

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 functions - with tournament 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 standard deviation (std) and the confidence interval (C.I) of 40 runs of a configuration. An example of a configuration, given by: evaluation function, tournament size, is GABBOB F1 with $k = 2$. For each configuration two plots are given. One, with the mean and the standard 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 values 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.

Standard Deviation: F20 -> For $k = 1 \dots 25$ 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, though for the other functions it achieved average 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].

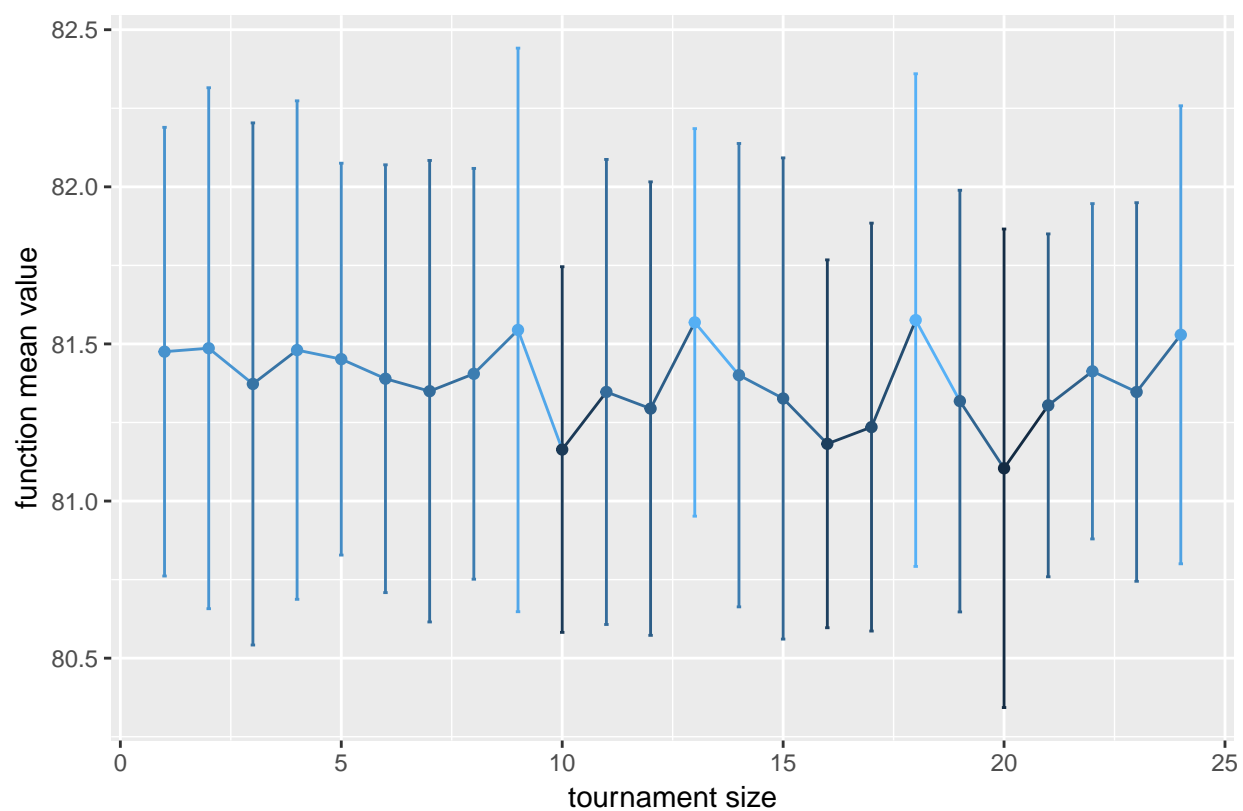
[1] Sawyerr, B.A., Adewumi, A.O., Ali, M.M.: Benchmarking rcgau on the noiseless bboob testbed. The Scientific World Journal 2015 (2015).

Plots

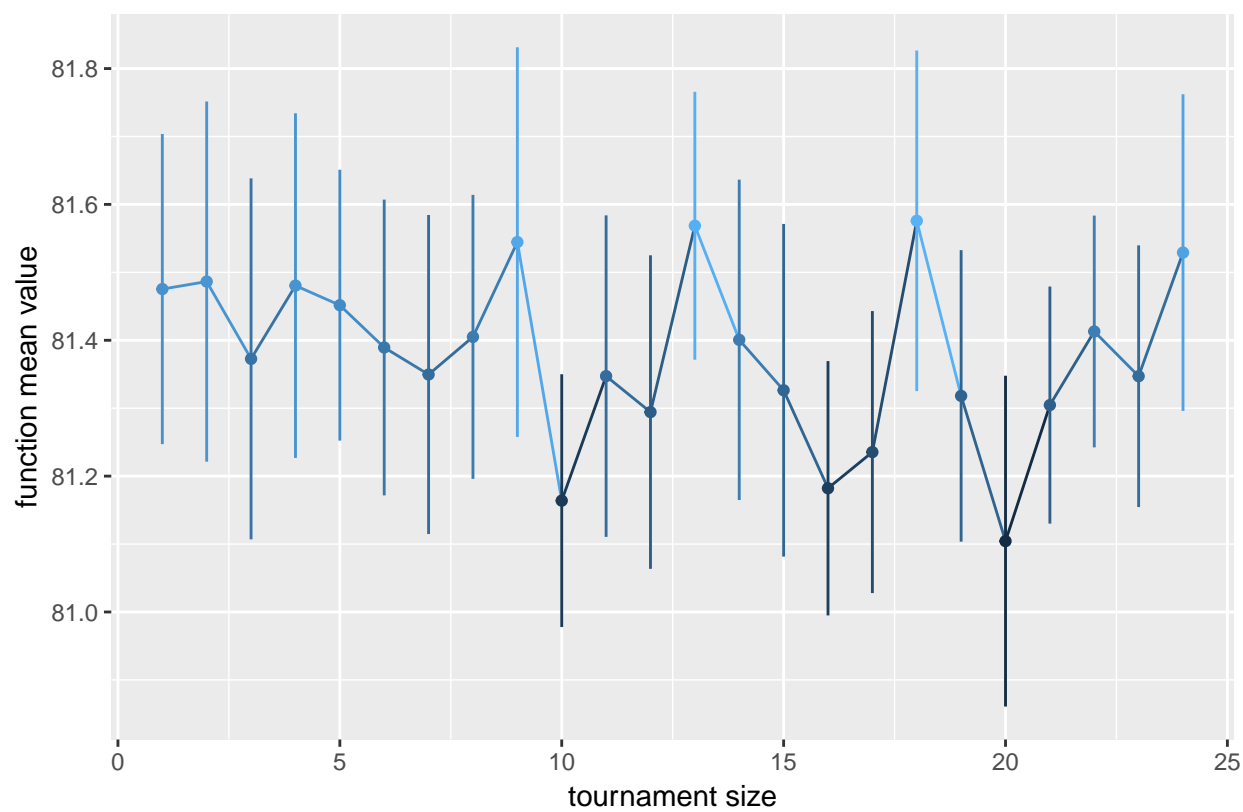
The order of the plots is: first we show the GAModel plots and then the BBOB benchmark functions, from F1 to F24.

```
## [1] 0.7139055 0.8289418 0.8308137 0.7931633 0.6234994 0.6807398 0.7342919
## [8] 0.6536267 0.8967404 0.5817976 0.7399752 0.7215930 0.6166287 0.7373217
## [15] 0.7657099 0.5853431 0.6490536 0.7838785 0.6709419 0.7614265 0.5455874
## [22] 0.5335124 0.6023415 0.7287624
```

F1 means and std

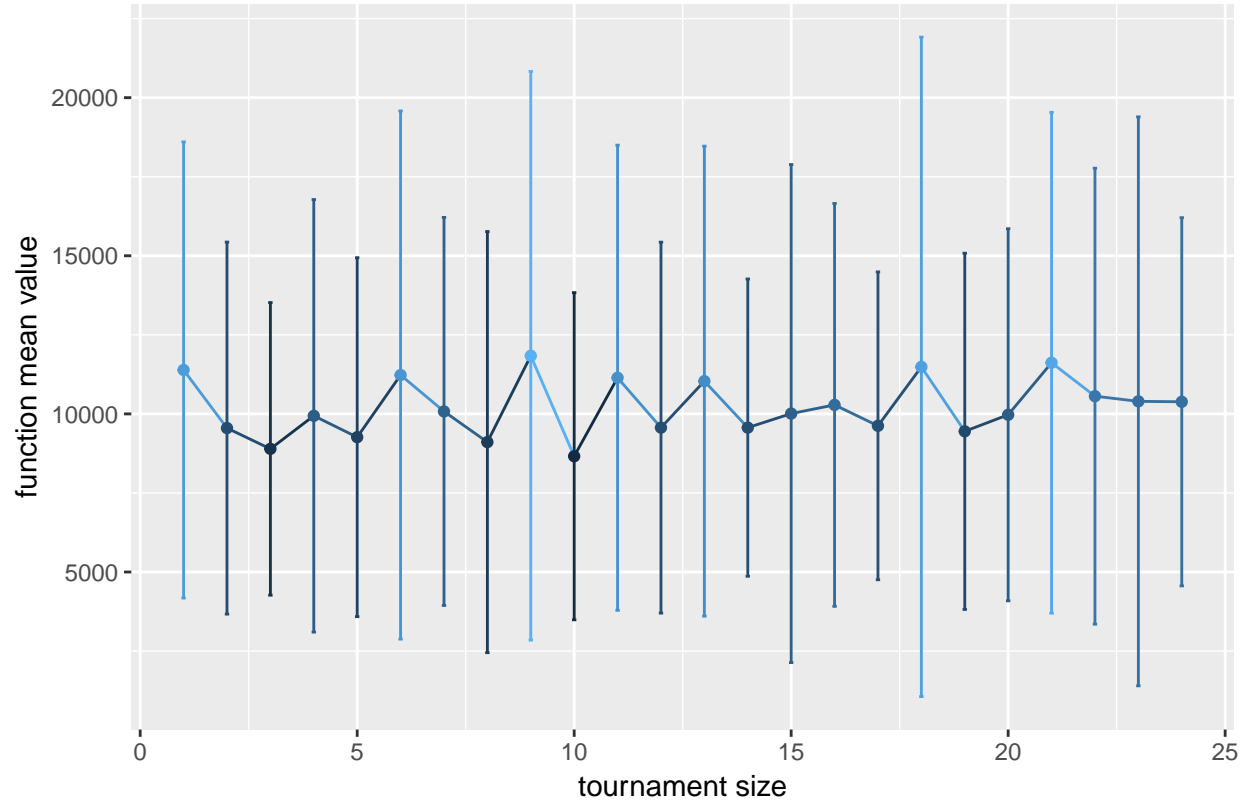


F1 means and C.I.

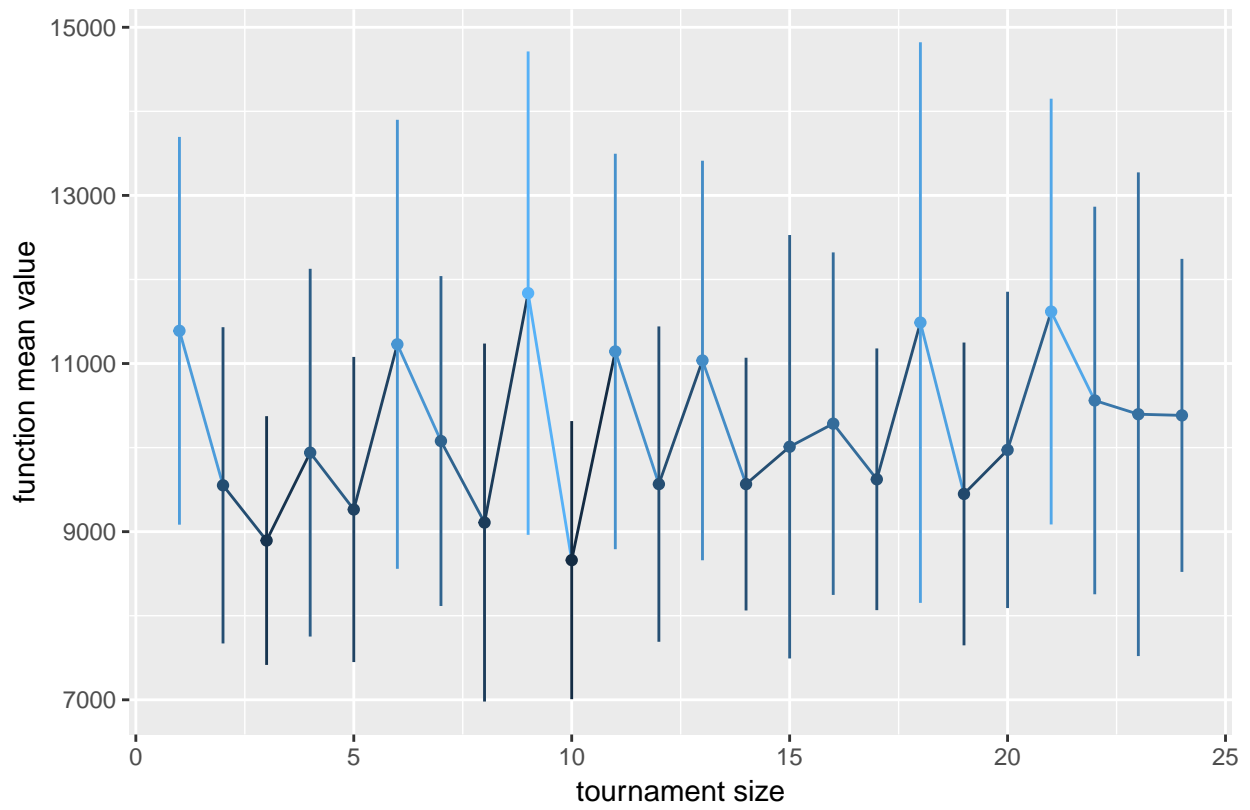


```
## [1] 7211.668 5881.594 4626.367 6838.854 5674.854 8350.499 6135.408
## [8] 6658.045 8990.206 5172.300 7354.622 5864.674 7431.025 4699.920
## [15] 7875.286 6369.964 4866.967 10425.999 5631.619 5883.124 7918.466
## [22] 7208.450 8995.879 5822.037
```

F2 means and std

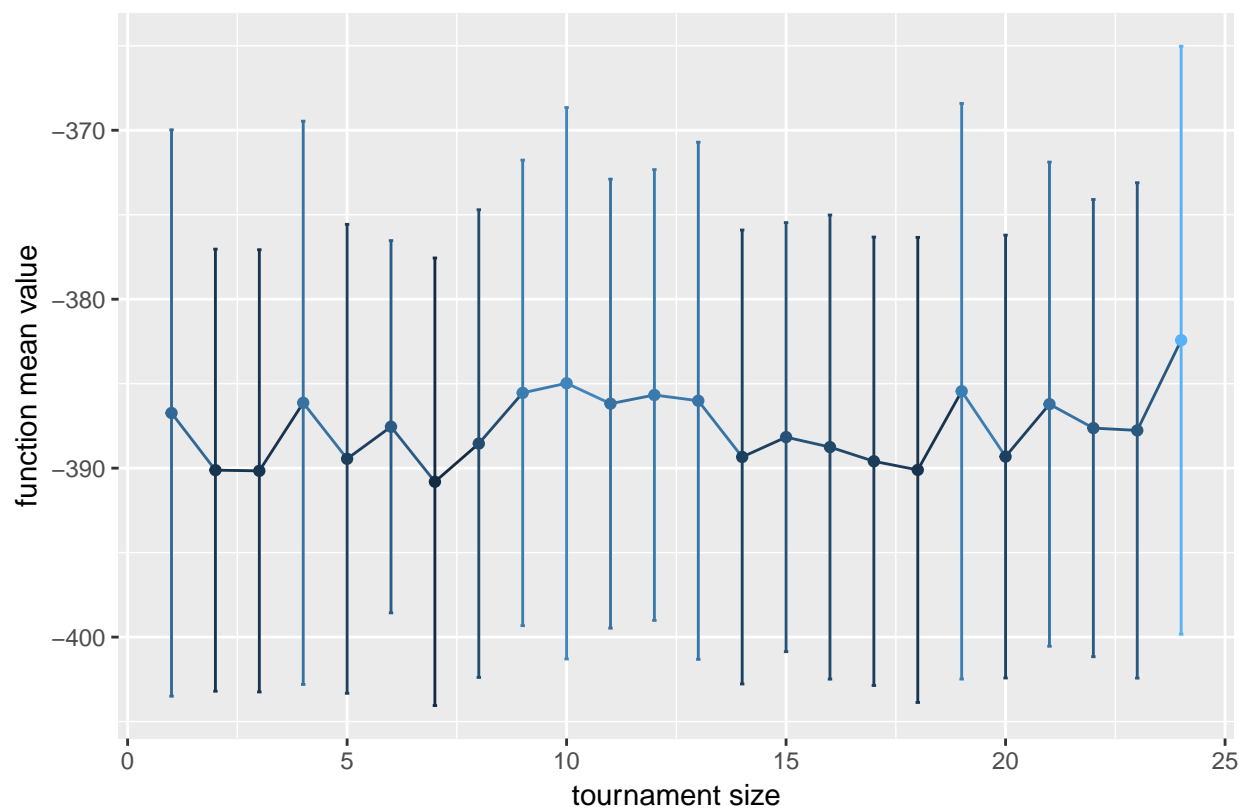


F2 means and C.I.

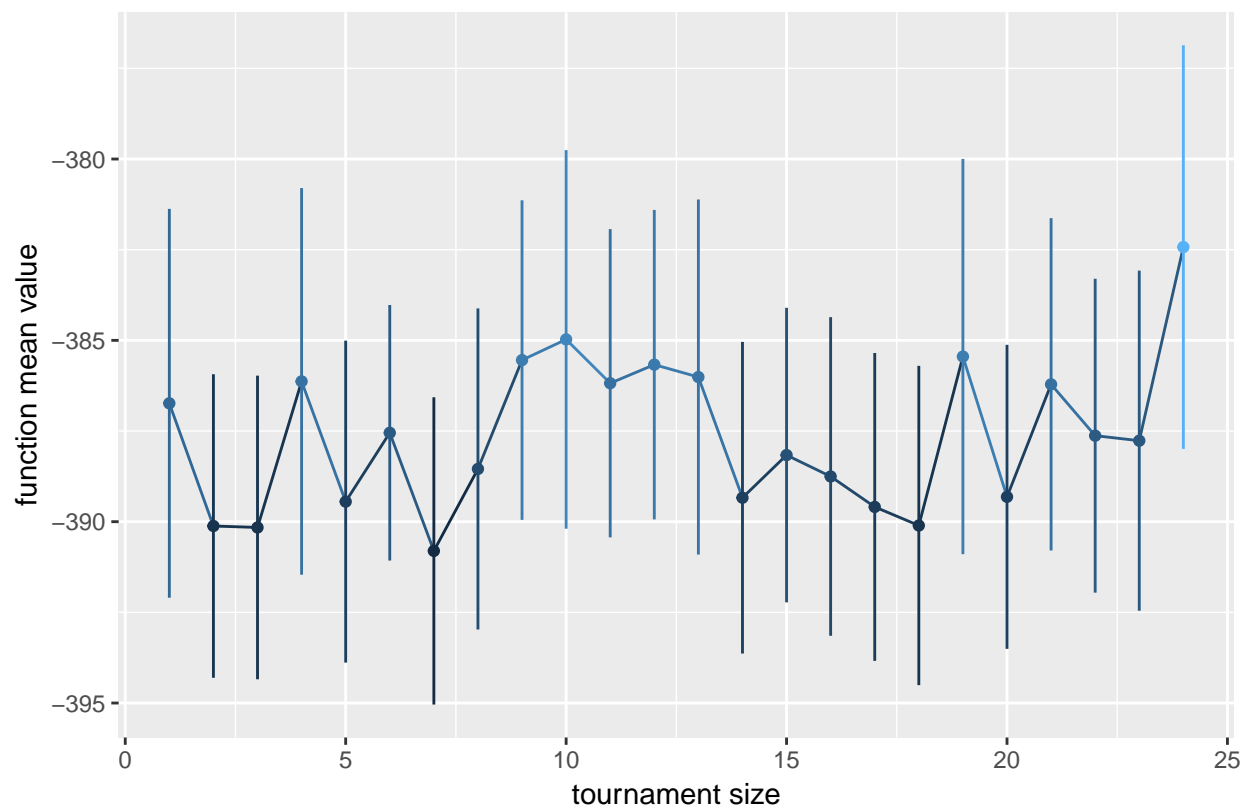


```
## [1] 16.76139 13.08336 13.08818 16.66896 13.87874 11.01607 13.24579
## [8] 13.84042 13.77544 16.31929 13.28820 13.34109 15.30535 13.43337
## [15] 12.69804 13.73411 13.27082 13.76323 17.03586 13.10683 14.32813
## [22] 13.53058 14.66101 17.39861
```

F3 means and std

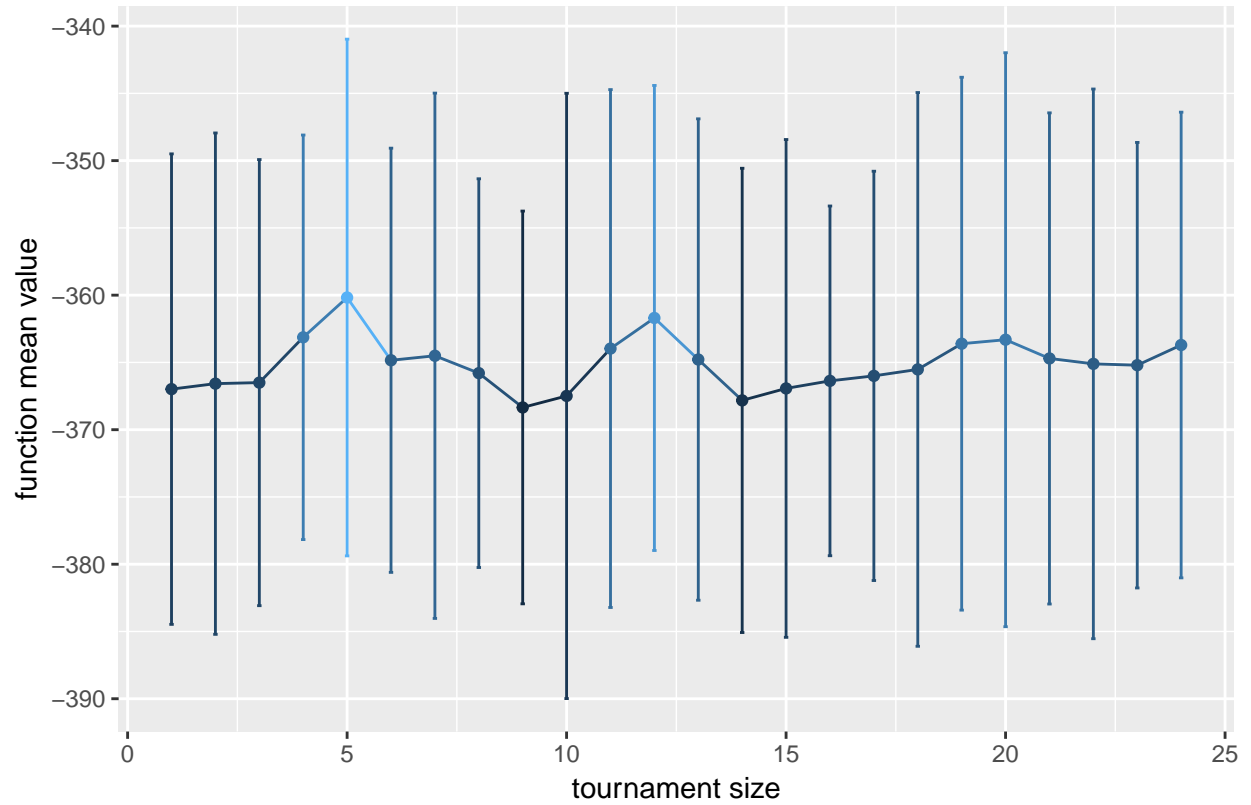


F3 means and C.I.

