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).

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.

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

Comments

We are experimenting with 40 dimensions. Thats just because I thought that it was harder for a GA, as the earthquake modeling is. I got the idea from Sawyerr et al (Check next paragraph), although they use a much more complex GA (a hybrid one).

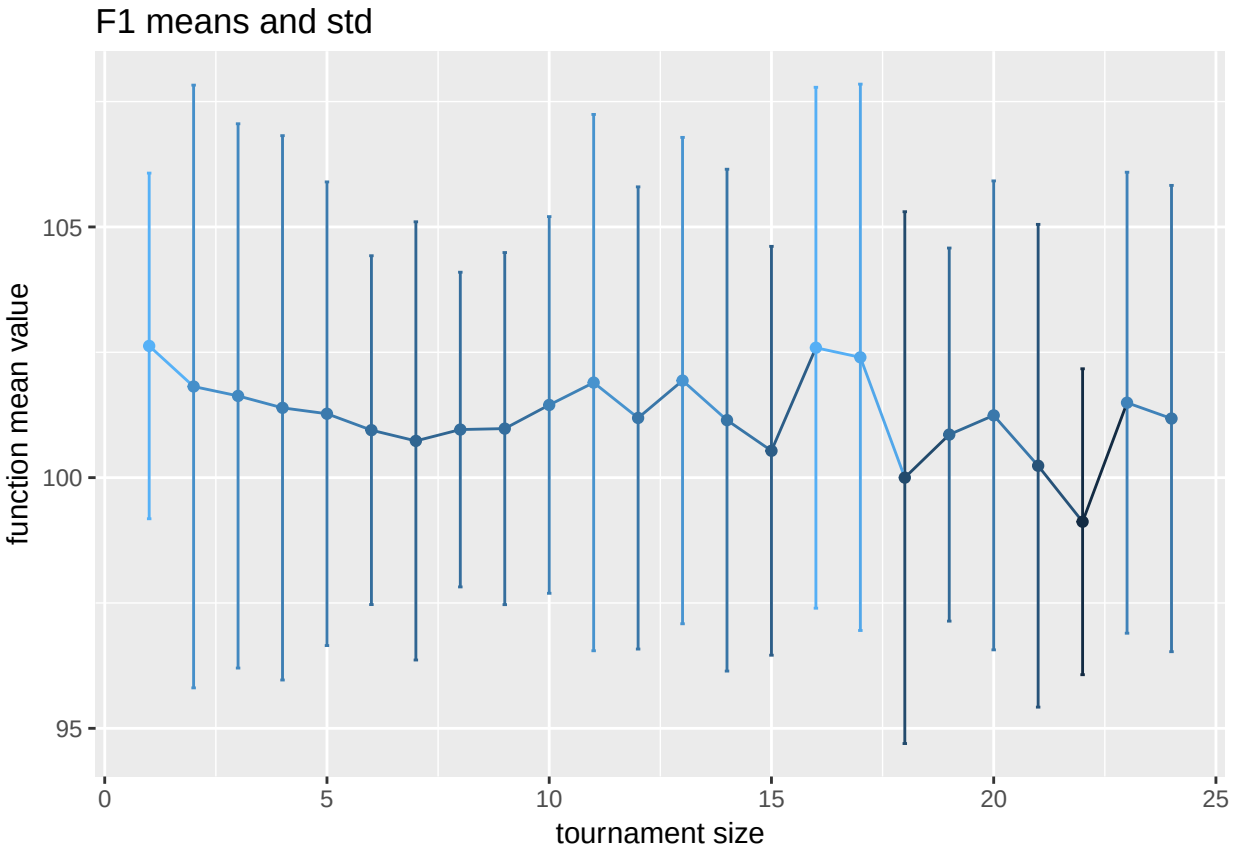
Sawyerr et al concluded that the RCGAu has excelled in solving the f1, f2, f3, f7 and f21, tough for the other functions it achieved avarage results. They also state that real value GA do not efficiently solve highly conditioned problems and studies have currently been carried out to find out why [1].

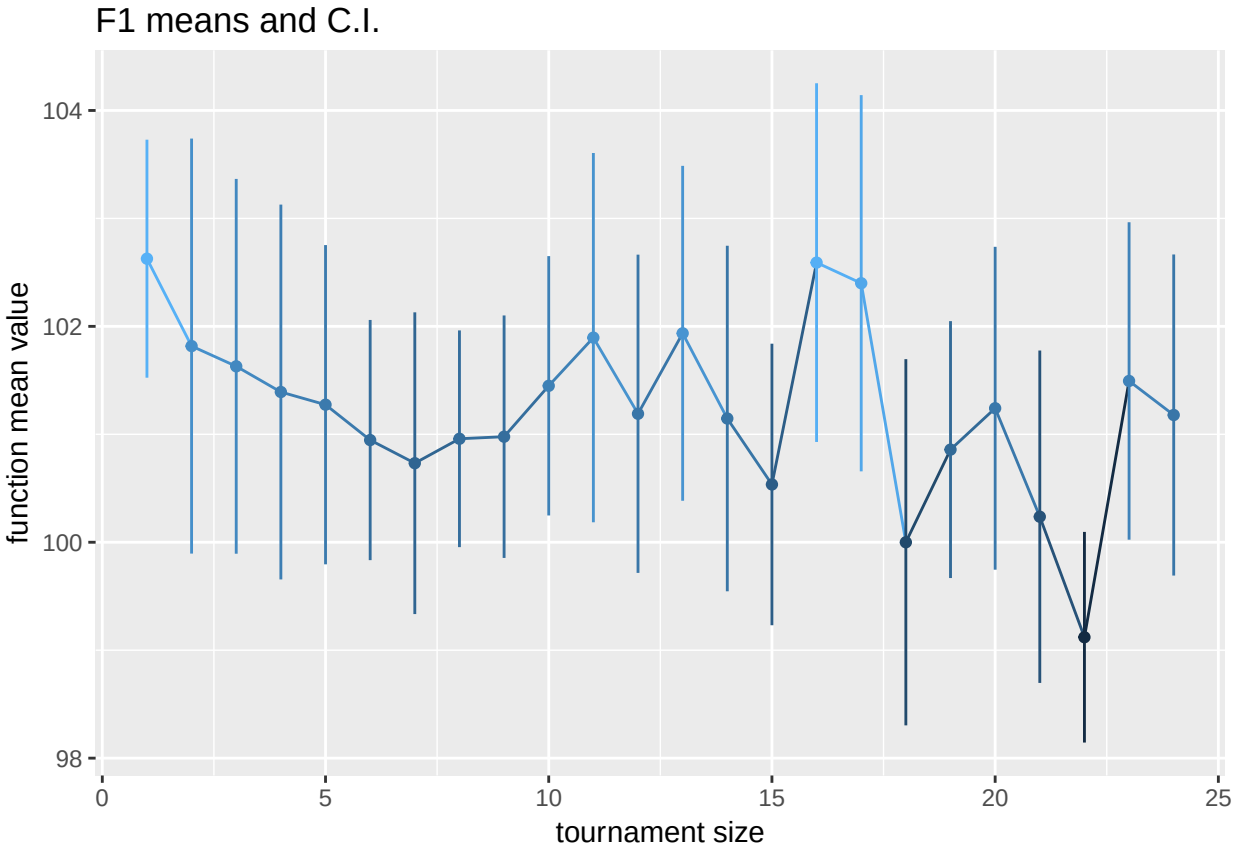
[1] Sawyerr, B.A., Adewumi, A.O., Ali, M.M.: Benchmarking rcgau on the noiseless bbob testbed. The Scientific World Journal 2015 (2015).

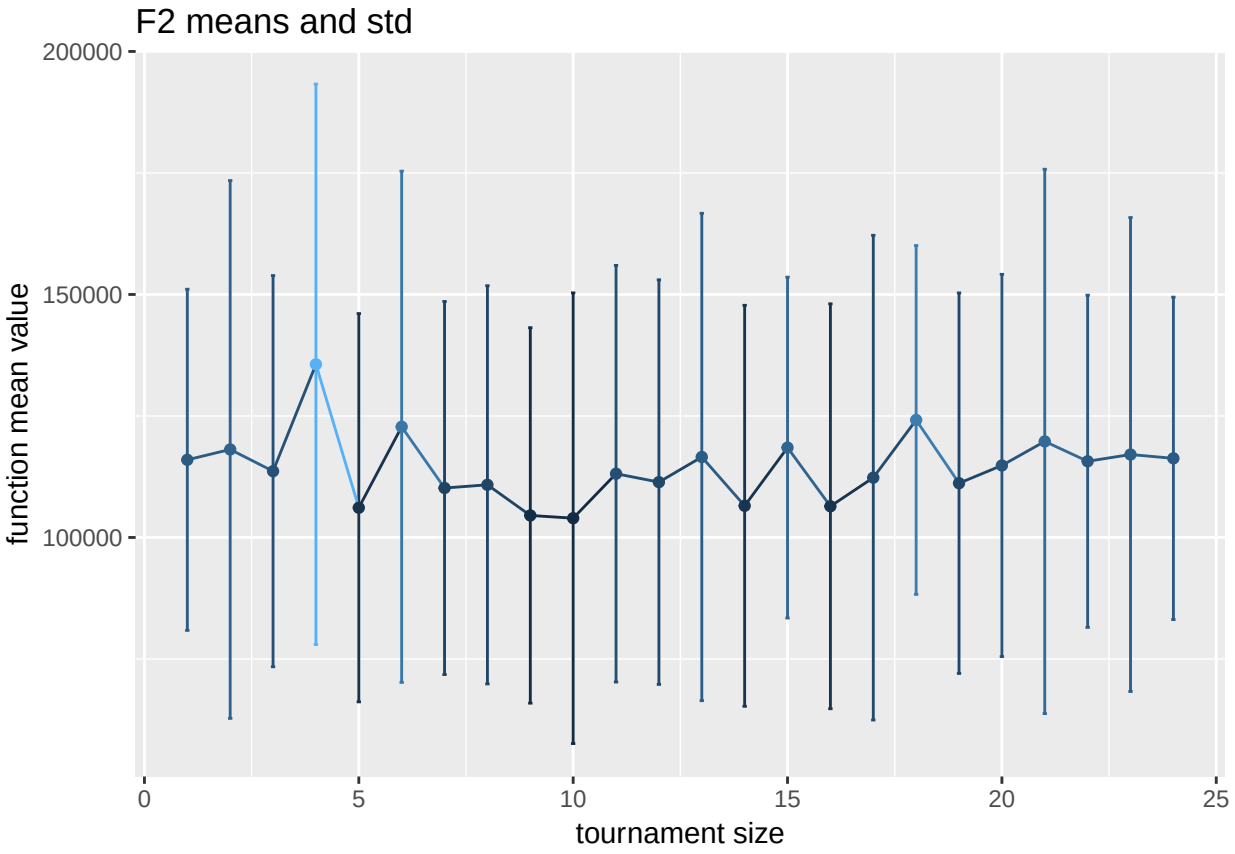
1. Maybe we should change to 20 dimensions or less.
2. Maybe we should do more evaluations, in some cases it looks like the ga for the beanchmark functions did not converge at all.
3. In same cases, I do not think any of this will help. The functions are just too dificult for the GA. Even for hybrid GA, even for the best ones that got published in CEC - COCO conferences.

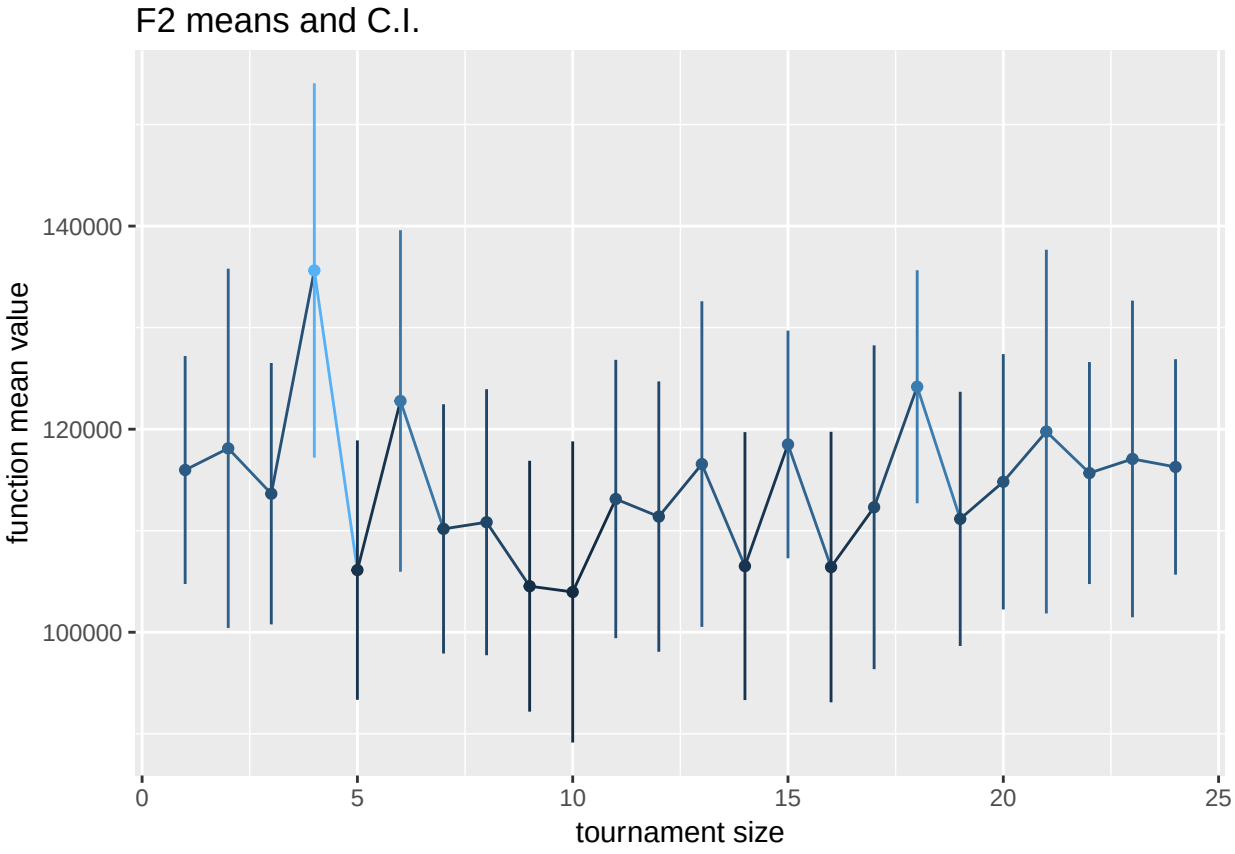
Plots

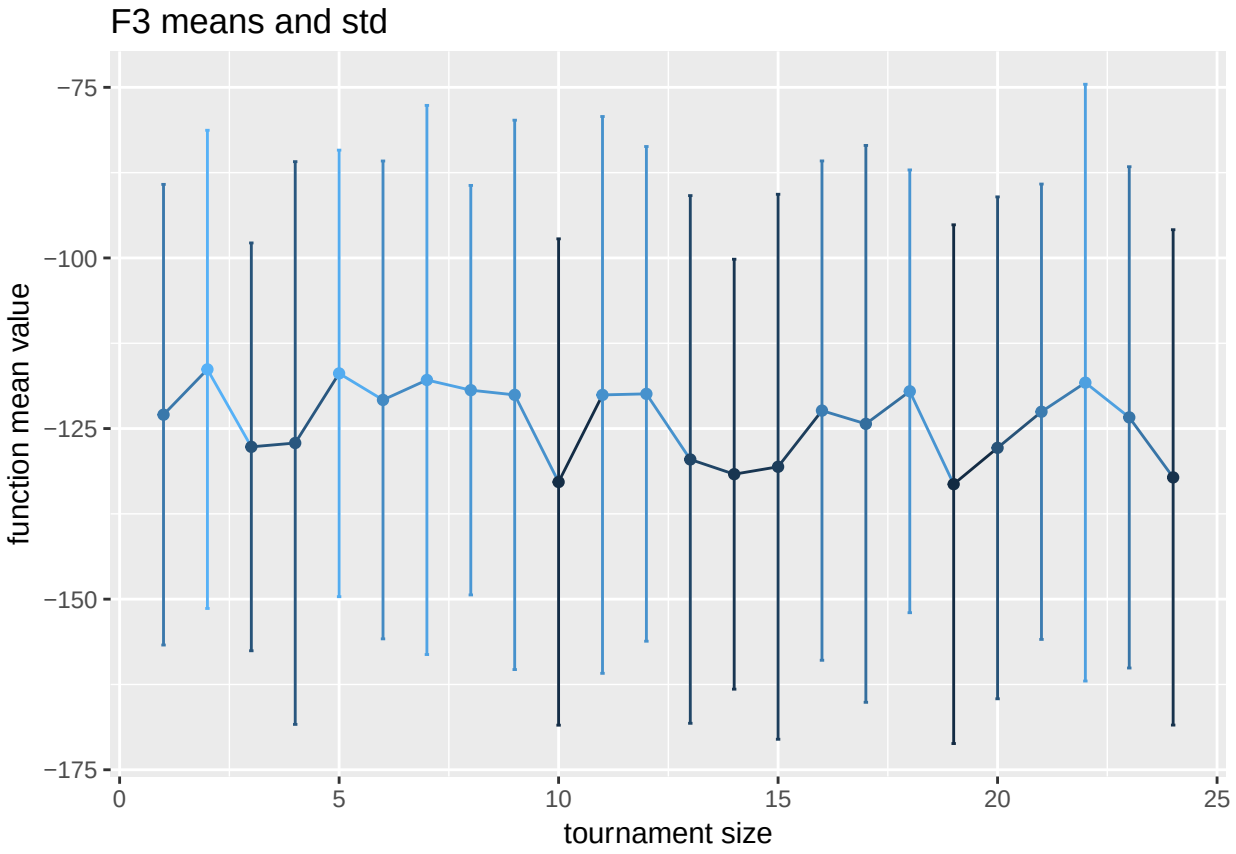
The order of the plots is: first we show the GAModel plots and the the BBOB benchmark functions, from F1 to F24.

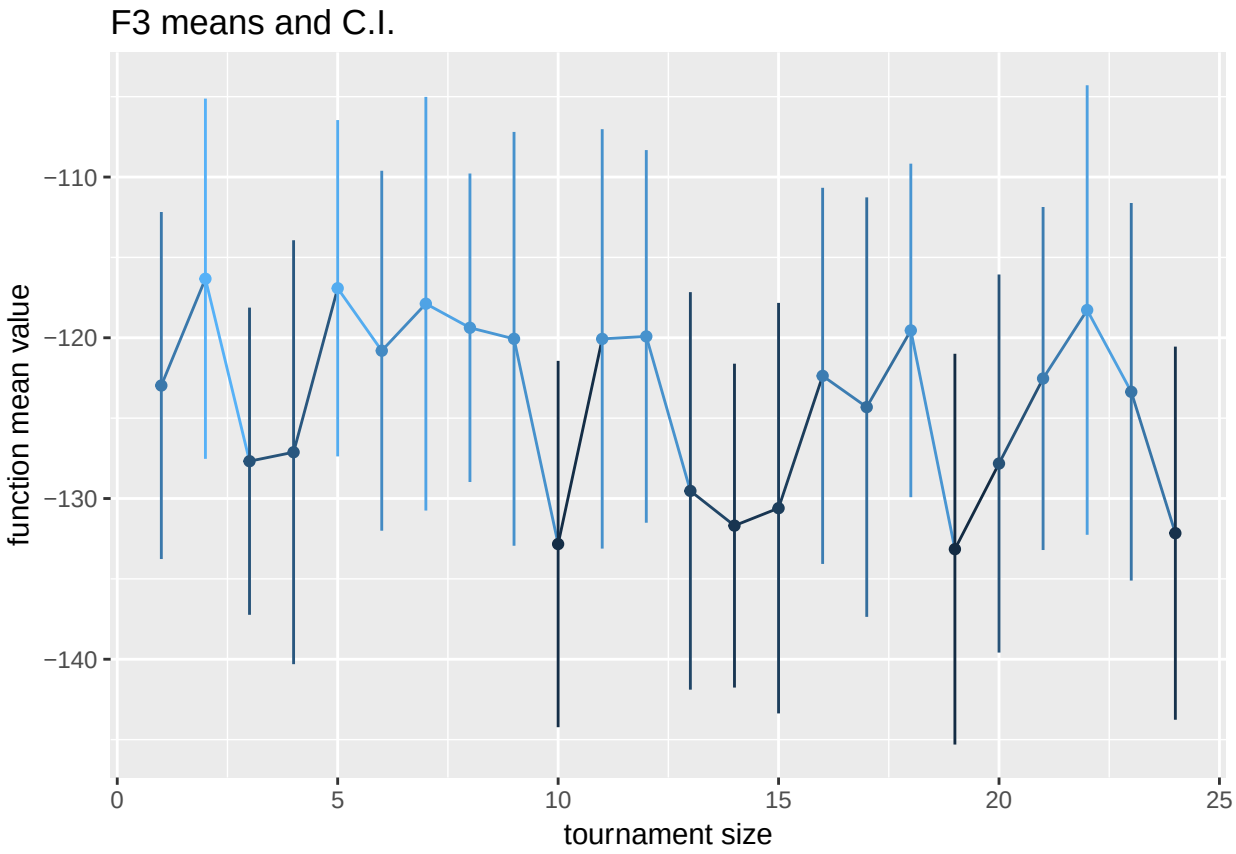

F1 means and std
function mean value
105
100
95
0
5
10
15
20
25
tournament size

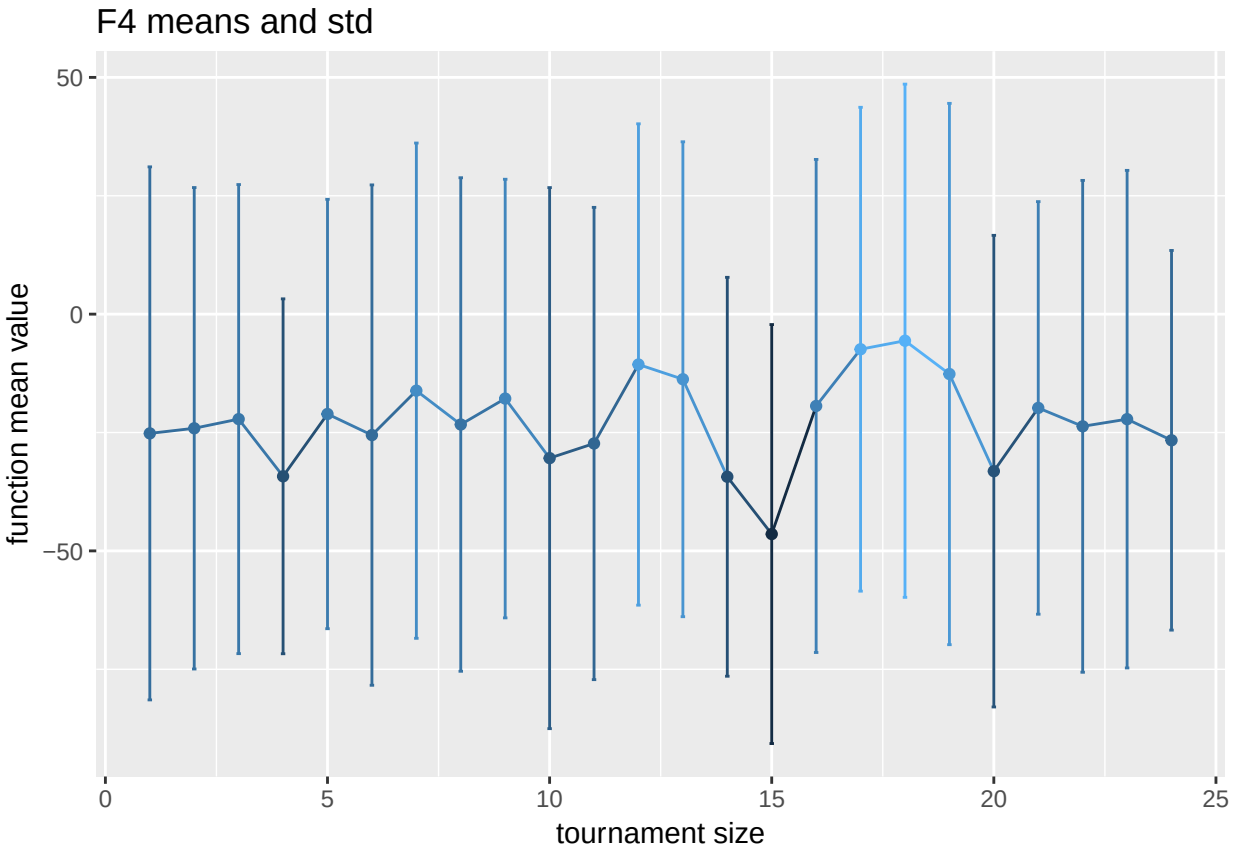

F1 means and C.I.
function mean value
104
102
100
98
0
5
10
15
20
25
tournament size

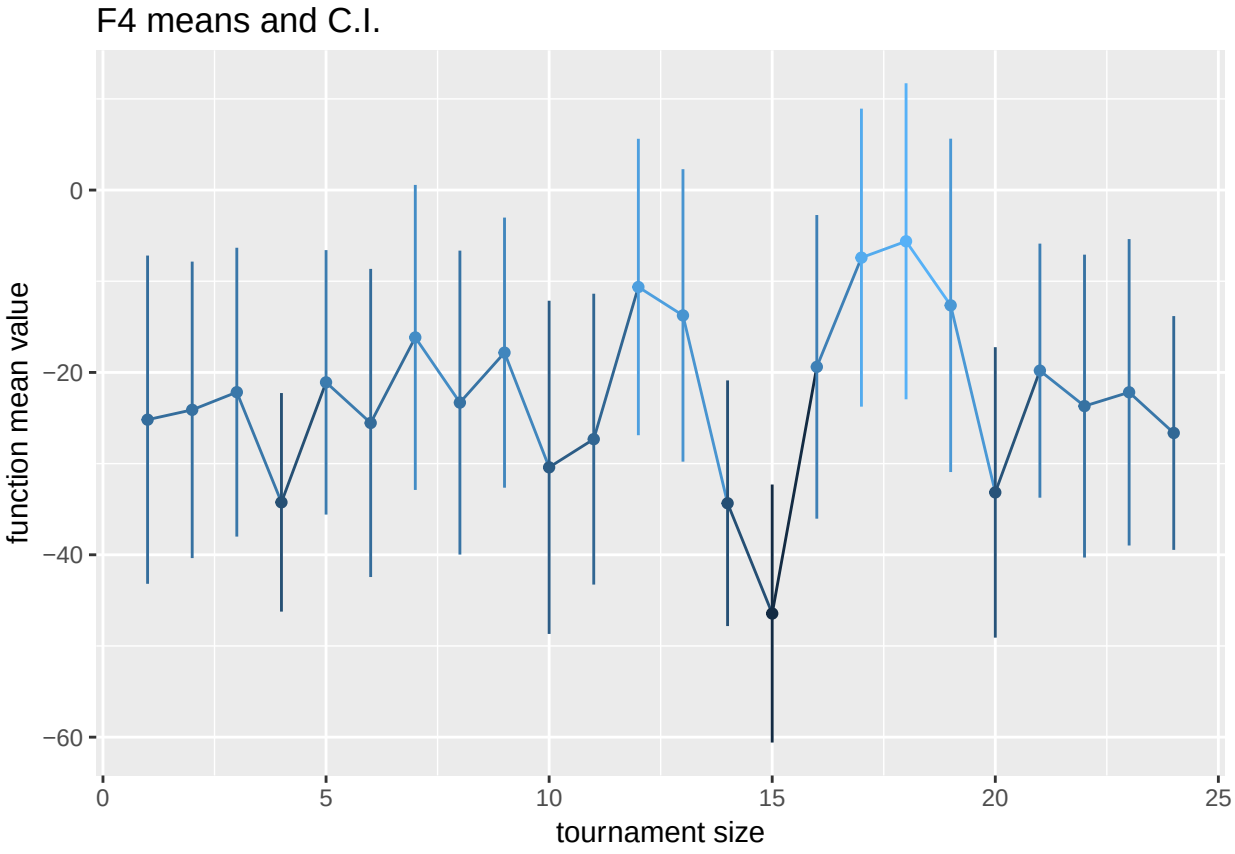

F2 means and std
200000
150000
100000
function mean value
0
5
10
15
20
25
tournament size

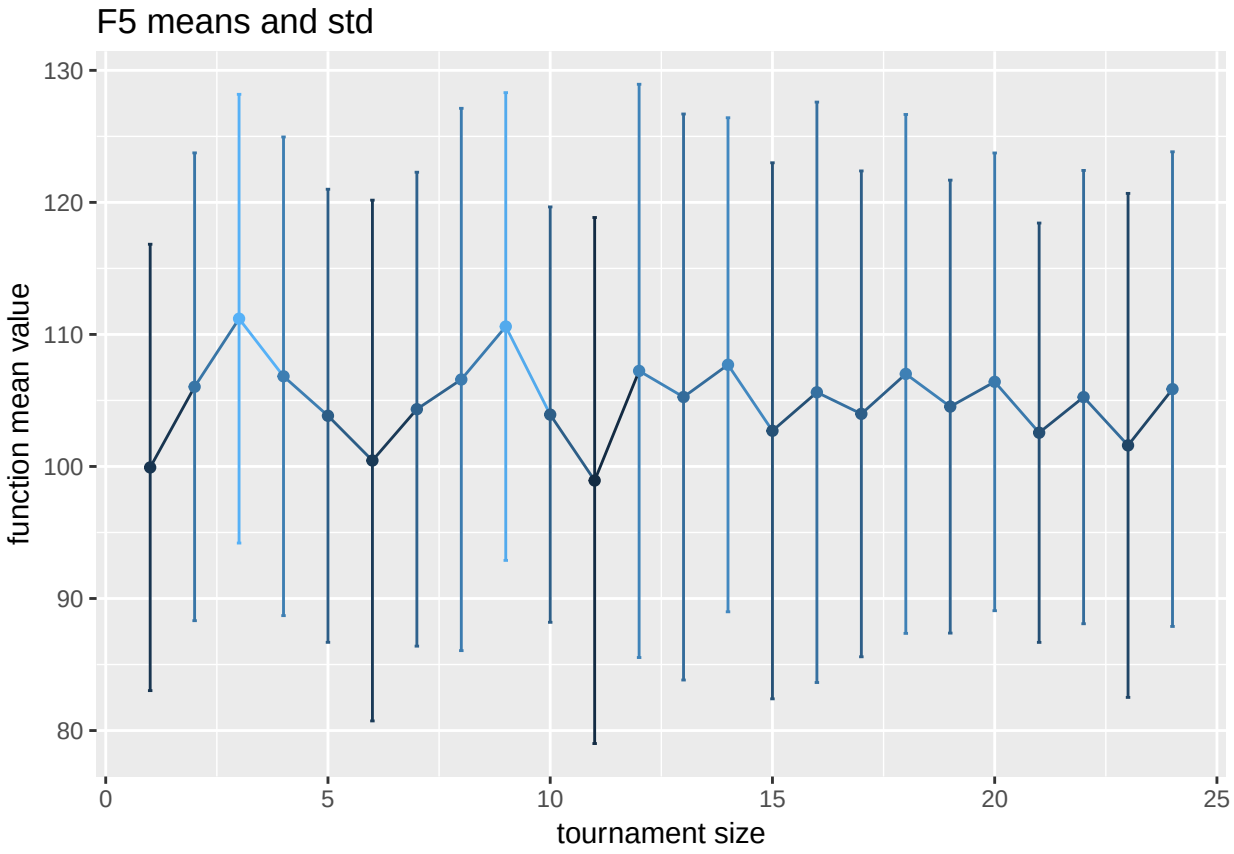

F2 means and C.I.
140000
120000
100000
function mean value
0
5
10
15
20
25
tournament size

