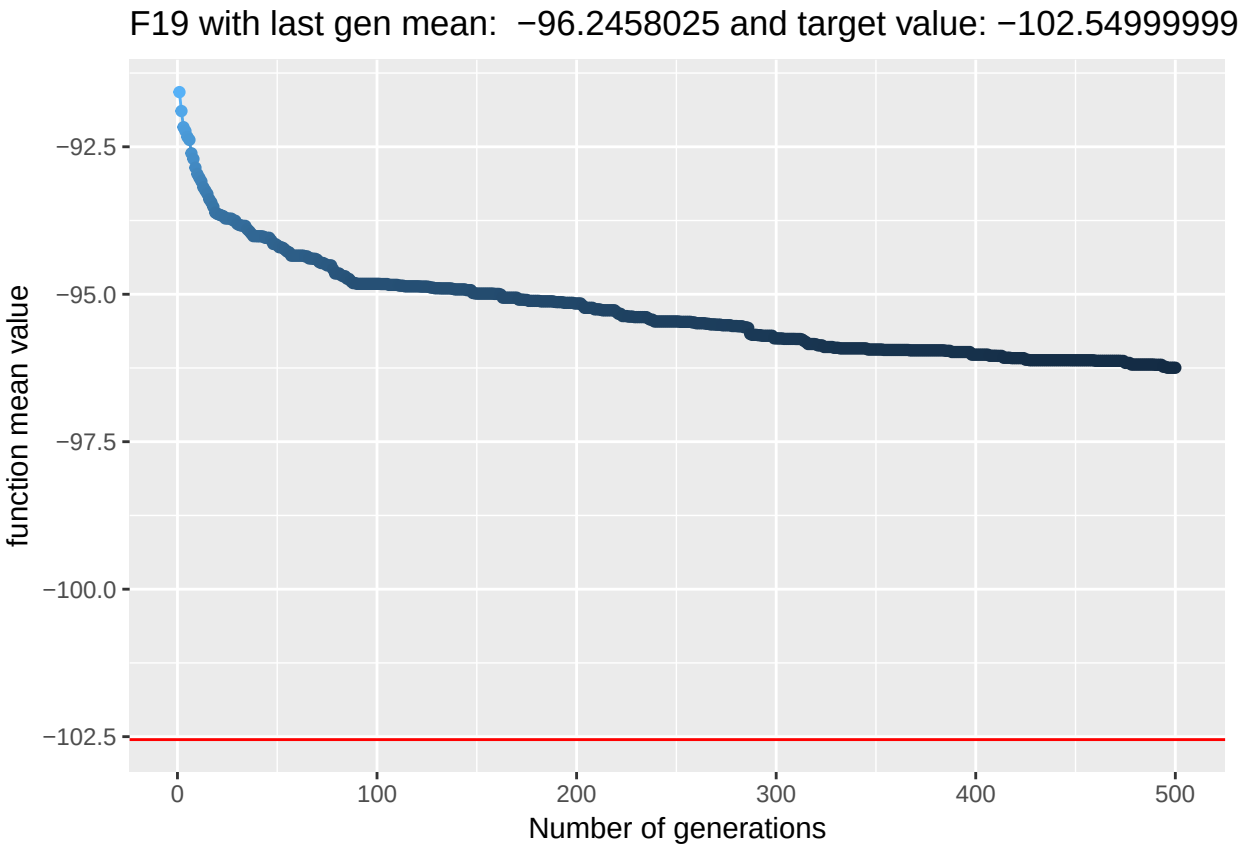

F14 with last gen mean: −50.929 and target value: −52.34999999
function mean value
−30
−35
−40
−45
−50
0
100
200
300
400
500
Number of generations