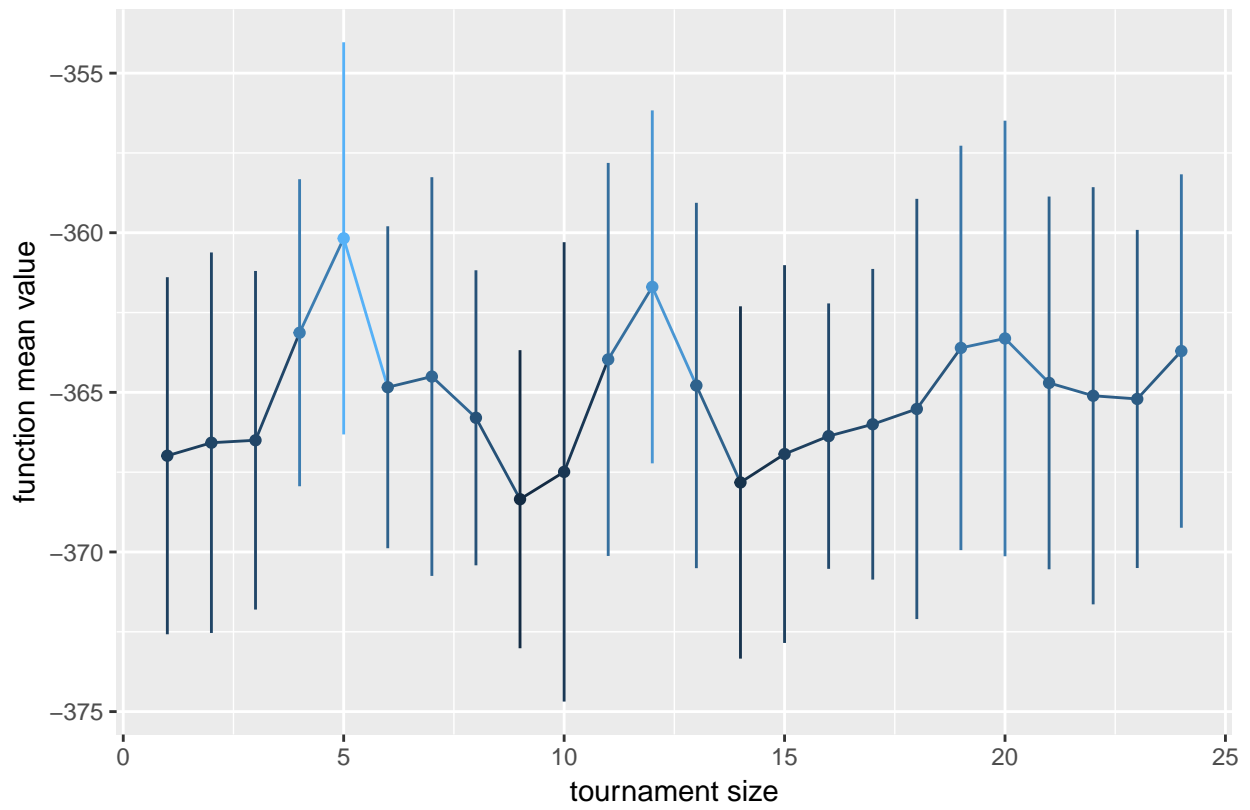


```
## [1] 17.48647 18.63400 16.58086 15.03612 19.20523 15.76600 19.52504
## [8] 14.44812 14.59748 22.49618 19.24753 17.28514 17.89199 17.25395
## [15] 18.50173 12.99815 15.21180 20.58028 19.80483 21.33224 18.25407
## [22] 20.42991 16.55808 17.30761
```

F4 means and std

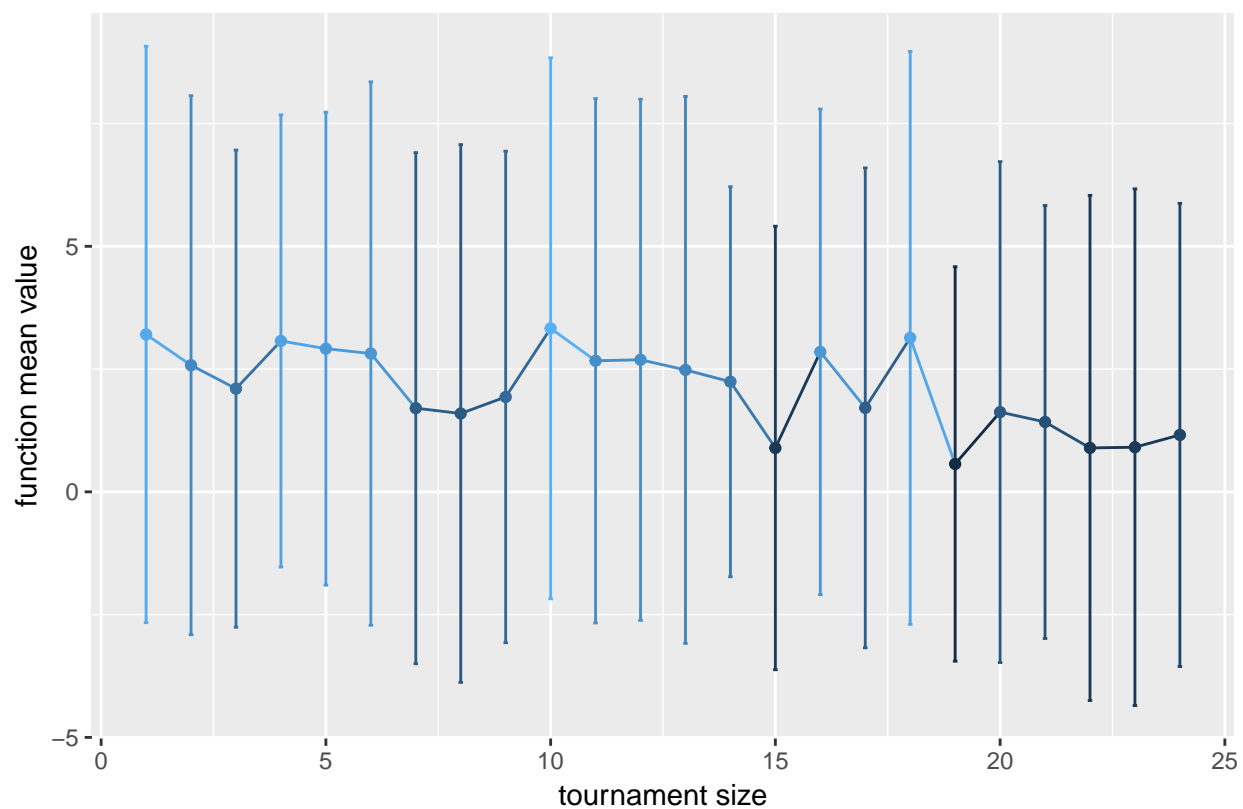


F4 means and C.I.

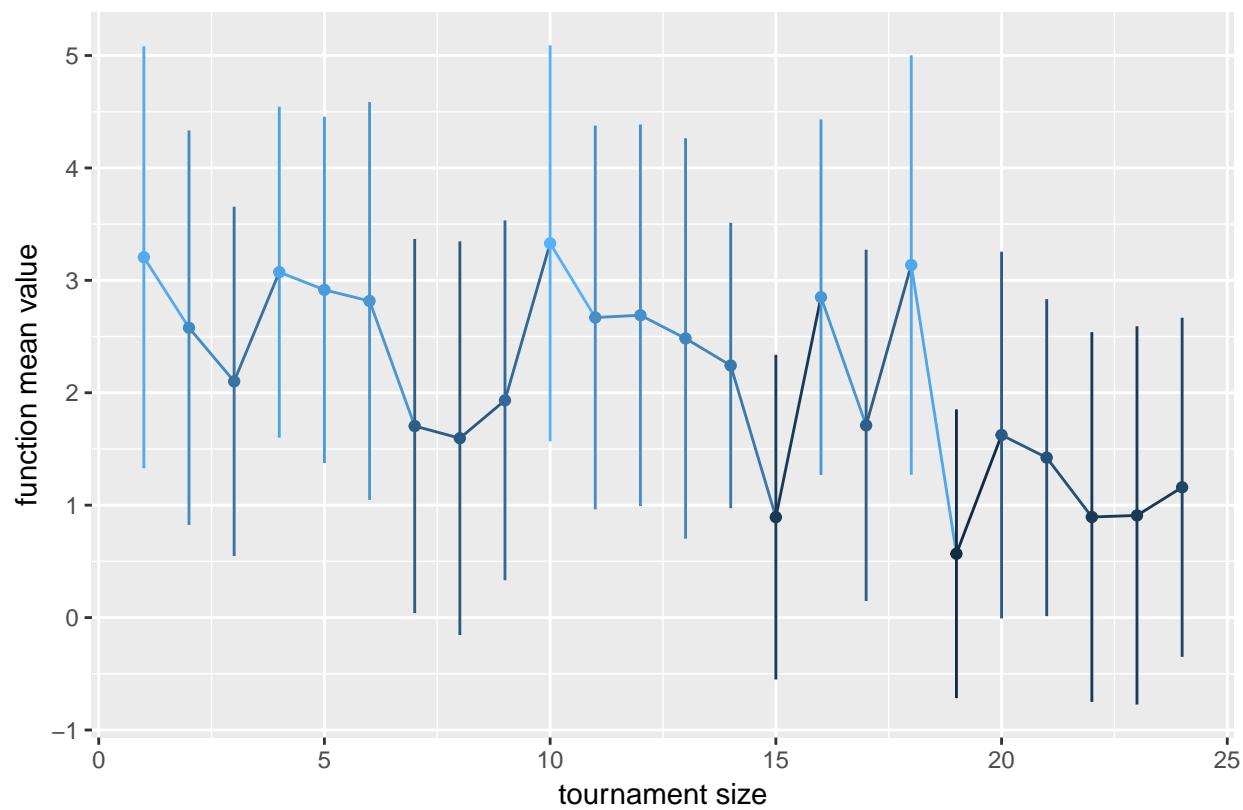


```
## [1] 5.868027 5.486881 4.857948 4.602932 4.815847 5.532857 5.203379
## [8] 5.475063 5.003710 5.508436 5.337955 5.305910 5.568891 3.969888
## [15] 4.515582 4.943945 4.885589 5.833196 4.015628 5.099625 4.408278
## [22] 5.142791 5.260220 4.716032
```

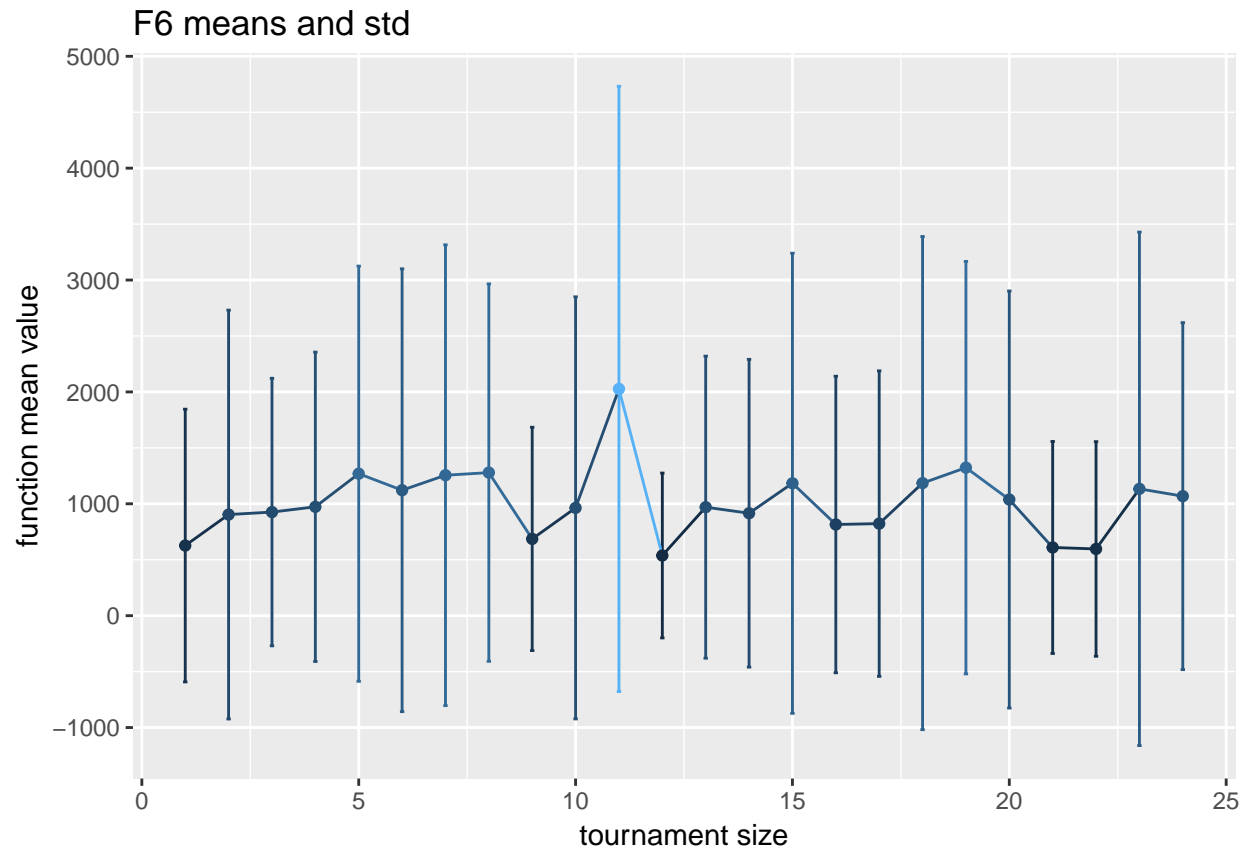
F5 means and std

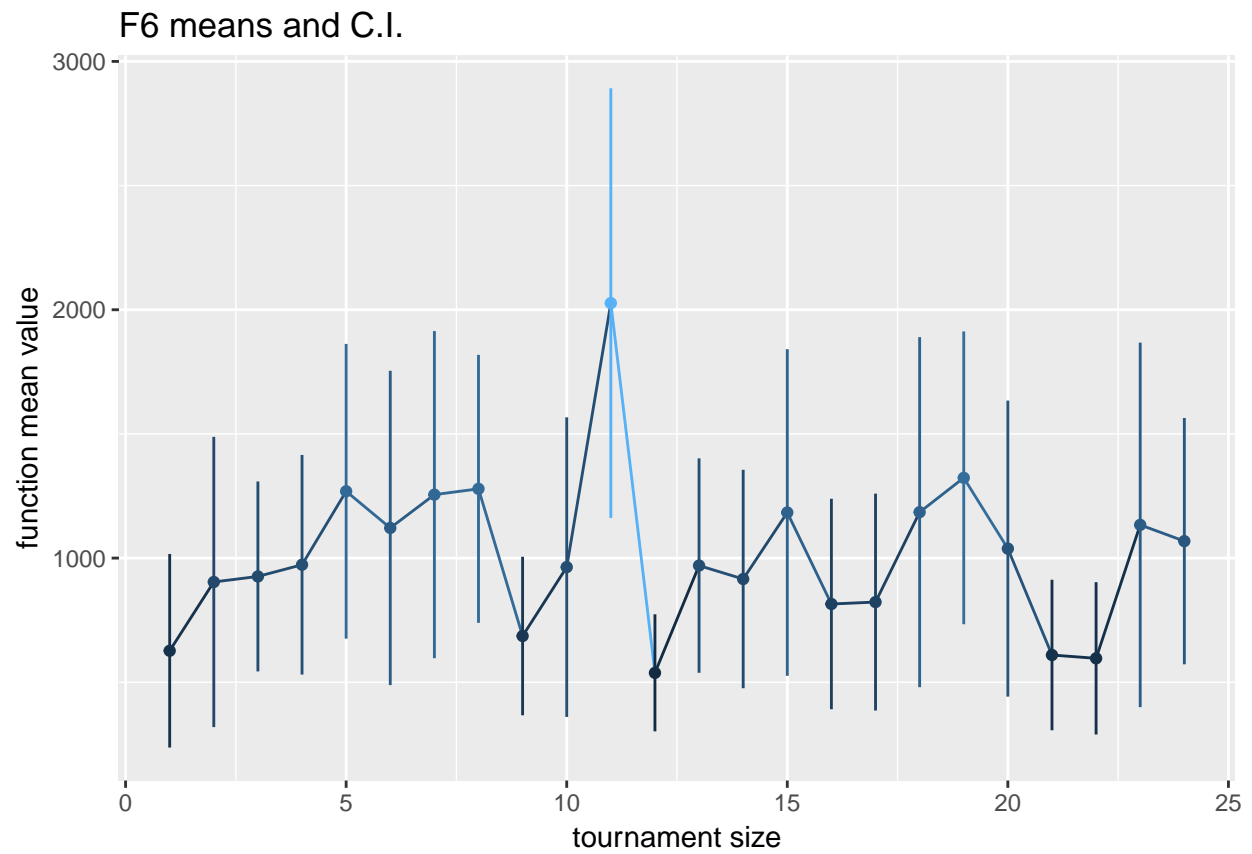


F5 means and C.I.