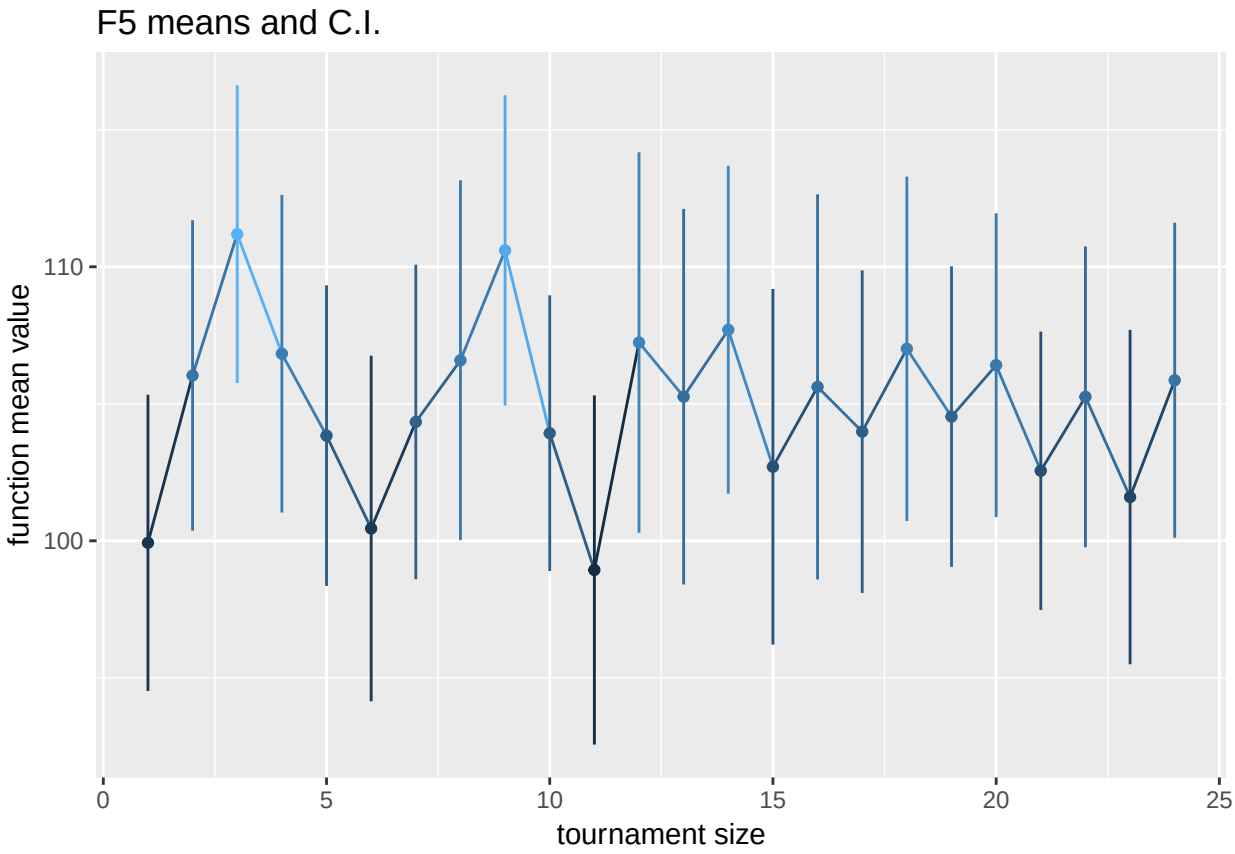

F3 means and std
function mean value
−75
−100
−125
−150
−175
0
5
10
15
20
25
tournament size

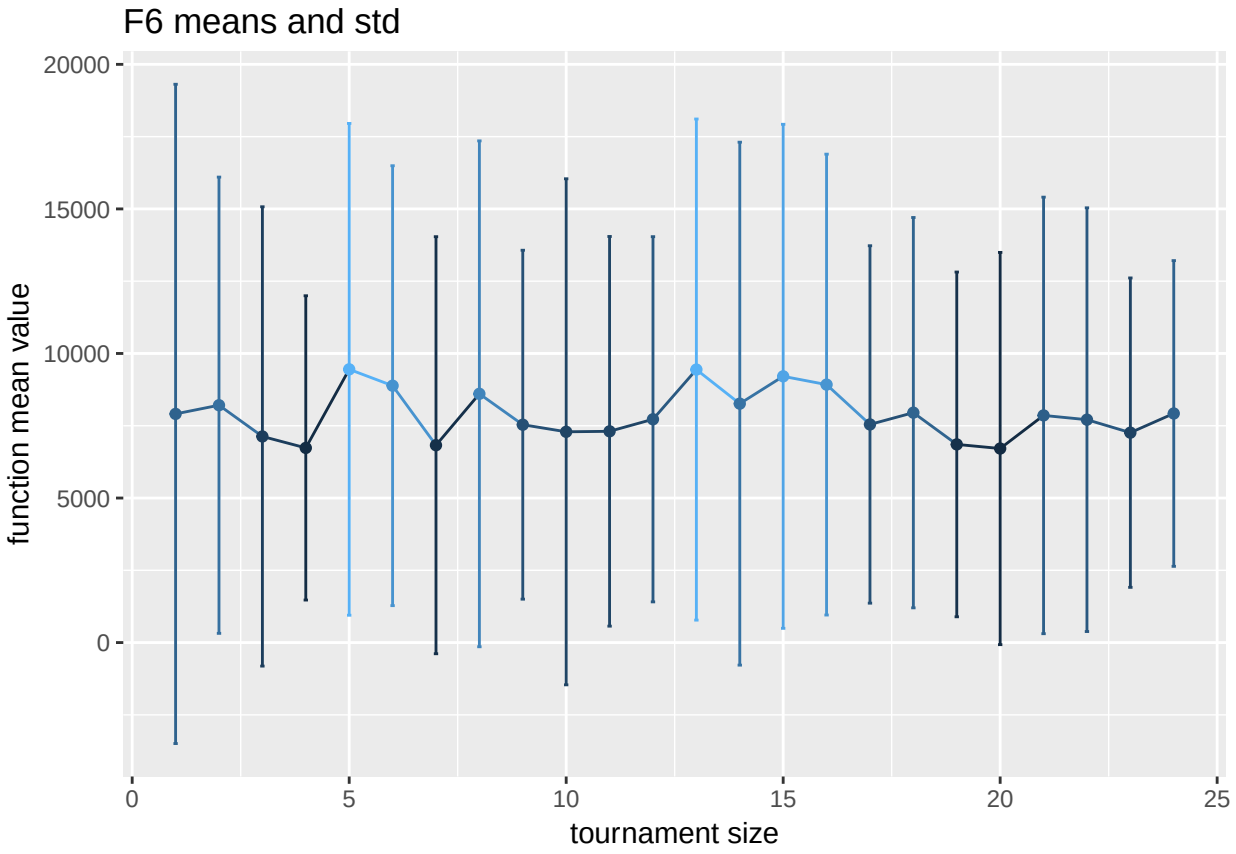

F3 means and C.I.
function mean value
−110
−120
−130
−140
0
5
10
15
20
25
tournament size

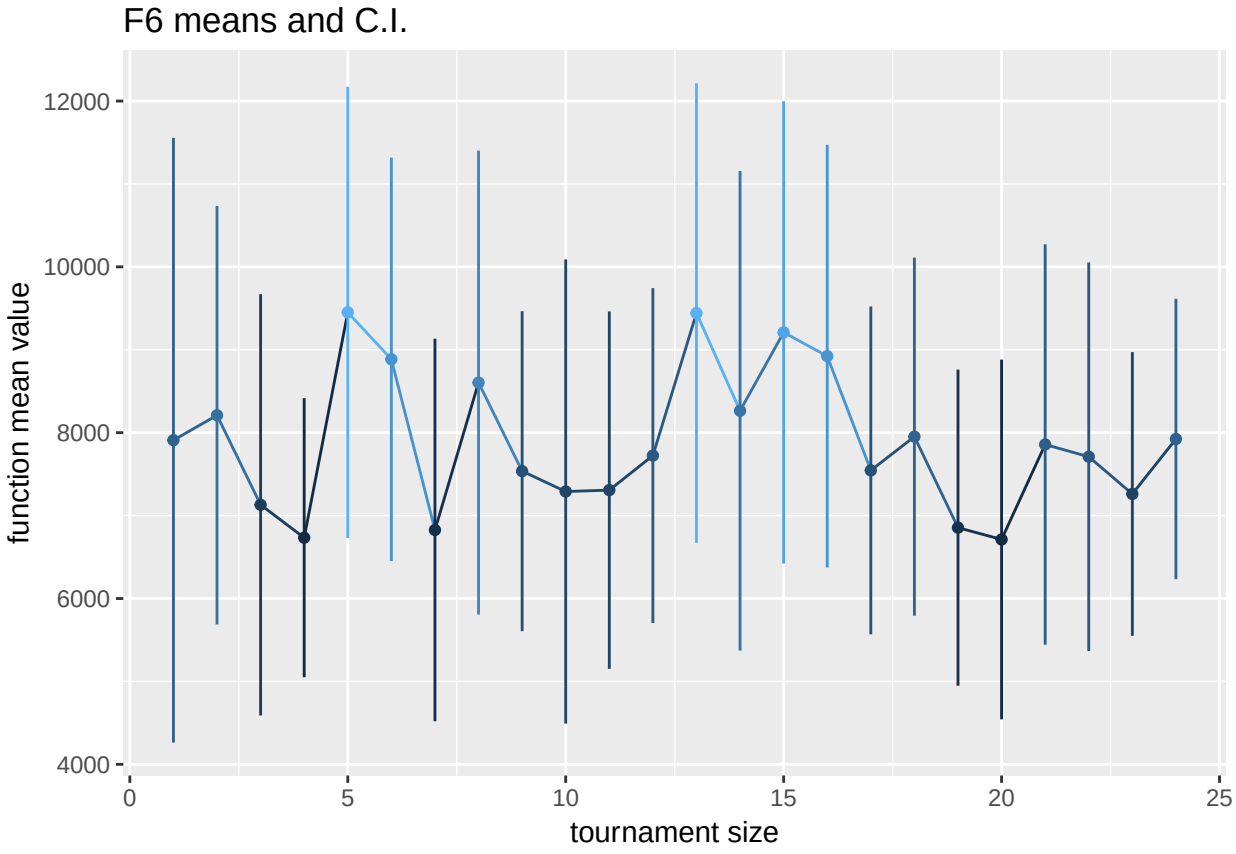

F4 means and std
50
0
−50
function mean value
0
5
10
15
20
25
tournament size

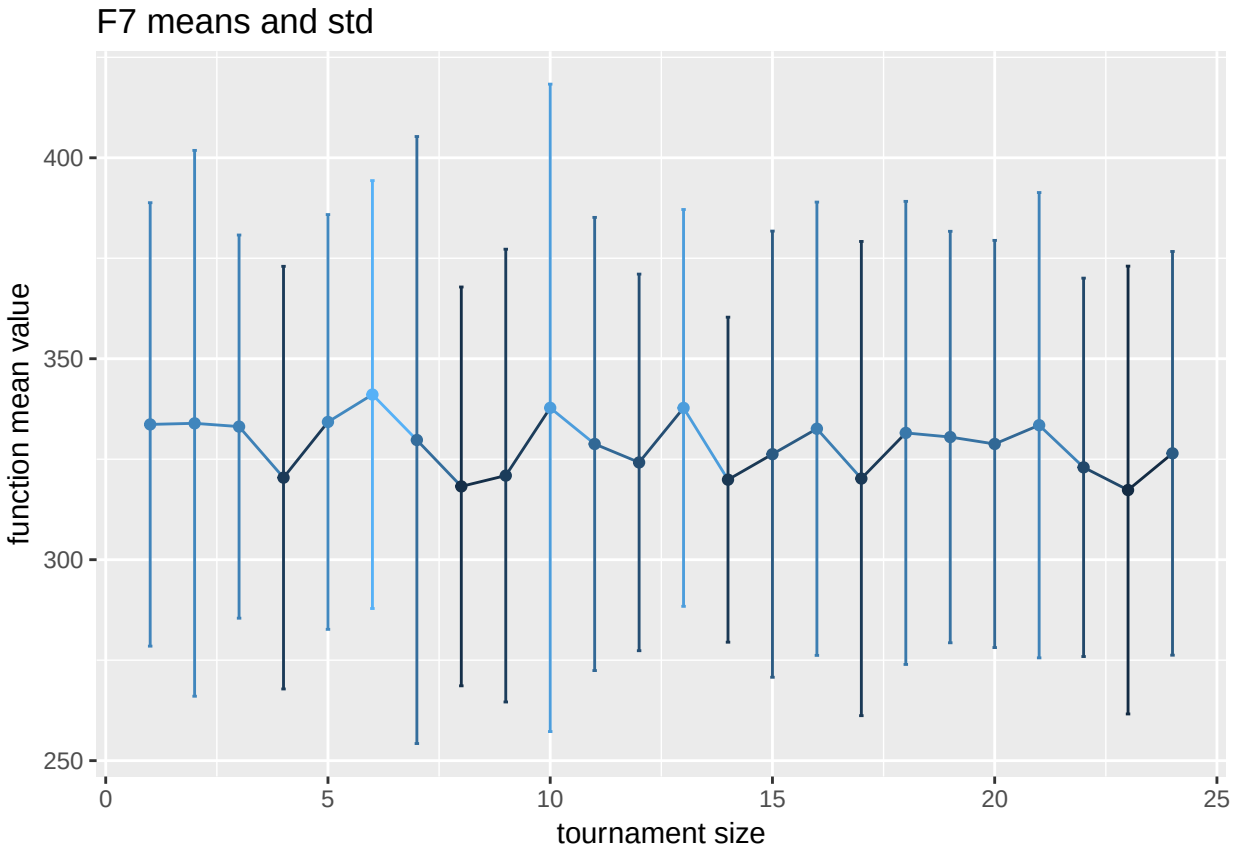

F4 means and C.I.
0
−20
−40
−60
function mean value
0
5
10
15
20
25
tournament size

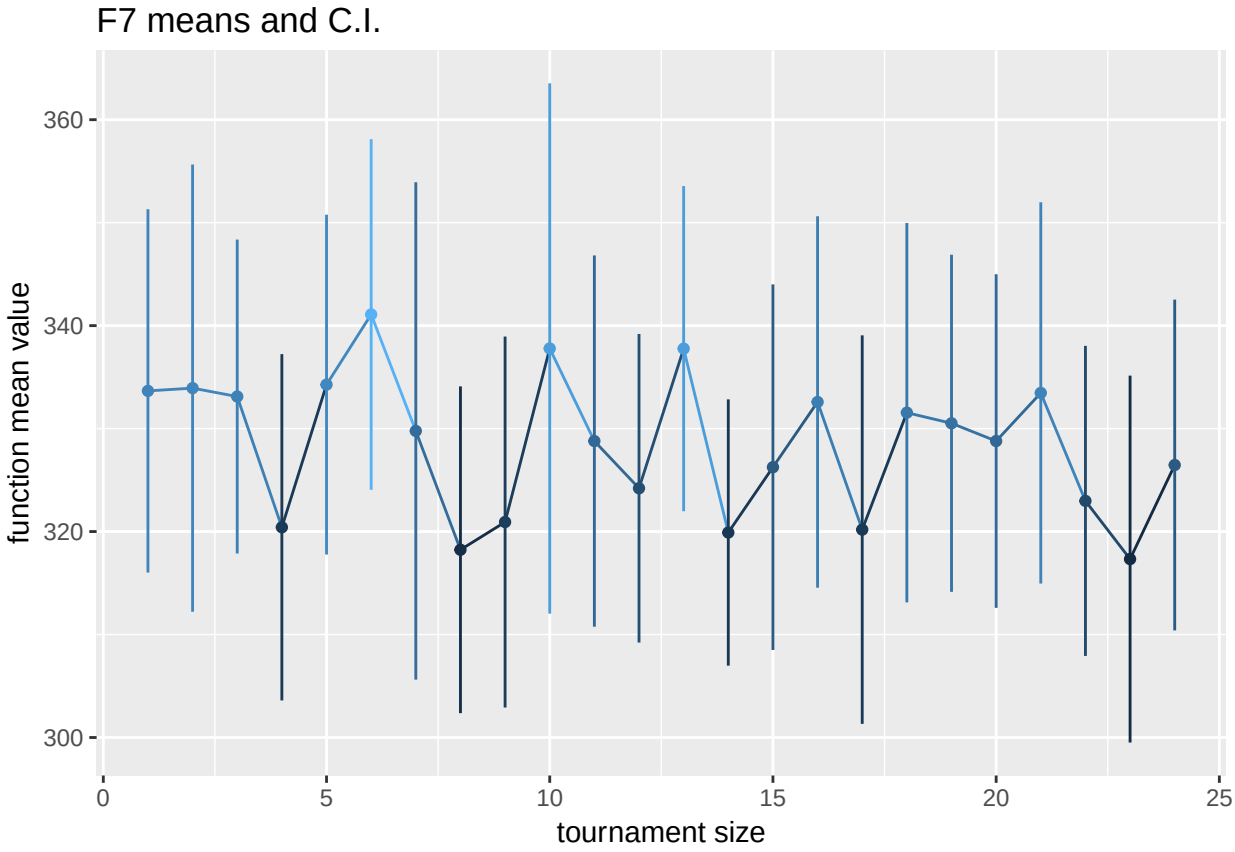

F5 means and std
function mean value
130
120
110
100
90
80
0
5
10
15
20
25
tournament size

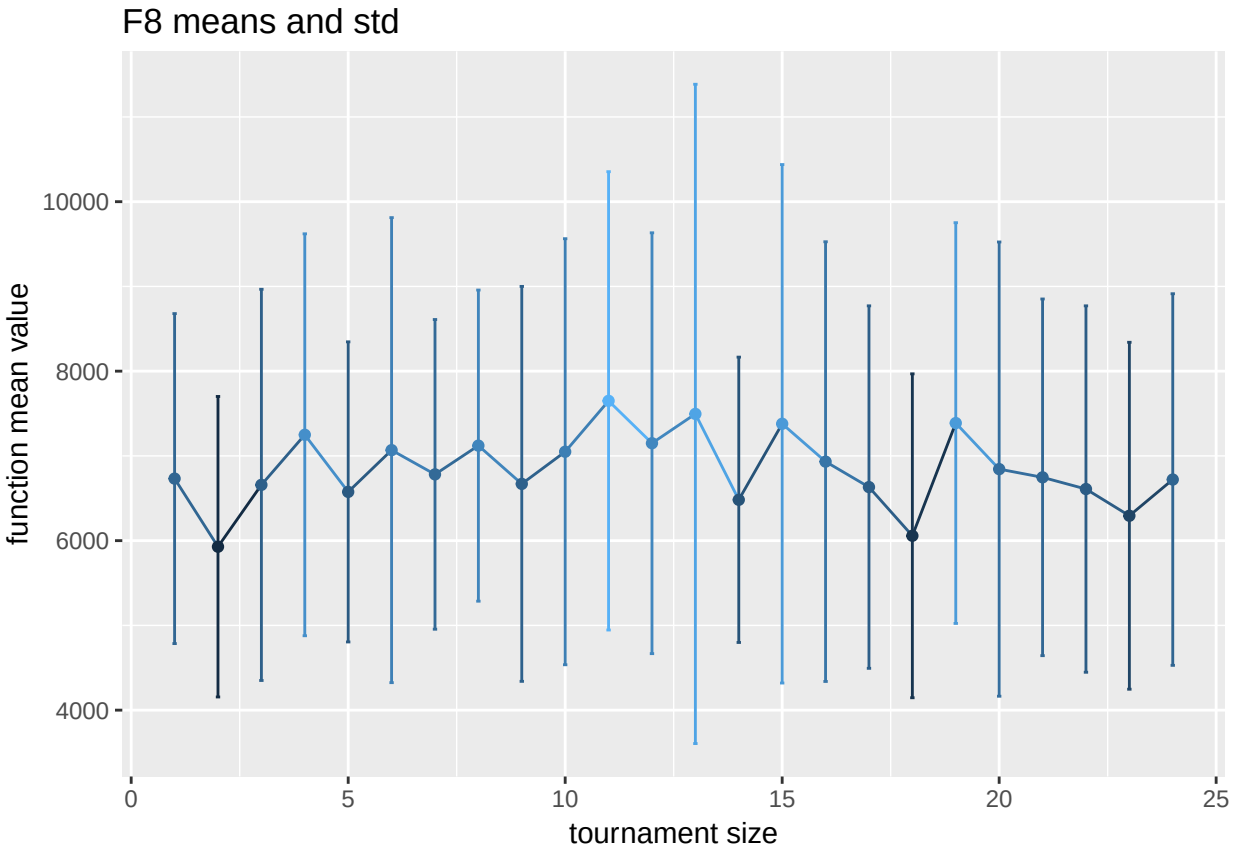

F5 means and C.I.
function mean value
110
100
0
5
10
15
20
25
tournament size

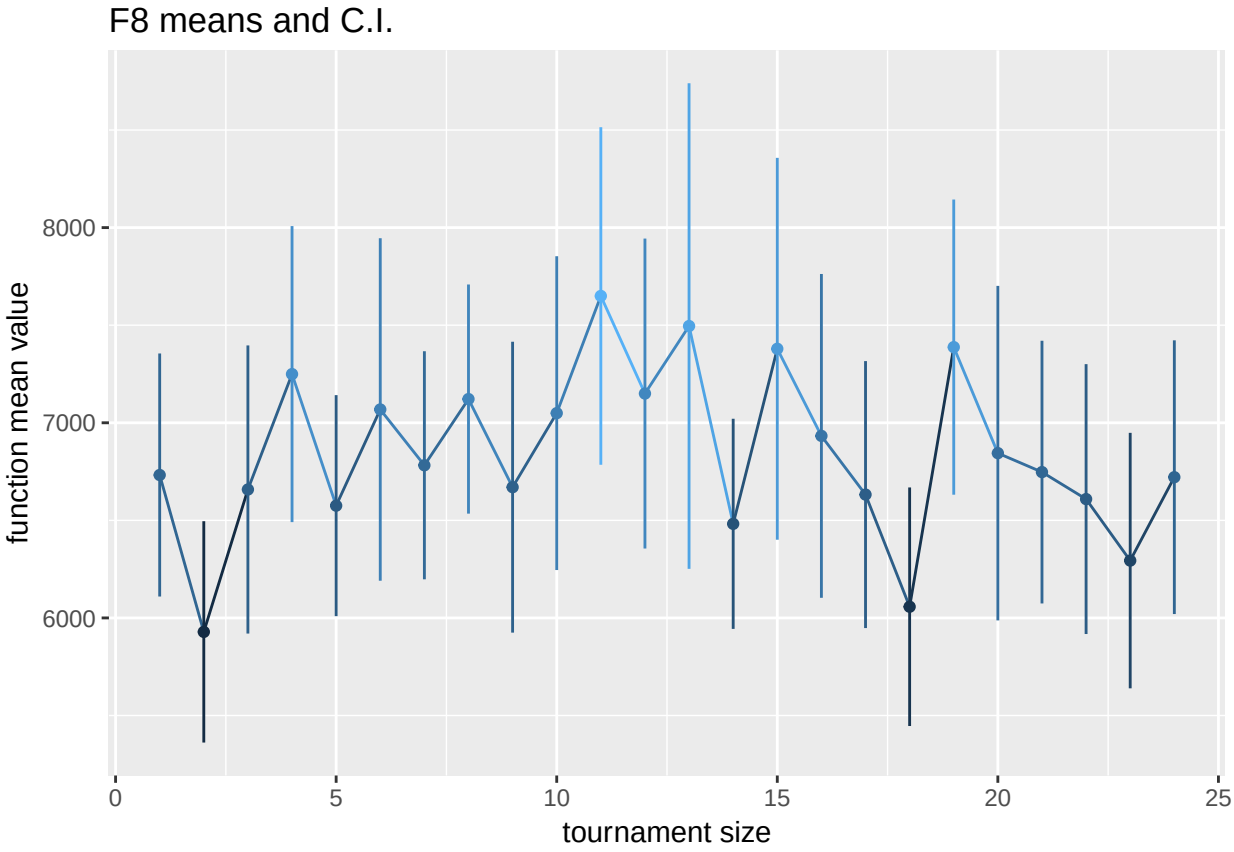

F6 means and std
function mean value
20000
15000
10000
5000
0
0
5
10
15
20
25
tournament size

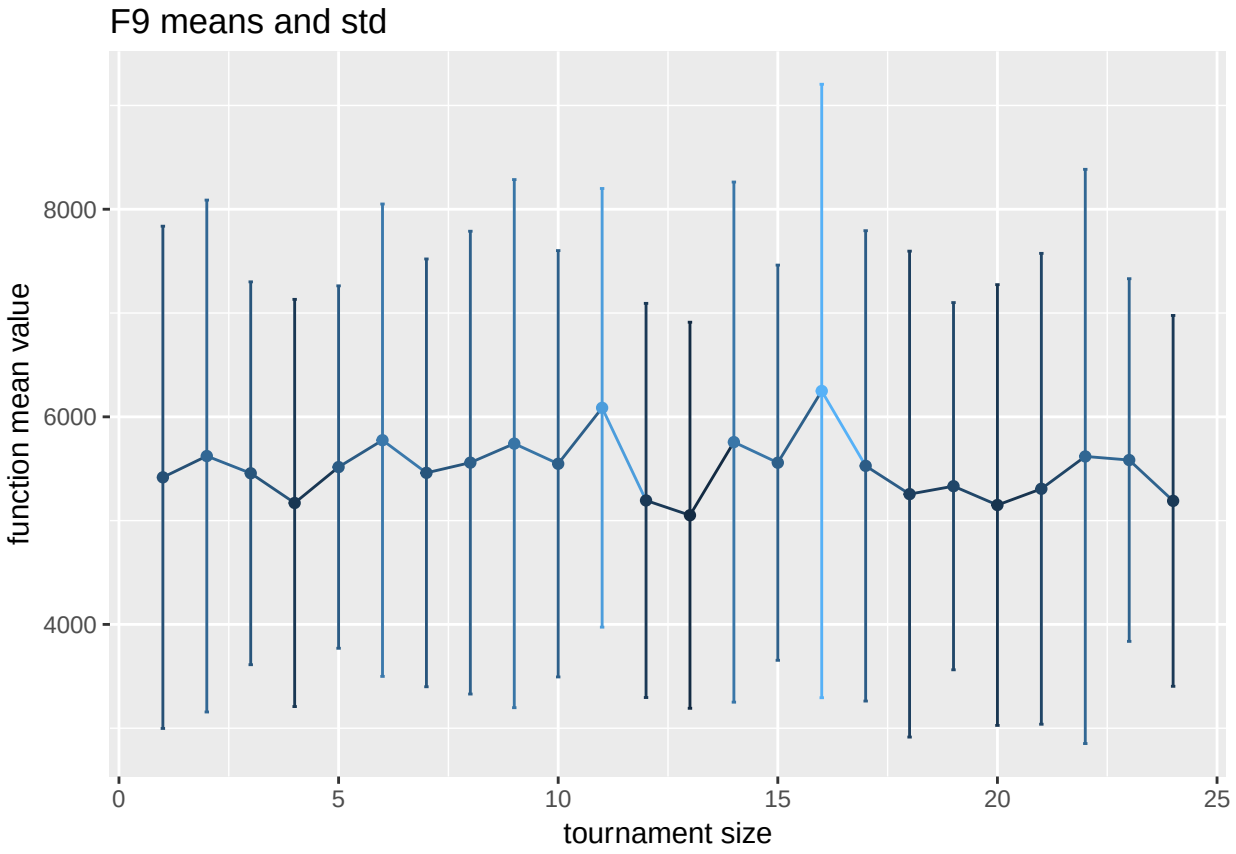

F6 means and C.I.
function mean value
12000
10000
8000
6000
4000
0
5
10
15
20
25
tournament size

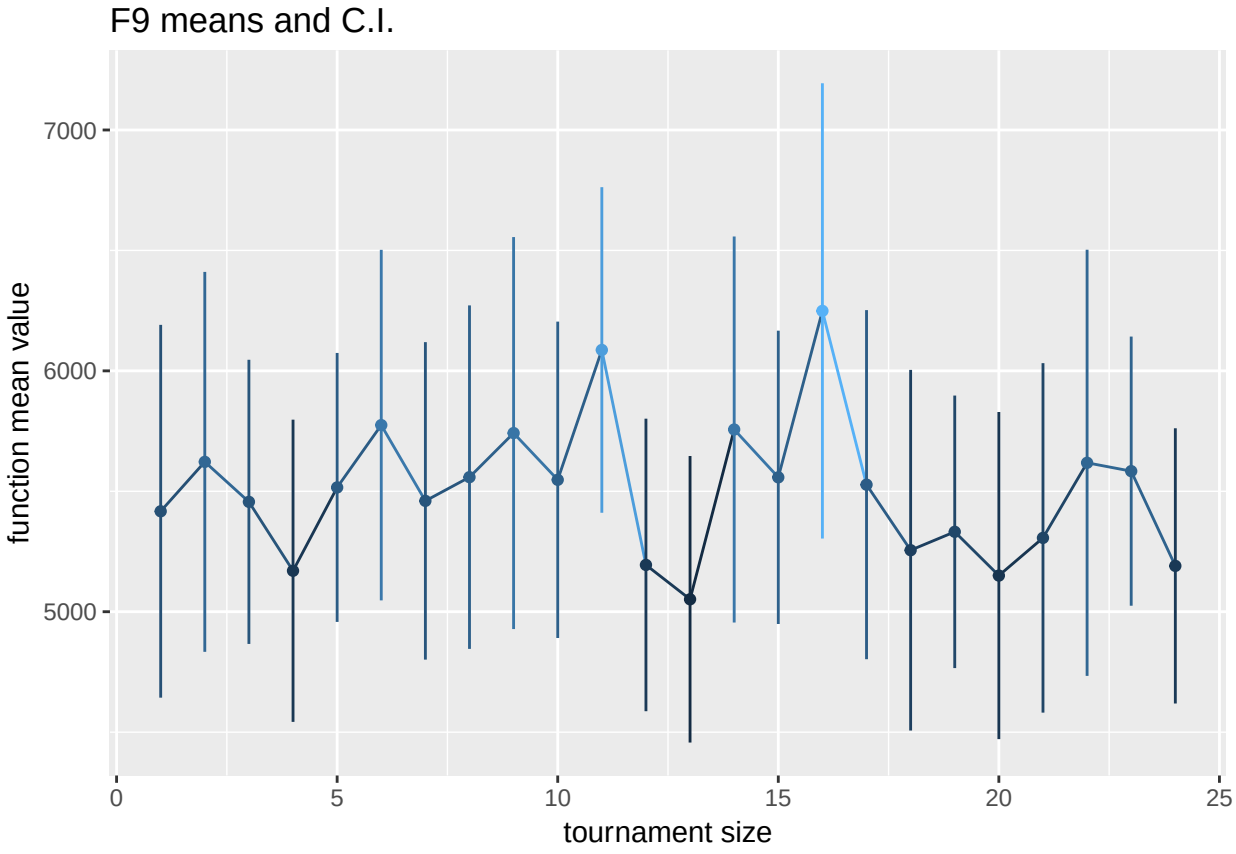

F7 means and std
function mean value
400
350
300
250
0
5
10
15
20
25
tournament size