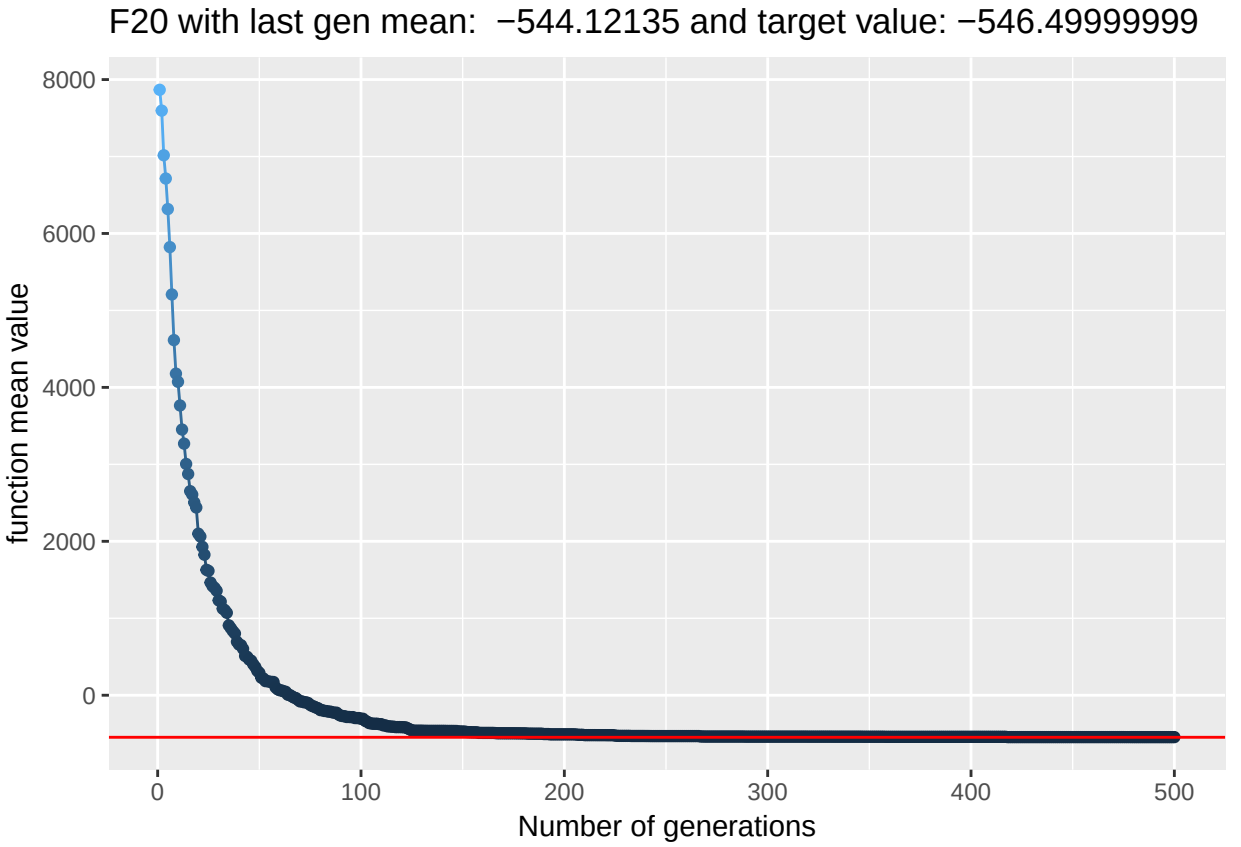

F15 with last gen mean: 1197.7335 and target value: 1000.00000001
function mean value
1400
1300
1200
1100
1000
0
100
200
300
400
500
Number of generations