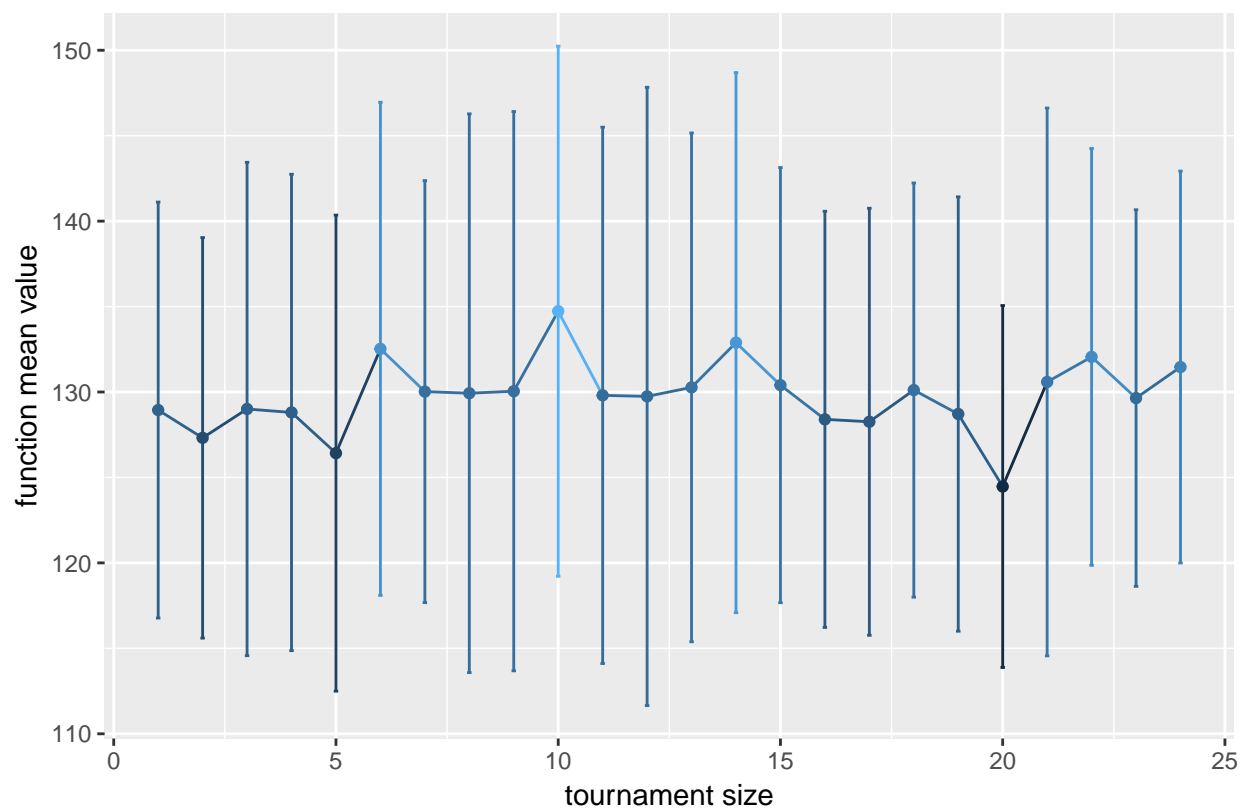

```
## [1] 1218.6983 1827.3272 1195.8164 1382.4404 1855.6368 1979.0458 2059.3142
## [8] 1686.8535 997.9826 1886.4301 2705.1893 736.7752 1349.8869 1375.4317
## [15] 2056.3382 1325.1456 1365.5066 2203.7958 1843.4644 1863.7977 947.5585
## [22] 958.9739 2294.7687 1550.8241
```



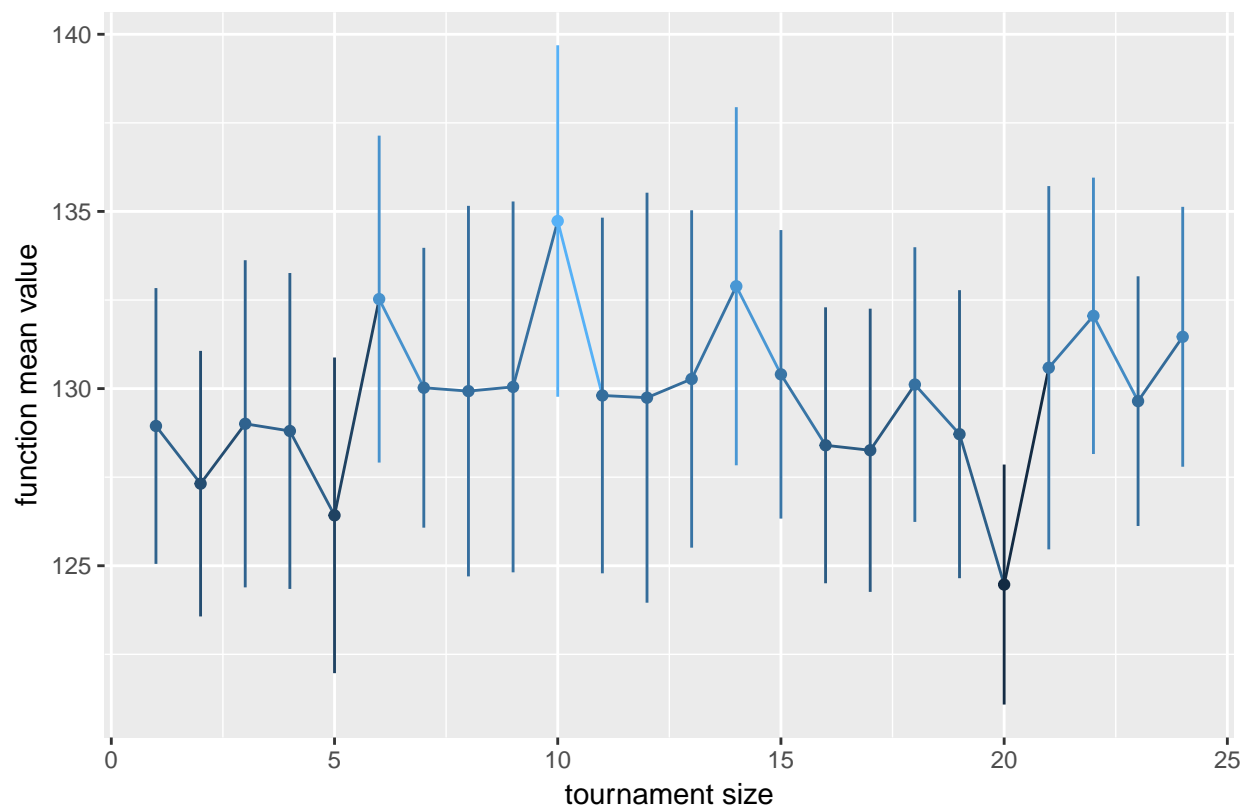


```
## [1] 12.16985 11.71737 14.43515 13.93819 13.92807 14.42611 12.34705
## [8] 16.35000 16.36461 15.51023 15.69257 18.09056 14.88736 15.80130
## [15] 12.73114 12.17589 12.49554 12.11866 12.70873 10.58937 16.02890
## [22] 12.19477 11.01693 11.46764
```

F7 means and std

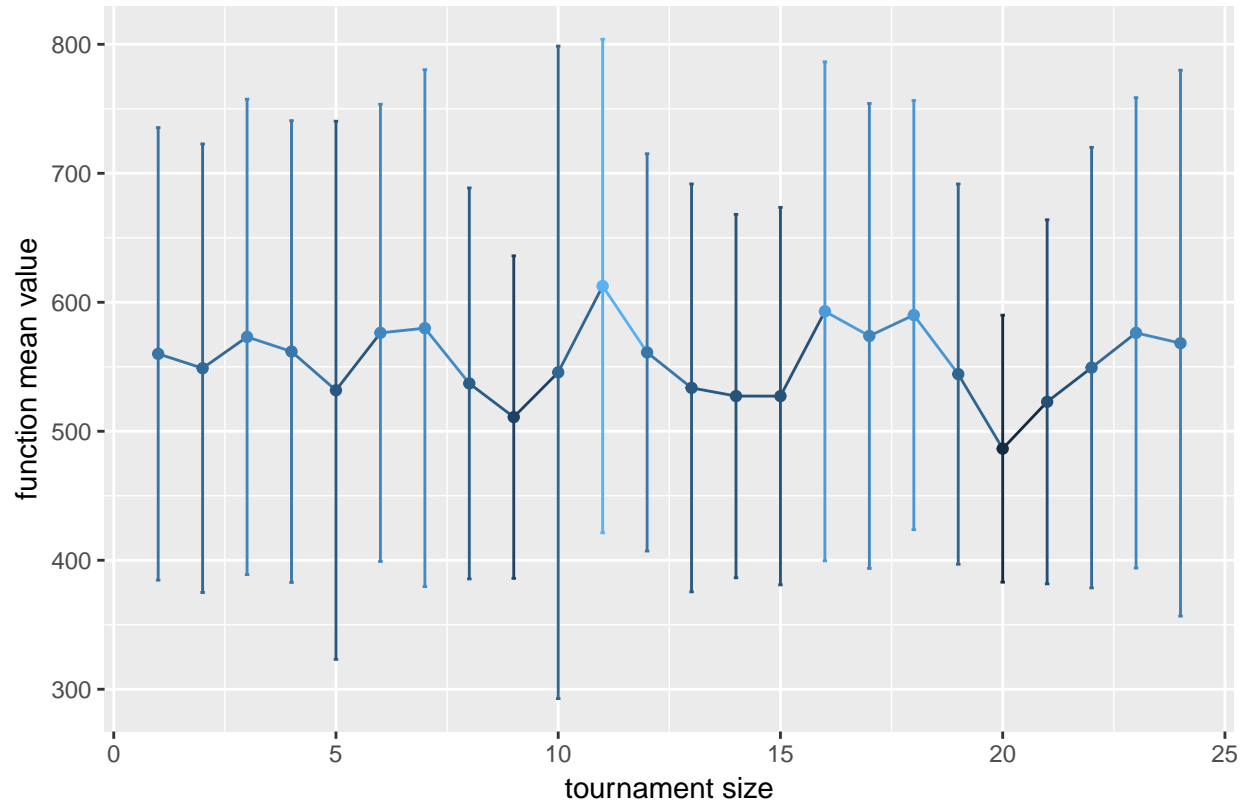


F7 means and C.I.

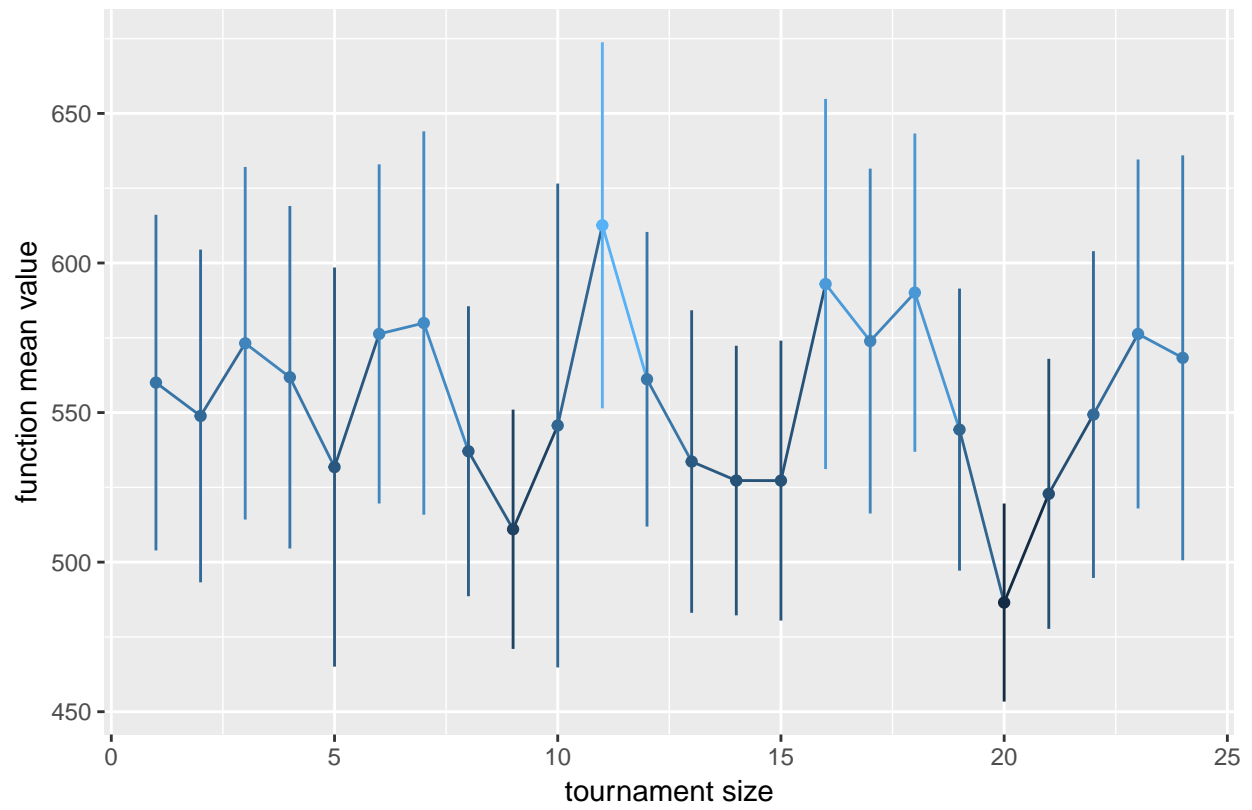


```
## [1] 175.4160 173.8861 184.2644 179.0027 208.6088 177.2462 200.3689
## [8] 151.5542 125.0308 252.9111 191.2874 153.9895 158.1010 140.8899
## [15] 146.3246 193.4304 180.2334 166.3383 147.3928 103.4930 141.1166
## [22] 170.7662 182.3536 211.6032
```

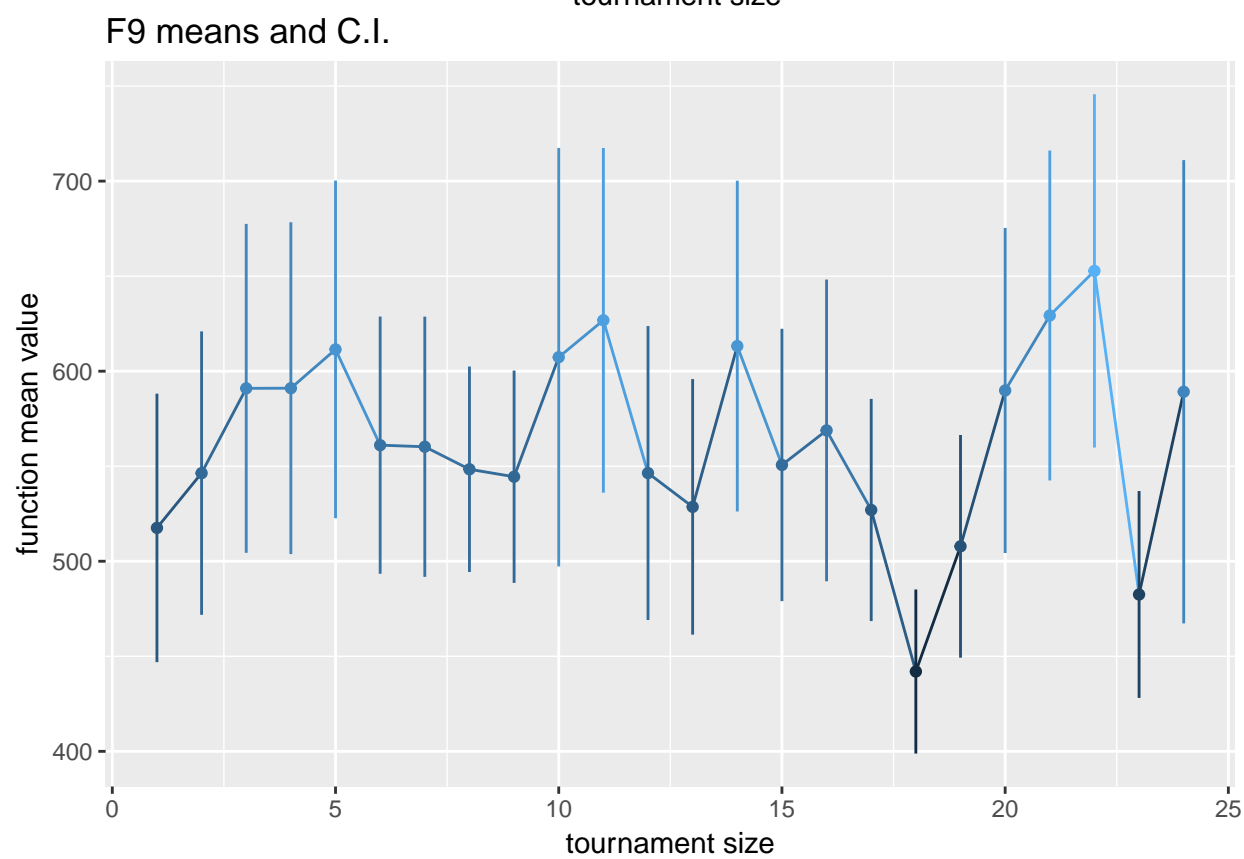
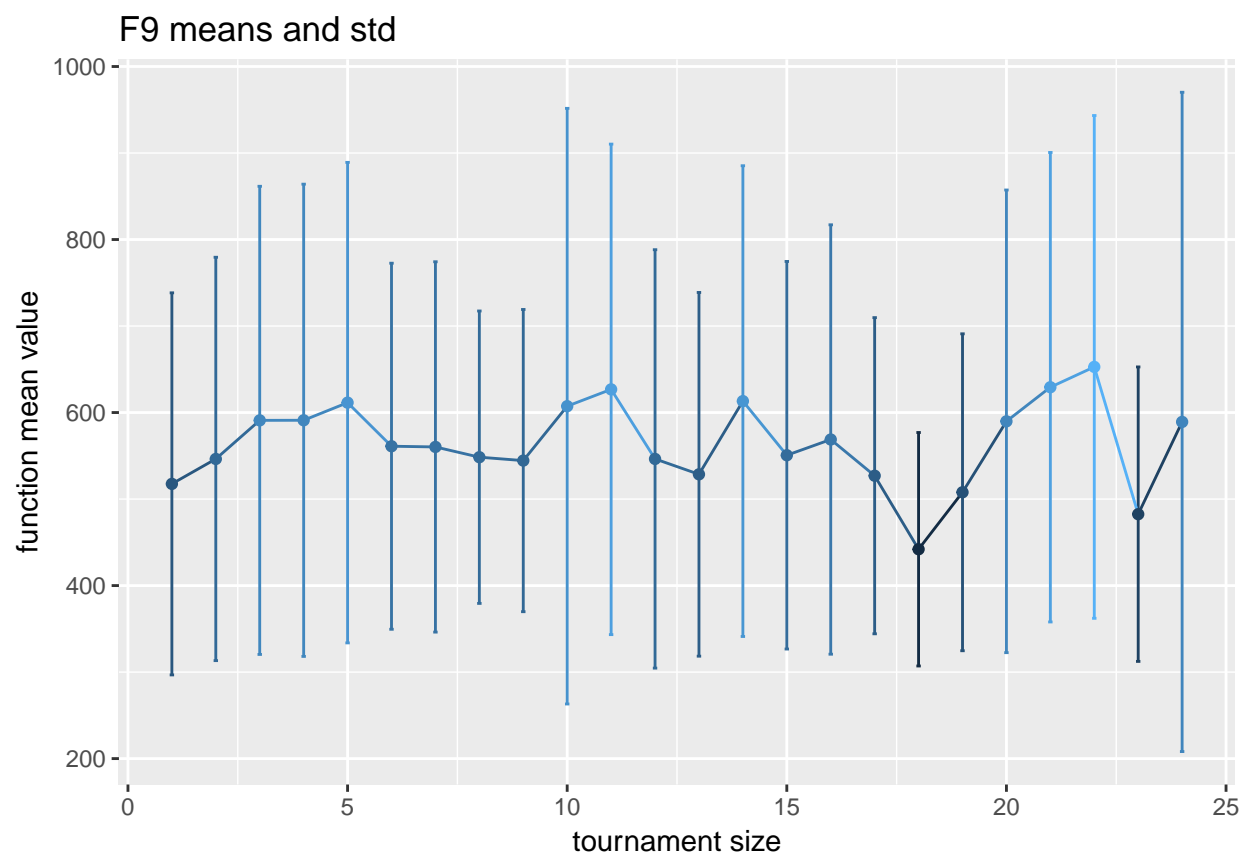
F8 means and std



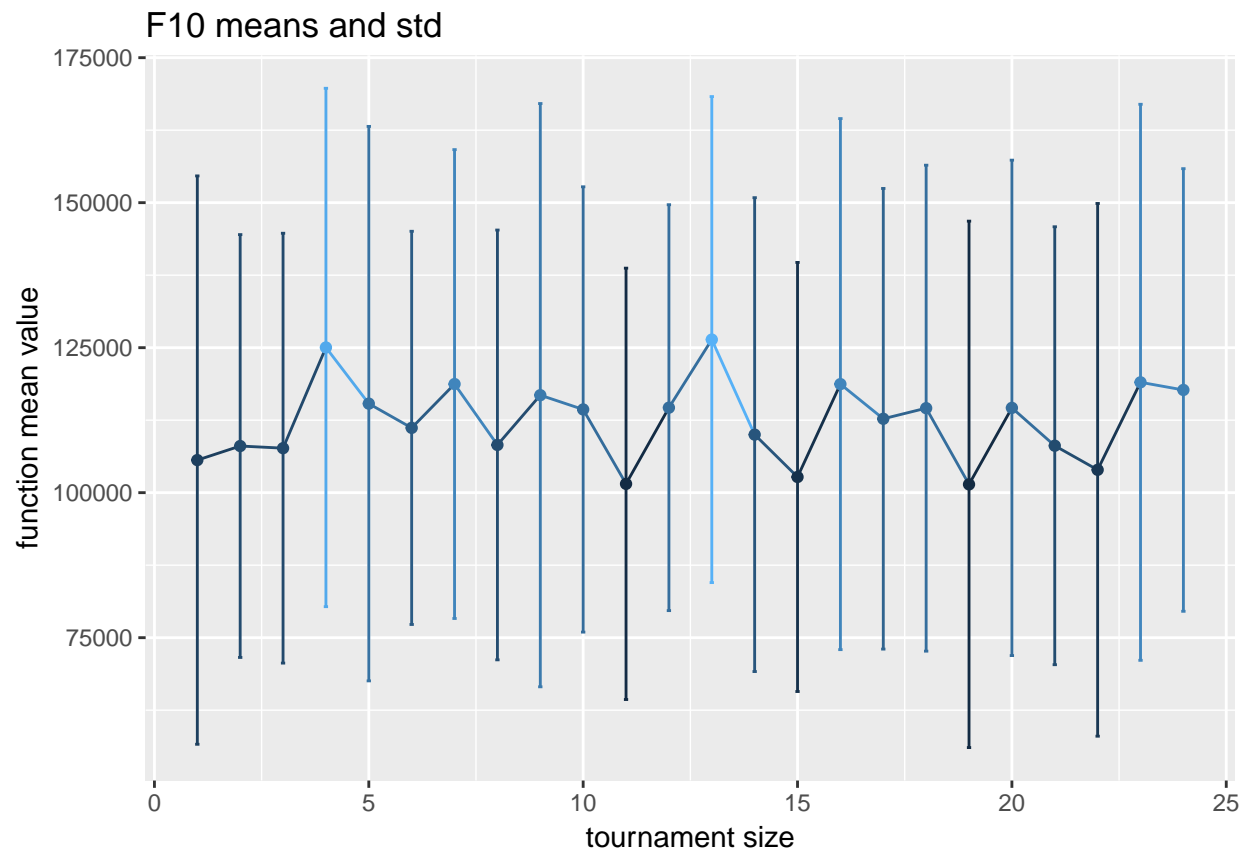
F8 means and C.I.