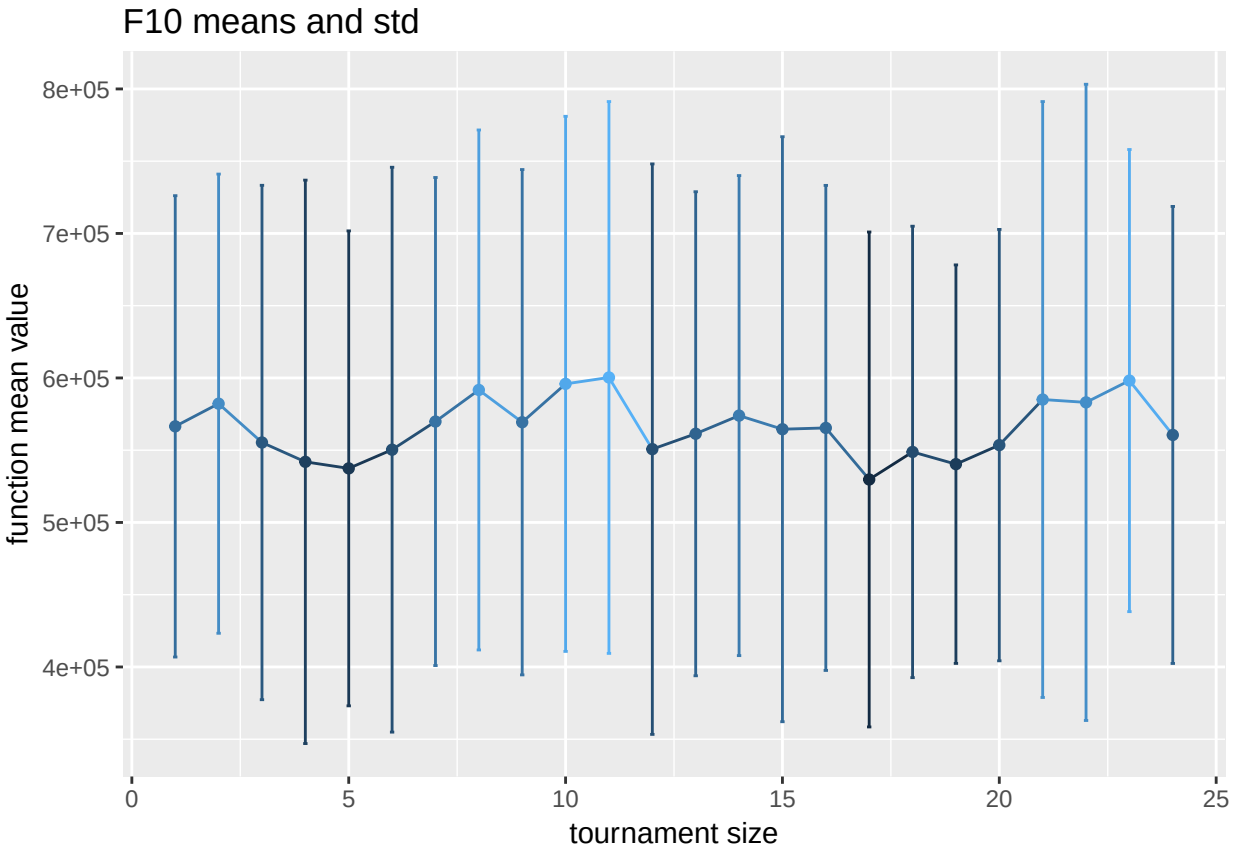

F7 means and C.I.
function mean value
360
340
320
300
0
5
10
15
20
25
tournament size

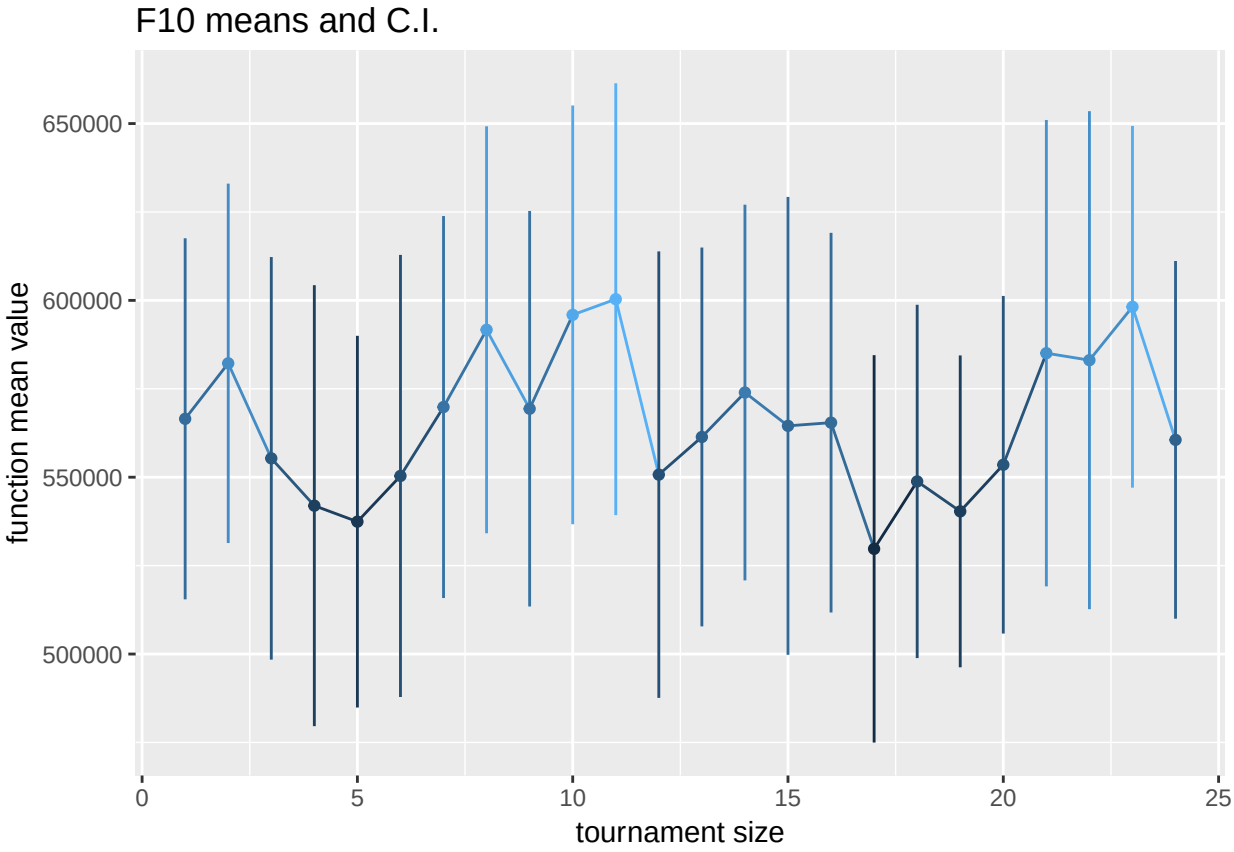

F8 means and std
function mean value
10000
8000
6000
4000
0
5
10
15
20
25
tournament size

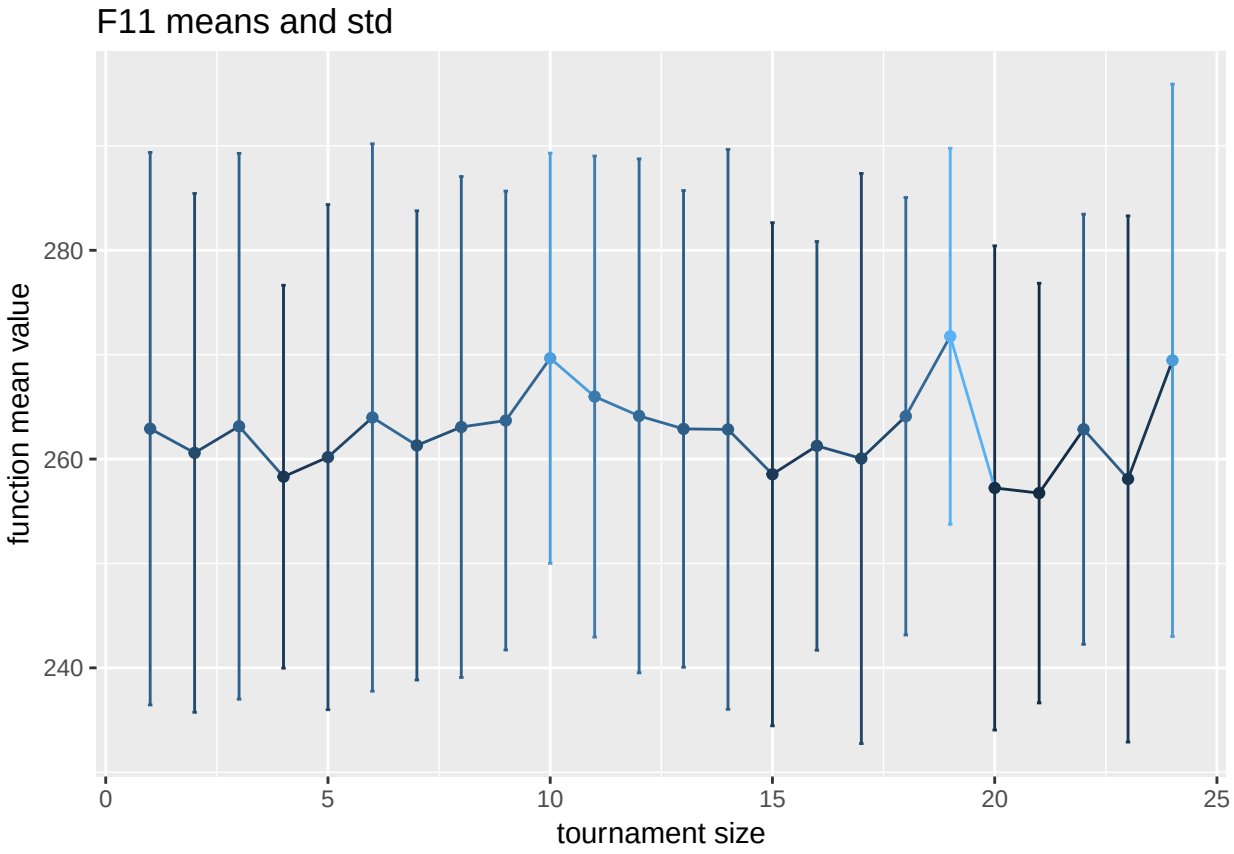

F8 means and C.I.
function mean value
8000
7000
6000
0
5
10
15
20
25
tournament size

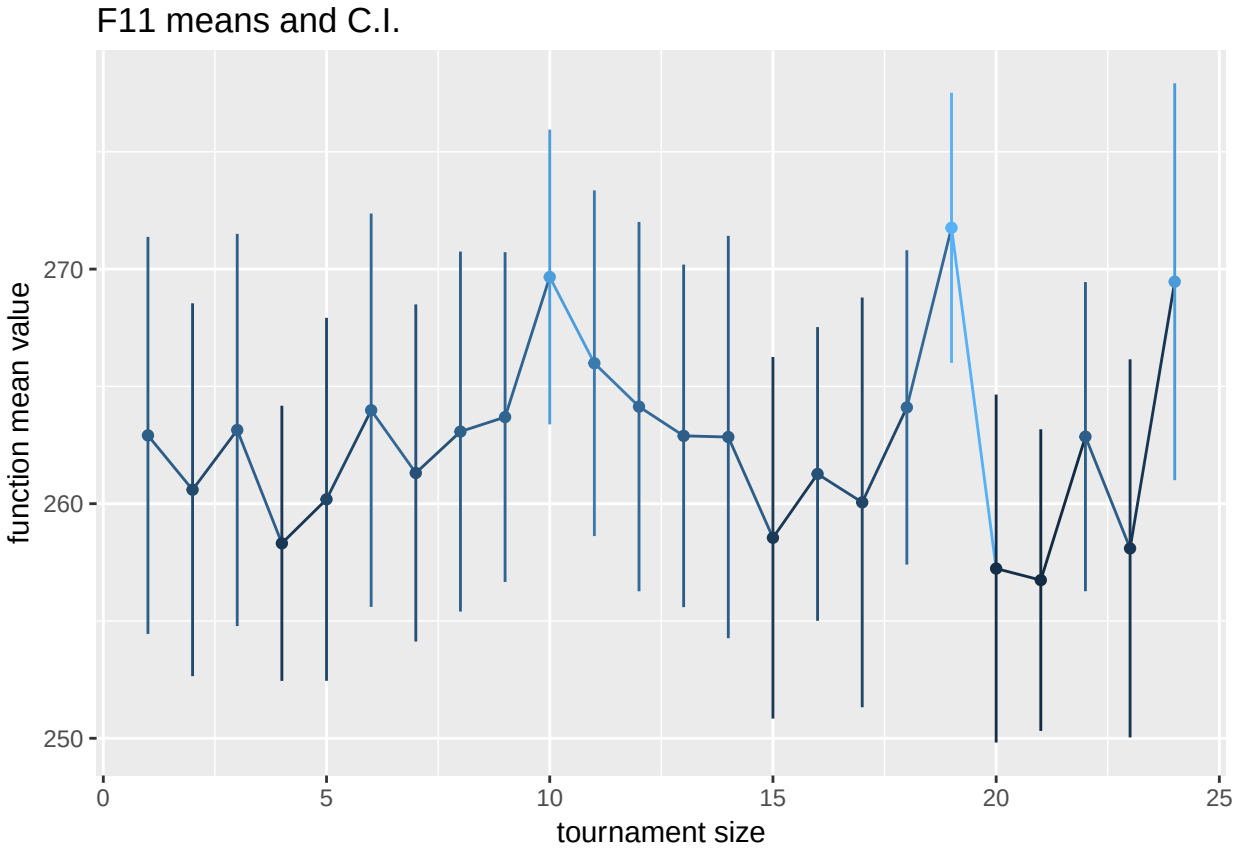

F9 means and std
function mean value
8000
6000
4000
0
5
10
15
20
25
tournament size

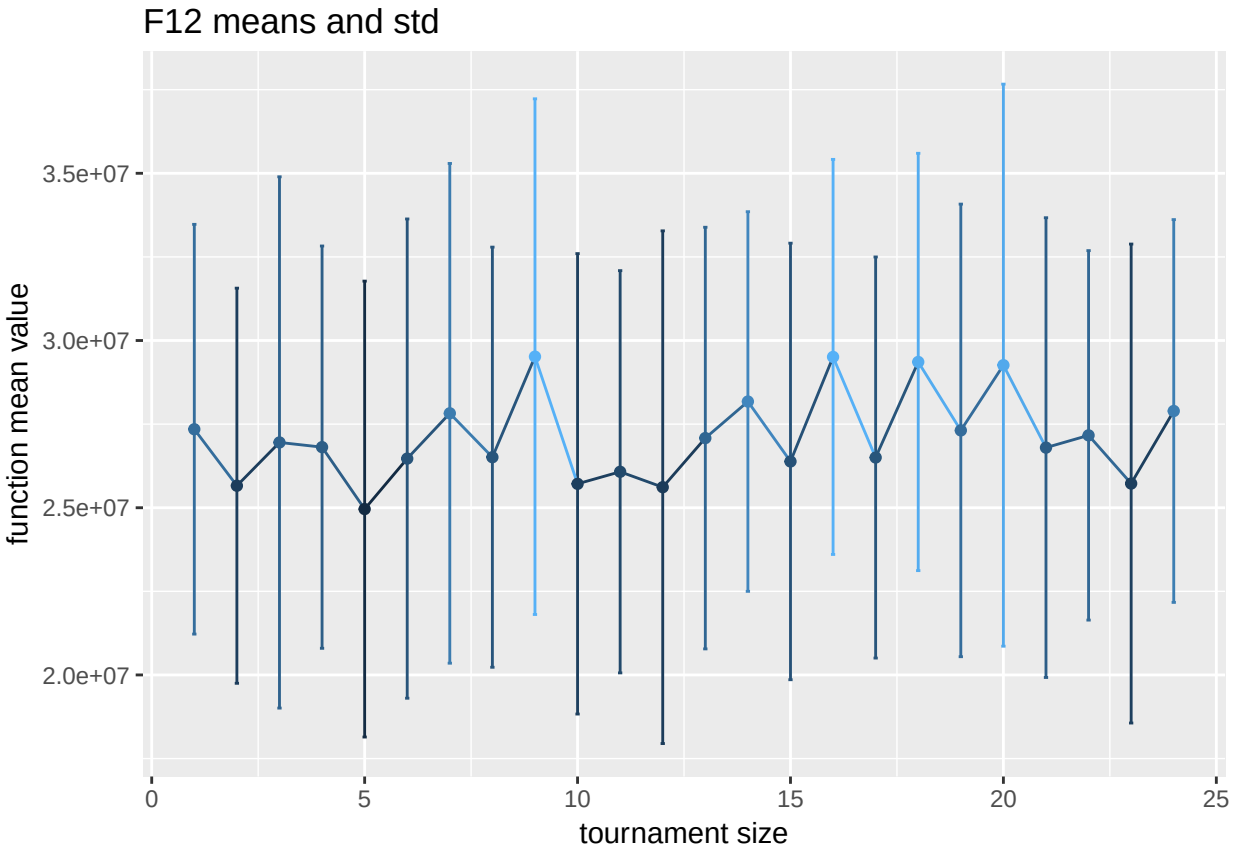

F9 means and C.I.
function mean value
7000
6000
5000
0
5
10
15
20
25
tournament size

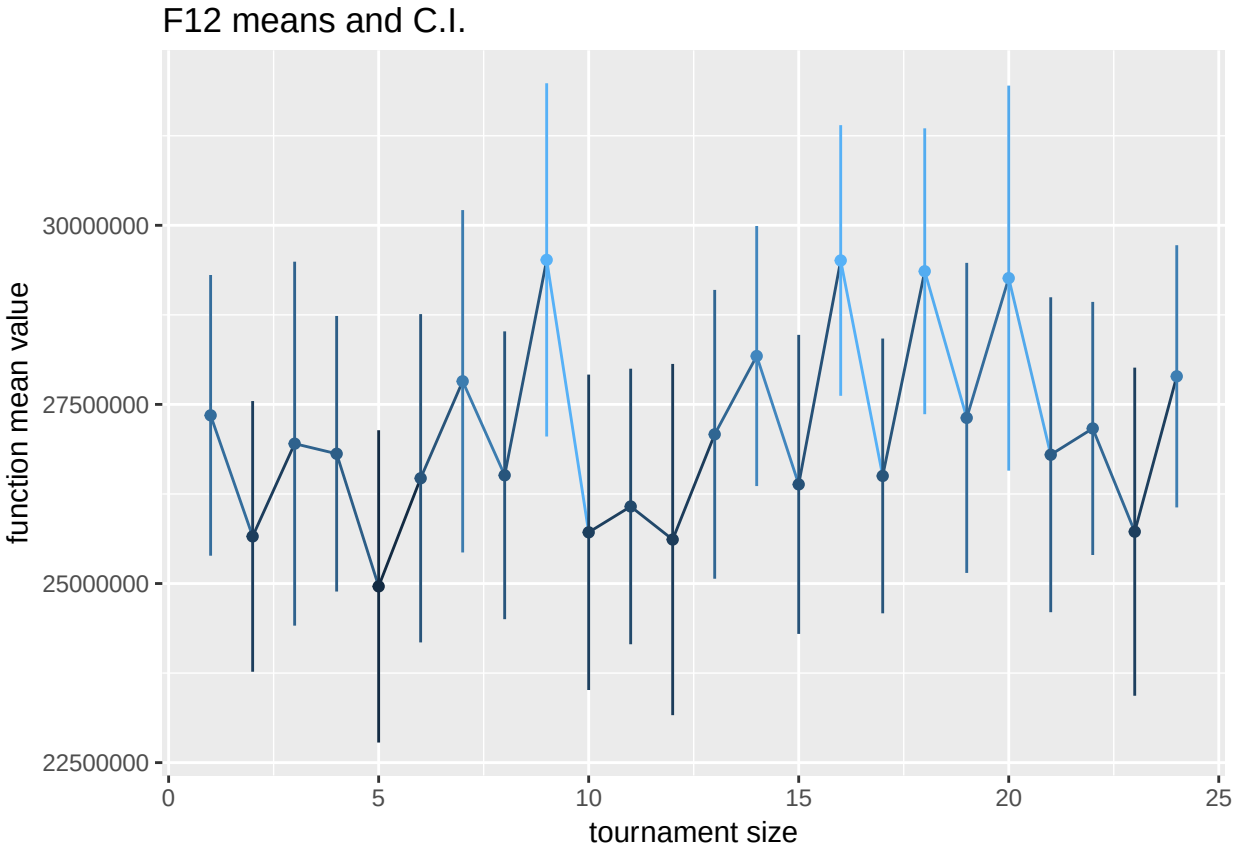

F10 means and std
function mean value
8e+05
7e+05
6e+05
5e+05
4e+05
0
5
10
15
20
25
tournament size

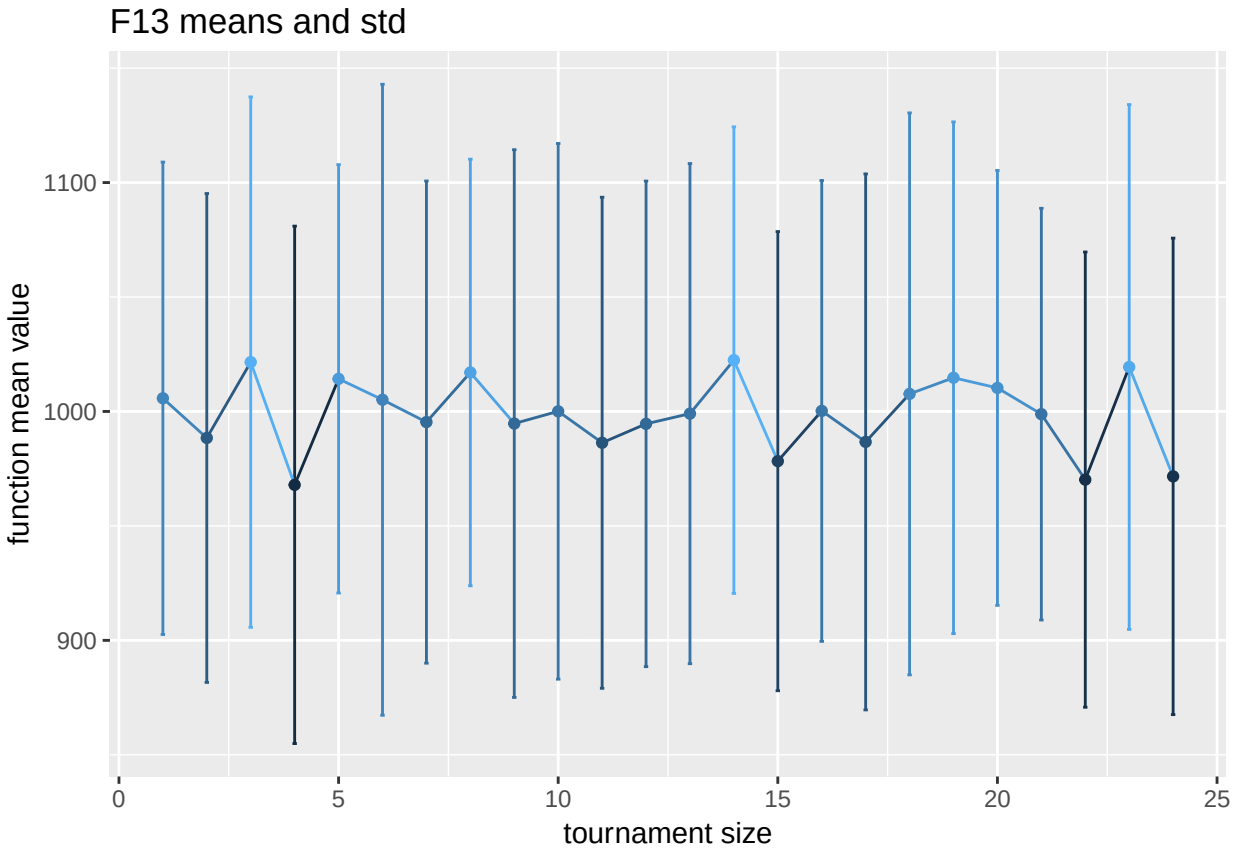

F10 means and C.I.
function mean value
650000
600000
550000
500000
0
5
10
15
20
25
tournament size

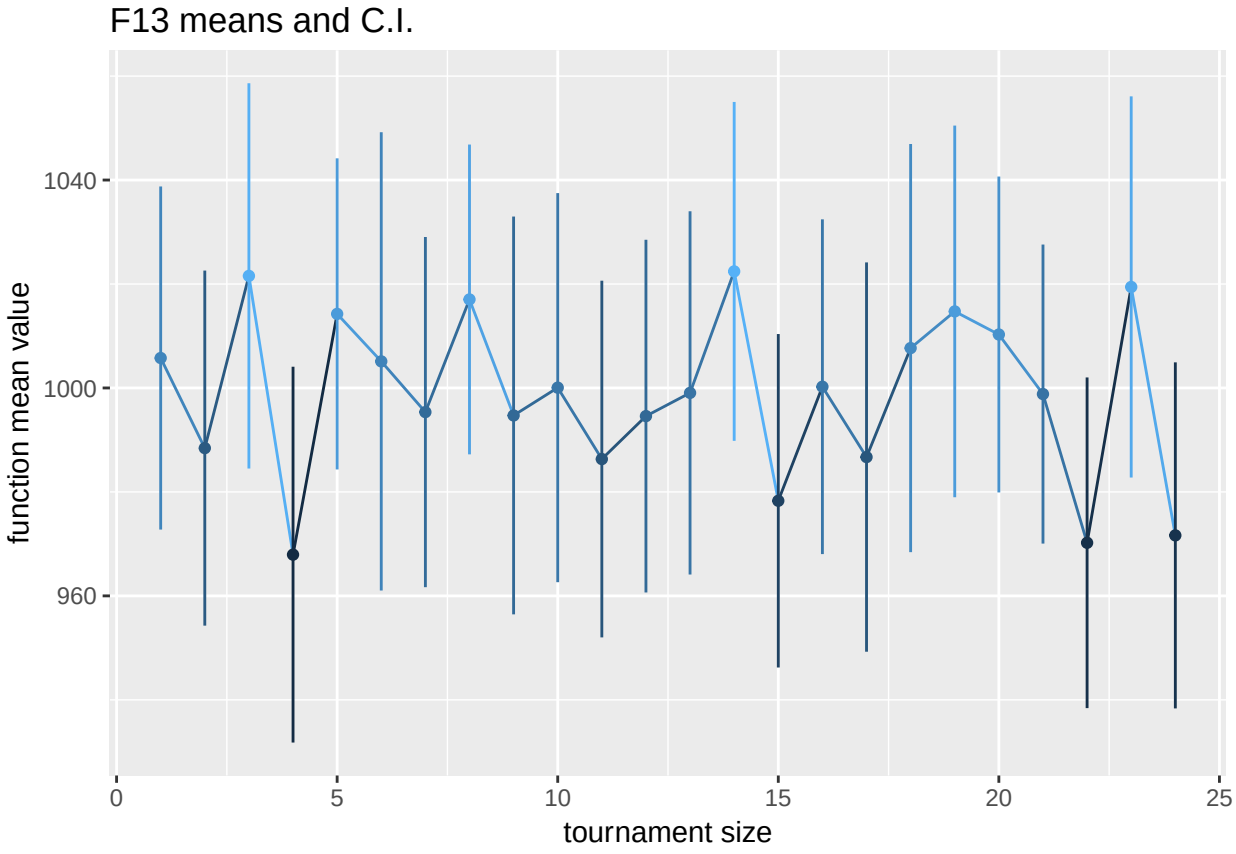

F11 means and std
function mean value
280
260
240
0
5
10
15
20
25
tournament size

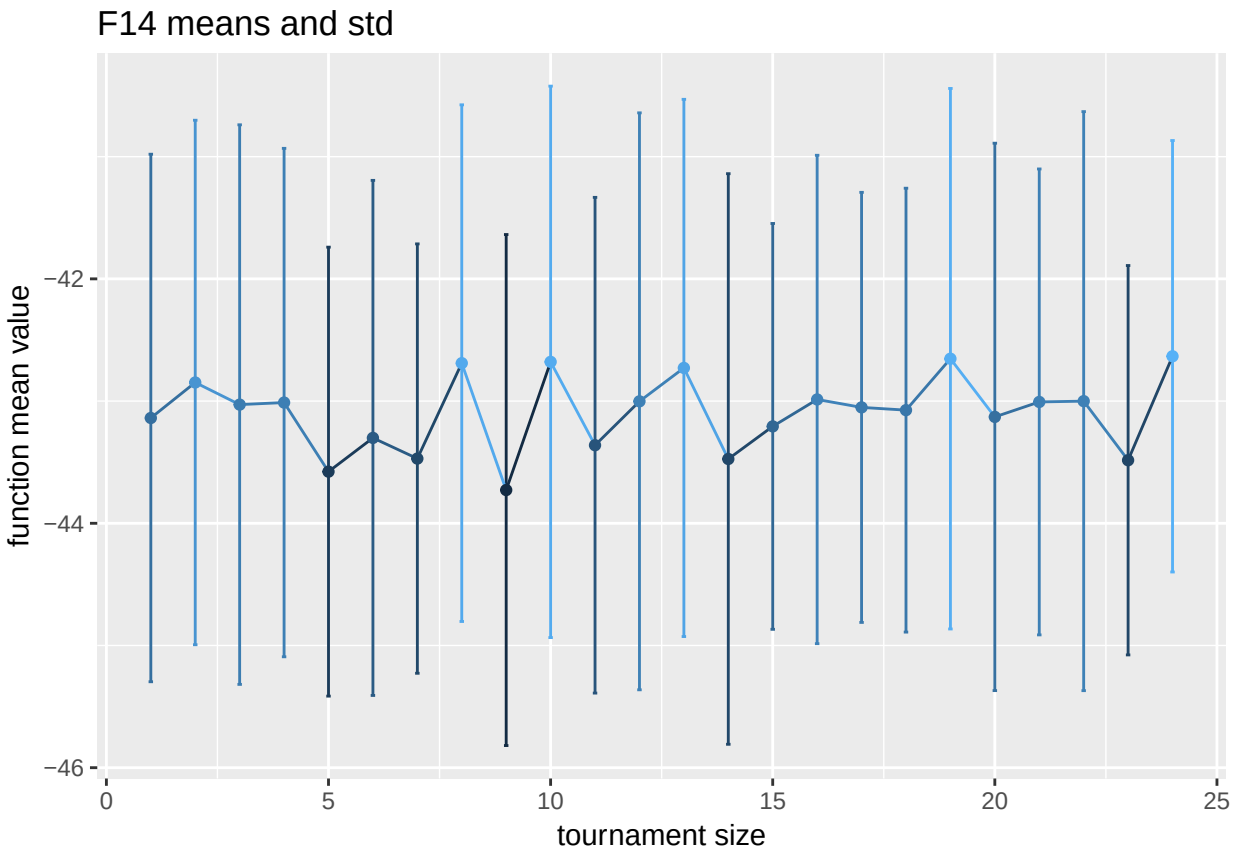

F11 means and C.I.
function mean value
270
260
250
0
5
10
15
20
25
tournament size