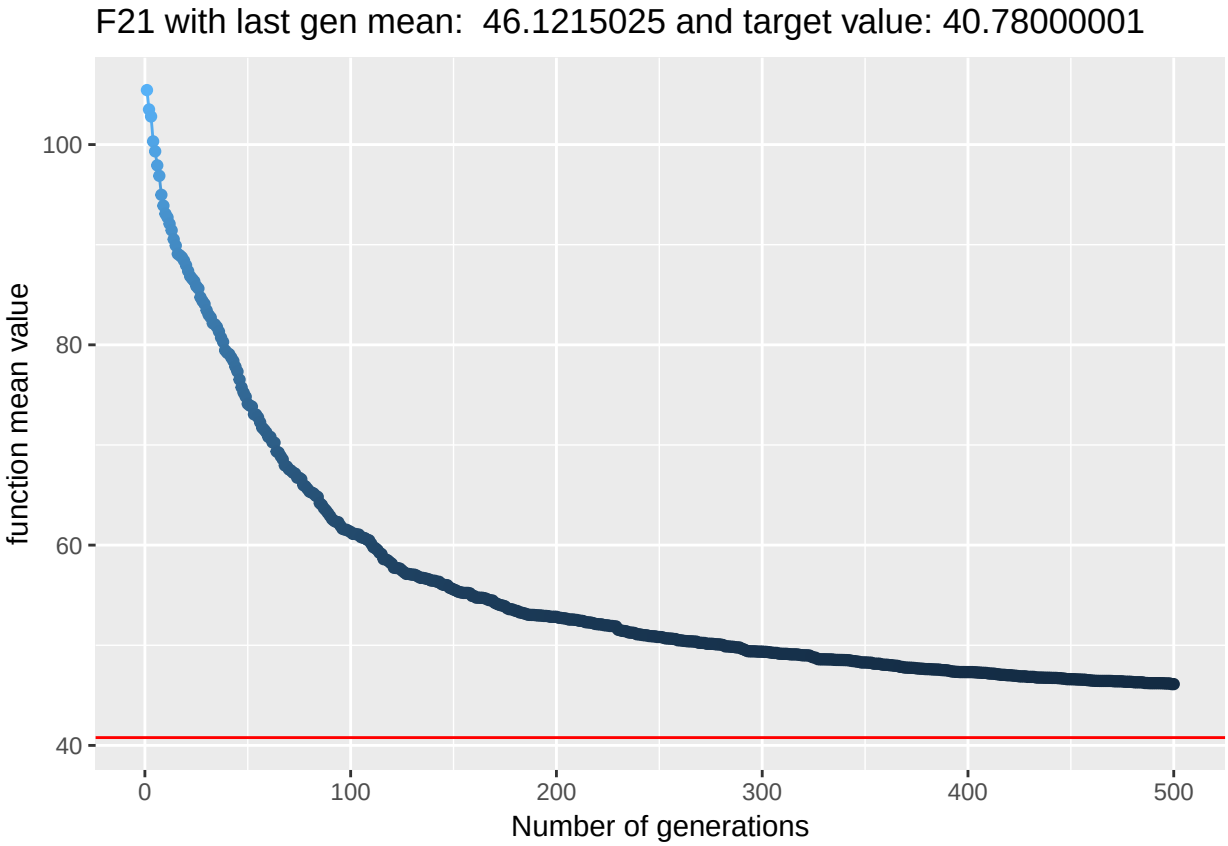

F16 with last gen mean: 84.63501 and target value: 71.35000001
function mean value
100
90
80
70
0
100
200
300
400
500
Number of generations