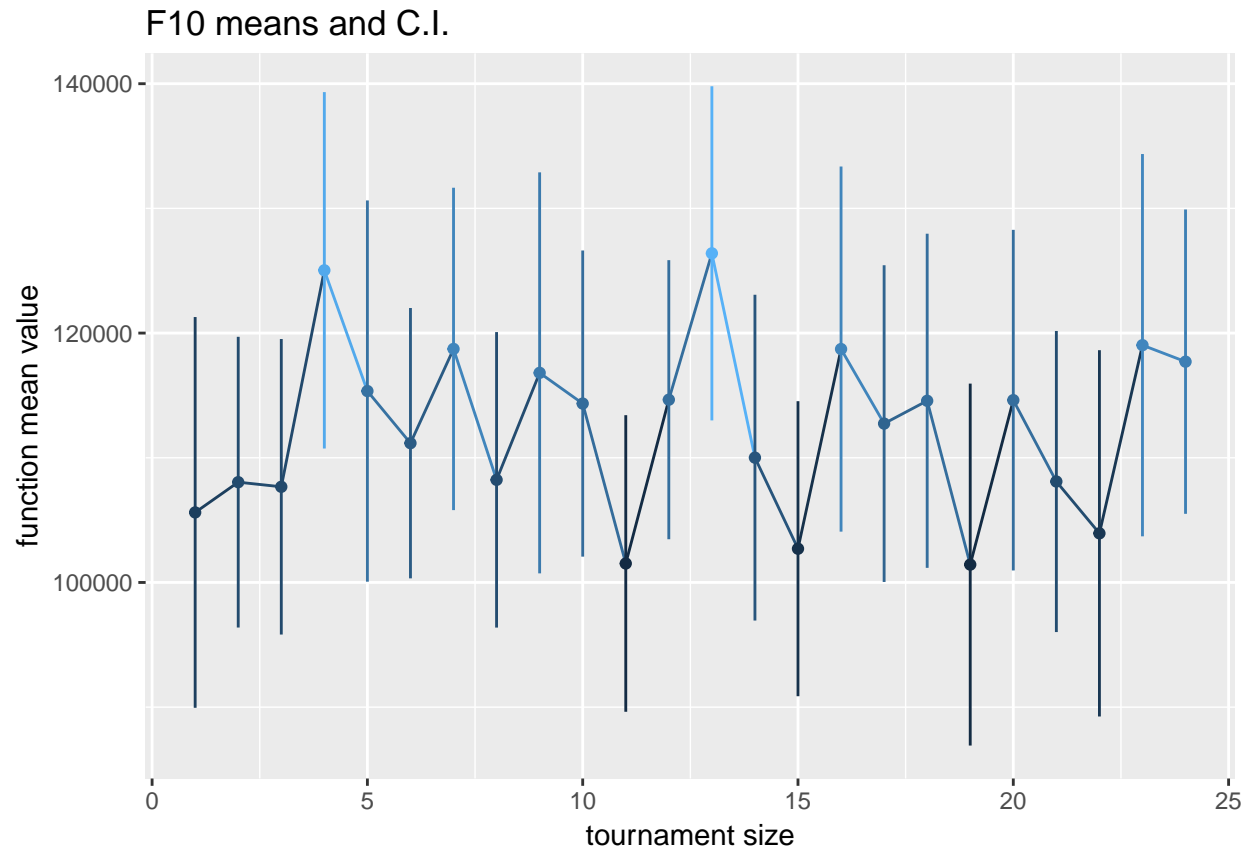


```
## [1] 220.8257 233.1201 270.5582 272.9288 277.7207 211.5722 214.0287
## [8] 169.0085 174.6630 344.2515 283.4948 241.8201 210.2079 272.0743
## [15] 223.9926 248.1824 182.7265 134.9354 183.1601 267.3799 271.3381
## [22] 290.5872 170.1804 381.0393
```



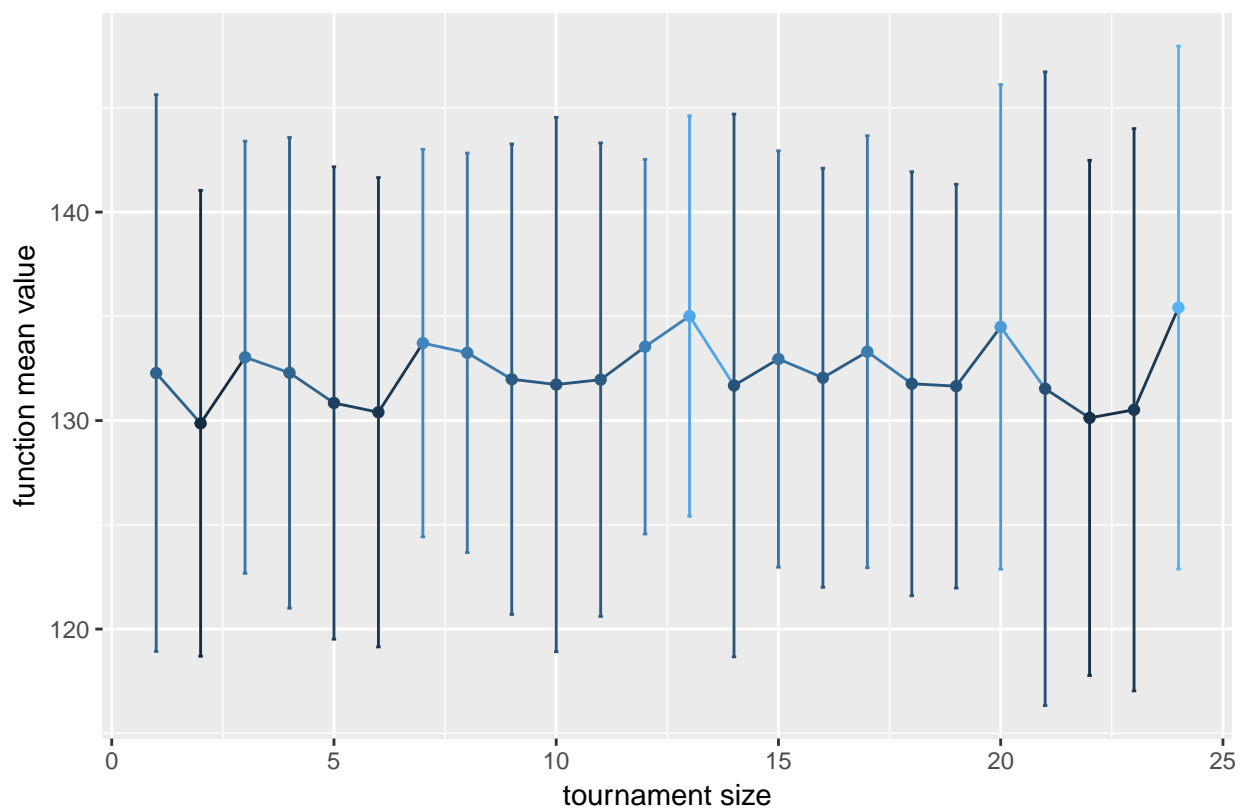
```
## [1] 48995.08 36450.33 37054.85 44687.70 47801.31 33897.77 40418.87
## [8] 37051.68 50280.94 38388.49 37187.18 34992.09 41896.27 40849.93
## [15] 36992.69 45778.91 39711.46 41893.51 45380.89 42708.04 37752.41
## [22] 45925.94 47933.84 38157.47
```



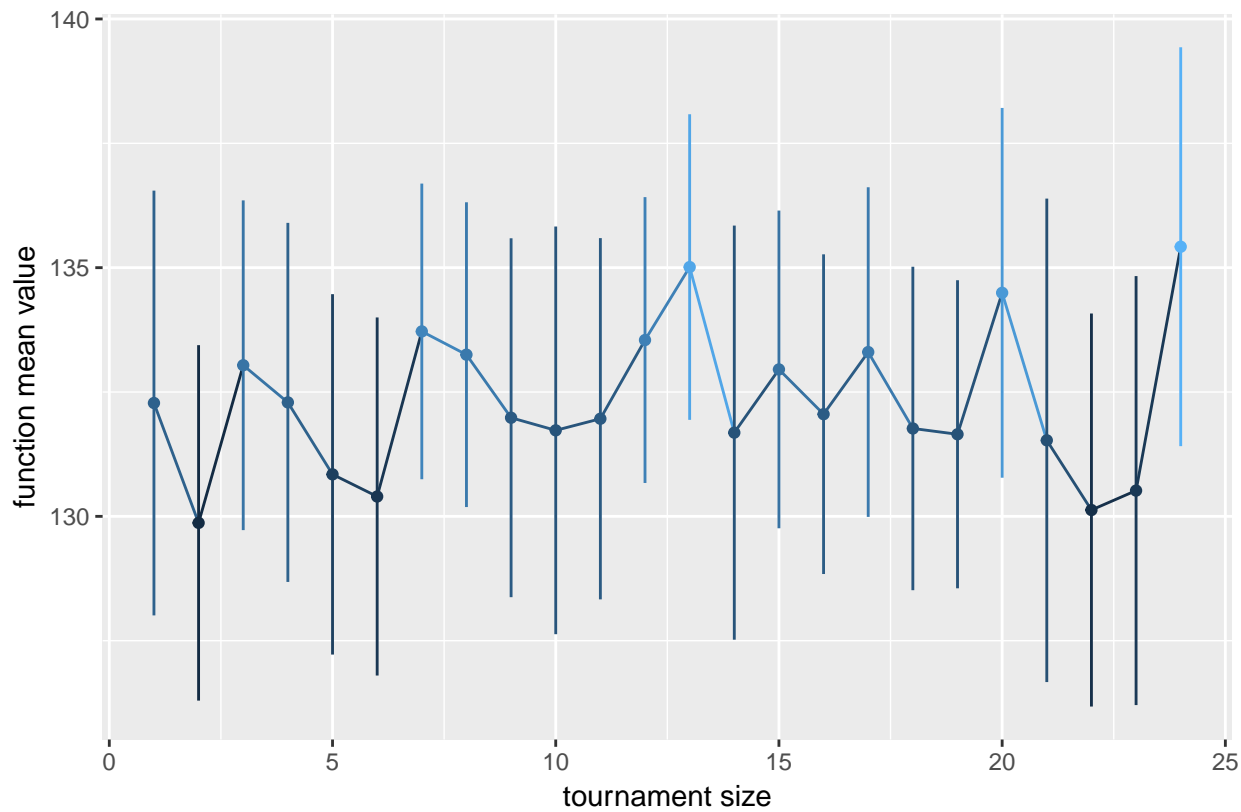


```
## [1] 13.351154 11.172028 10.364463 11.286418 11.327532 11.255511 9.292873
## [8] 9.579901 11.281308 12.813801 11.354865 8.984355 9.605246 13.016334
## [15] 9.985638 10.048407 10.360218 10.166838 9.683441 11.622745 15.196455
## [22] 12.353825 13.483725 12.537986
```


F11 means and std

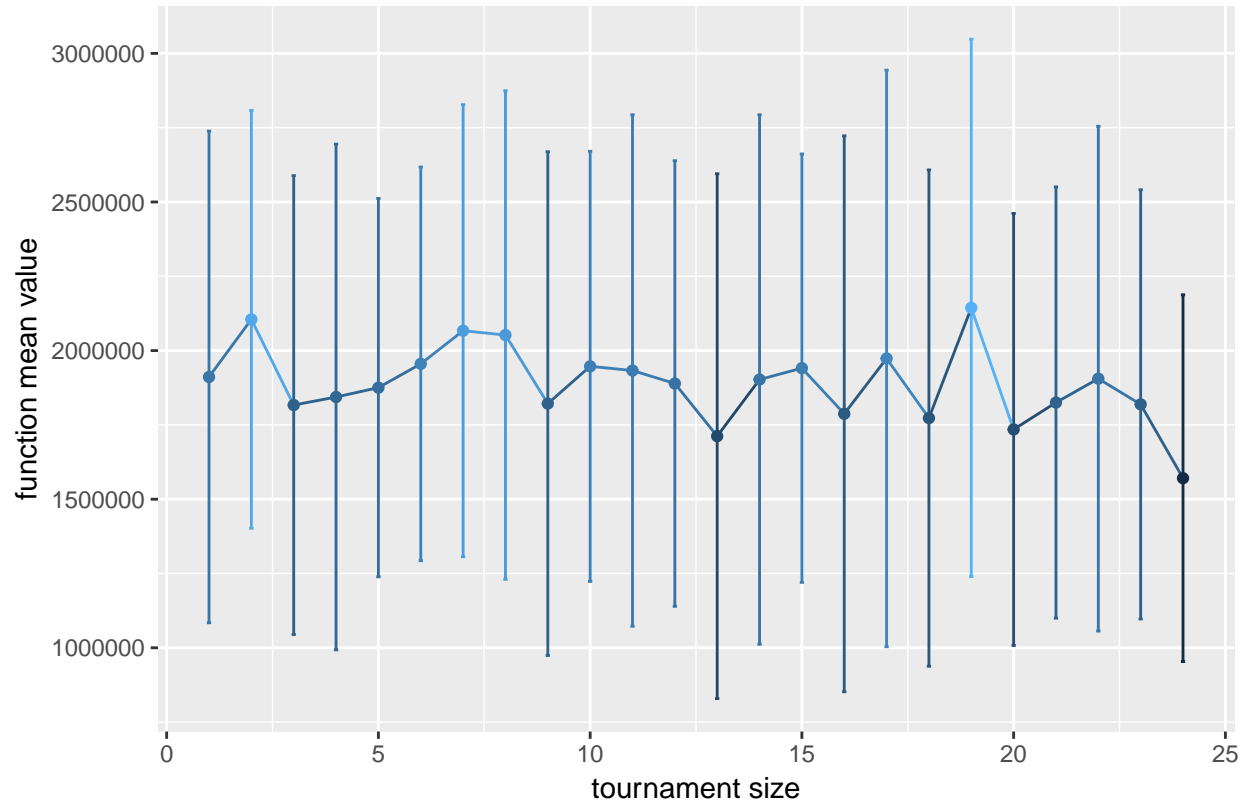


F11 means and C.I.

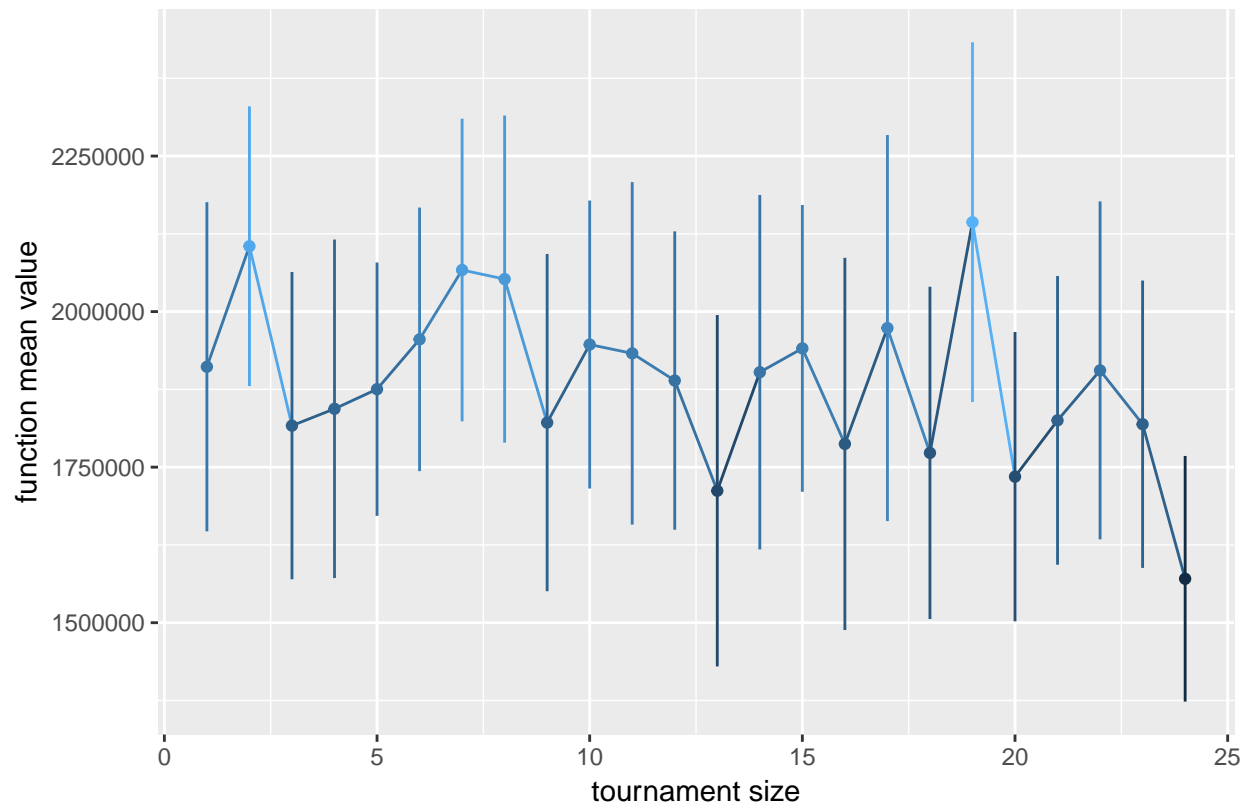


```
## [1] 827202.6 702883.2 771989.4 850656.8 636604.1 662228.5 760534.8
## [8] 822001.2 847465.0 723684.4 860507.3 749625.0 882941.2 890692.5
## [15] 720736.4 935298.0 970053.1 834987.4 904154.5 726828.1 725465.5
## [22] 849252.7 722104.1 617105.2
```

F12 means and std

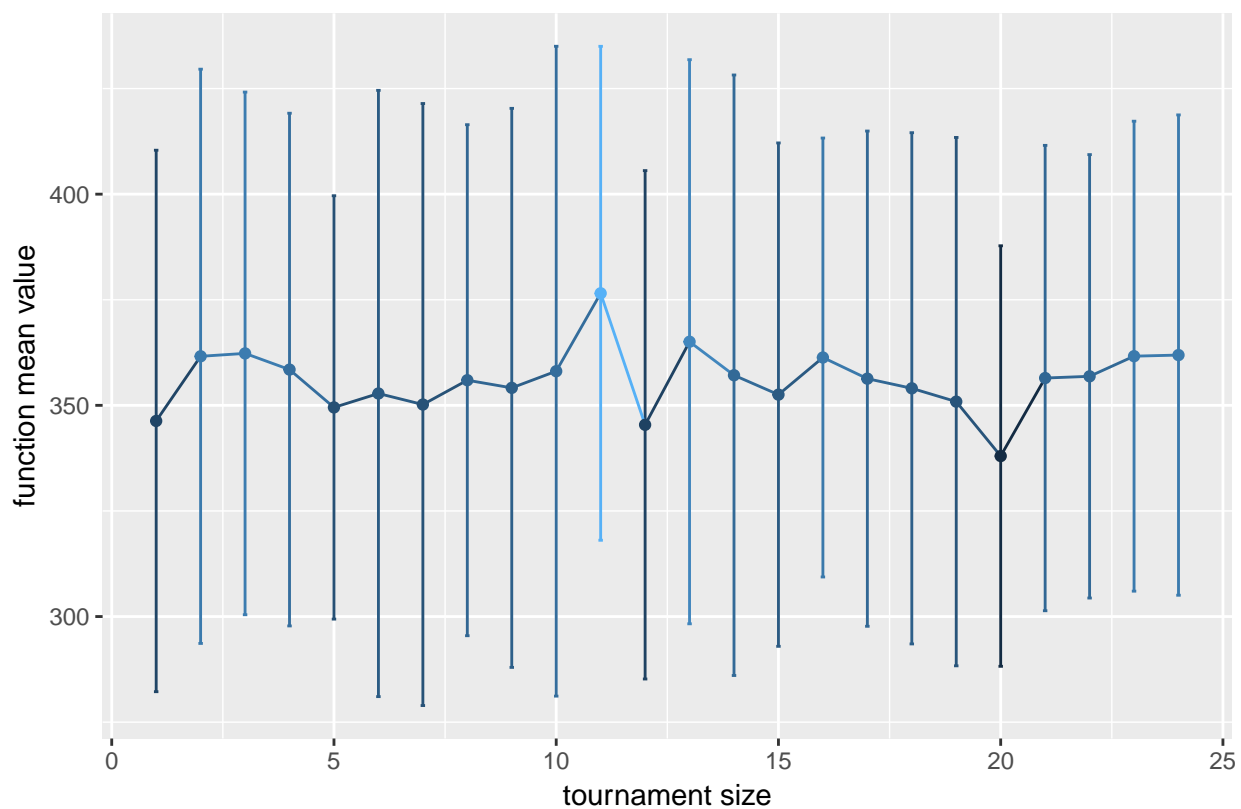


F12 means and C.I.