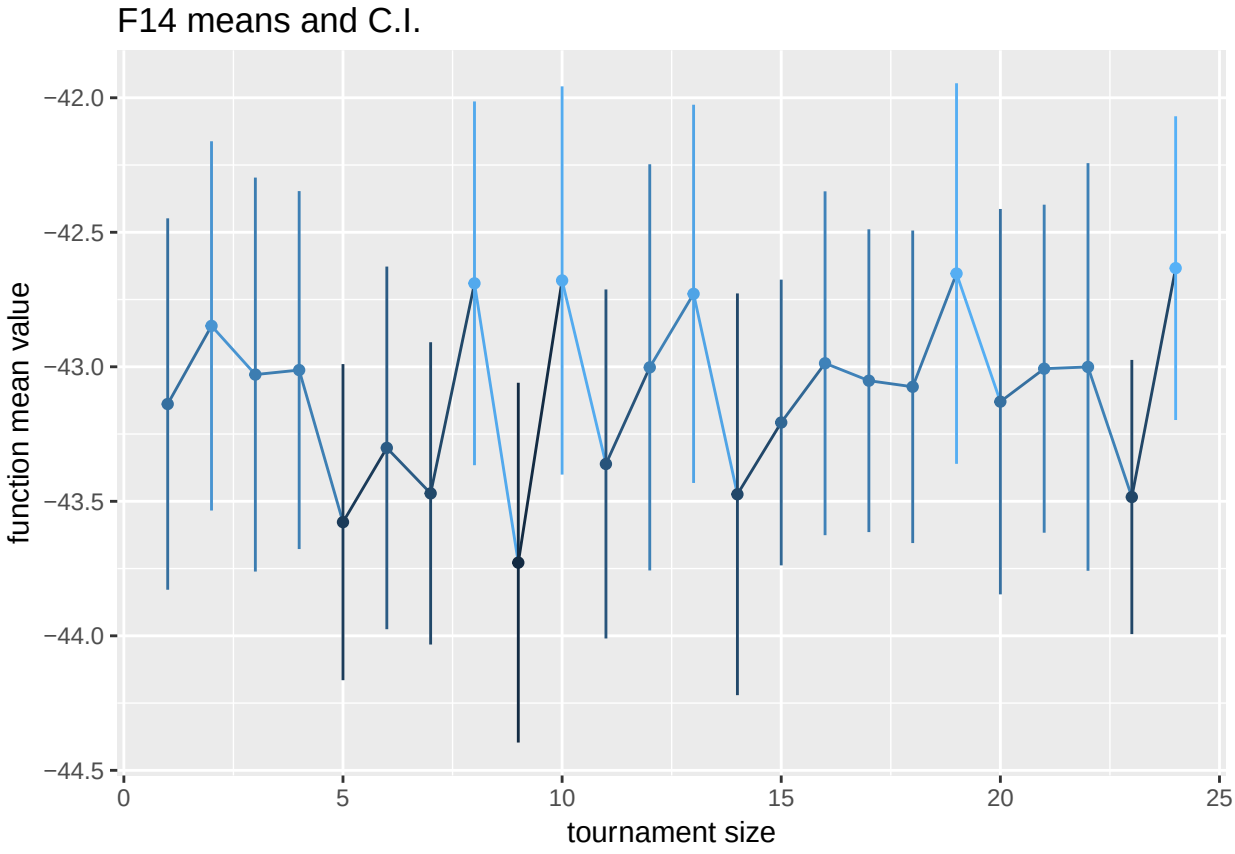

F12 means and std
function mean value
3.5e+07
3.0e+07
2.5e+07
2.0e+07
0
5
10
15
20
25
tournament size

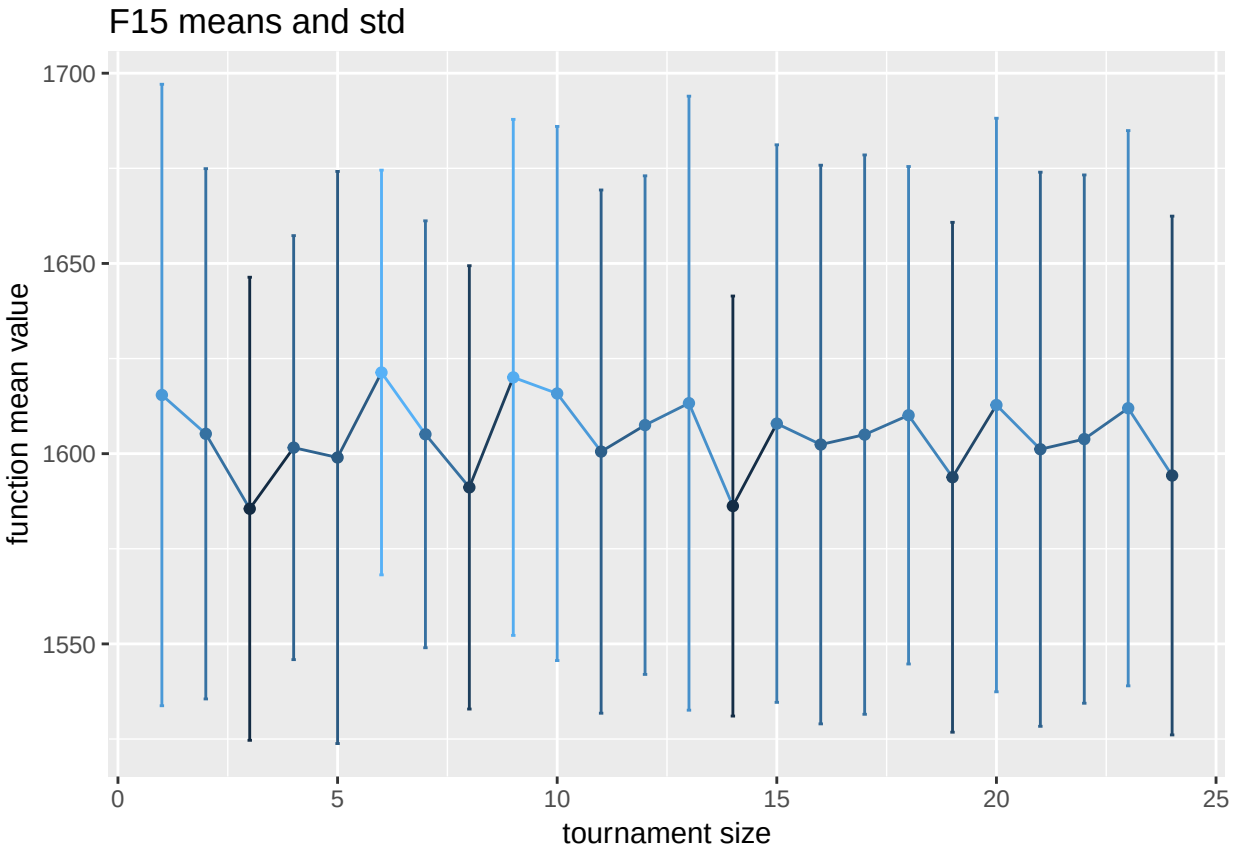

F12 means and C.I.
function mean value
30000000
27500000
25000000
22500000
0
5
10
15
20
25
tournament size

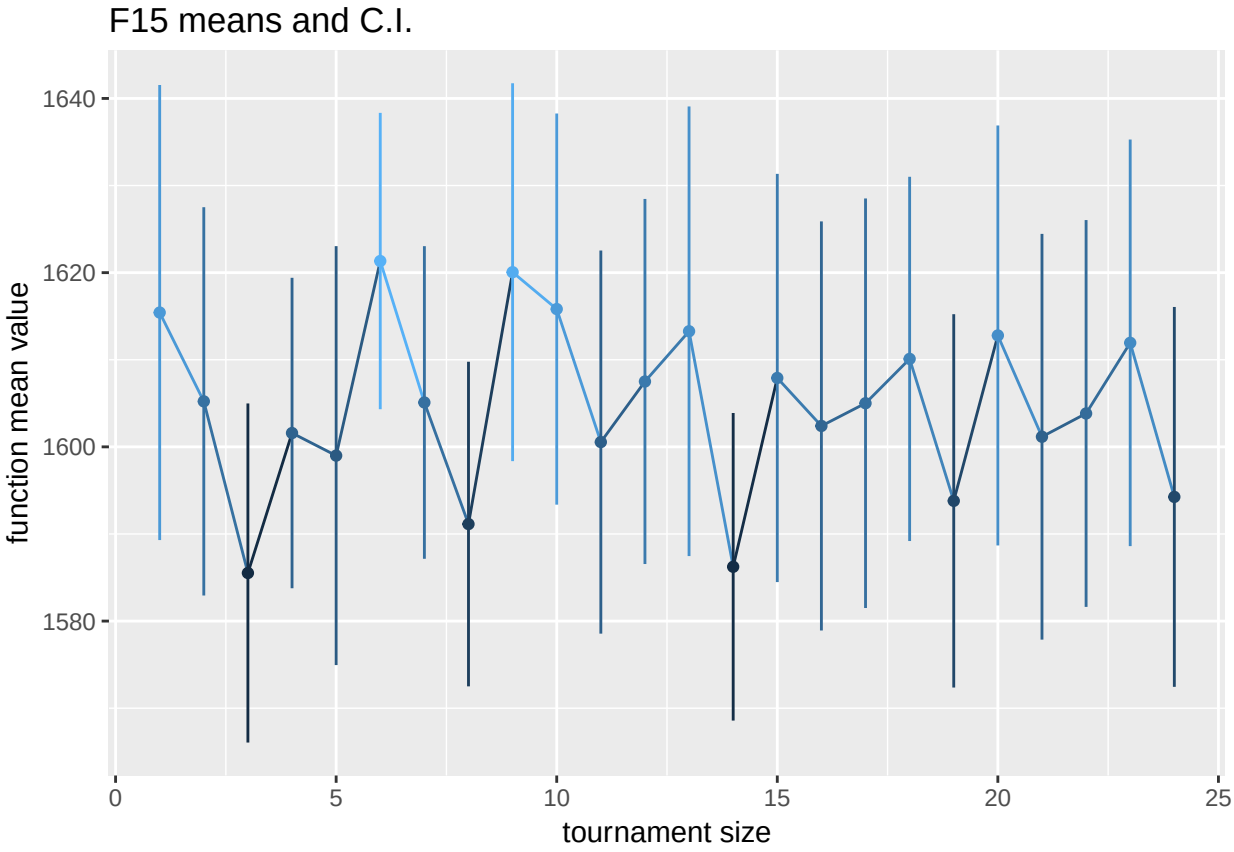

F13 means and std
function mean value
1100
1000
900
0
5
10
15
20
25
tournament size

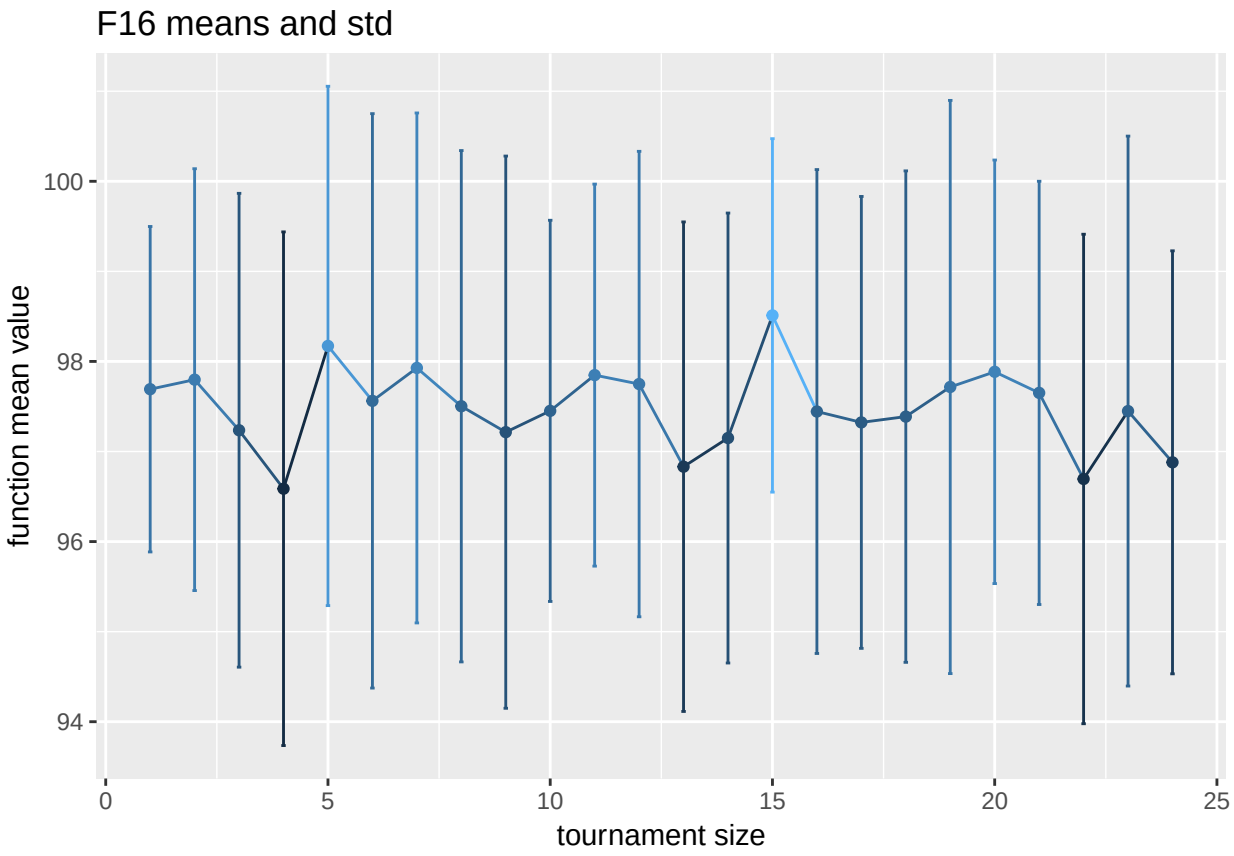

F13 means and C.I.
function mean value
1040
1000
960
0
5
10
15
20
25
tournament size

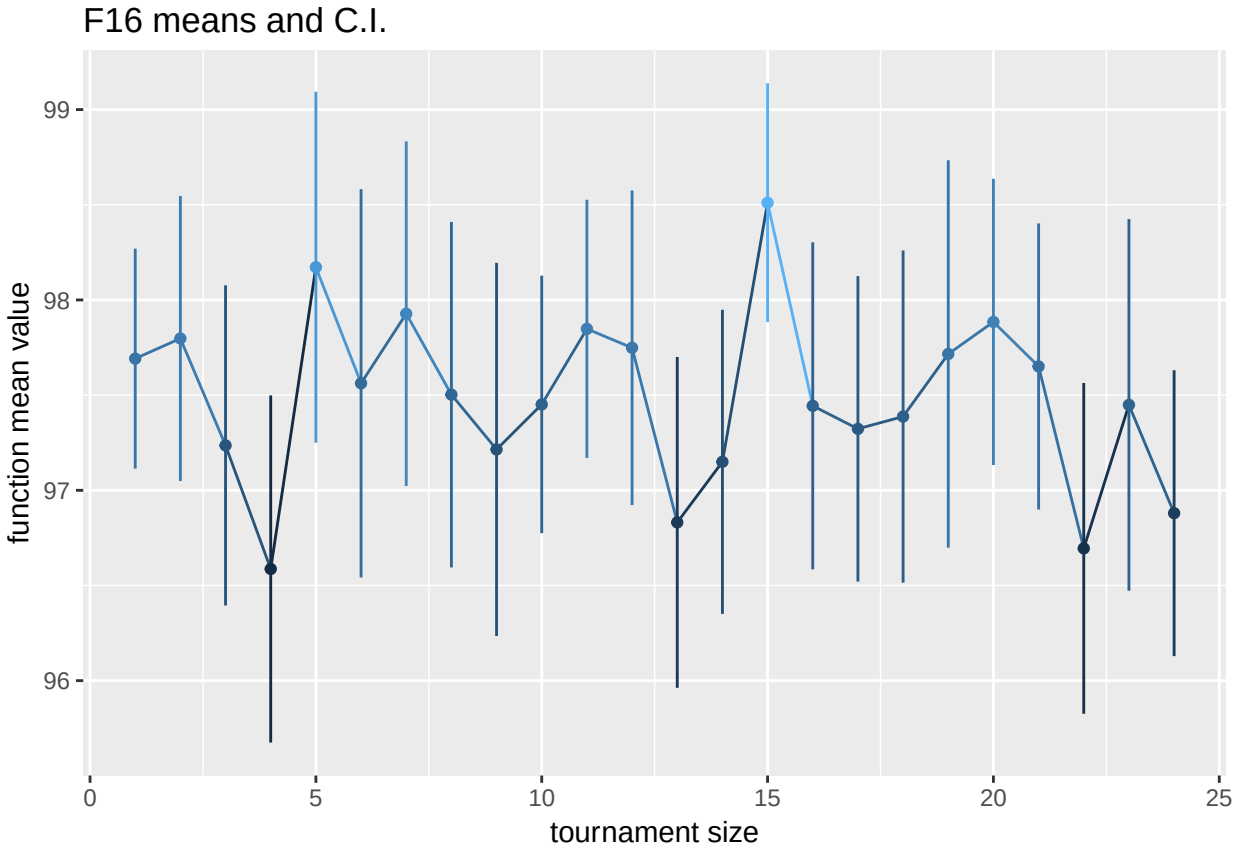

F14 means and std
function mean value
−42
−44
−46
0
5
10
15
20
25
tournament size

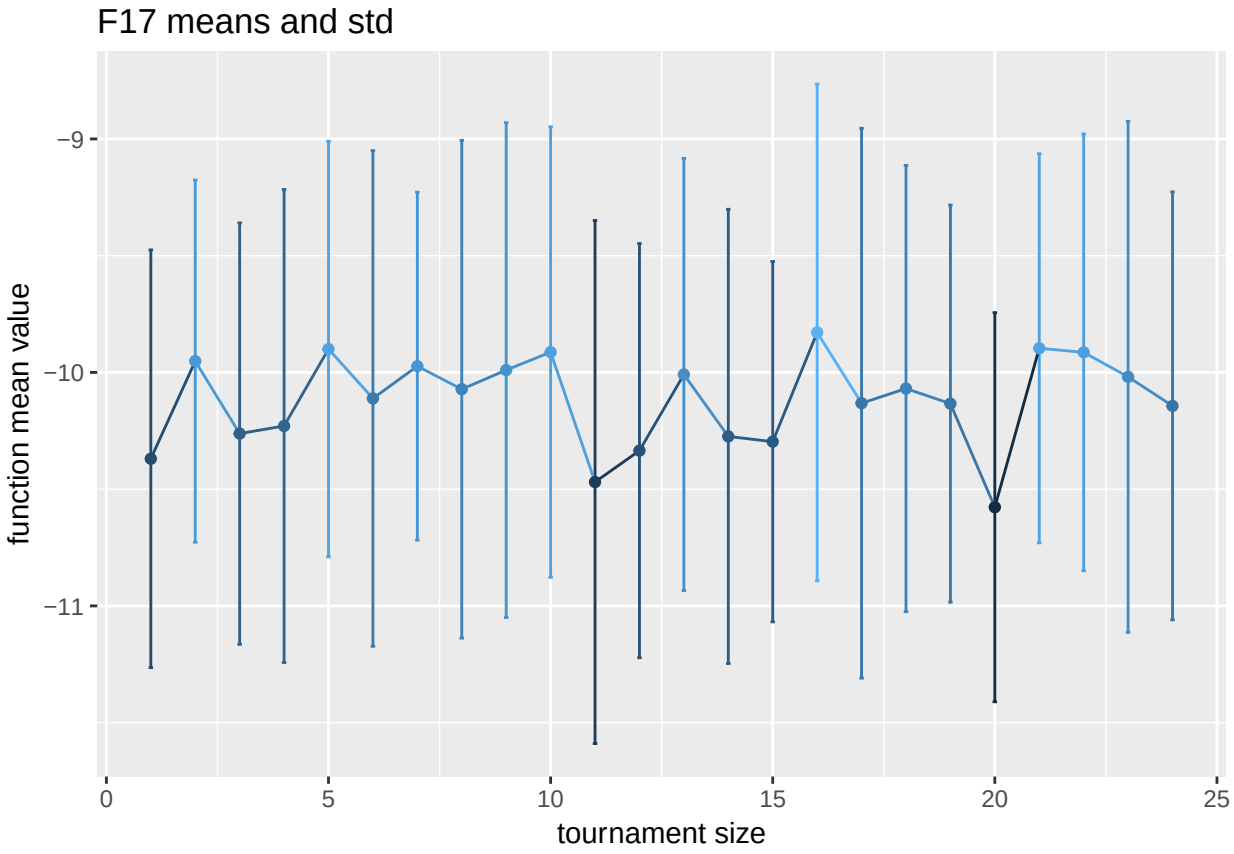

F14 means and C.I.
function mean value
−42.0
−42.5
−43.0
−43.5
−44.0
−44.5
0
5
10
15
20
25
tournament size

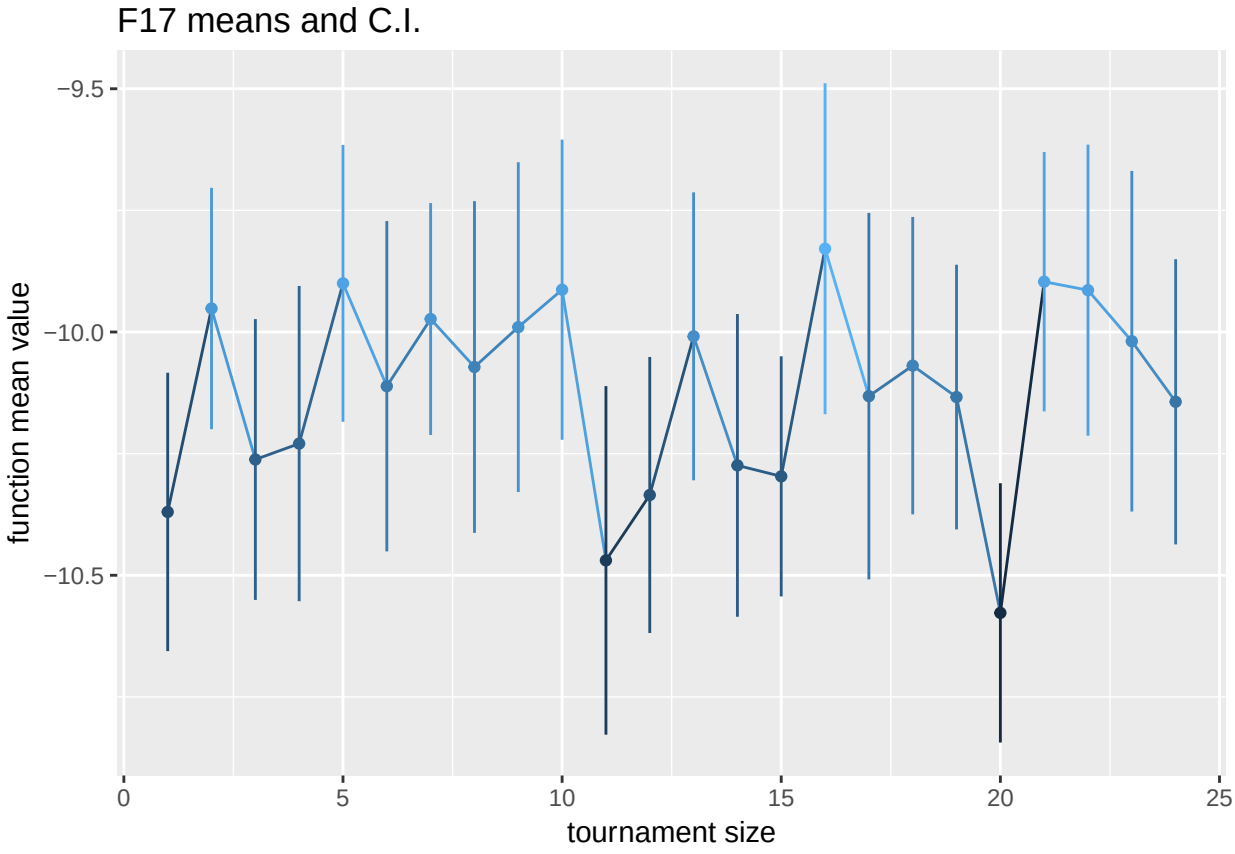

F15 means and std
1700
1650
1600
1550
function mean value
0
5
10
15
20
25
tournament size

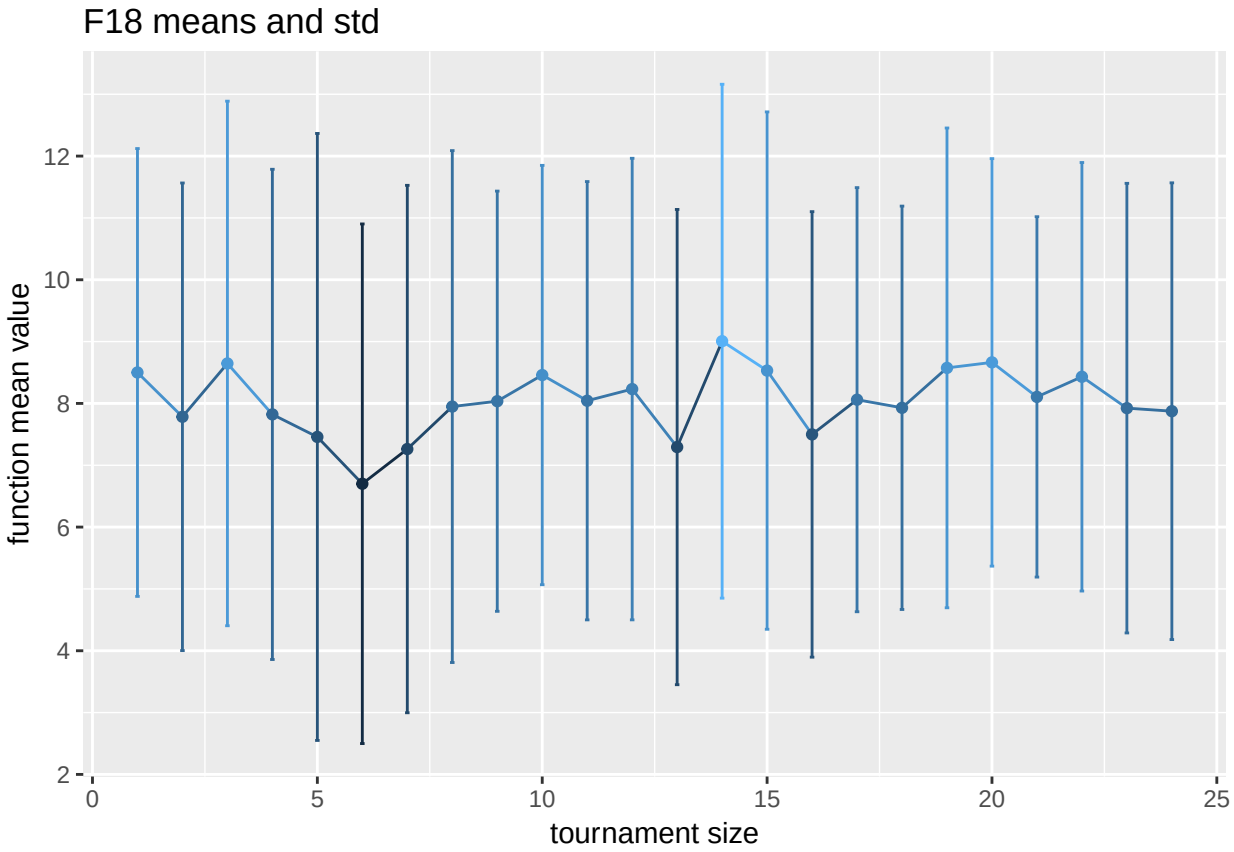

F15 means and C.I.
1640
1620
1600
1580
function mean value
0
5
10
15
20
25
tournament size