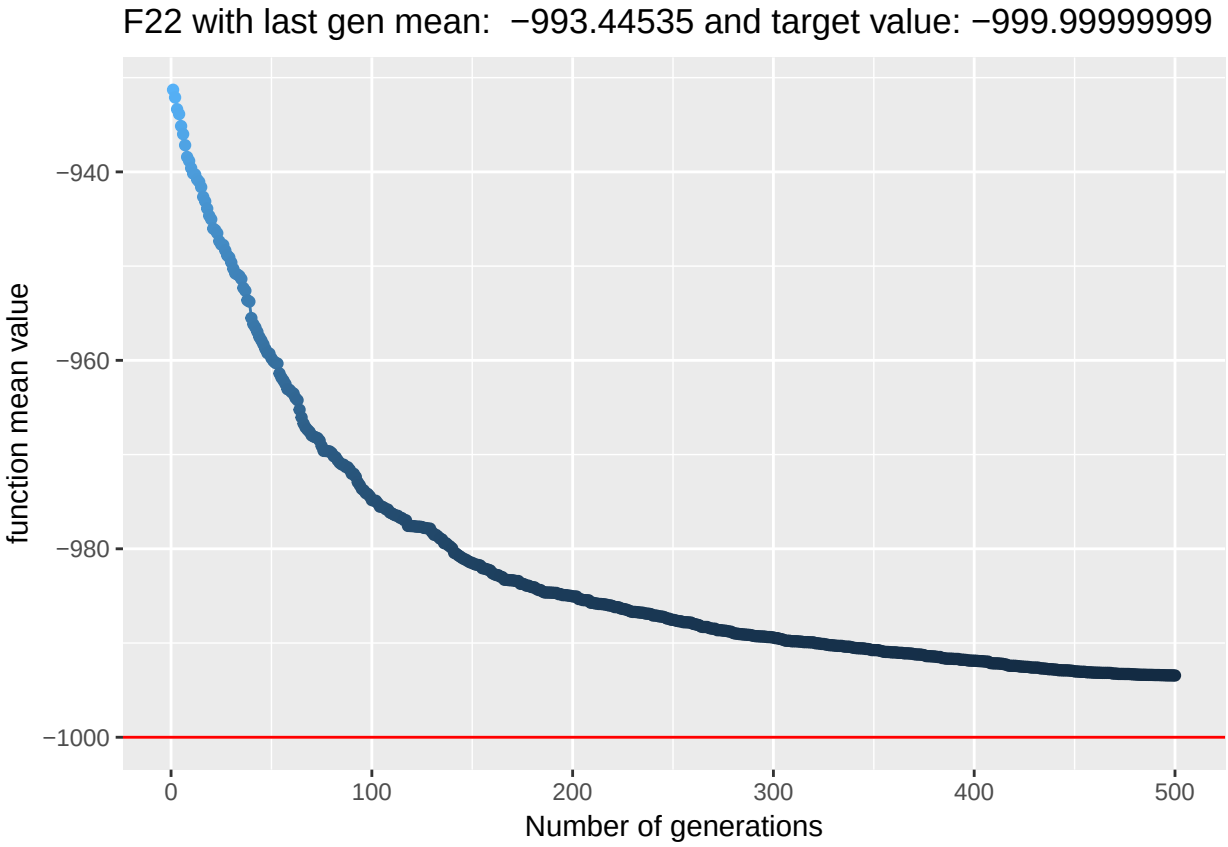

F17 with last gen mean: −13.650825 and target value: −16.93999999
function mean value
−6
−9
−12
−15
0
100
200
300
400
500
Number of generations

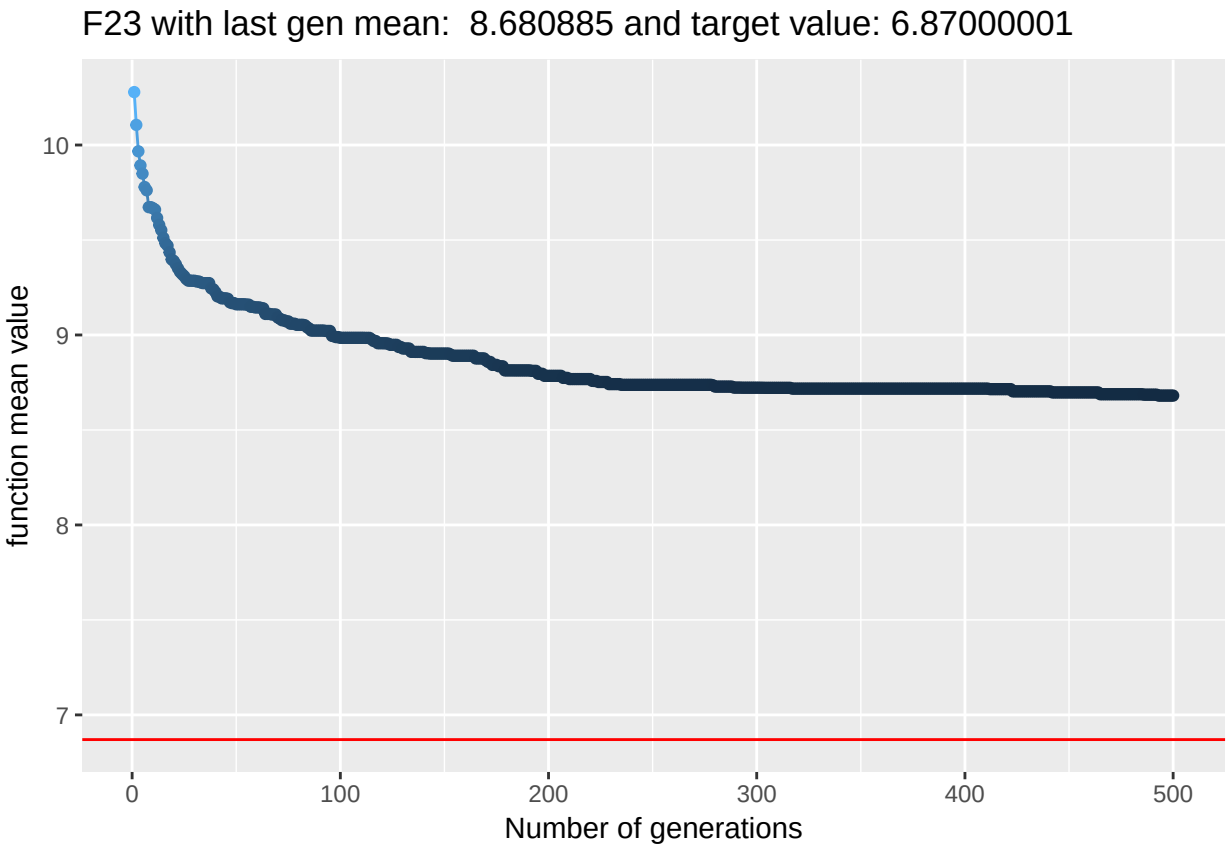

F18 with last gen mean: −3.82025845 and target value: −16.93999999
function mean value
20
10
0
−10
0
100
200
300
400
500
Number of generations