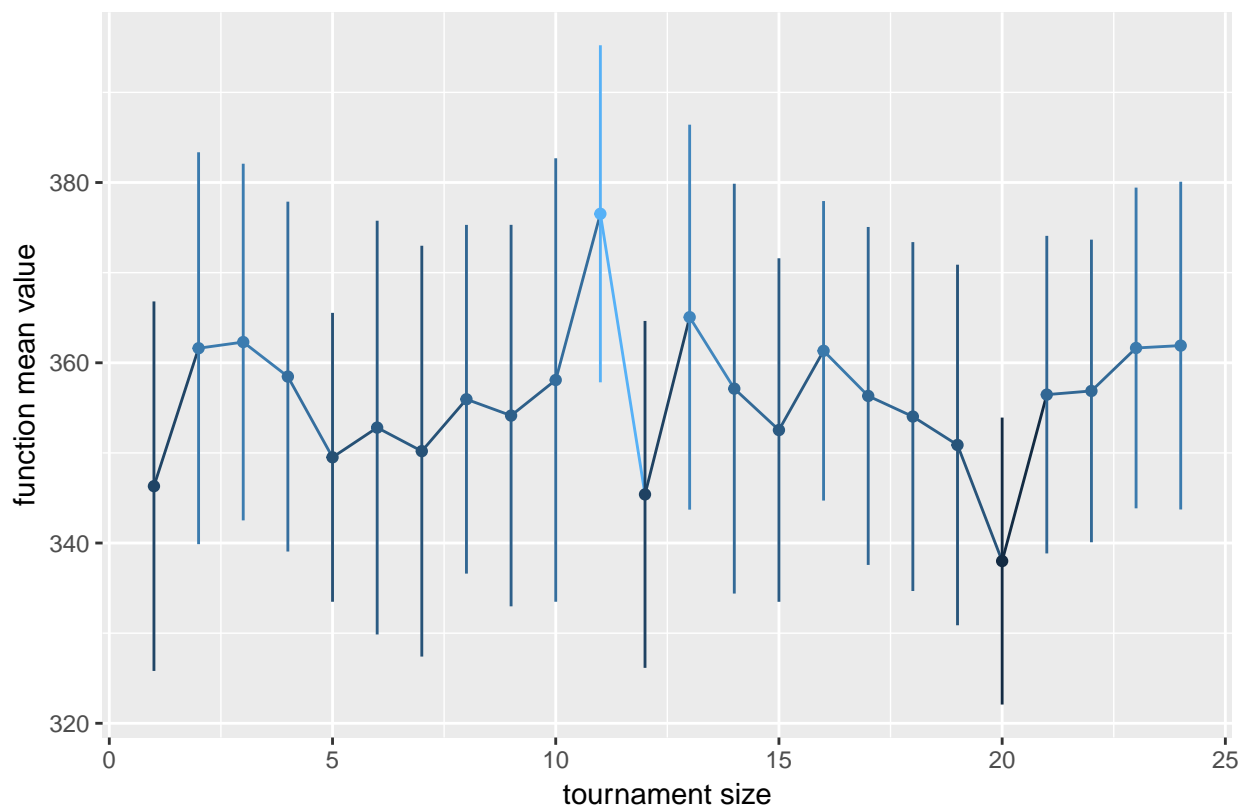


```
## [1] 64.09727 67.97683 61.86644 60.69024 50.11523 71.76788 71.26615
## [8] 60.49052 66.17676 76.92534 58.46723 60.17896 66.77675 71.08483
## [15] 59.59024 51.95846 58.62284 60.51681 62.54583 49.77787 55.08800
## [22] 52.49040 55.63215 56.85804
```

F13 means and std

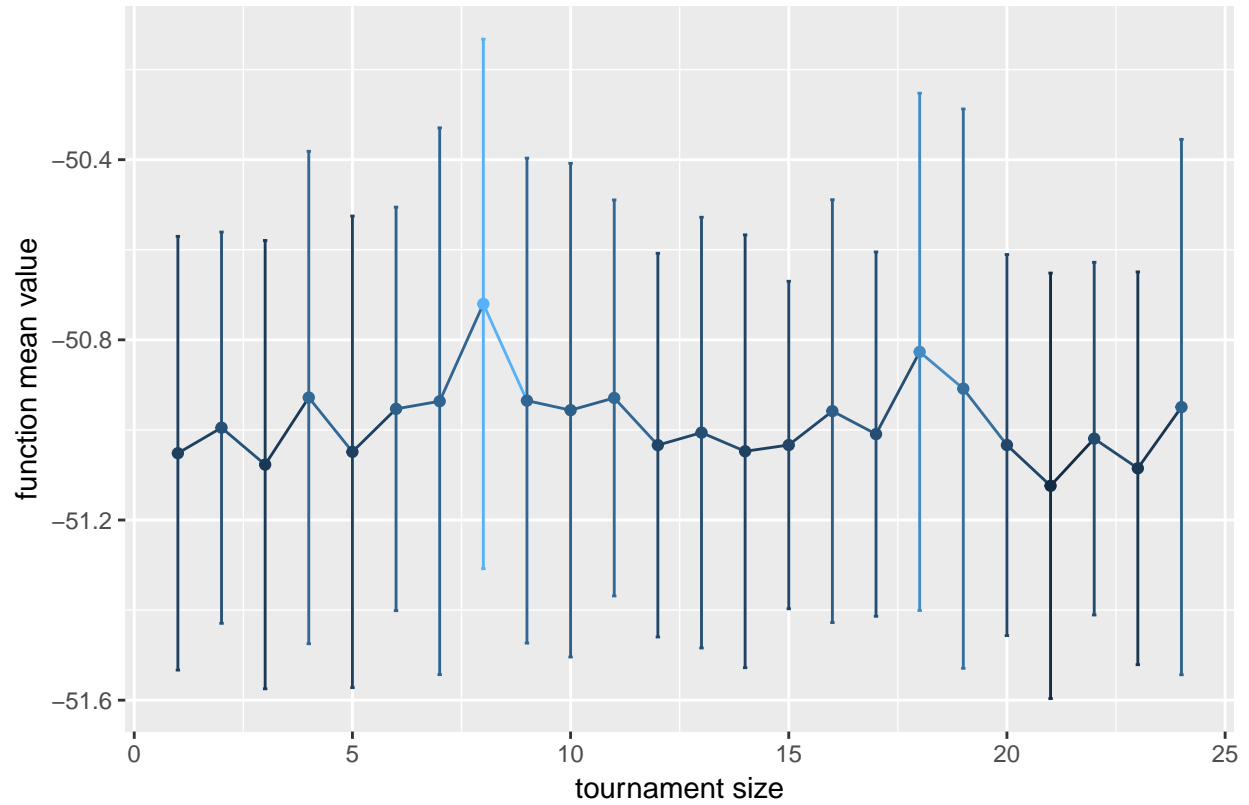


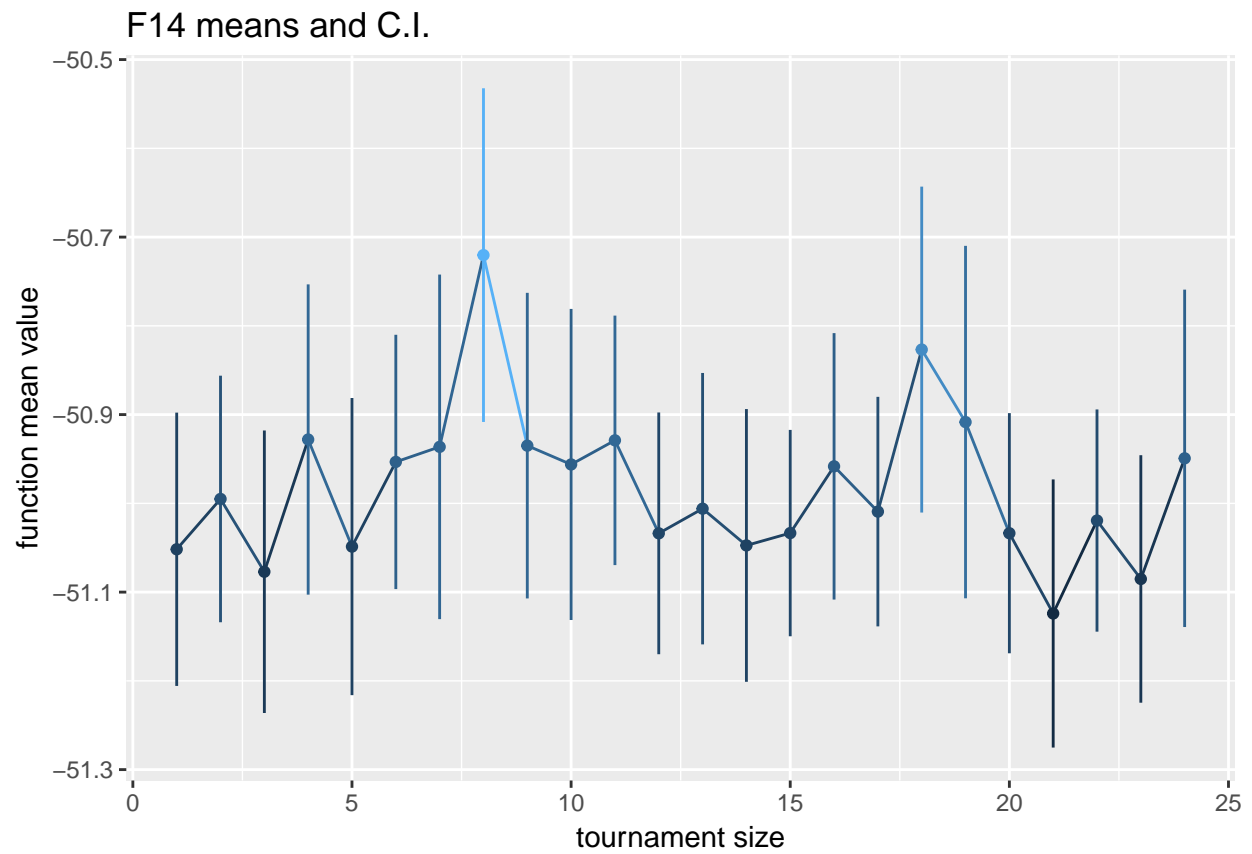
F13 means and C.I.



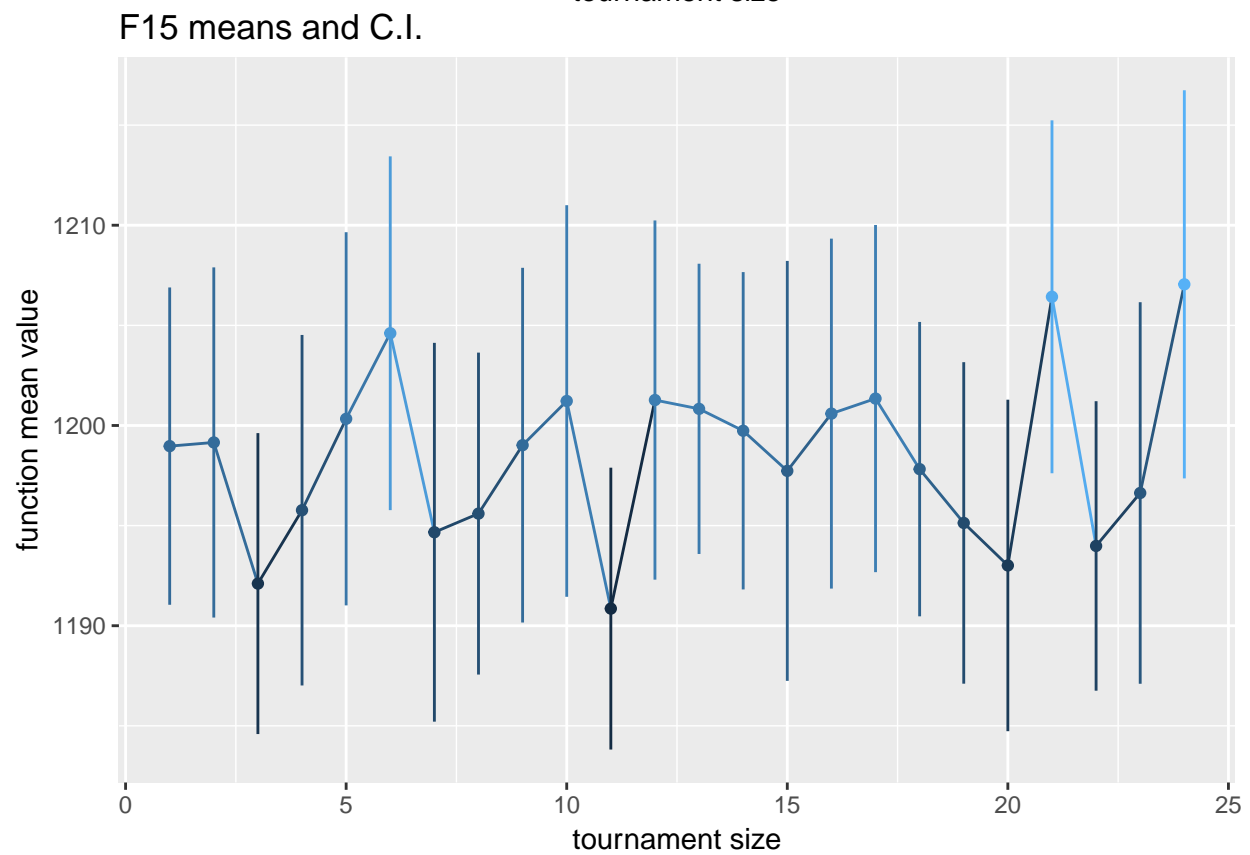
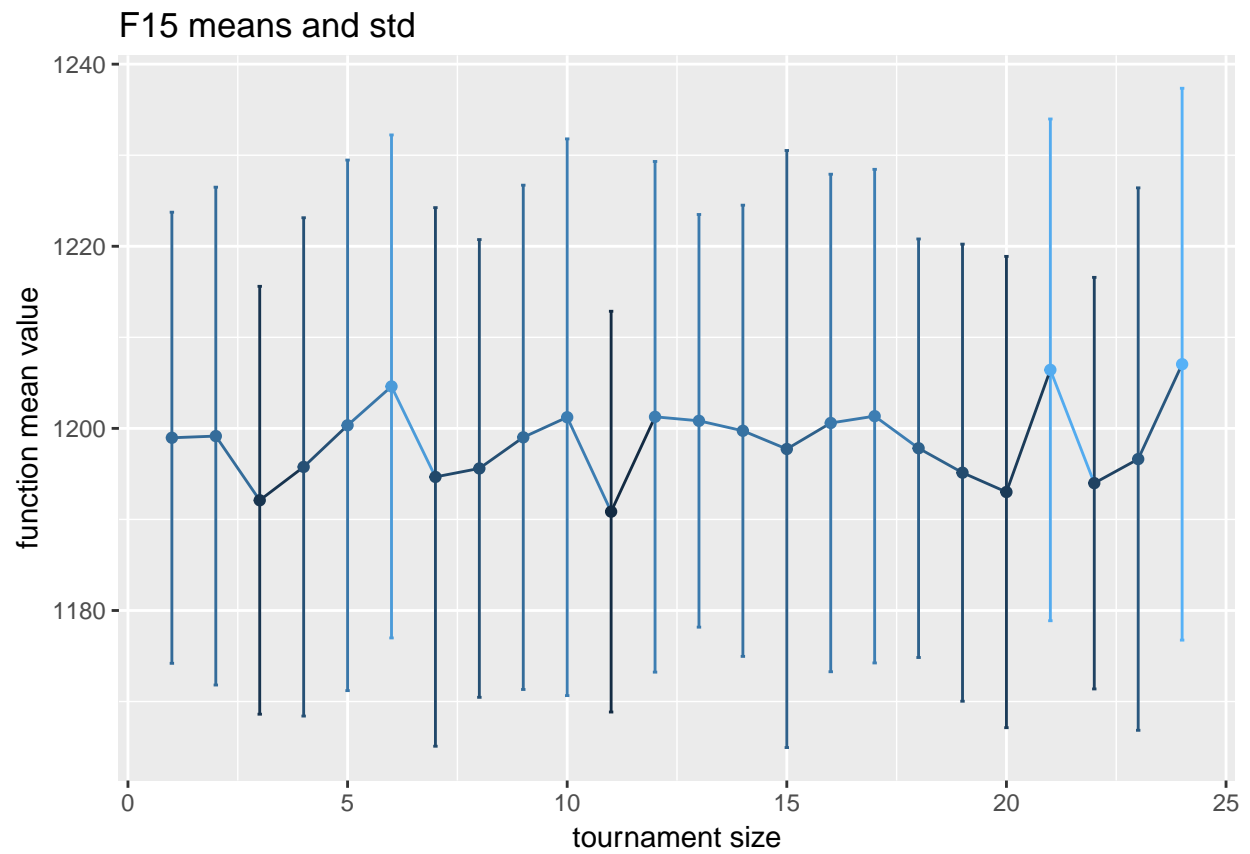
```
## [1] 0.4814395 0.4343005 0.4976516 0.5465540 0.5234439 0.4479238 0.6069602
## [8] 0.5877810 0.5383098 0.5480271 0.4394921 0.4258970 0.4781147 0.4804394
## [15] 0.3635230 0.4693204 0.4043612 0.5741512 0.6208216 0.4230184 0.4723206
## [22] 0.3914378 0.4360014 0.5942940
```

F14 means and std



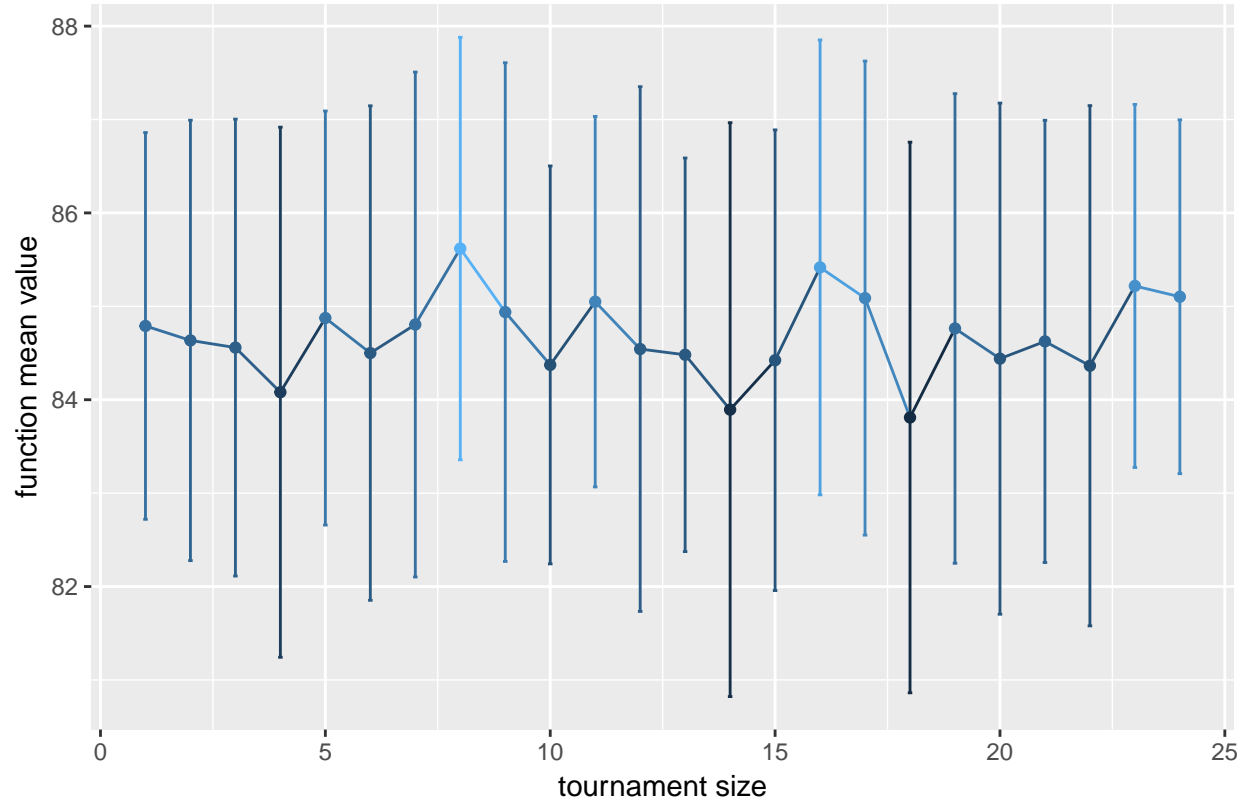


```
## [1] 24.77231 27.33841 23.49581 27.36533 29.13496 27.62088 29.57460
## [8] 25.13646 27.69231 30.57294 22.00689 28.04315 22.66164 24.77661
## [15] 32.78733 27.32187 27.10604 22.98350 25.10050 25.88179 27.55181
## [22] 22.60185 29.78813 30.30463
```