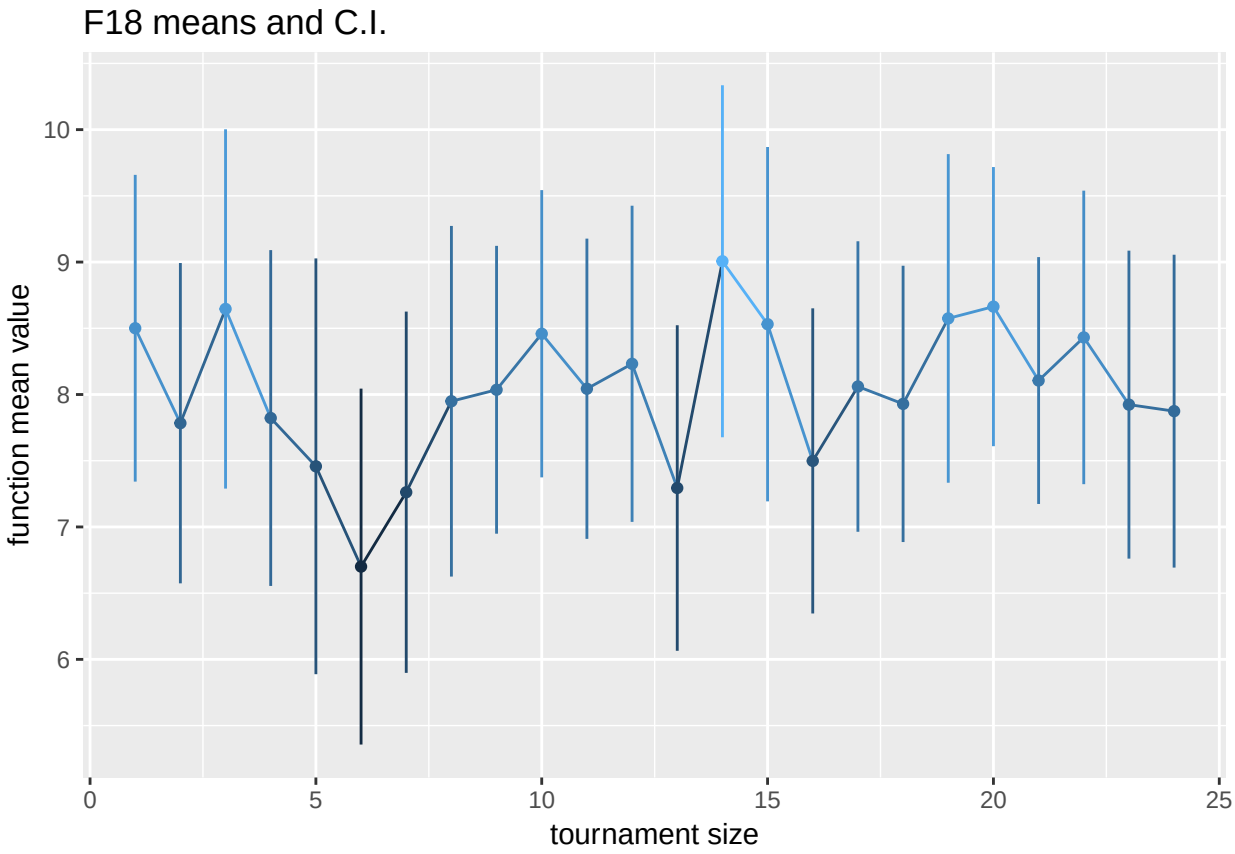

F16 means and std
function mean value
100
98
96
94
0
5
10
15
20
25
tournament size

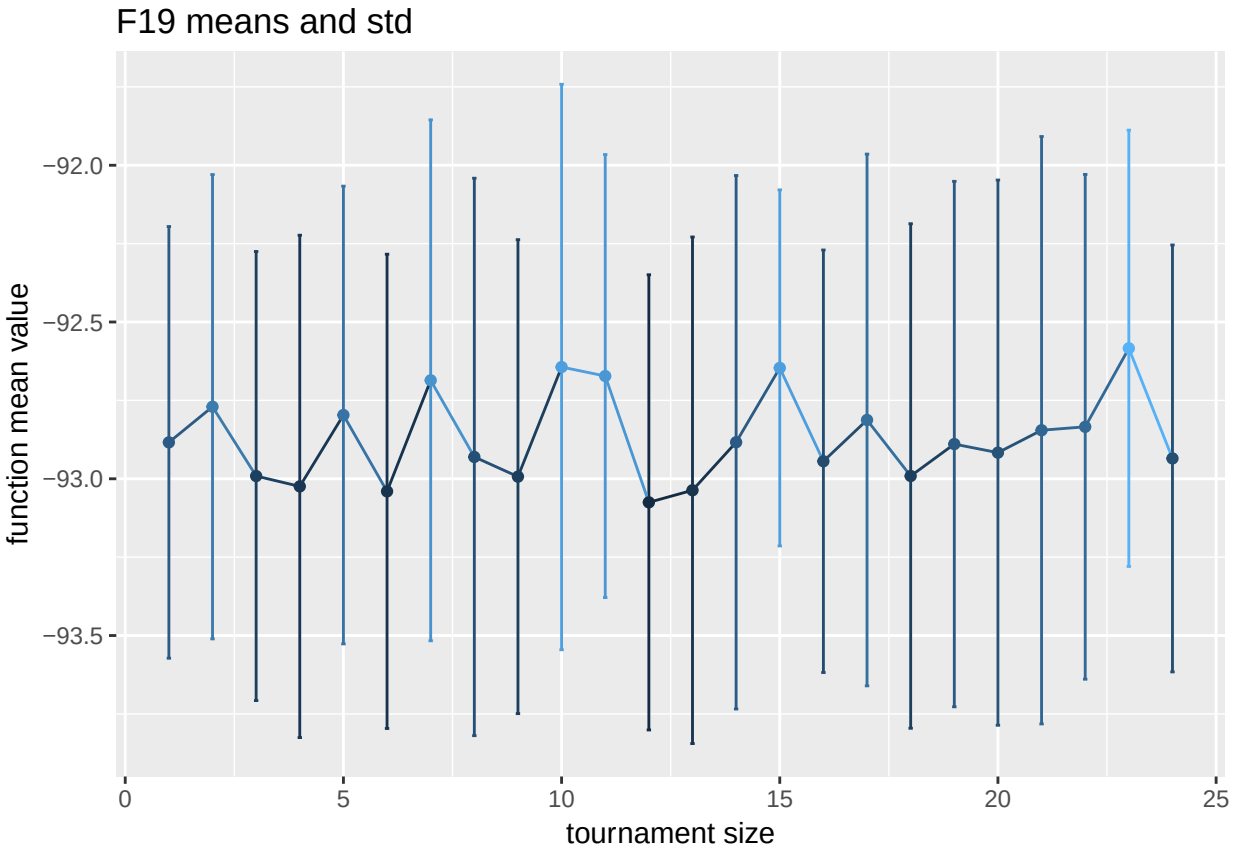

F16 means and C.I.
function mean value
99
98
97
96
0
5
10
15
20
25
tournament size

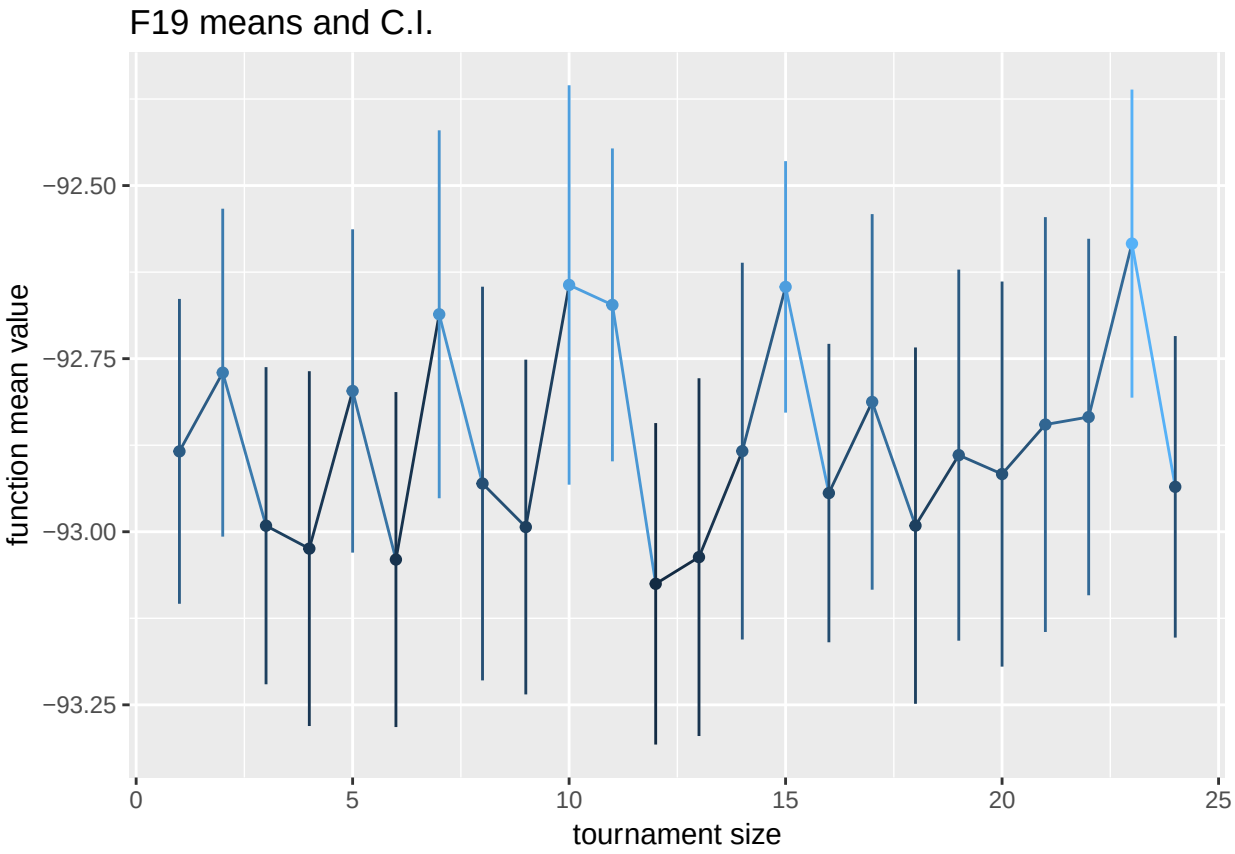

F17 means and std
function mean value
−9
−10
−11
0
5
10
15
20
25
tournament size

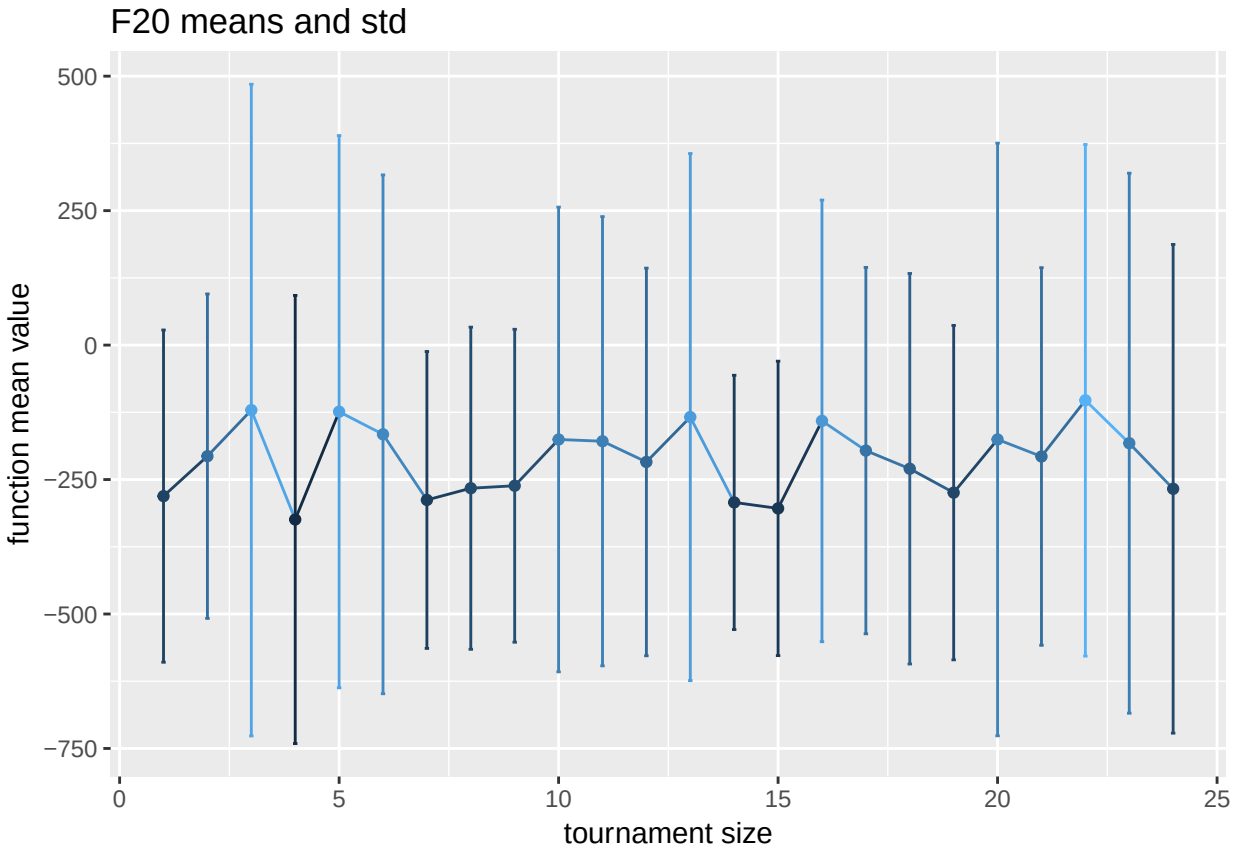

F17 means and C.I.
function mean value
−9.5
−10.0
−10.5
0
5
10
15
20
25
tournament size

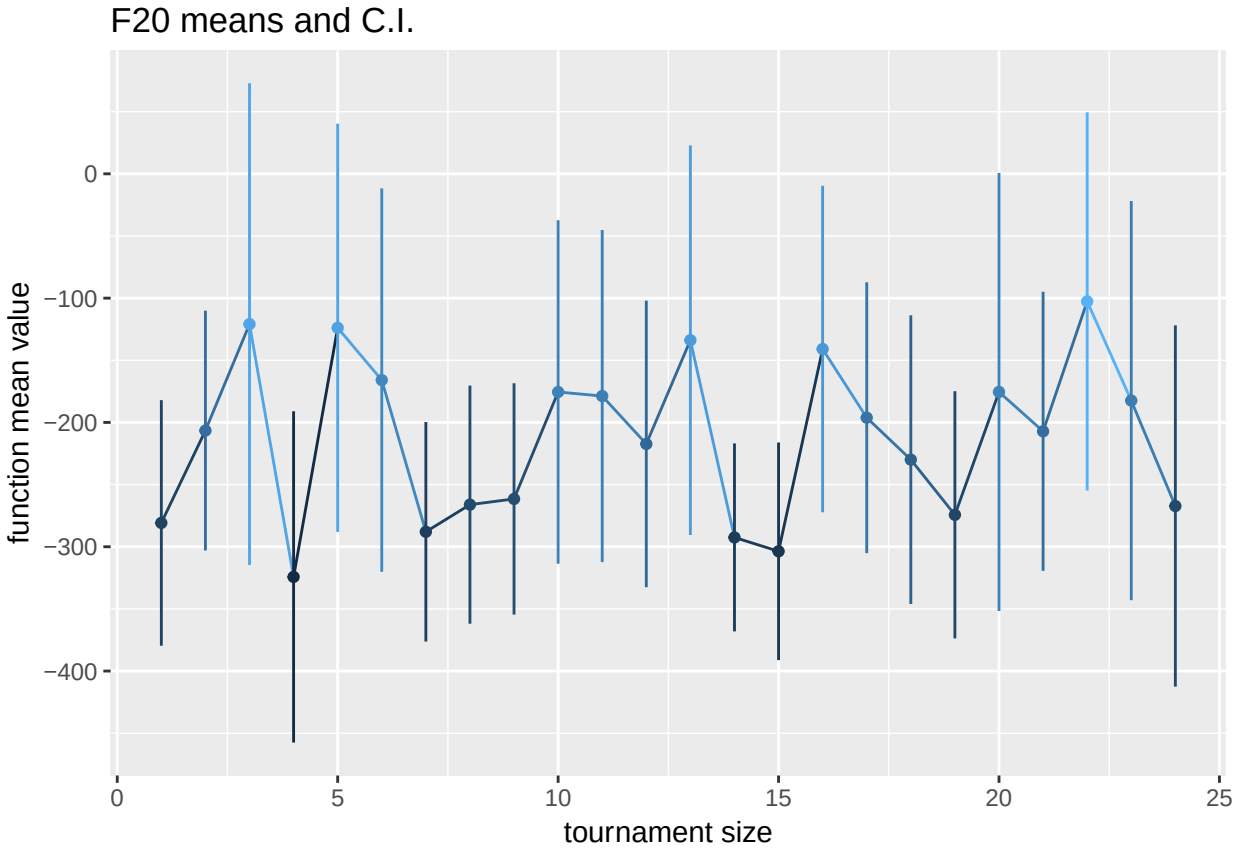

F18 means and std
function mean value
tournament size
2
4
6
8
10
12
0
5
10
15
20
25

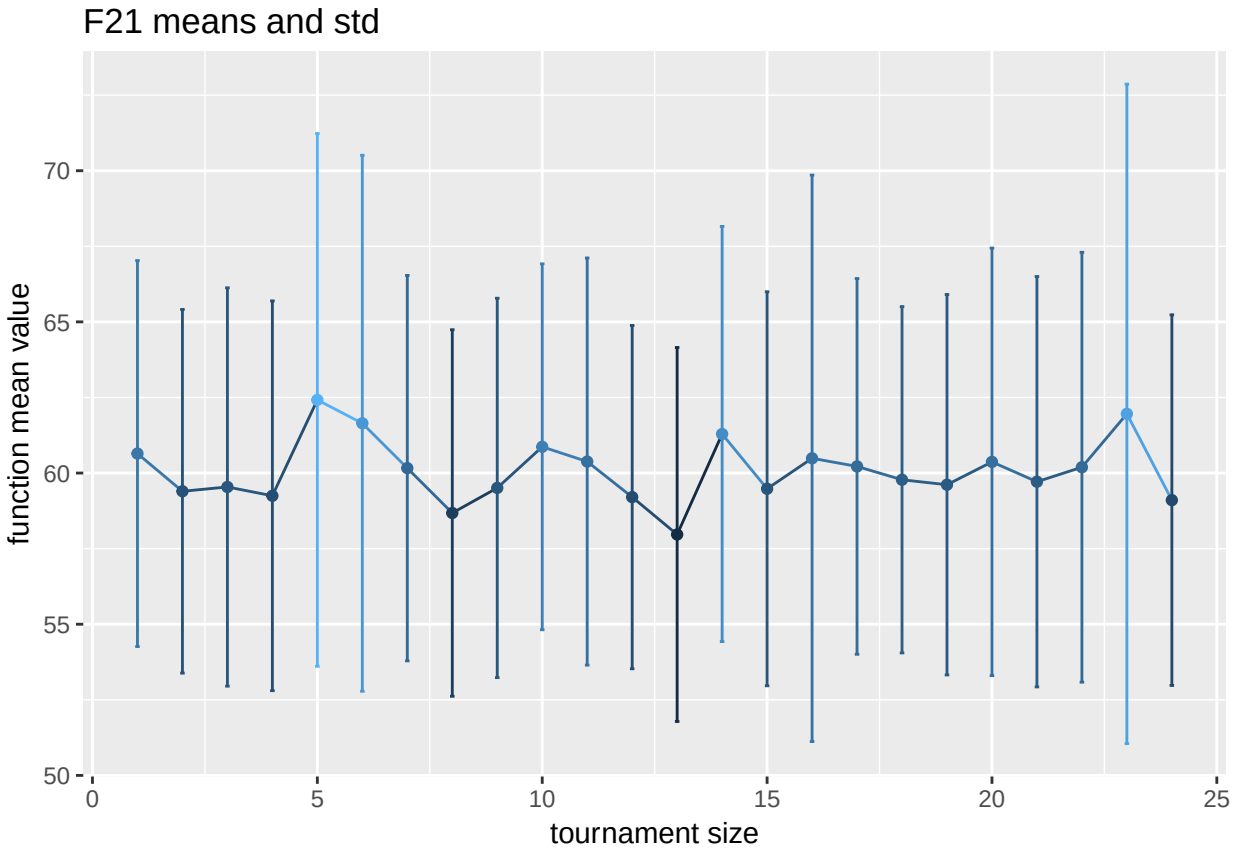

F18 means and C.I.
function mean value
tournament size
6
7
8
9
10
0
5
10
15
20
25

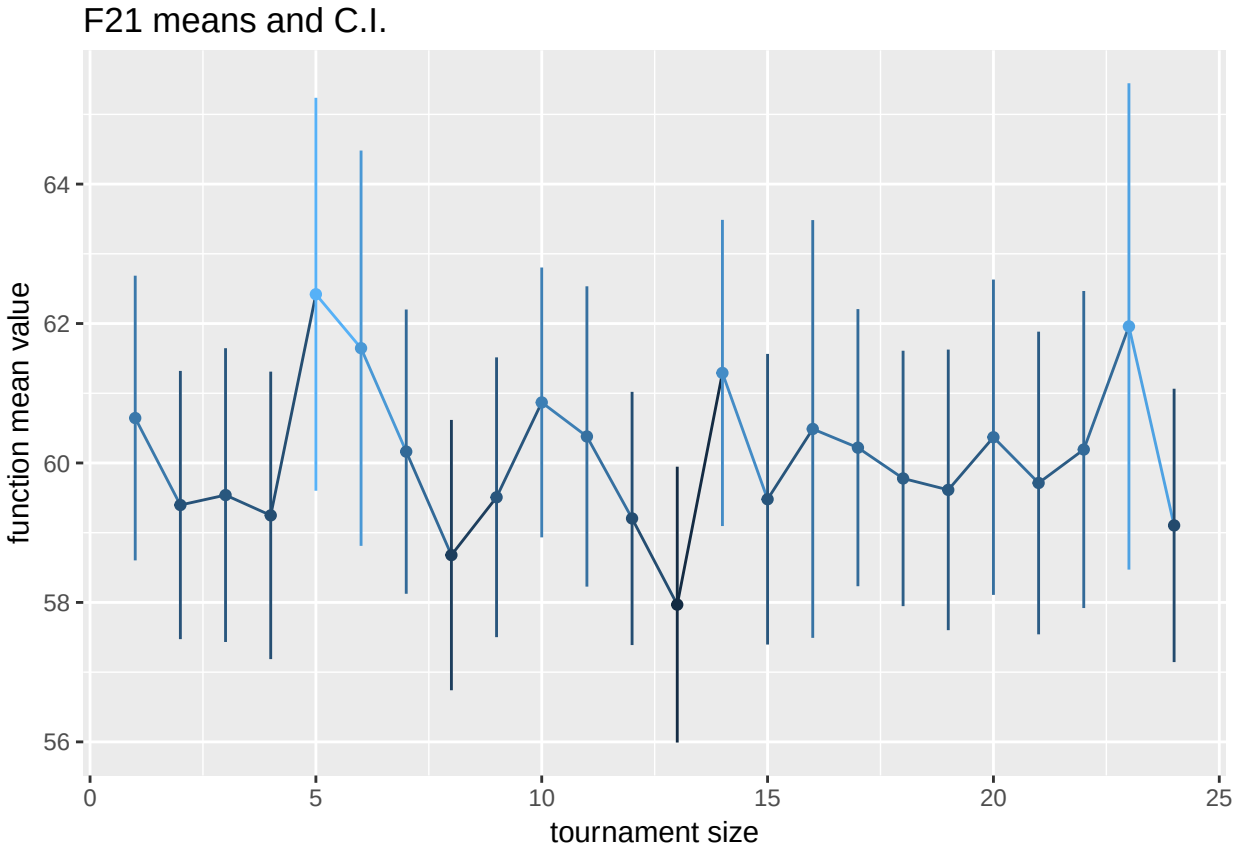

F19 means and std
function mean value
−92.0
−92.5
−93.0
−93.5
0
5
10
15
20
25
tournament size

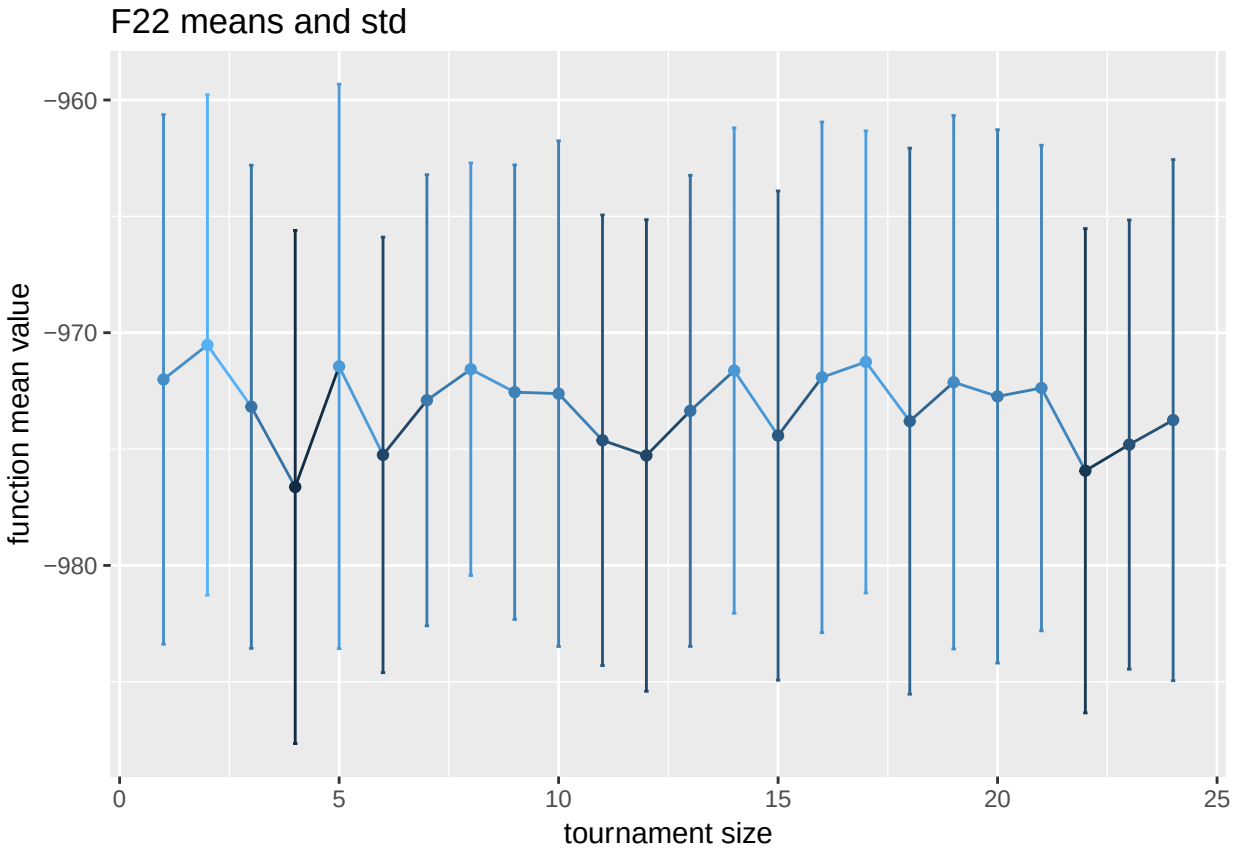

F19 means and C.I.
function mean value
−92.50
−92.75
−93.00
−93.25
0
5
10
15
20
25
tournament size

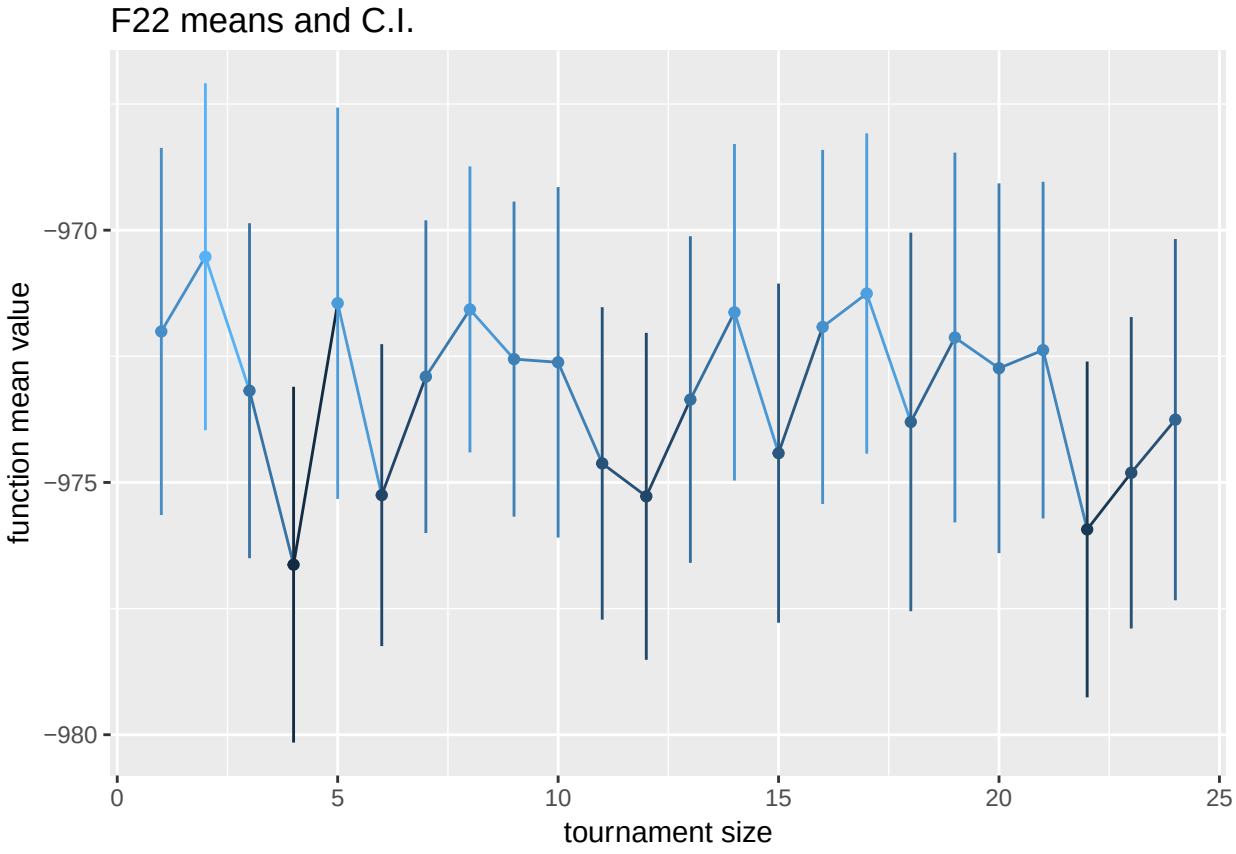

F20 means and std
500
250
0
−250
−500
−750
function mean value
0
5
10
15
20
25
tournament size