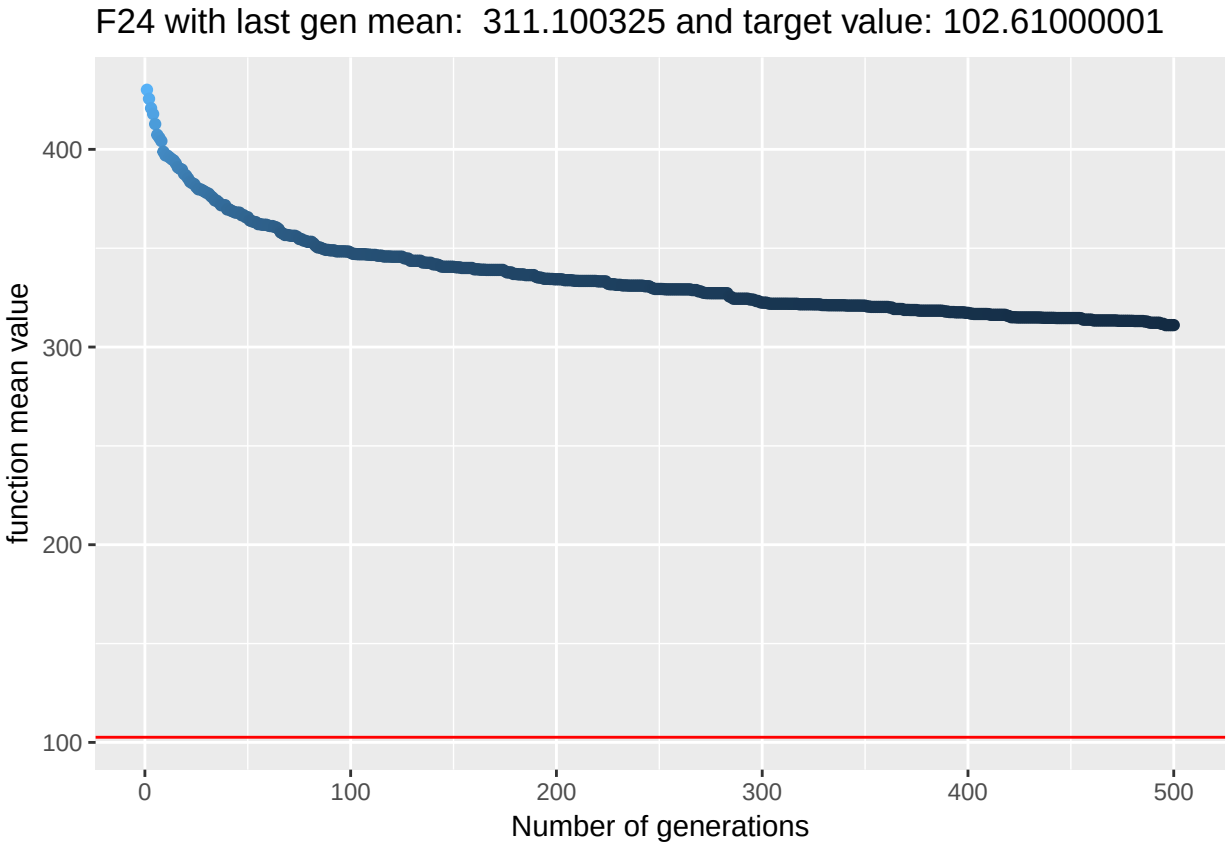

F19 with last gen mean: −96.2458025 and target value: −102.54999999
function mean value
−92.5
−95.0
−97.5
−100.0
−102.5
0
100
200
300
400
500
Number of generations


F20 with last gen mean: −544.12135 and target value: −546.49999999
function mean value
8000
6000
4000
2000
0
0
100
200
300
400
500
Number of generations


F21 with last gen mean: 46.1215025 and target value: 40.78000001
function mean value
100
80
60
40
0
100
200
300
400
500
Number of generations


F22 with last gen mean: −993.44535 and target value: −999.99999999
function mean value
−940
−960
−980
−1000
0
100
200
300
400
500
Number of generations


F23 with last gen mean: 8.680885 and target value: 6.87000001
function mean value
10
9
8
7
0
100
200
300
400
500
Number of generations


F24 with last gen mean: 311.100325 and target value: 102.61000001
function mean value
400
300
200
100
0
100
200
300
400
500
Number of generations