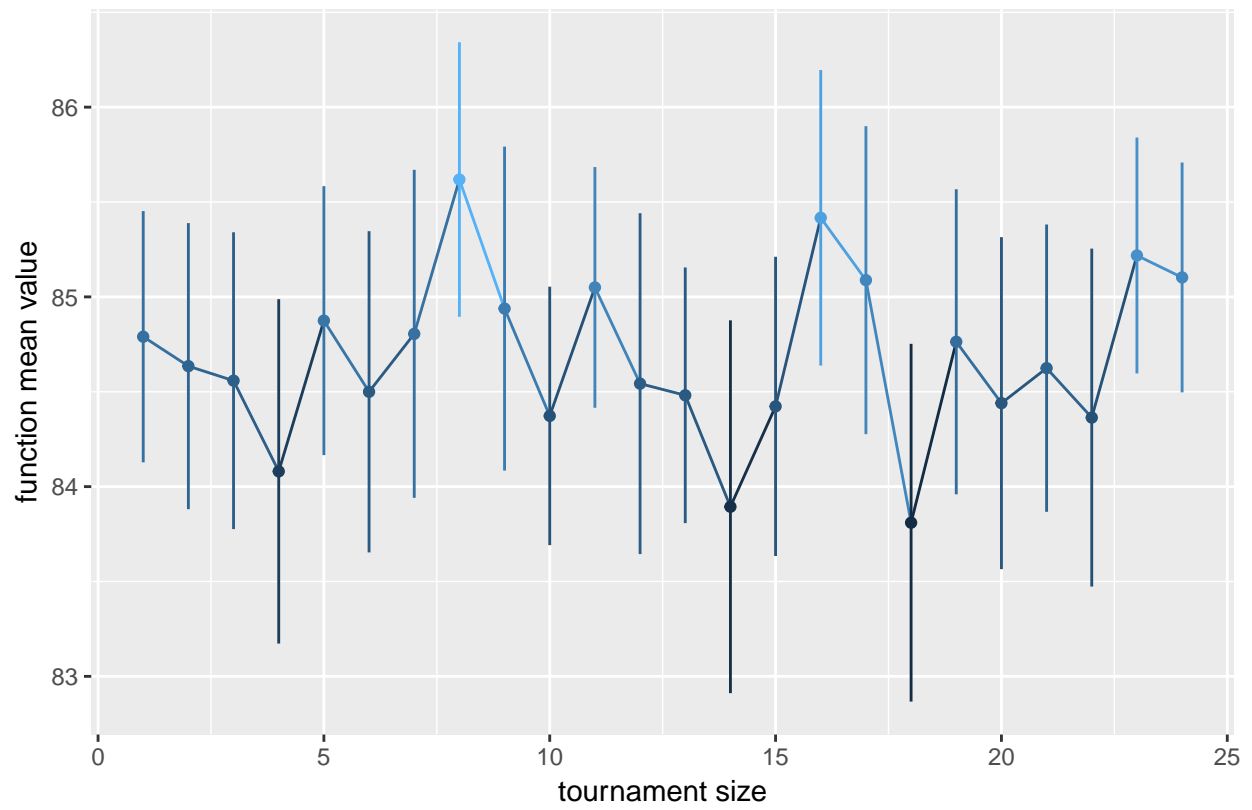


```
## [1] 2.070183 2.357381 2.445849 2.837632 2.216630 2.646814 2.702935
## [8] 2.261909 2.669514 2.130132 1.983347 2.808800 2.106714 3.072016
## [15] 2.465842 2.435004 2.537595 2.947694 2.513972 2.736096 2.367306
## [22] 2.784922 1.943490 1.894014
```

F16 means and std

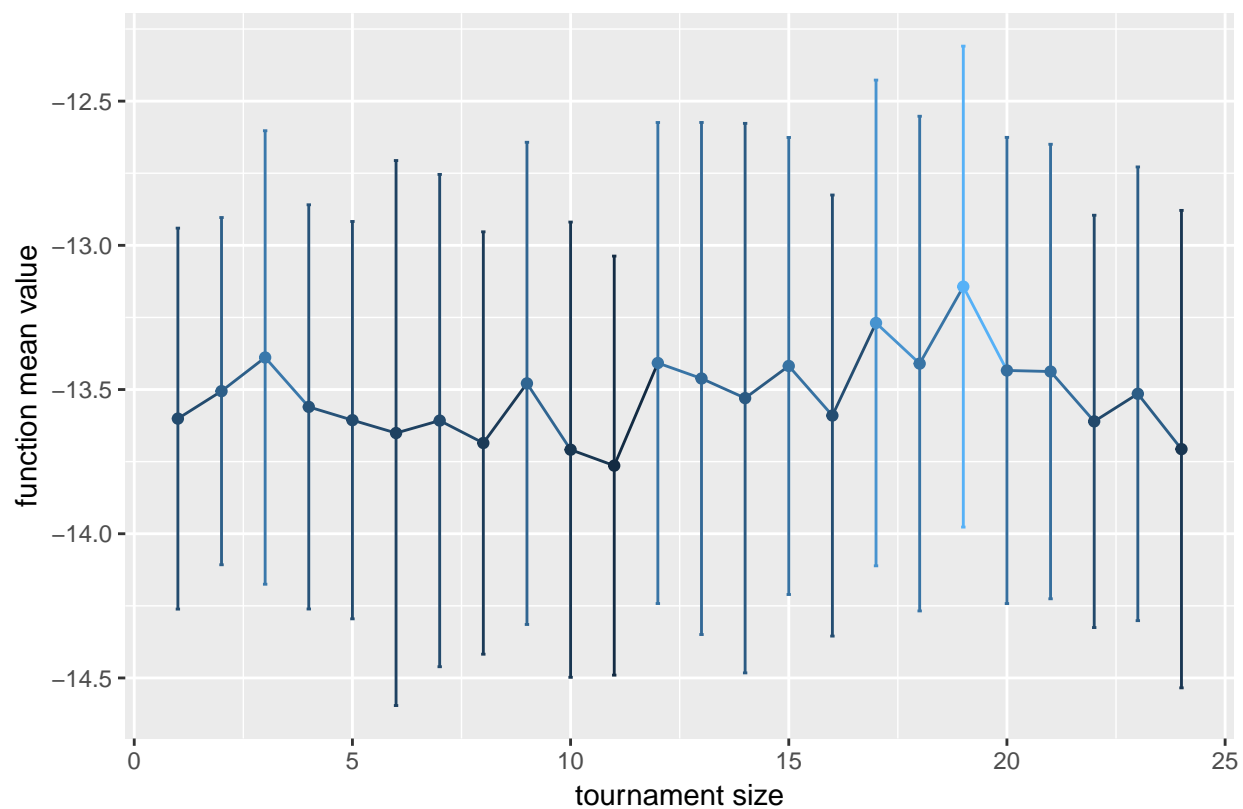


F16 means and C.I.

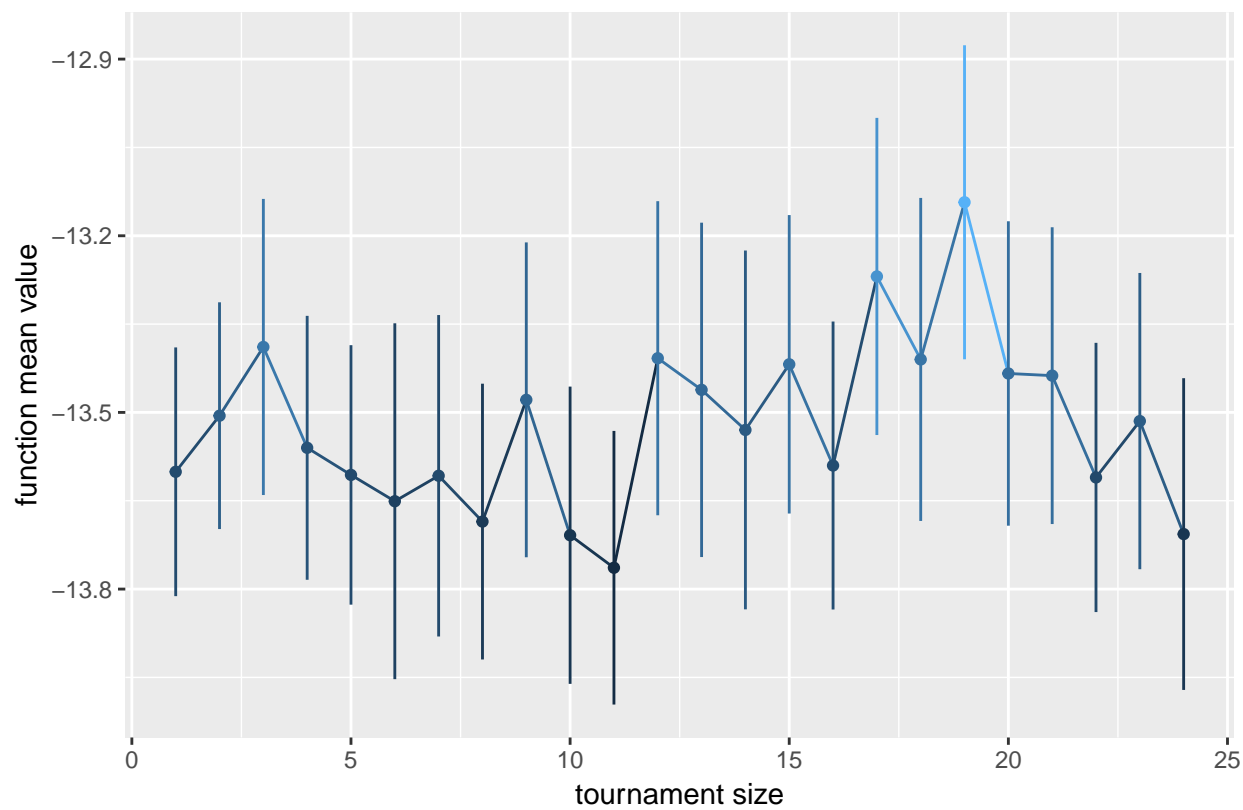


```
## [1] 0.6604195 0.6019788 0.7862048 0.7007566 0.6888933 0.9448538 0.8534757
## [8] 0.7322104 0.8359773 0.7892186 0.7264628 0.8339485 0.8877658 0.9526843
## [15] 0.7924082 0.7646333 0.8420770 0.8576400 0.8337743 0.8082637 0.7879569
## [22] 0.7148024 0.7865516 0.8277217
```

F17 means and std

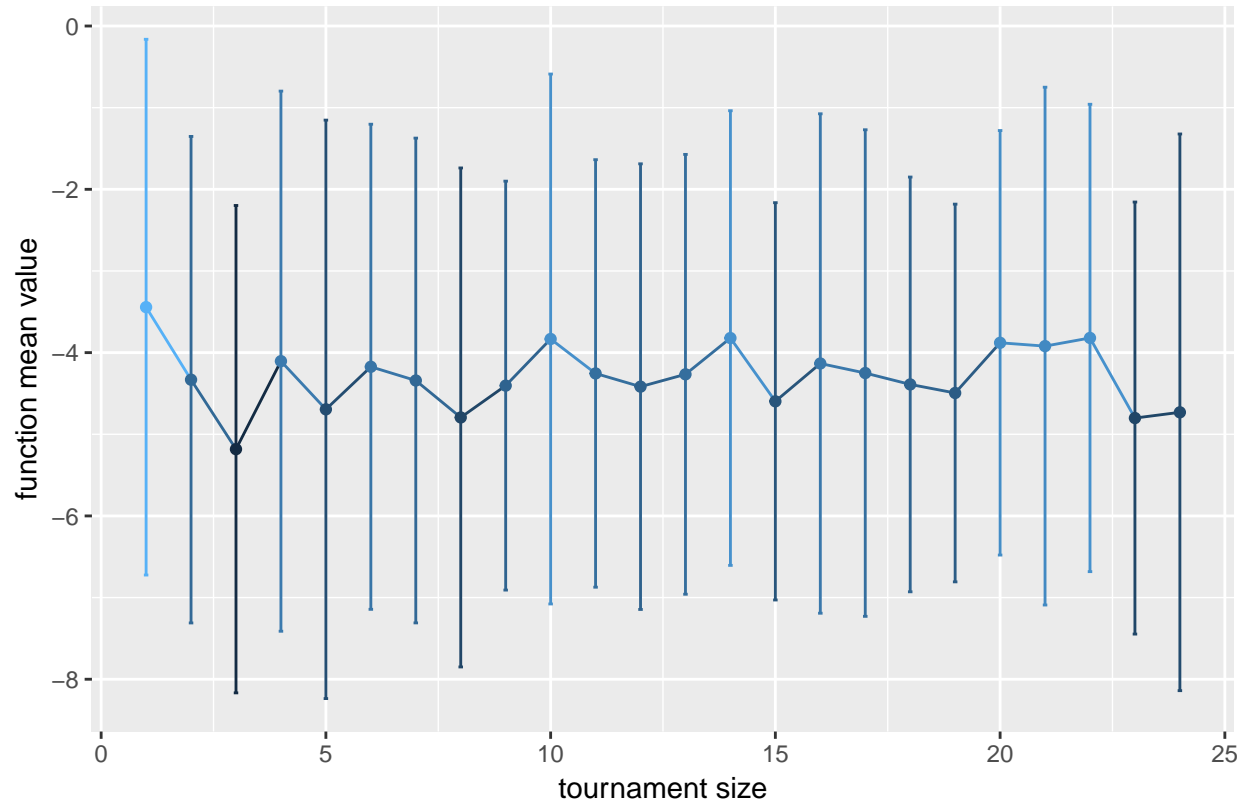


F17 means and C.I.

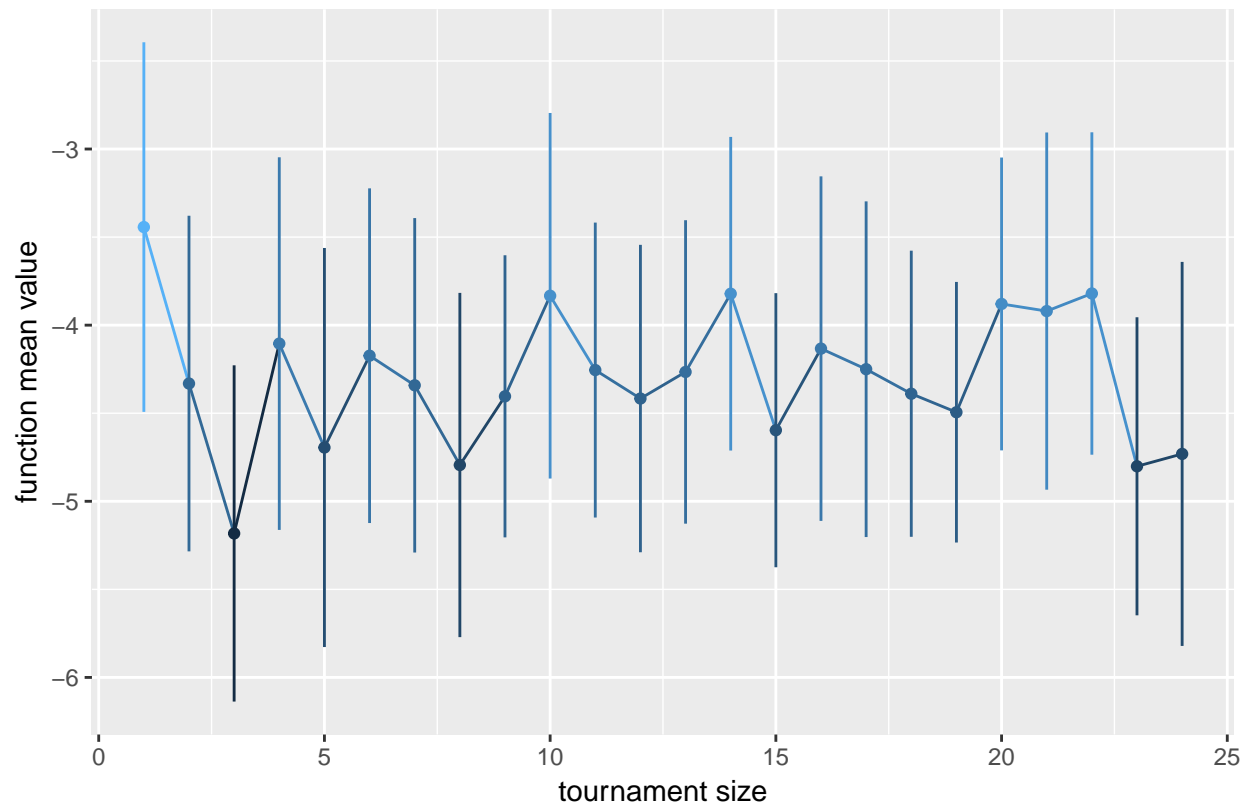


```
## [1] 3.280567 2.979206 2.984575 3.307596 3.542163 2.970408 2.968474
## [8] 3.055539 2.503932 3.244965 2.617915 2.728702 2.693269 2.783869
## [15] 2.432934 3.058268 2.979488 2.539687 2.312920 2.599466 3.170537
## [22] 2.861863 2.645612 3.408654
```

F18 means and std

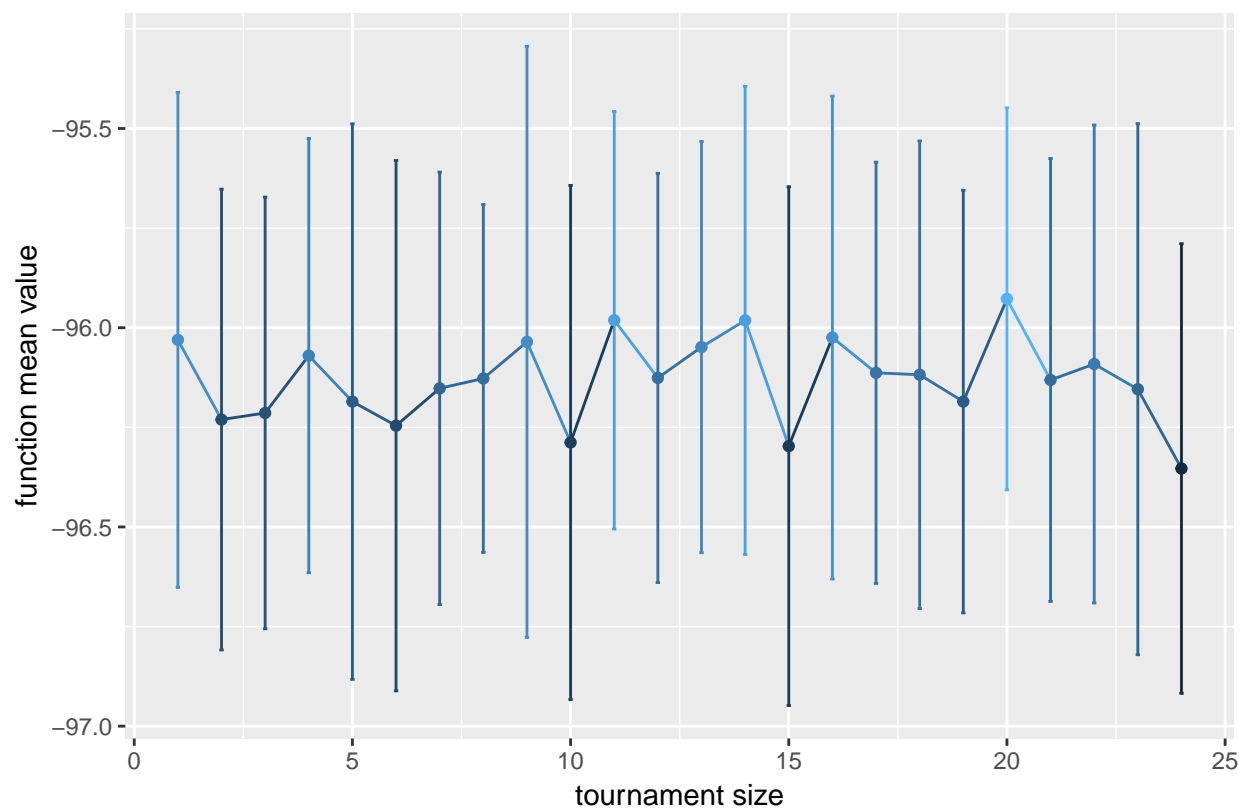


F18 means and C.I.