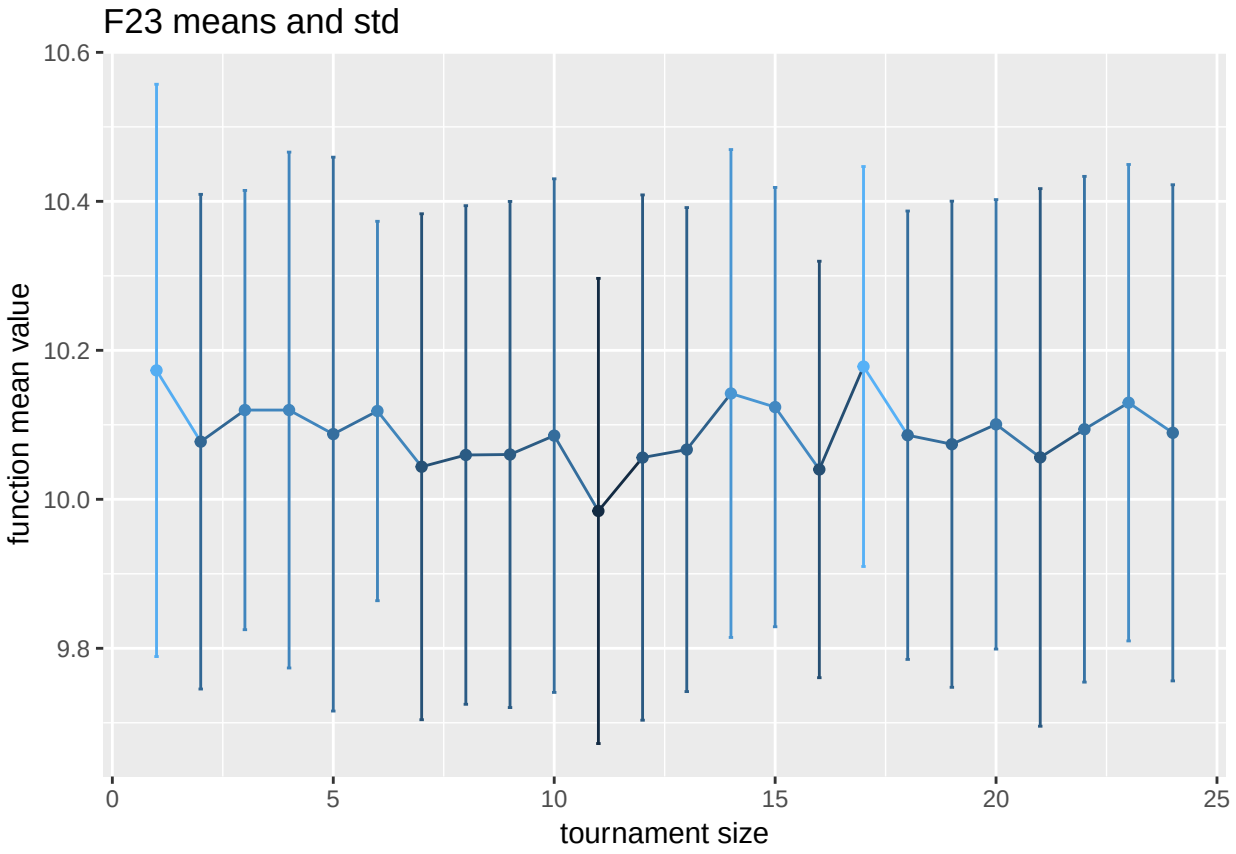

F20 means and C.I.
0
−100
−200
−300
−400
function mean value
0
5
10
15
20
25
tournament size

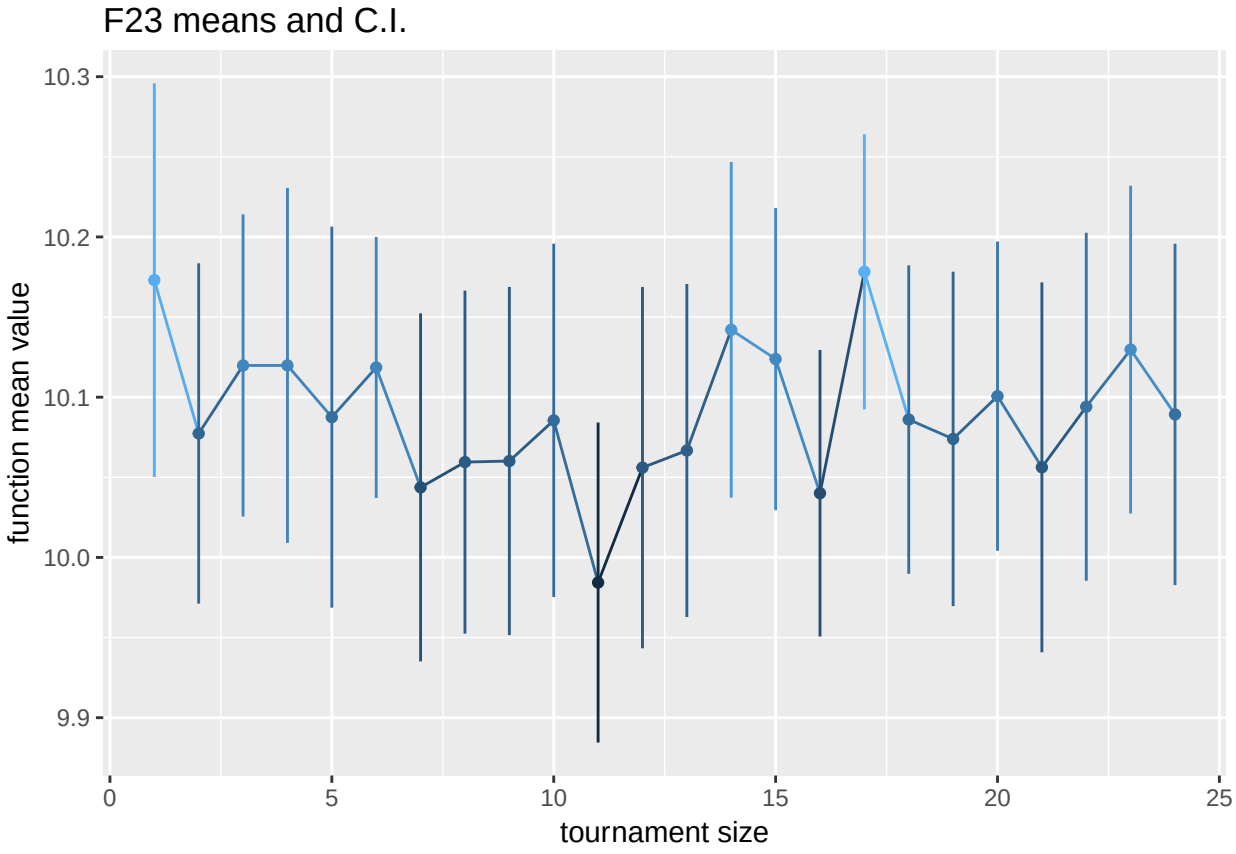

F21 means and std
function mean value
70
65
60
55
50
0
5
10
15
20
25
tournament size

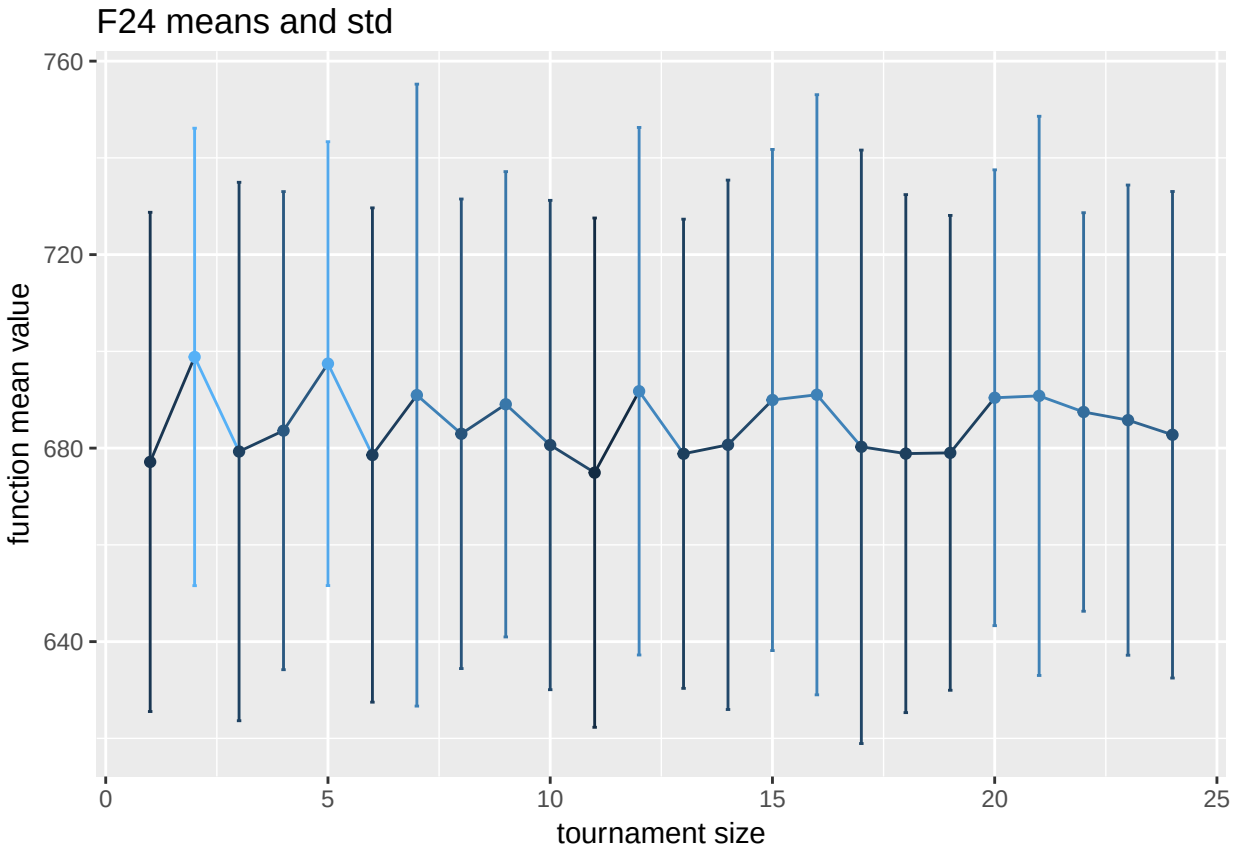

F21 means and C.I.
function mean value
64
62
60
58
56
0
5
10
15
20
25
tournament size

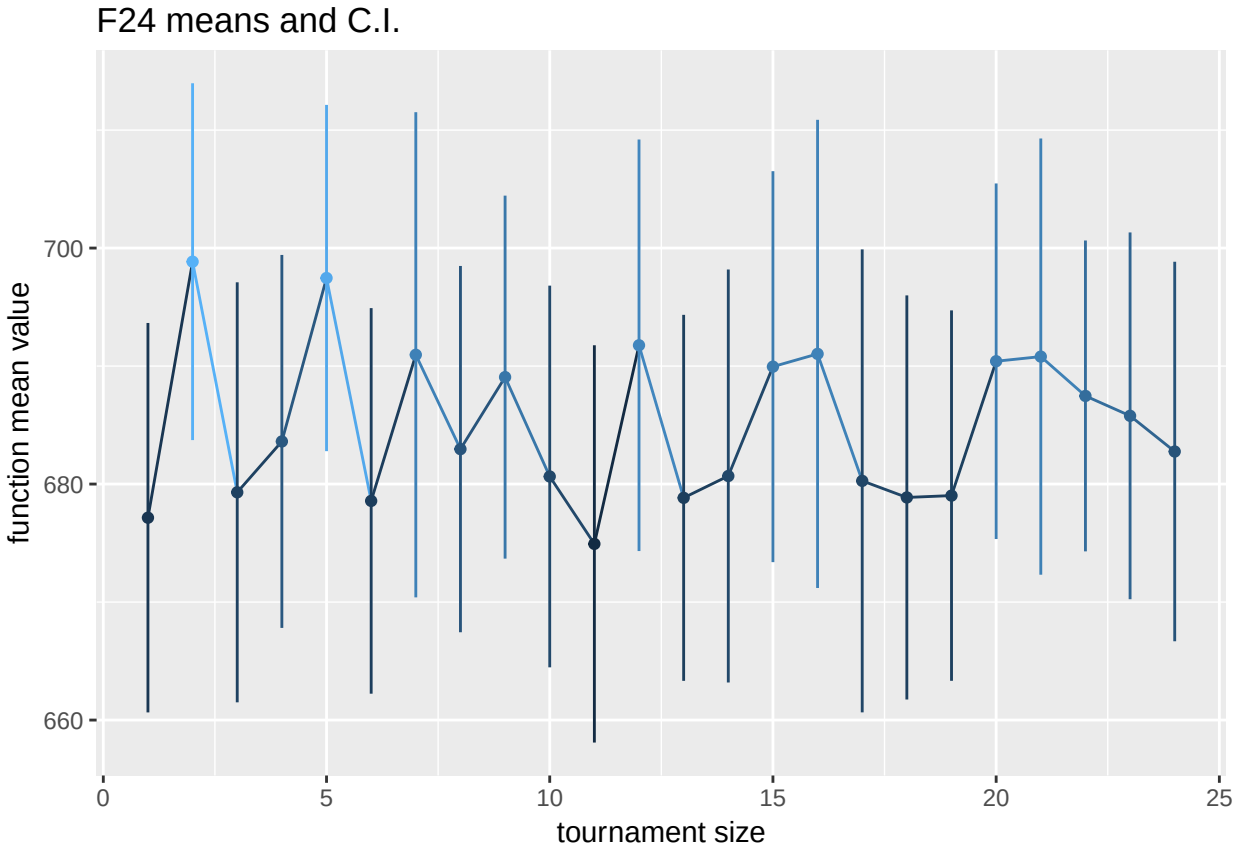

F22 means and std
function mean value
−960
−970
−980
0
5
10
15
20
25
tournament size


F22 means and C.I.
function mean value
−970
−975
−980
0
5
10
15
20
25
tournament size


F23 means and std
function mean value
10.6
10.4
10.2
10.0
9.8
0
5
10
15
20
25
tournament size

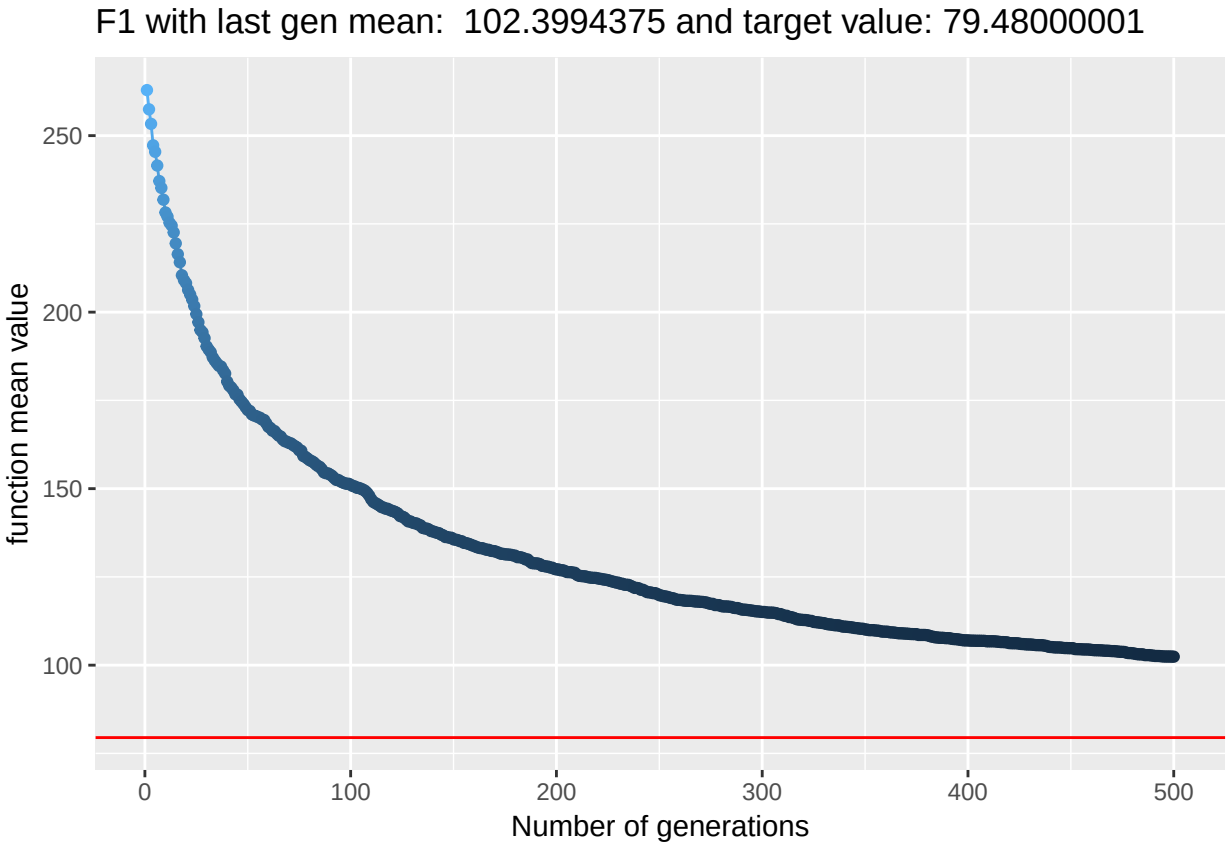

F23 means and C.I.
function mean value
10.3
10.2
10.1
10.0
9.9
0
5
10
15
20
25
tournament size

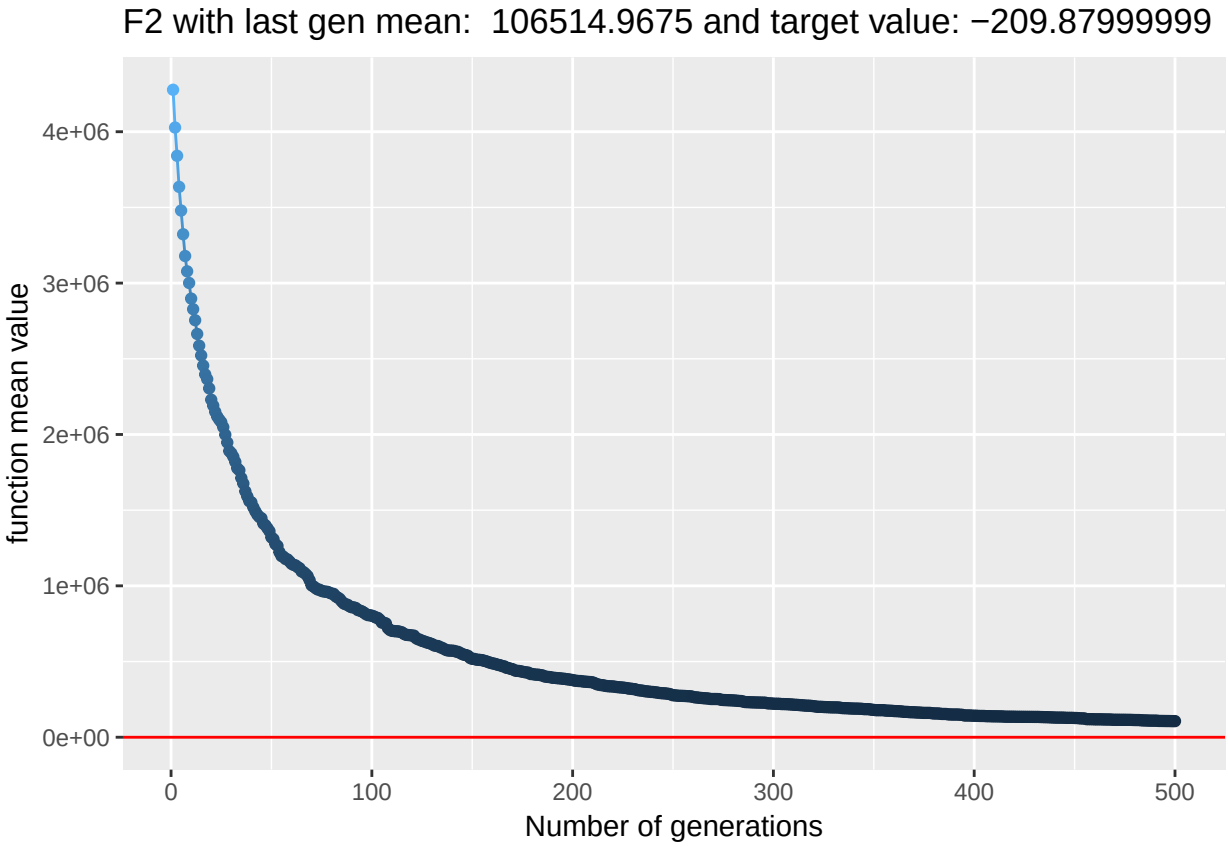

F24 means and std
760
720
680
640
function mean value
0
5
10
15
20
25
tournament size

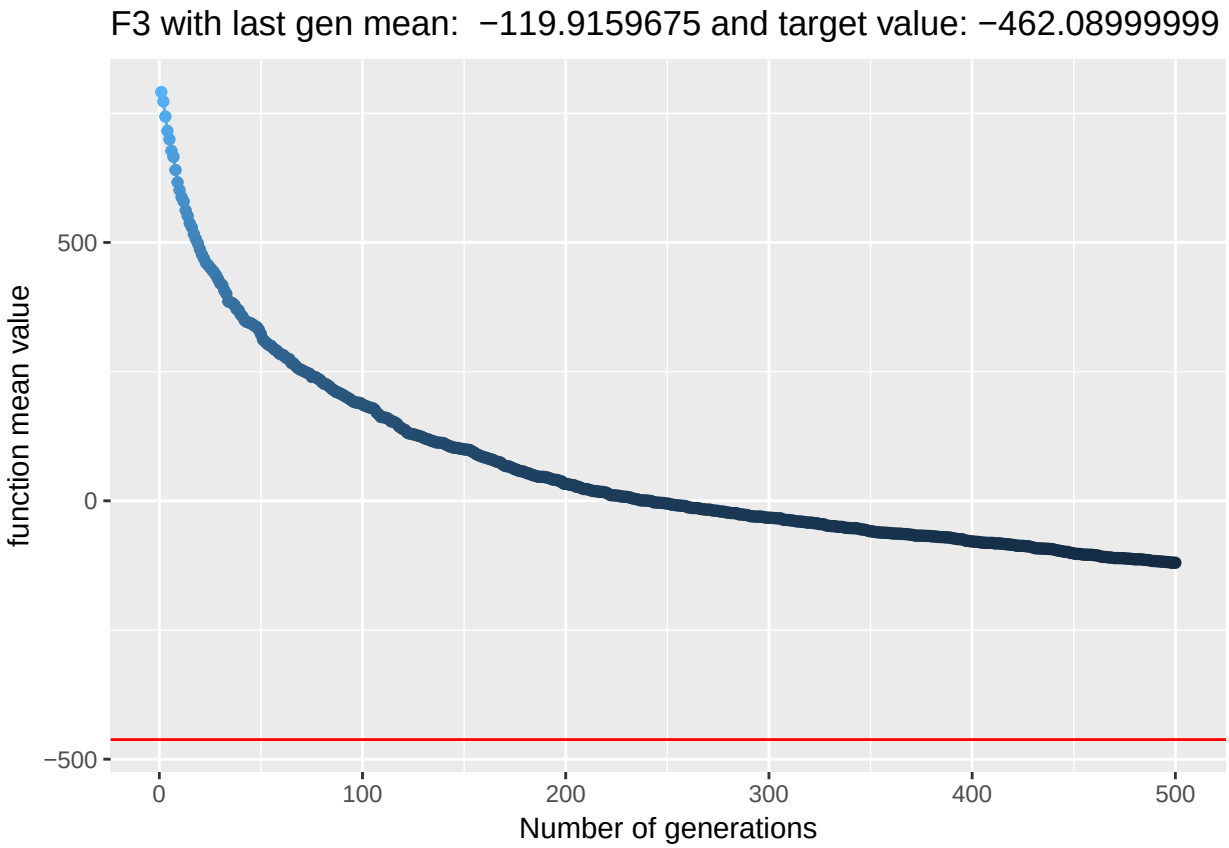

F24 means and C.I.
700
680
660
function mean value
0
5
10
15
20
25
tournament size

Convergency Plots

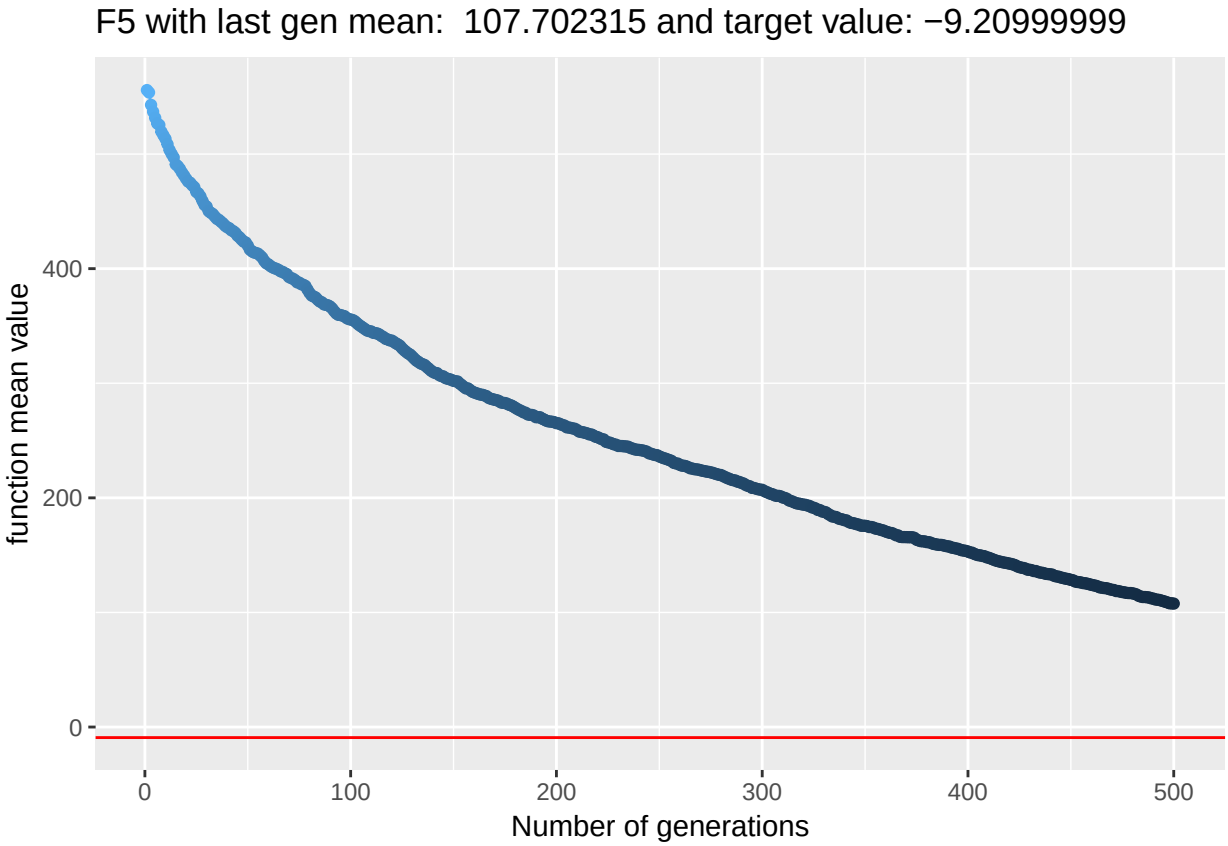
Based on the best values for K, from plots of the last section, we made the convergency plots. Not all k values are represented because the plot are basically the same. Also the std was omitted, because in some plots the difference betwen the std and the mean is very big. In those cases, it was difficult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

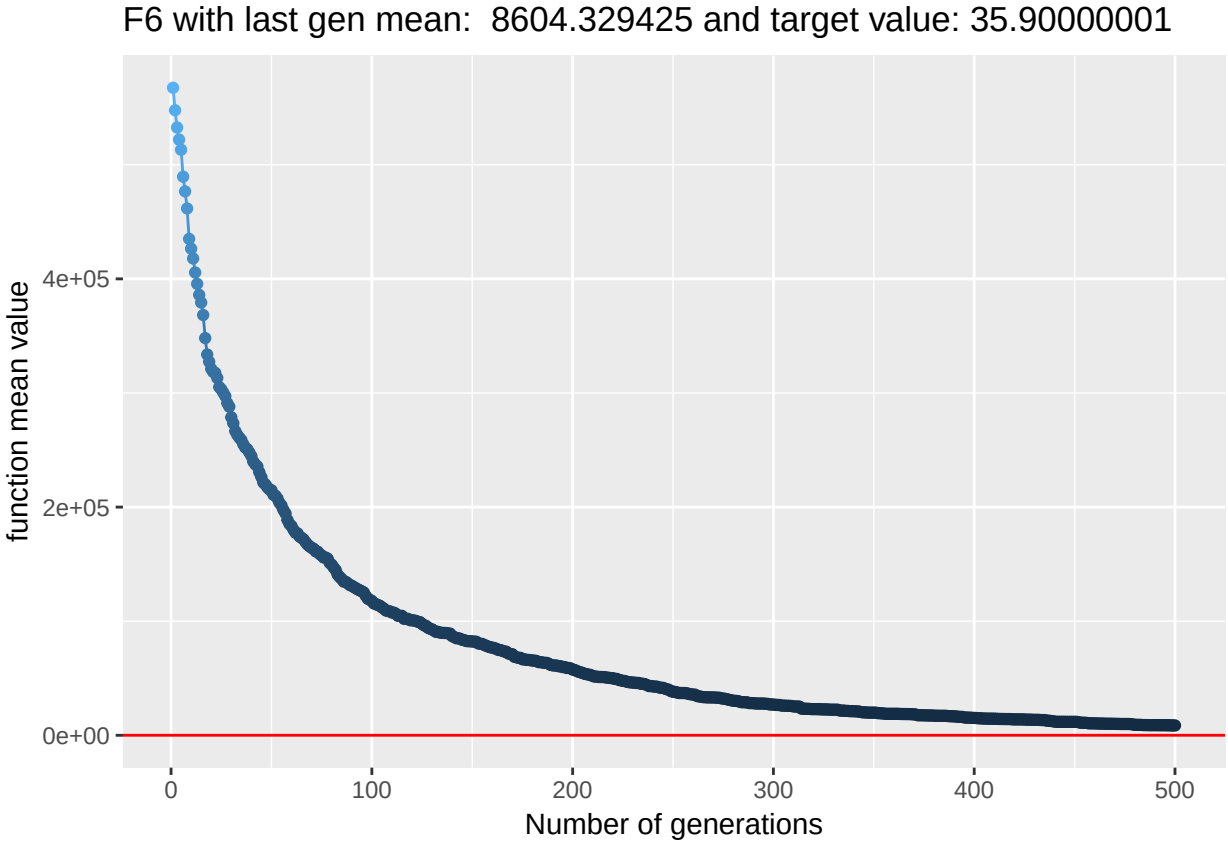

F1 with last gen mean: 102.3994375 and target value: 79.48000001
function mean value
250
200
150
100
0
100
200
300
400
500
Number of generations