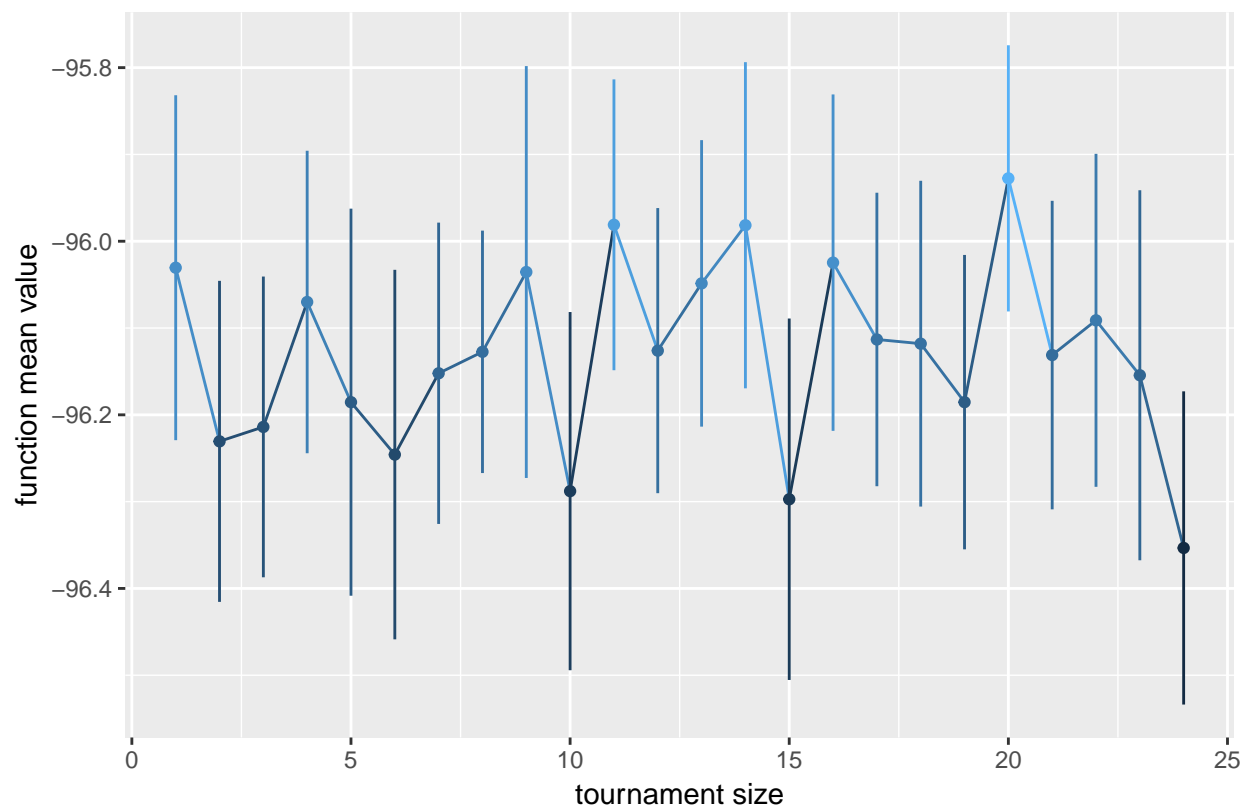


```
## [1] 0.6212857 0.5782335 0.5416732 0.5448711 0.6971953 0.6655747 0.5427168
## [8] 0.4366329 0.7418672 0.6451493 0.5239143 0.5135592 0.5160088 0.5874820
## [15] 0.6510199 0.6059383 0.5286227 0.5867929 0.5302576 0.4794745 0.5557401
## [22] 0.5997834 0.6664702 0.5641027
```

F19 means and std

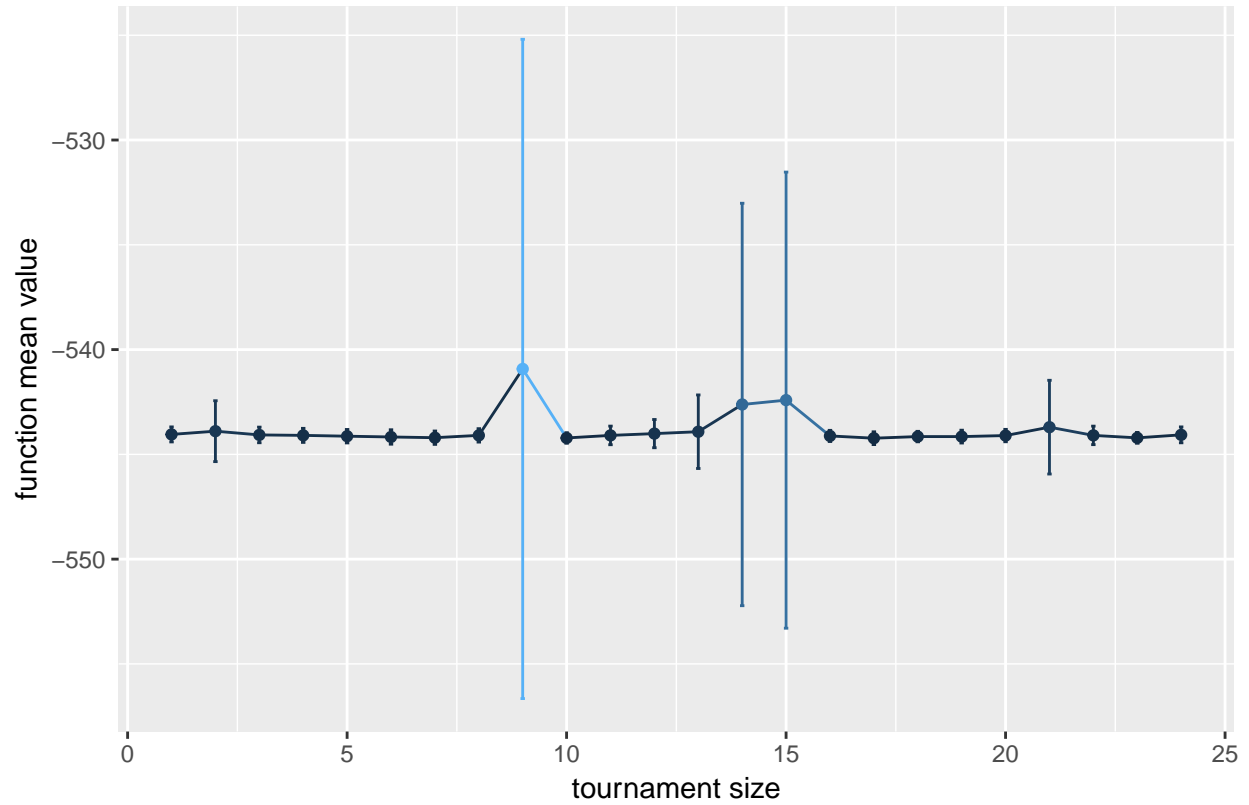


F19 means and C.I.

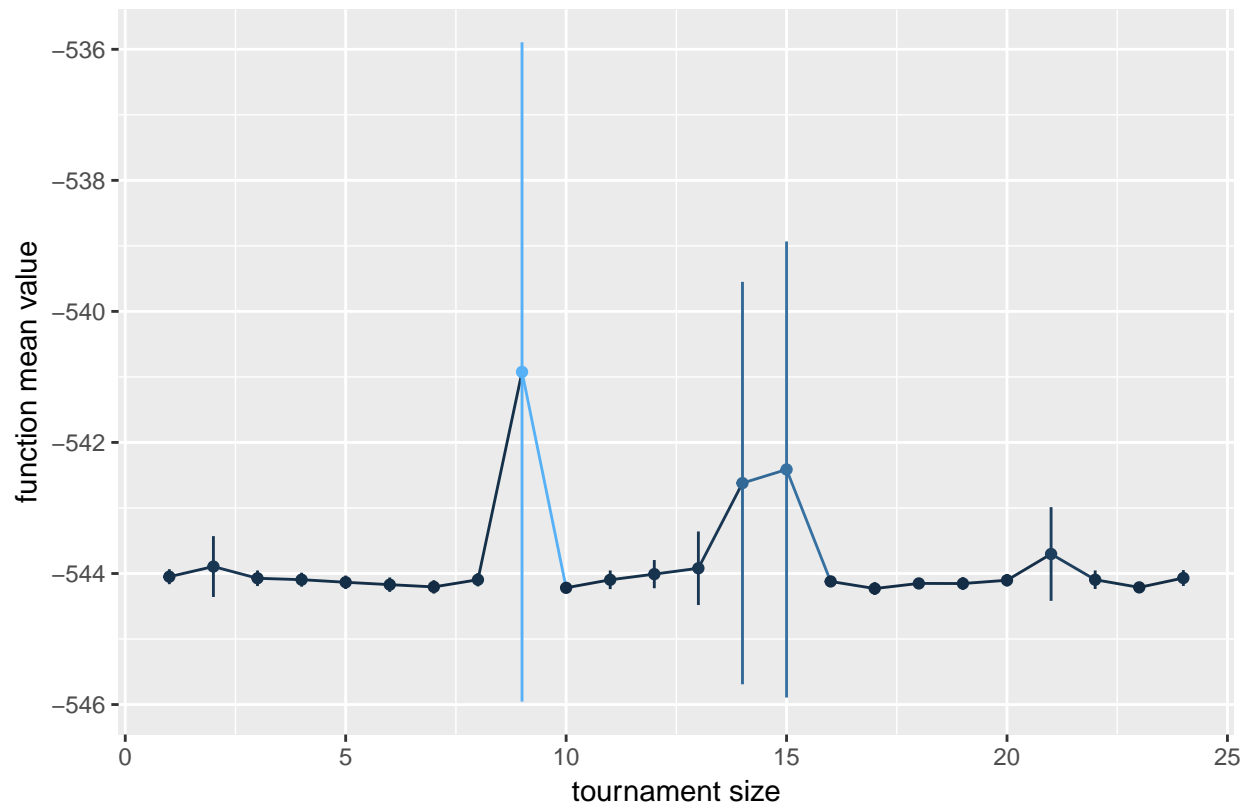


```
## [1] 0.3577385 1.4522482 0.3722891 0.3342789 0.3203987 0.3432203
## [7] 0.3179952 0.3193463 15.7308372 0.2495824 0.4440507 0.6733610
## [13] 1.7549915 9.6024268 10.8827583 0.2660707 0.3039624 0.2499267
## [19] 0.3054992 0.2952024 2.2356739 0.4414154 0.2572610 0.3786557
```

F20 means and std

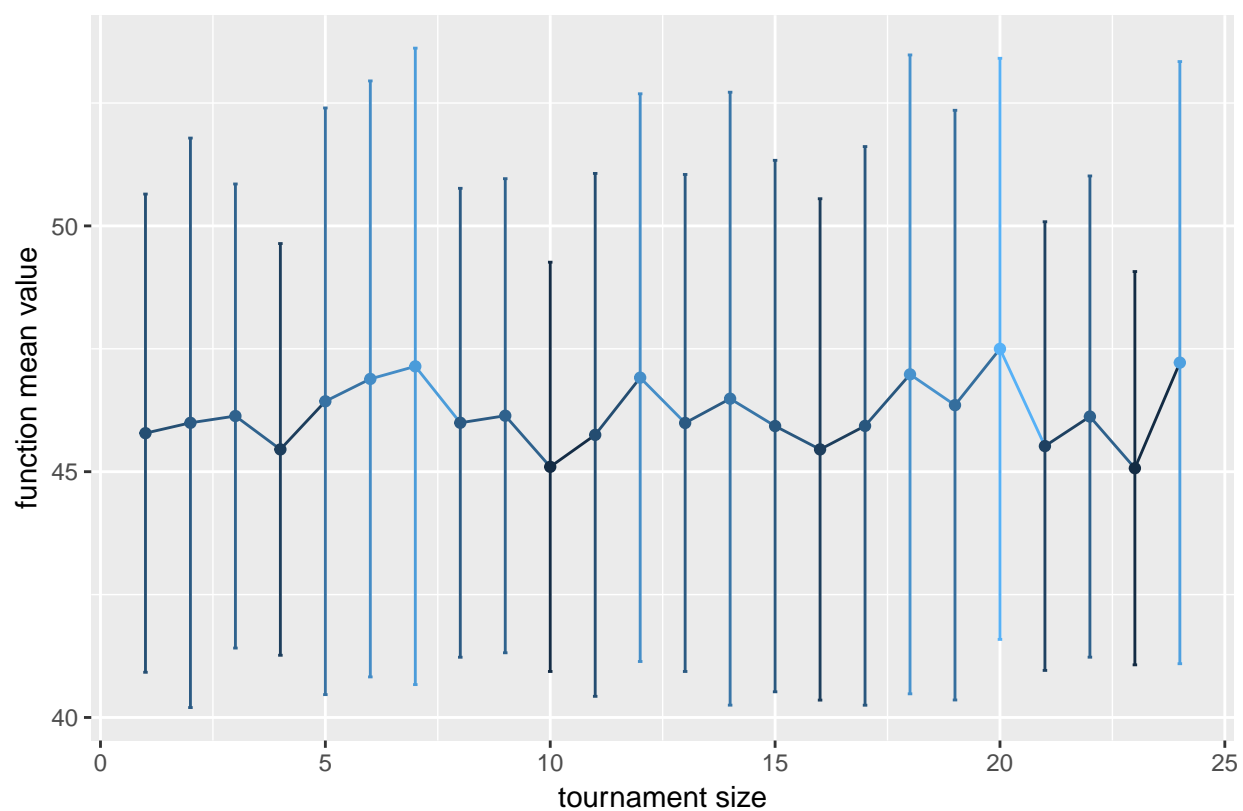


F20 means and C.I.

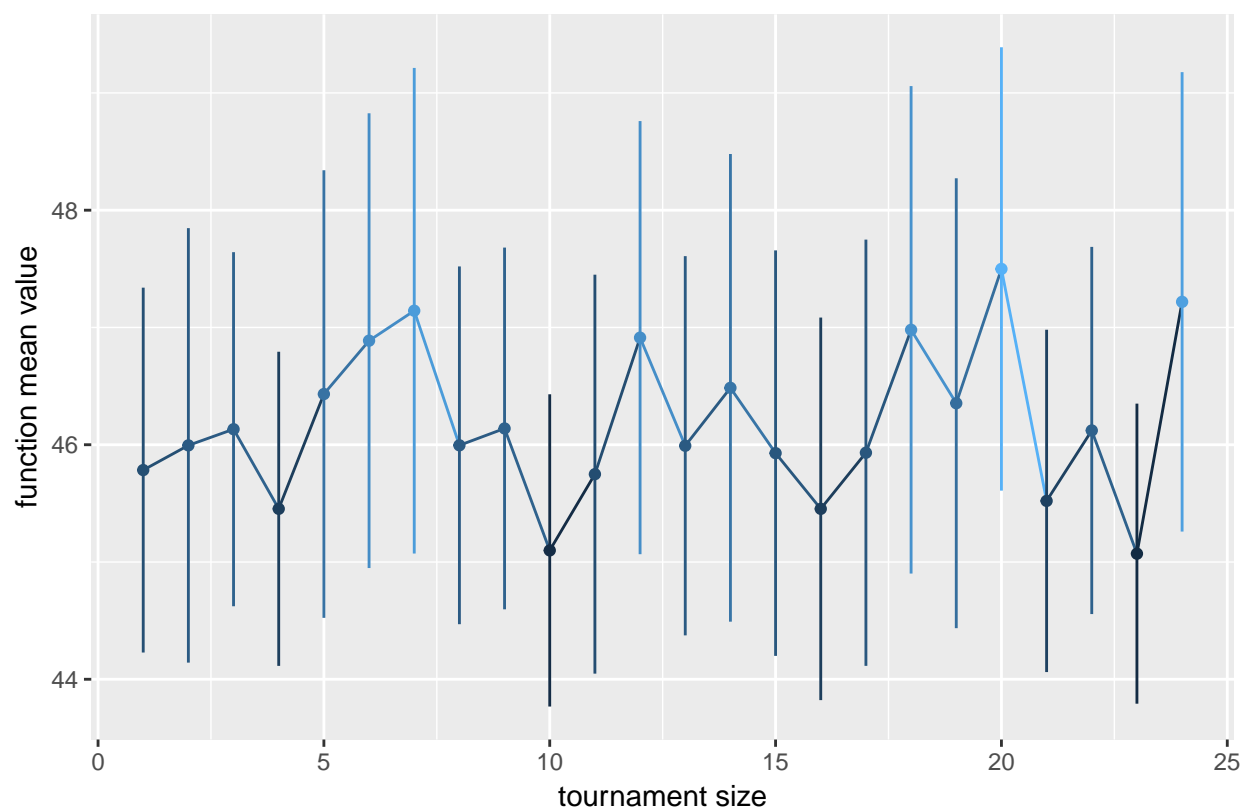


```
## [1] 4.864276 5.792396 4.720463 4.187665 5.967403 6.062405 6.473590
## [8] 4.769525 4.822391 4.162900 5.319030 5.774409 5.055593 6.234608
## [15] 5.405886 5.099901 5.682259 6.498483 5.997837 5.910579 4.563651
## [22] 4.894746 4.000173 6.124740
```

F21 means and std

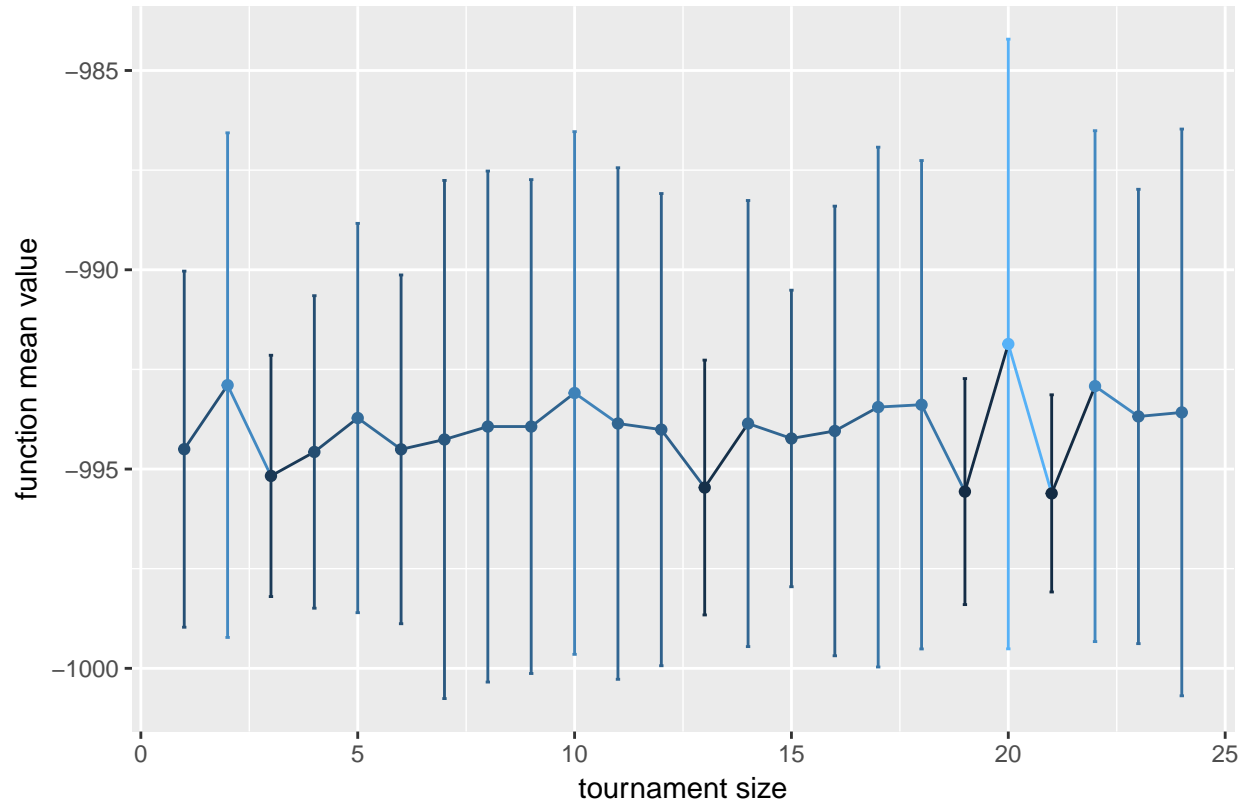


F21 means and C.I.