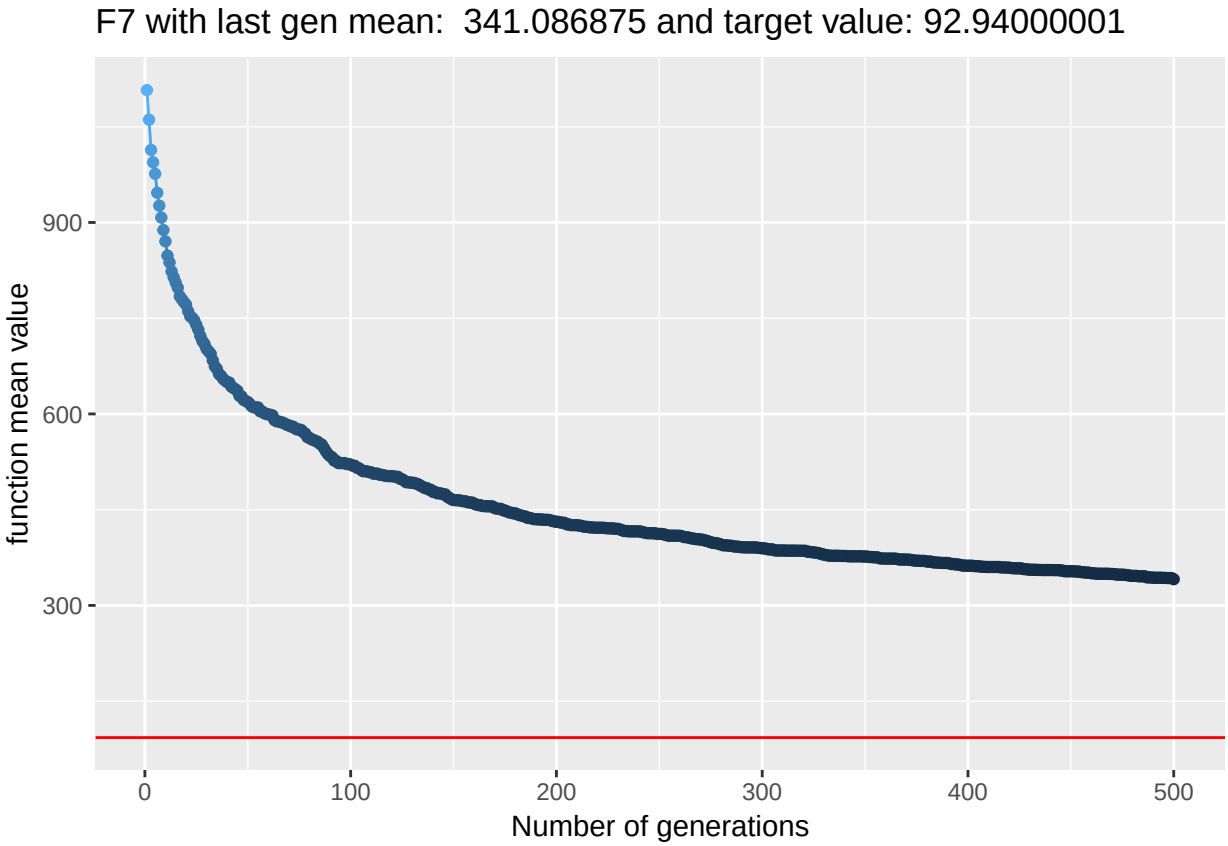

F2 with last gen mean: 106514.9675 and target value: −209.87999999
function mean value
4e+06
3e+06
2e+06
1e+06
0e+00
0
100
200
300
400
500
Number of generations

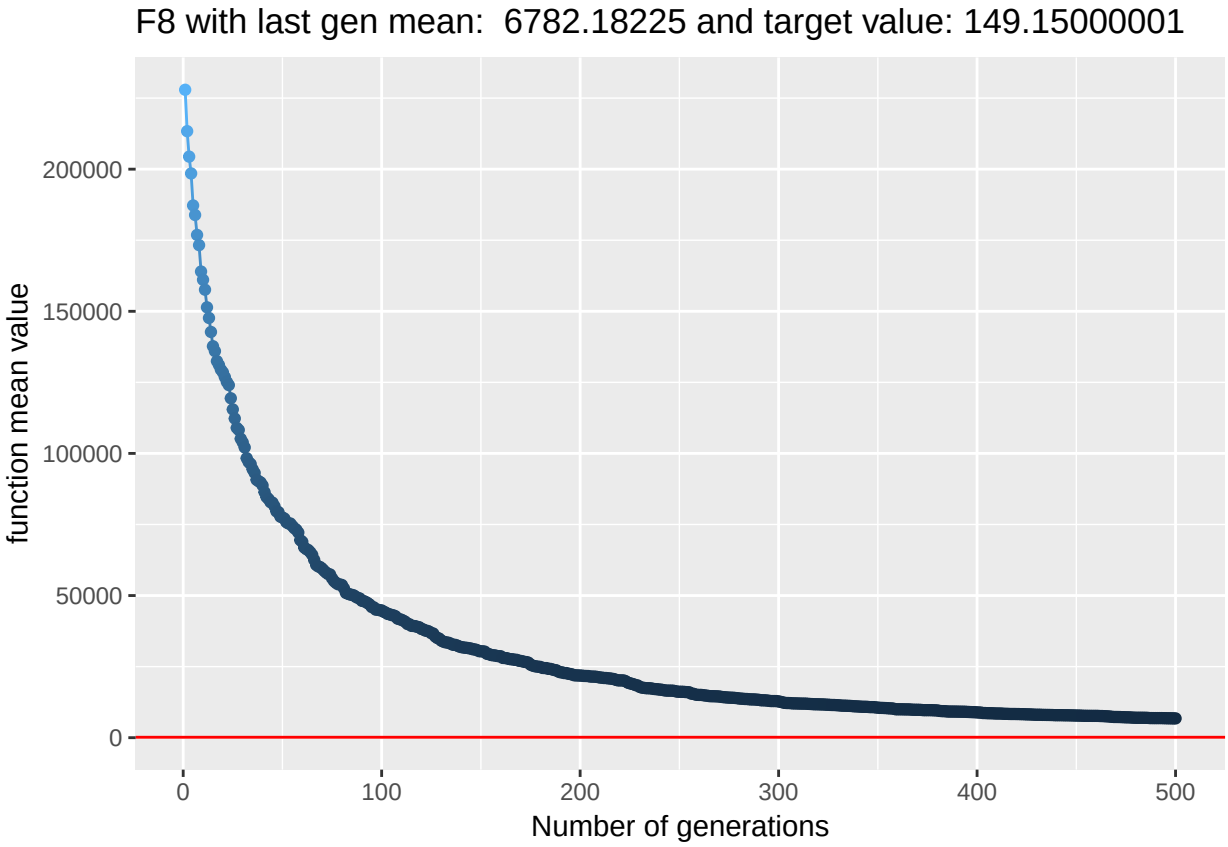

F3 with last gen mean: −119.9159675 and target value: −462.08999999
function mean value
500
0
−500
0
100
200
300
400
500
Number of generations

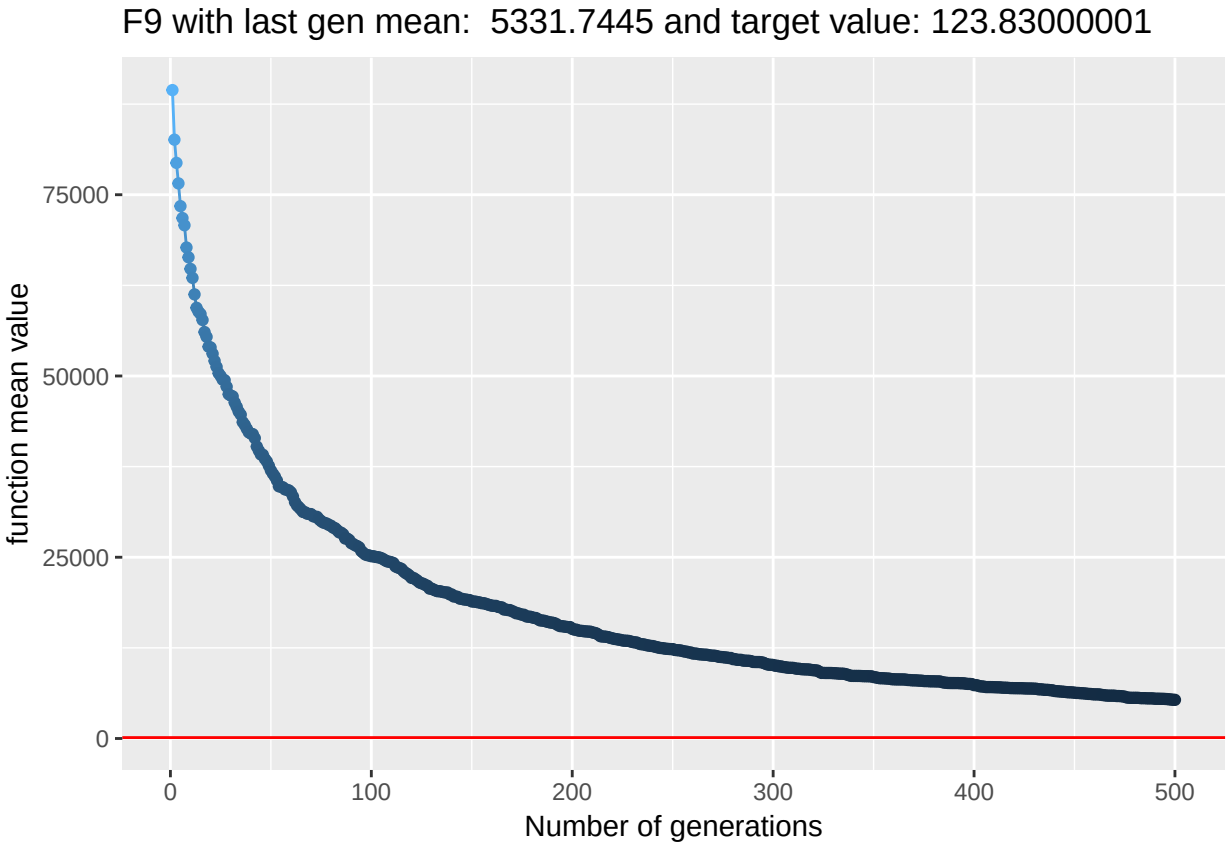

F4 with last gen mean: −19.80504075 and target value: −462.08999999
function mean value
1000
500
0
−500
0
100
200
300
400
500
Number of generations

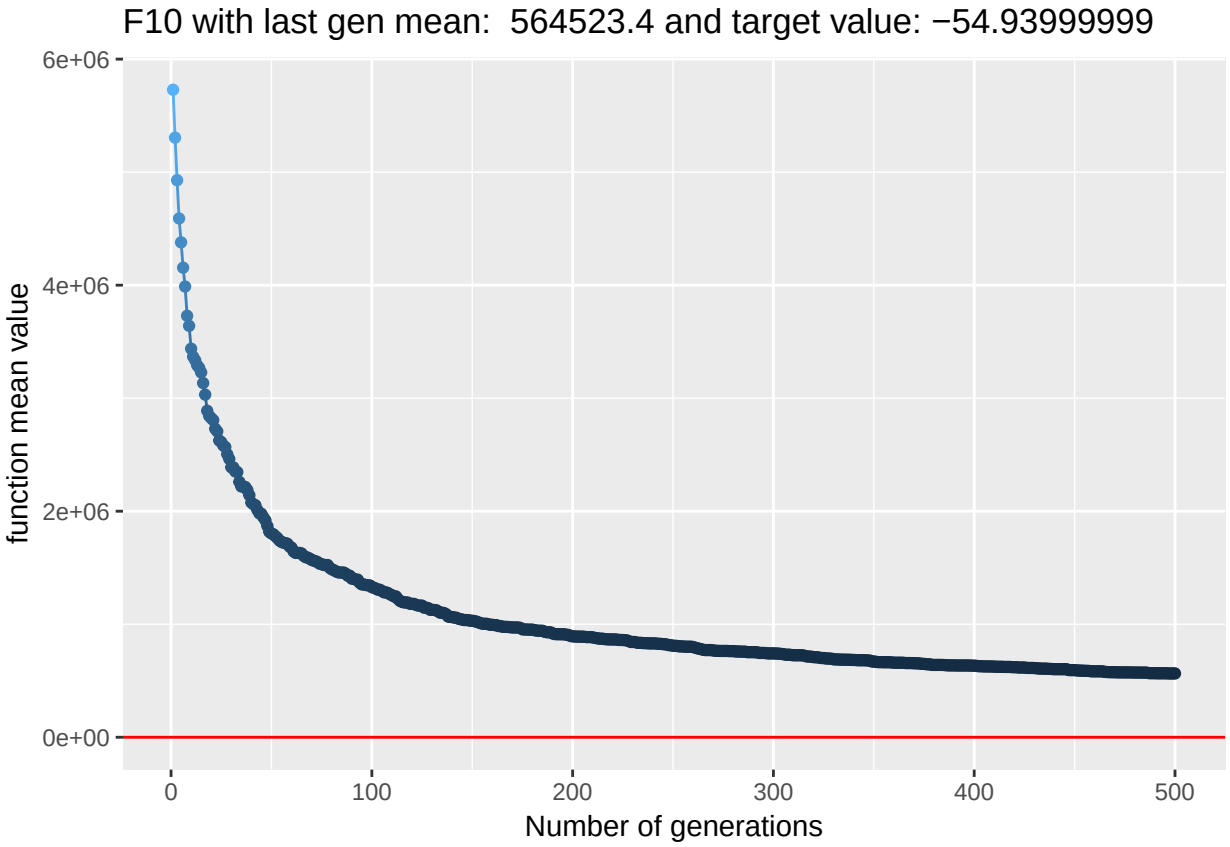

F5 with last gen mean: 107.702315 and target value: −9.20999999
function mean value
400
200
0
0
100
200
300
400
500
Number of generations

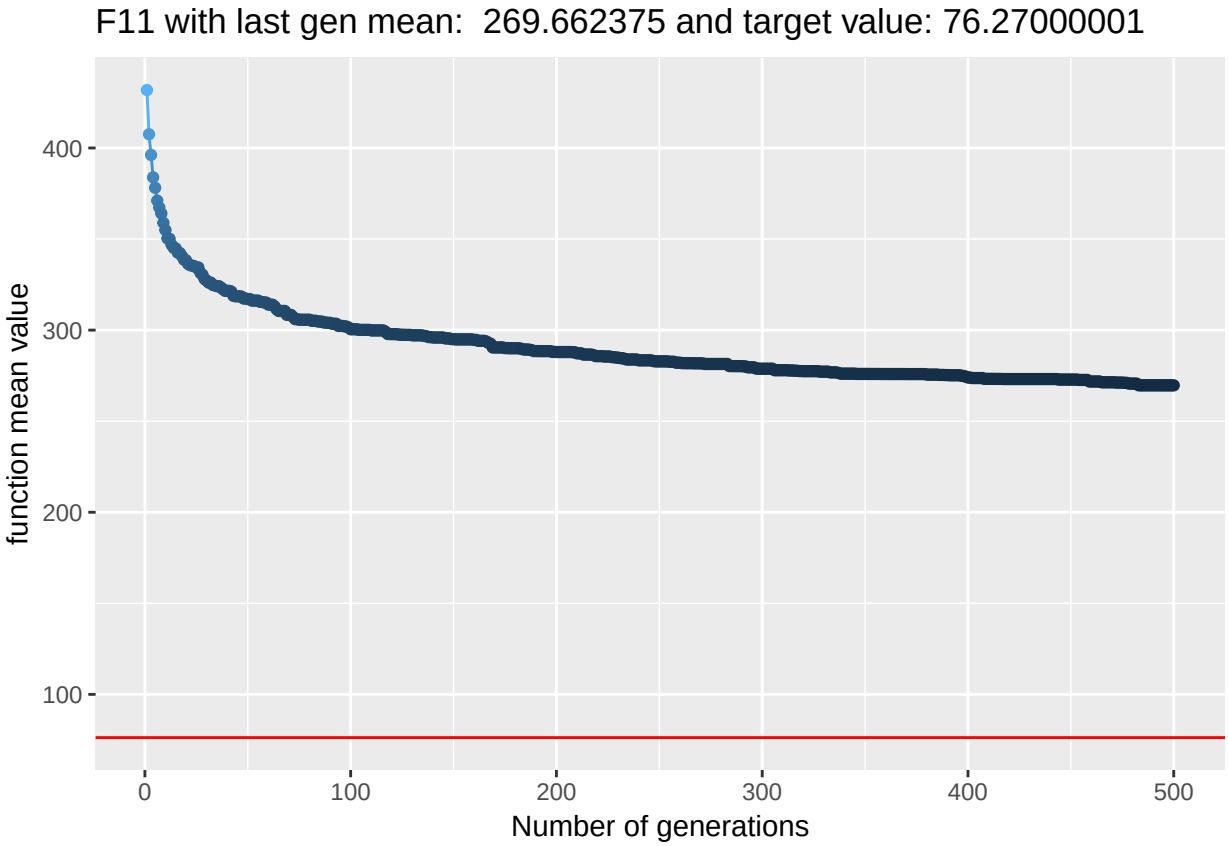

F6 with last gen mean: 8604.329425 and target value: 35.90000001
function mean value
4e+05
2e+05
0e+00
0
100
200
300
400
500
Number of generations

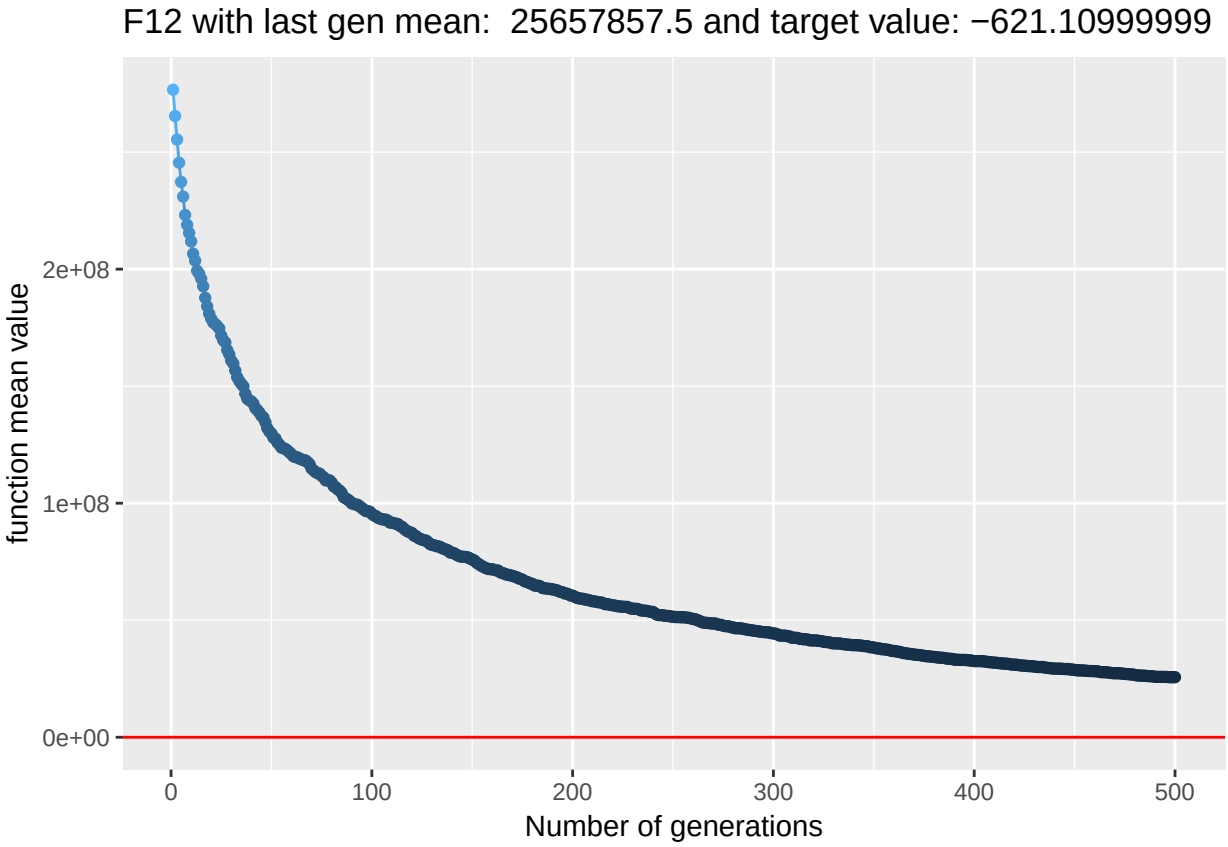

F7 with last gen mean: 341.086875 and target value: 92.94000001
function mean value
900
600
300
0
100
200
300
400
500
Number of generations

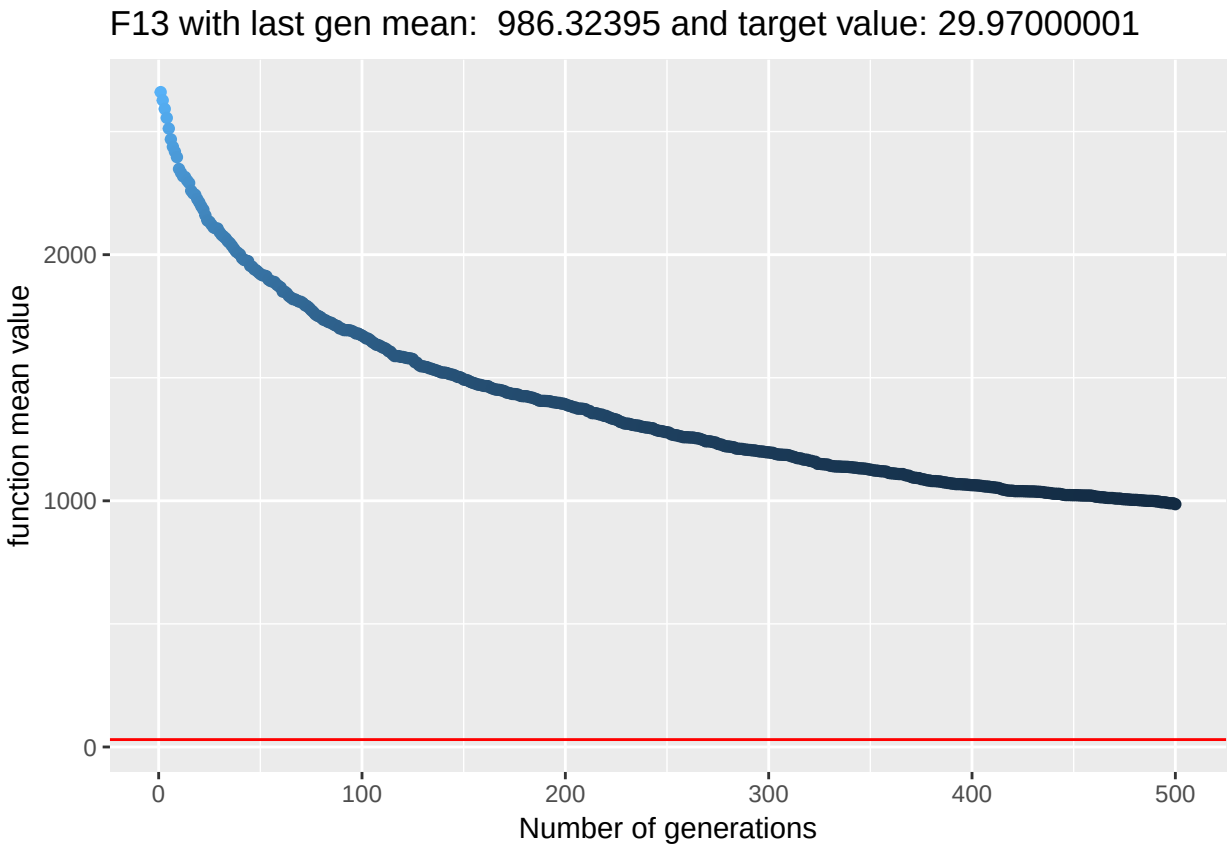

F8 with last gen mean: 6782.18225 and target value: 149.15000001
function mean value
200000
150000
100000
50000
0
0
100
200
300
400
500
Number of generations

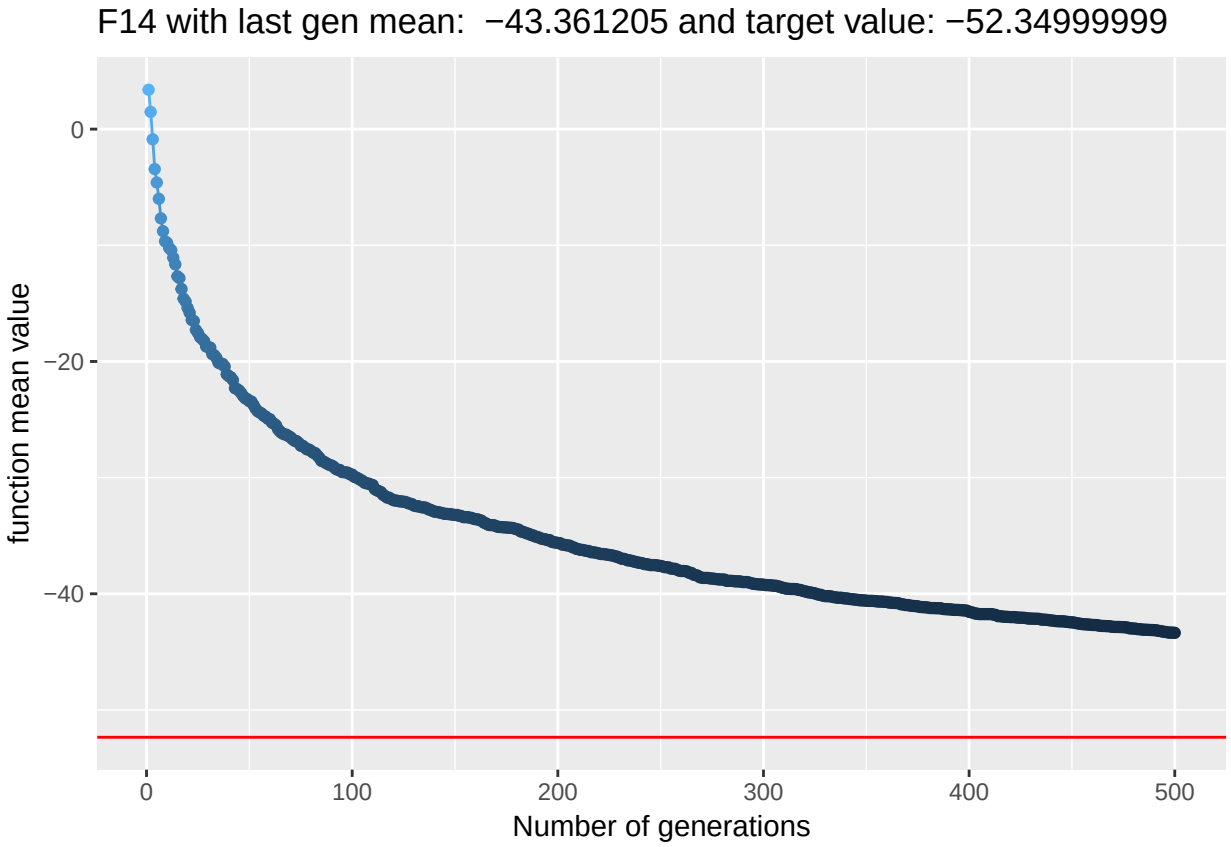

F9 with last gen mean: 5331.7445 and target value: 123.83000001
function mean value
75000
50000
25000
0
0
100
200
300
400
500
Number of generations

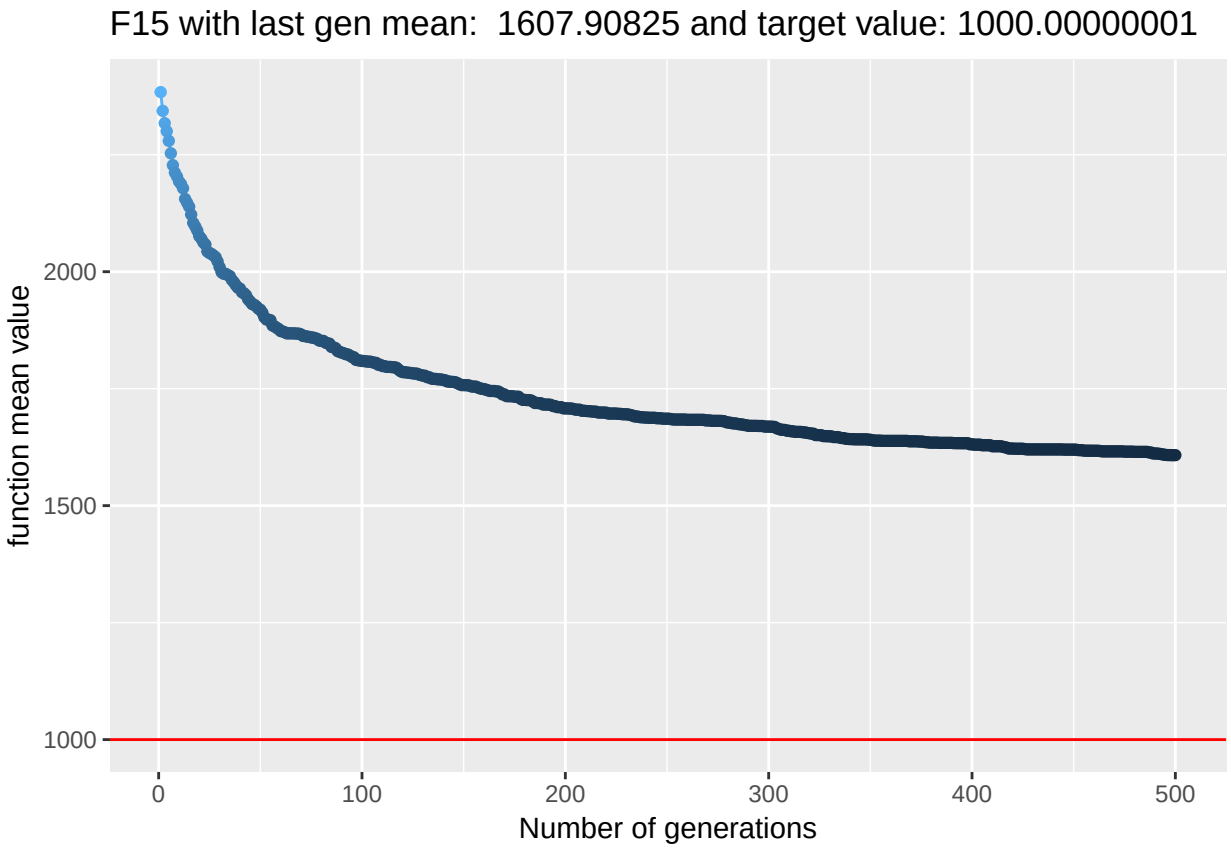

F10 with last gen mean: 564523.4 and target value: −54.93999999
function mean value
6e+06
4e+06
2e+06
0e+00
0
100
200
300
400
500
Number of generations

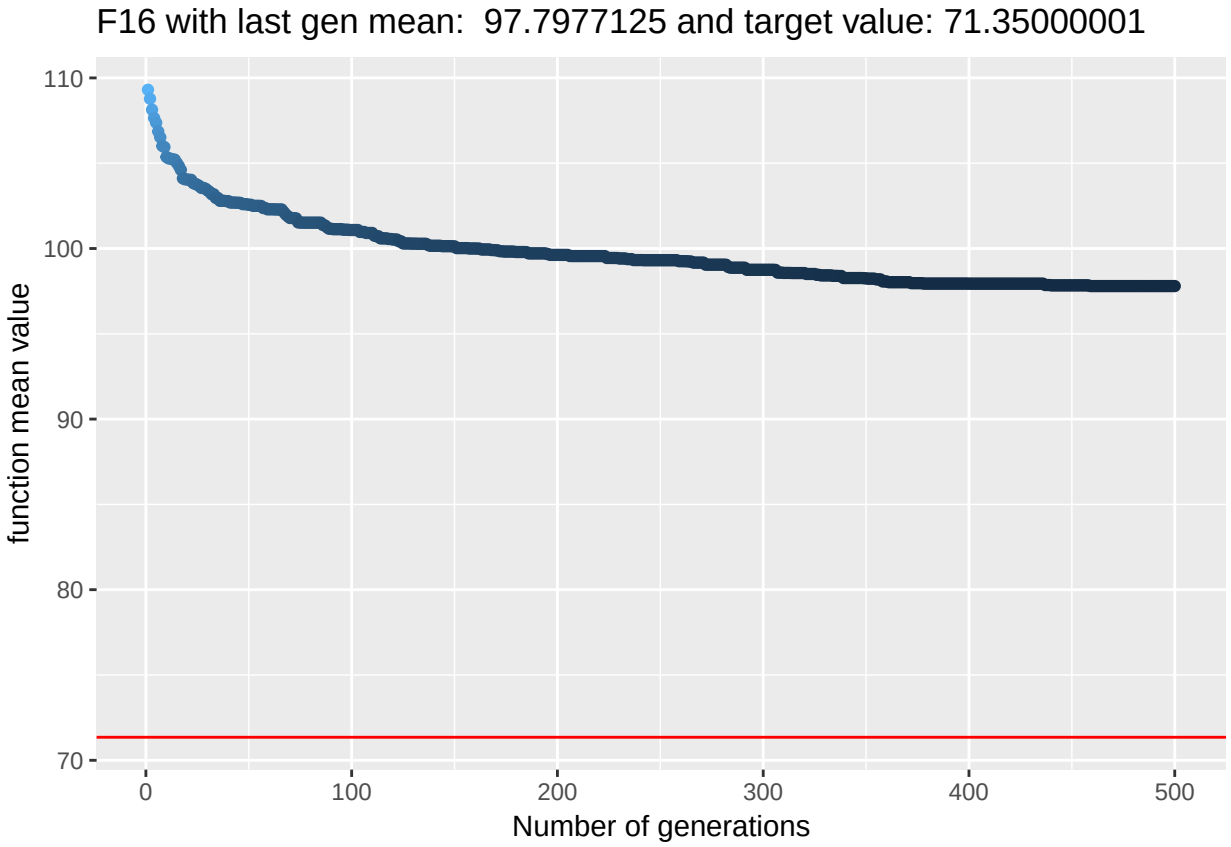

F11 with last gen mean: 269.662375 and target value: 76.27000001
function mean value
400
300
200
100
0
100
200
300
400
500
Number of generations

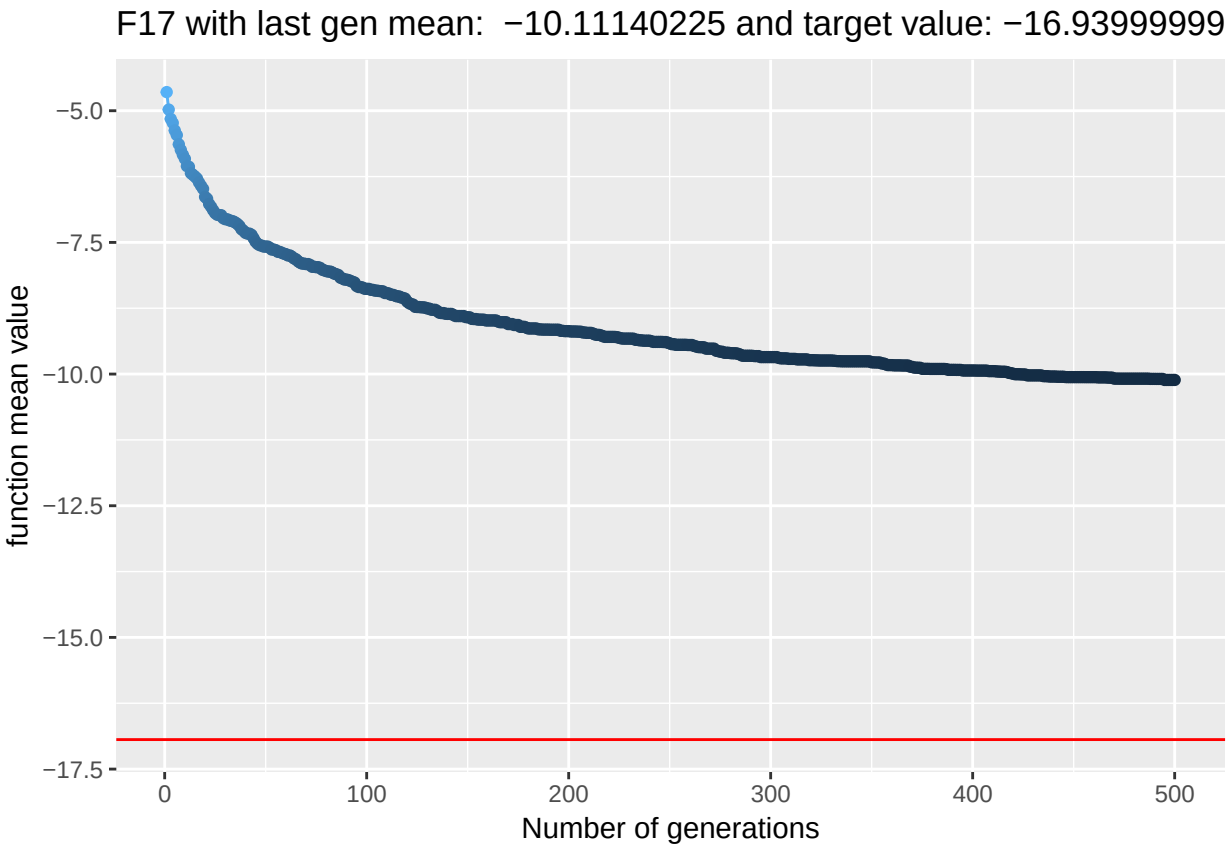

F12 with last gen mean: 25657857.5 and target value: −621.10999999
function mean value
2e+08
1e+08
0e+00
0
100
200
300
400
500
Number of generations

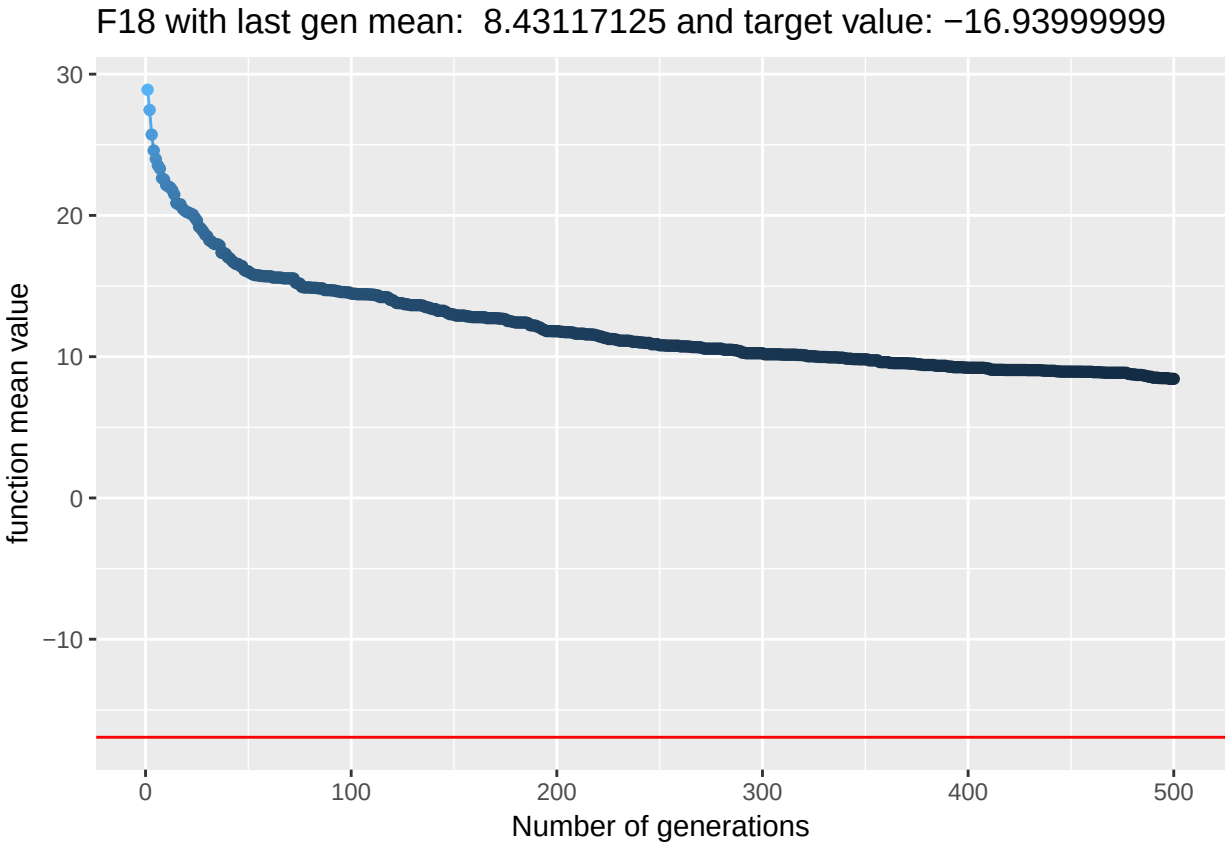

F13 with last gen mean: 986.32395 and target value: 29.97000001
function mean value
2000
1000
0
0
100
200
300
400
500
Number of generations

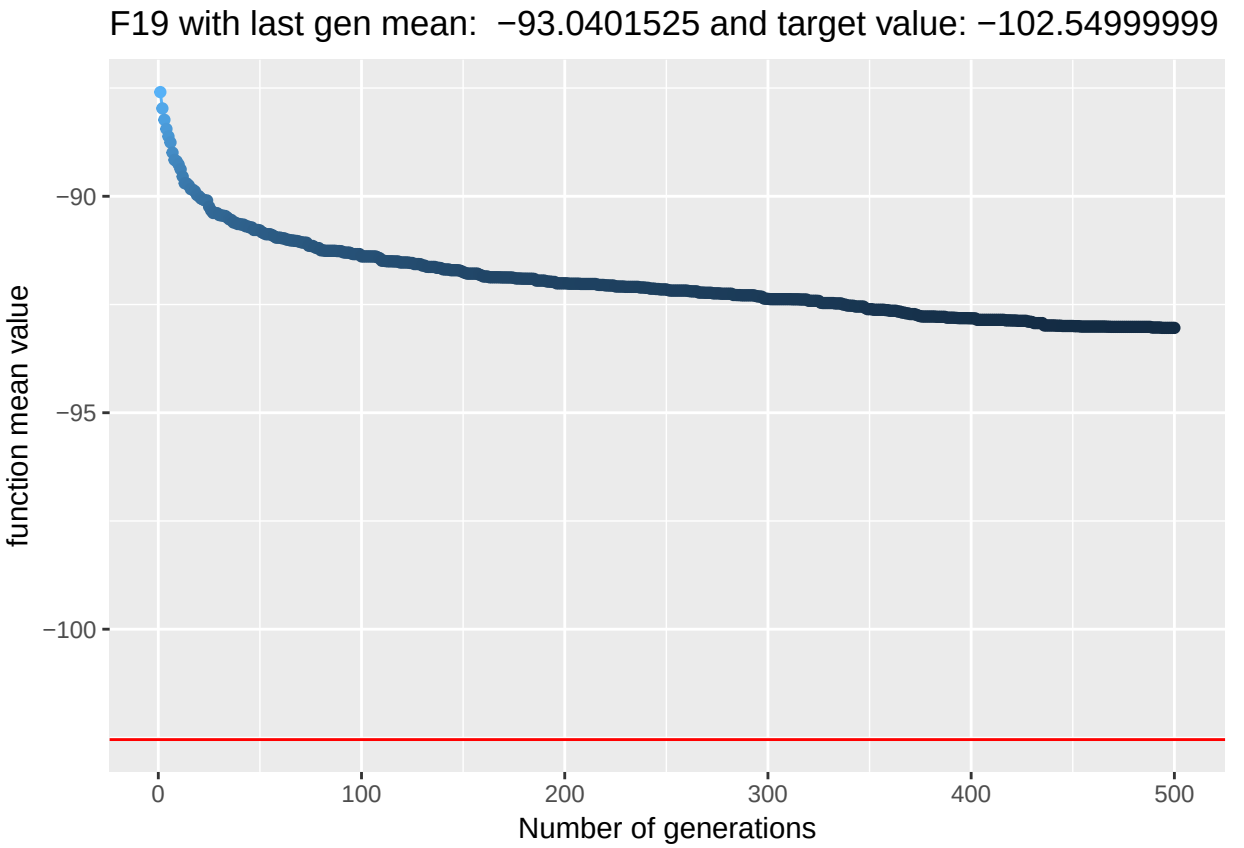

F14 with last gen mean: −43.361205 and target value: −52.34999999
function mean value
0
−20
−40
0
100
200
300
400
500
Number of generations

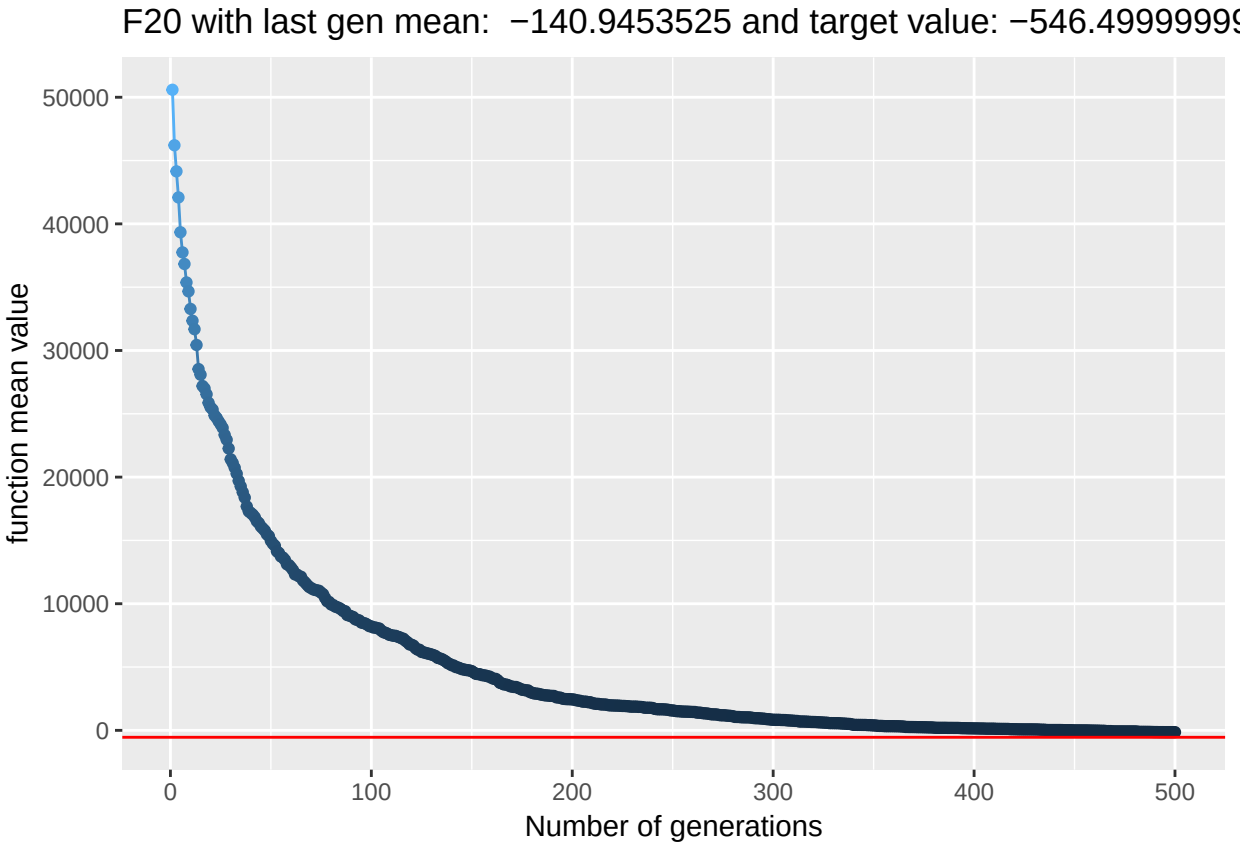

F15 with last gen mean: 1607.90825 and target value: 1000.00000001
function mean value
2000
1500
1000
0
100
200
300
400
500
Number of generations

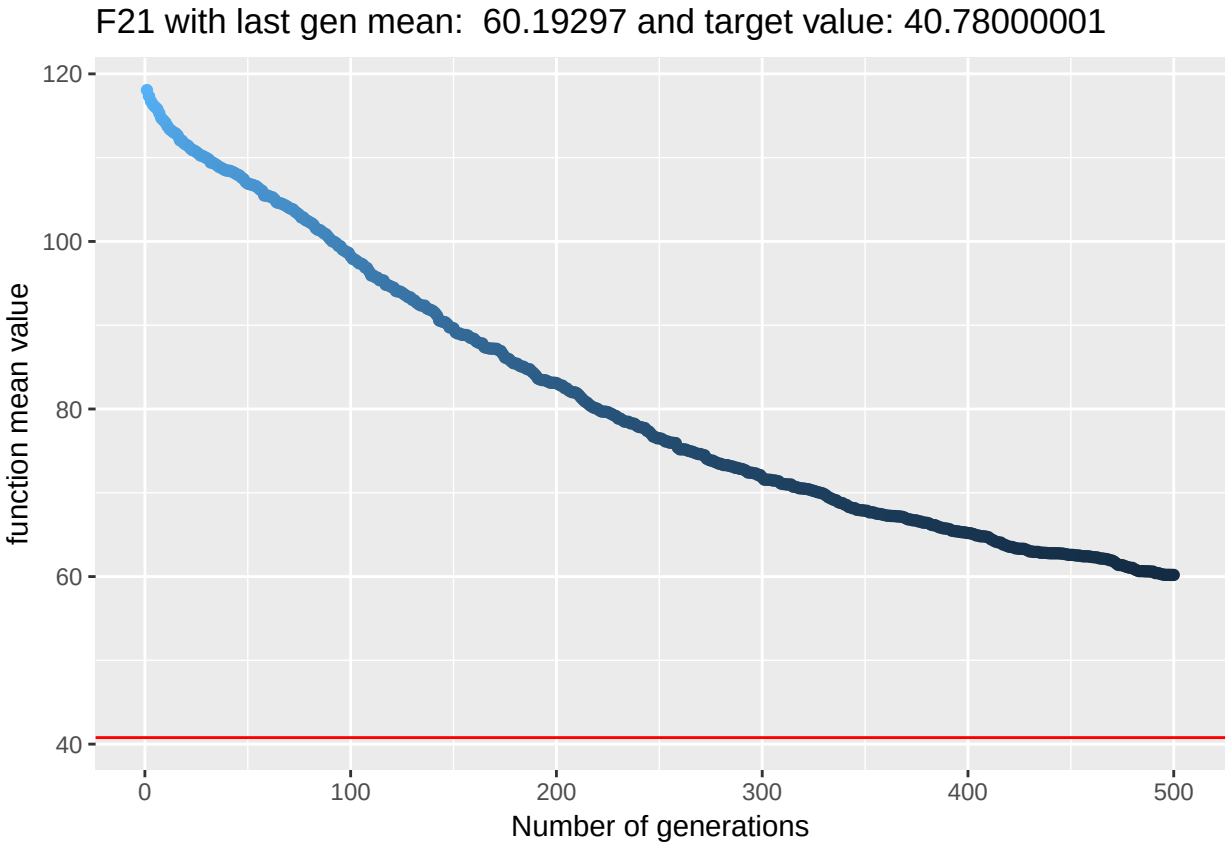

F16 with last gen mean: 97.7977125 and target value: 71.35000001
function mean value
110
100
90
80
70
0
100
200
300
400
500
Number of generations

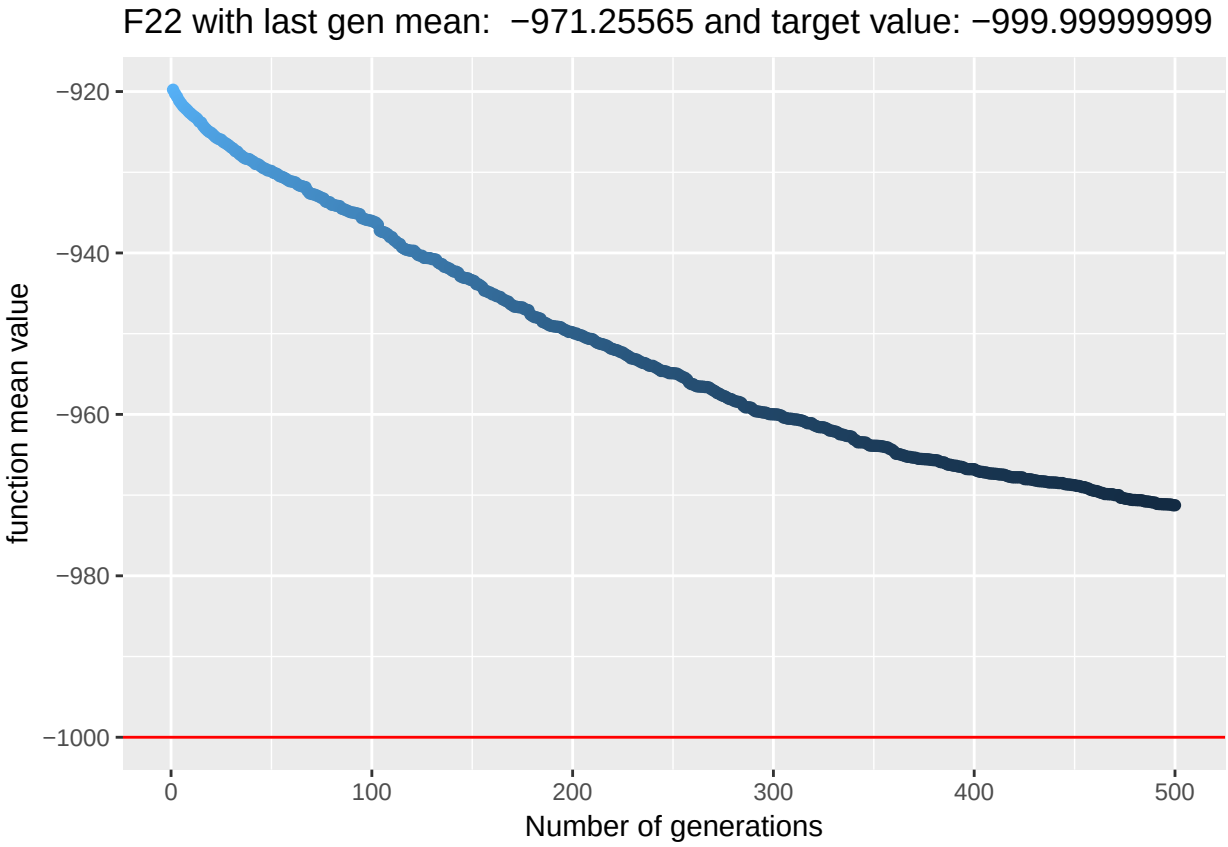

F17 with last gen mean: −10.11140225 and target value: −16.93999999
function mean value
−5.0
−7.5
−10.0
−12.5
−15.0
−17.5
0
100
200
300
400
500
Number of generations

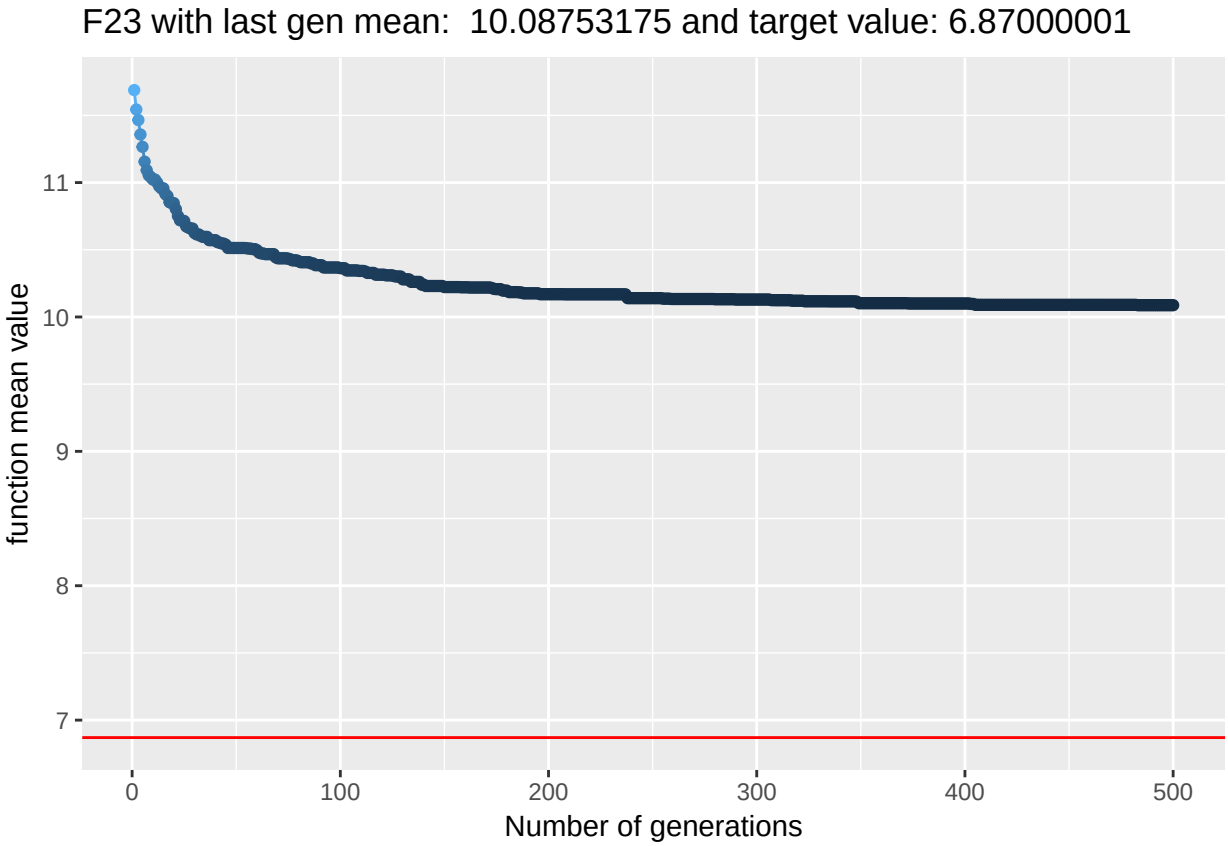

F18 with last gen mean: 8.43117125 and target value: −16.93999999
function mean value
30
20
10
0
−10
0
100
200
300
400
500
Number of generations

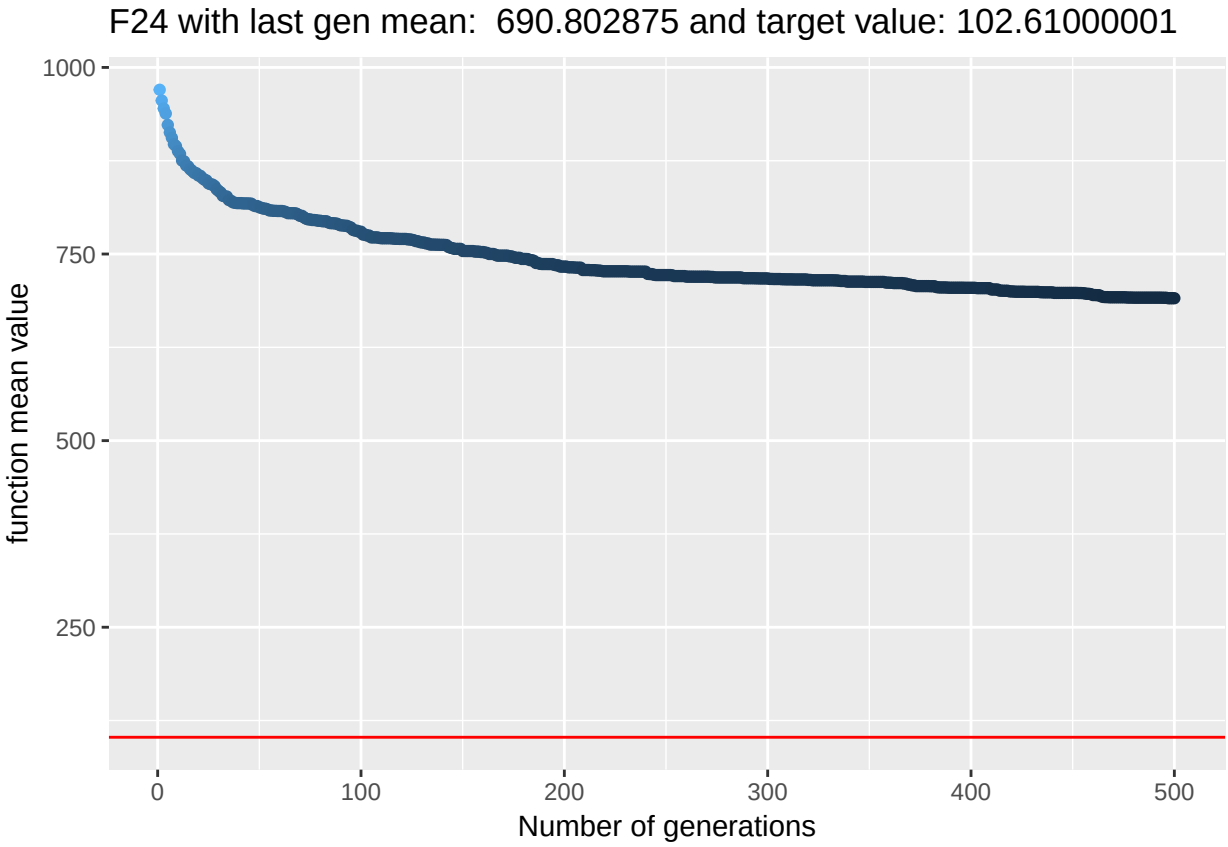

F19 with last gen mean: −93.0401525 and target value: −102.54999999
function mean value
−90
−95
−100
0
100
200
300
400
500
Number of generations


F20 with last gen mean: −140.9453525 and target value: −546.4999999
function mean value
50000
40000
30000
20000
10000
0
0
100
200
300
400
500
Number of generations


F21 with last gen mean: 60.19297 and target value: 40.78000001
120
100
80
60
40
function mean value
0
100
200
300
400
500
Number of generations


F22 with last gen mean: −971.25565 and target value: −999.99999999
−920
−940
−960
−980
−1000
function mean value
0
100
200
300
400
500
Number of generations


F23 with last gen mean: 10.08753175 and target value: 6.87000001
function mean value
11
10
9
8
7
0
100
200
300
400
500
Number of generations


F24 with last gen mean: 690.802875 and target value: 102.61000001
function mean value
1000
750
500
250
0
100
200
300
400
500
Number of generations