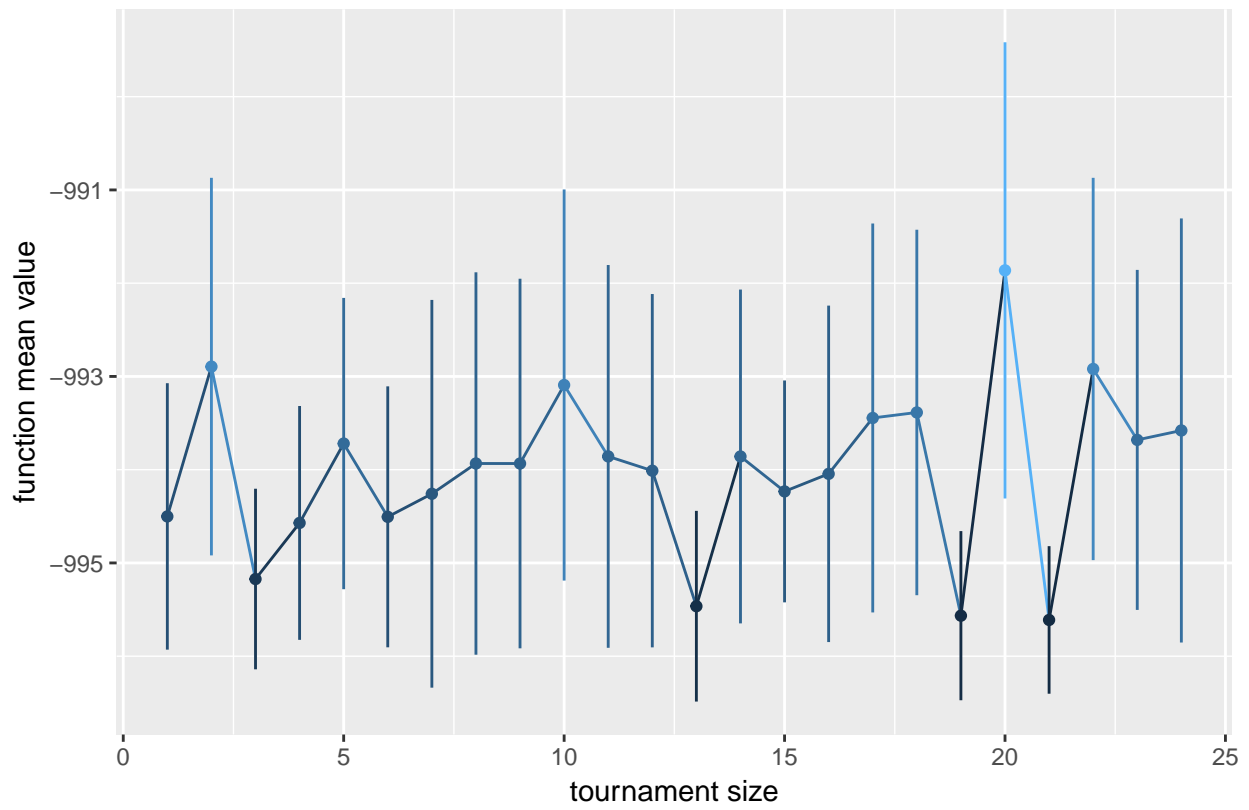



```
## [1] 4.466928 6.329920 3.027426 3.920230 4.883780 4.375054 6.500059
## [8] 6.410721 6.196162 6.556866 6.417499 5.923717 3.196893 5.596667
## [15] 3.719933 5.640552 6.520624 6.127006 2.835754 7.648499 2.473552
## [22] 6.409016 5.699988 7.109867
```

F22 means and std

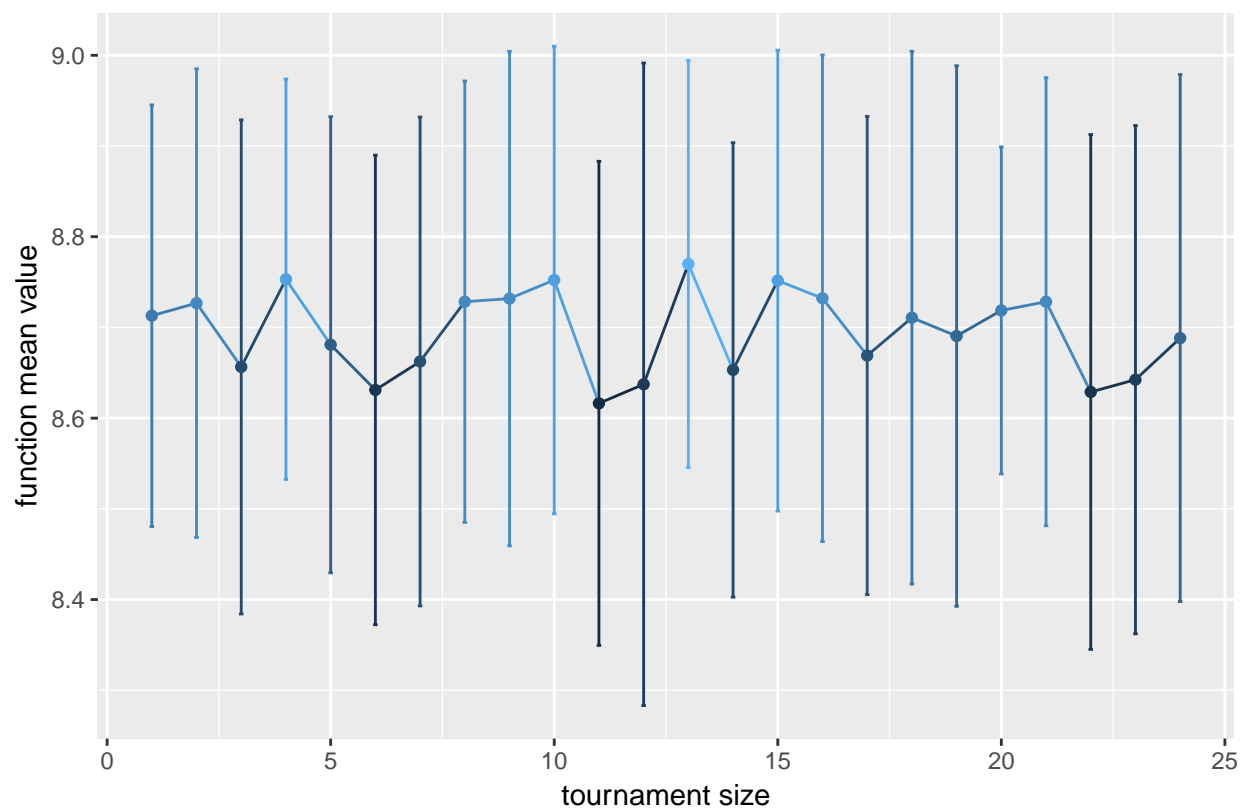


F22 means and C.I.

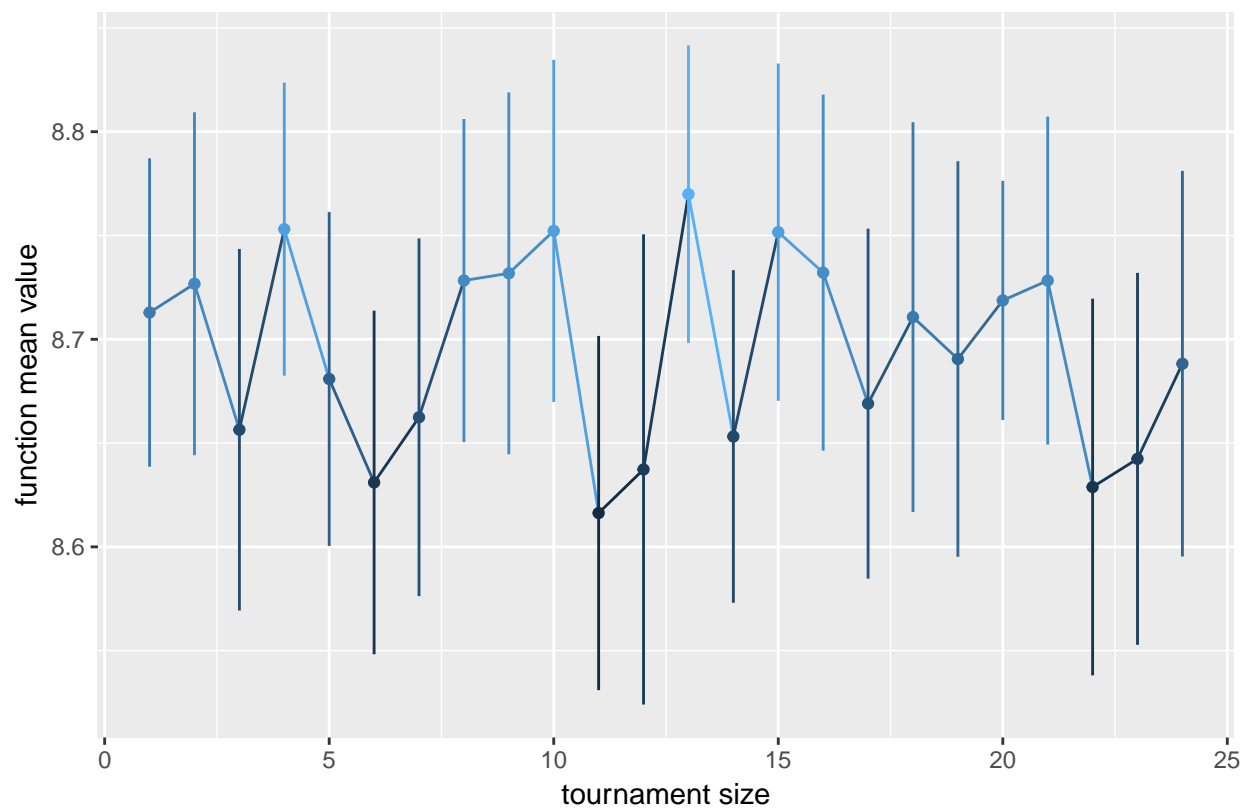


```
## [1] 0.2323611 0.2582782 0.2723161 0.2207022 0.2514377 0.2587894 0.2694308
## [8] 0.2433079 0.2725823 0.2576844 0.2667920 0.3541397 0.2243296 0.2504997
## [15] 0.2540371 0.2681385 0.2635970 0.2936195 0.2979388 0.1802342 0.2469685
## [22] 0.2837447 0.2801571 0.2904399
```

F23 means and std

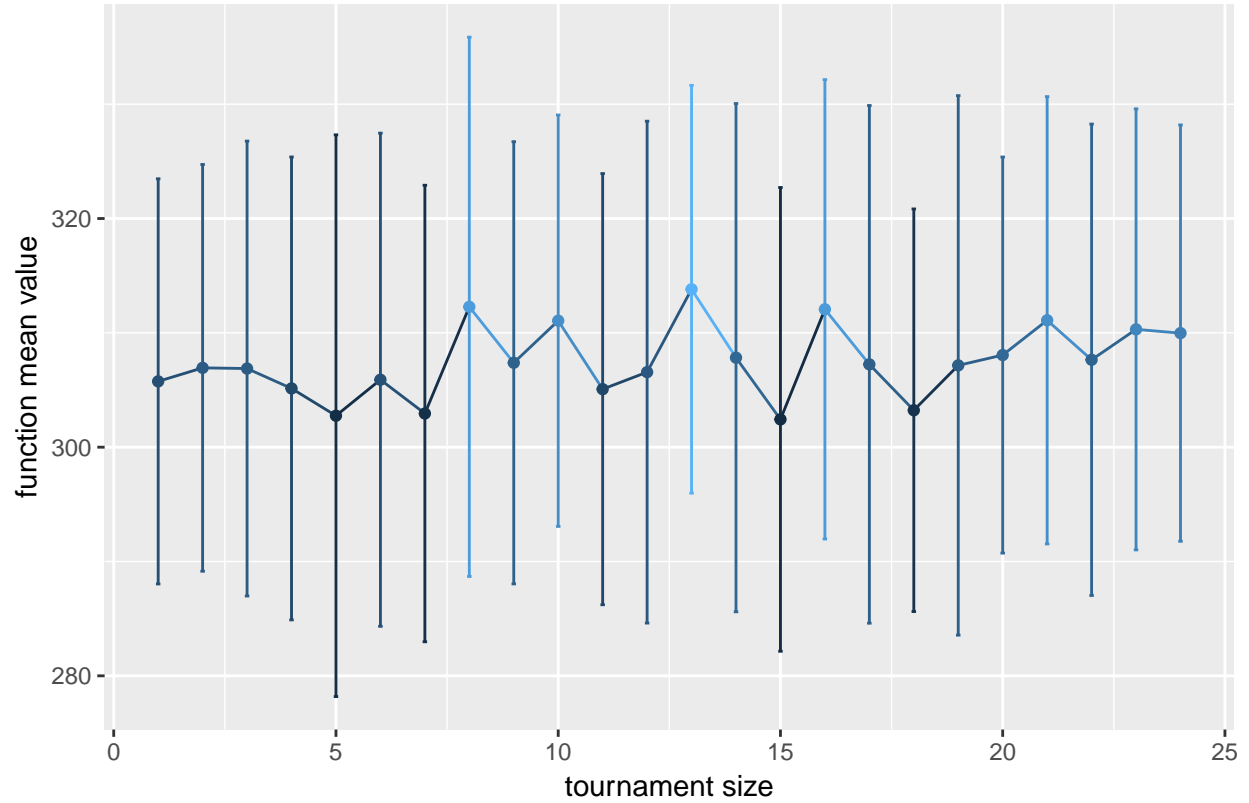


F23 means and C.I.

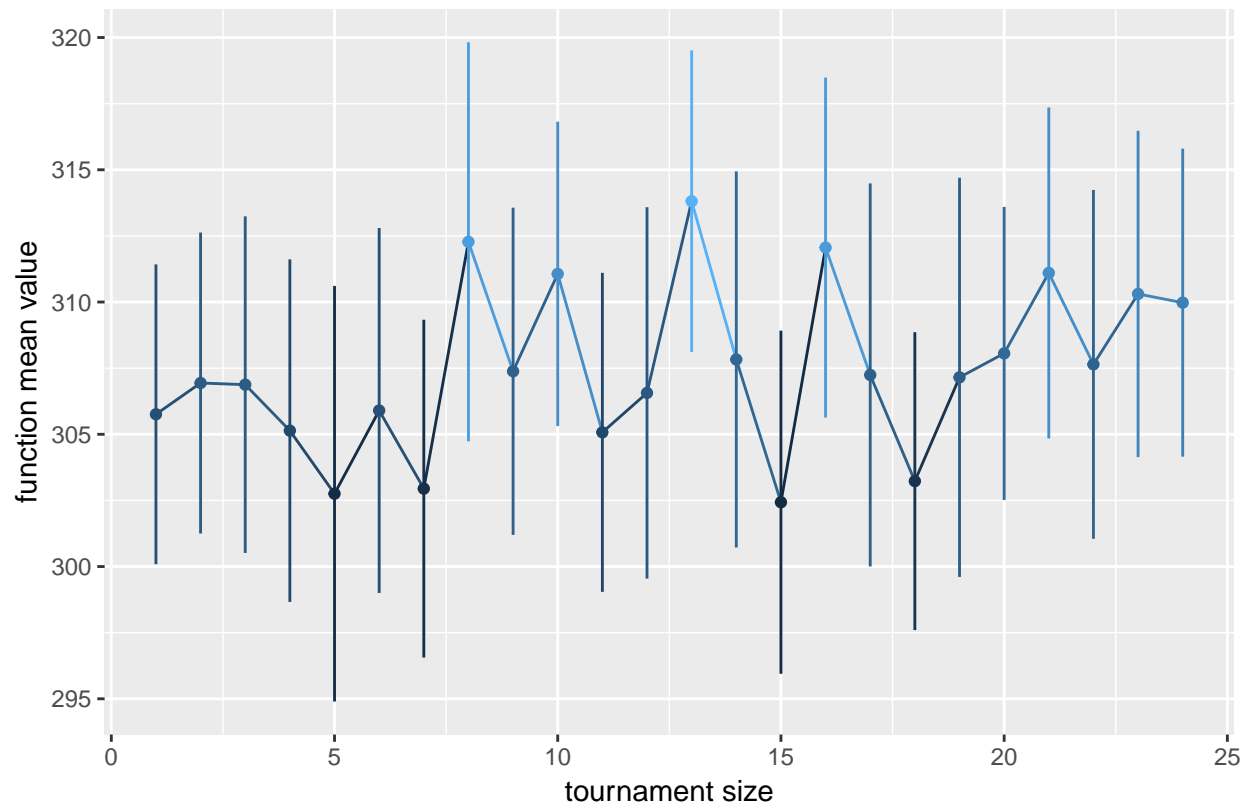


```
## [1] 17.71980 17.78820 19.89487 20.24352 24.56680 21.56881 19.96474
## [8] 23.58619 19.33846 17.99156 18.85612 21.94762 17.83373 22.22896
## [15] 20.28220 20.08969 22.63938 17.60637 23.59396 17.32108 19.56239
## [22] 20.61639 19.28606 18.20585
```

F24 means and std



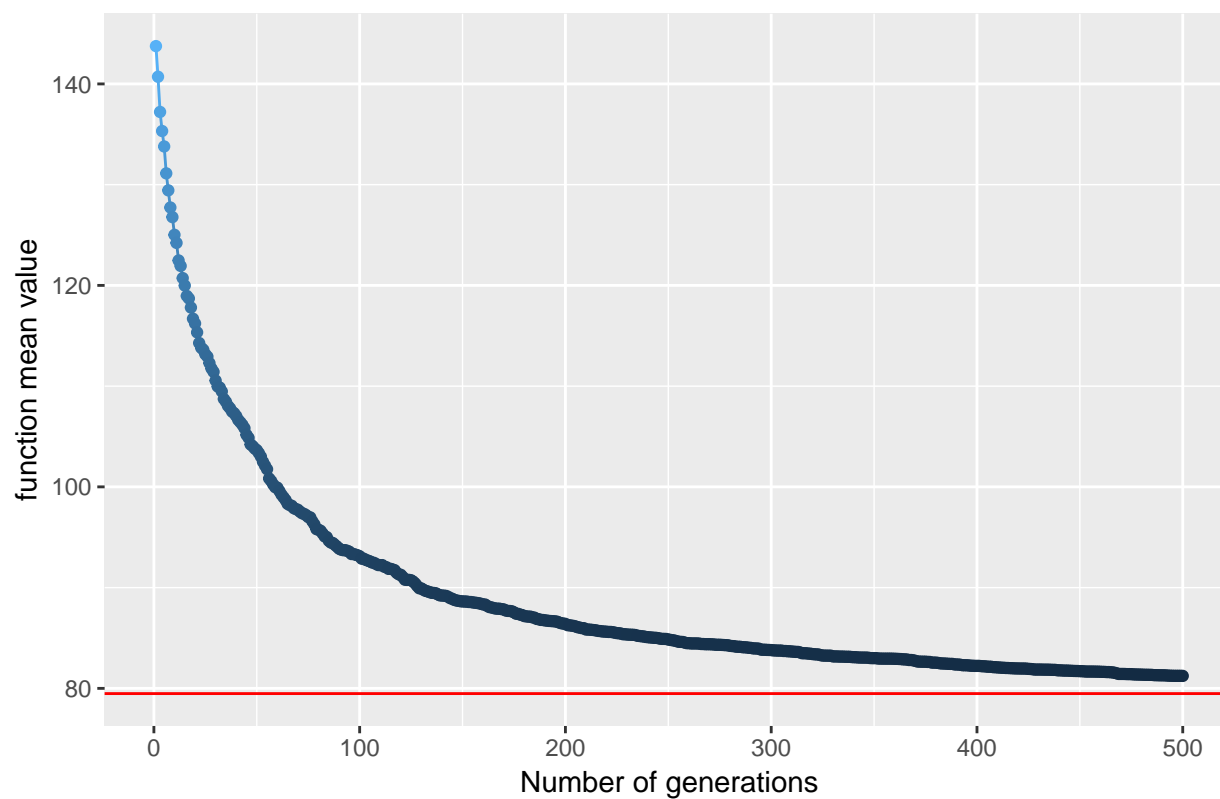
F24 means and C.I.



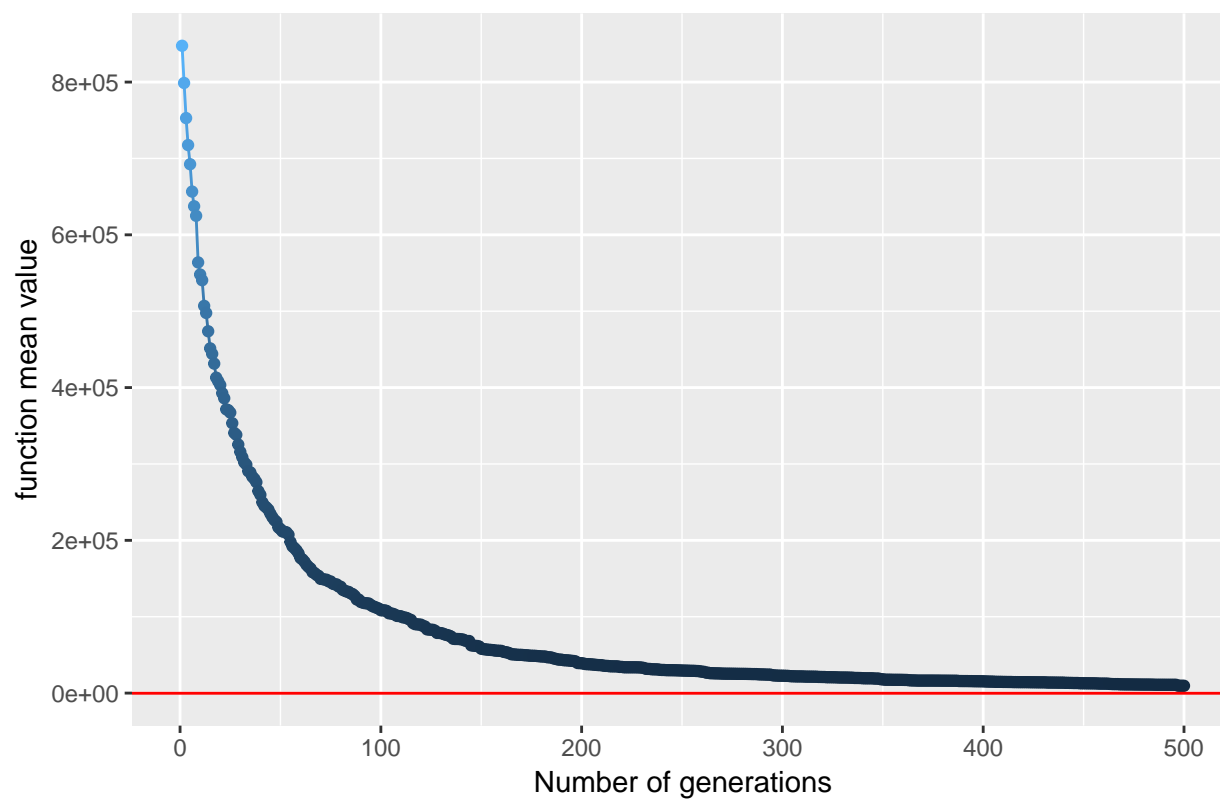
Convergency Plots

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 between 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).

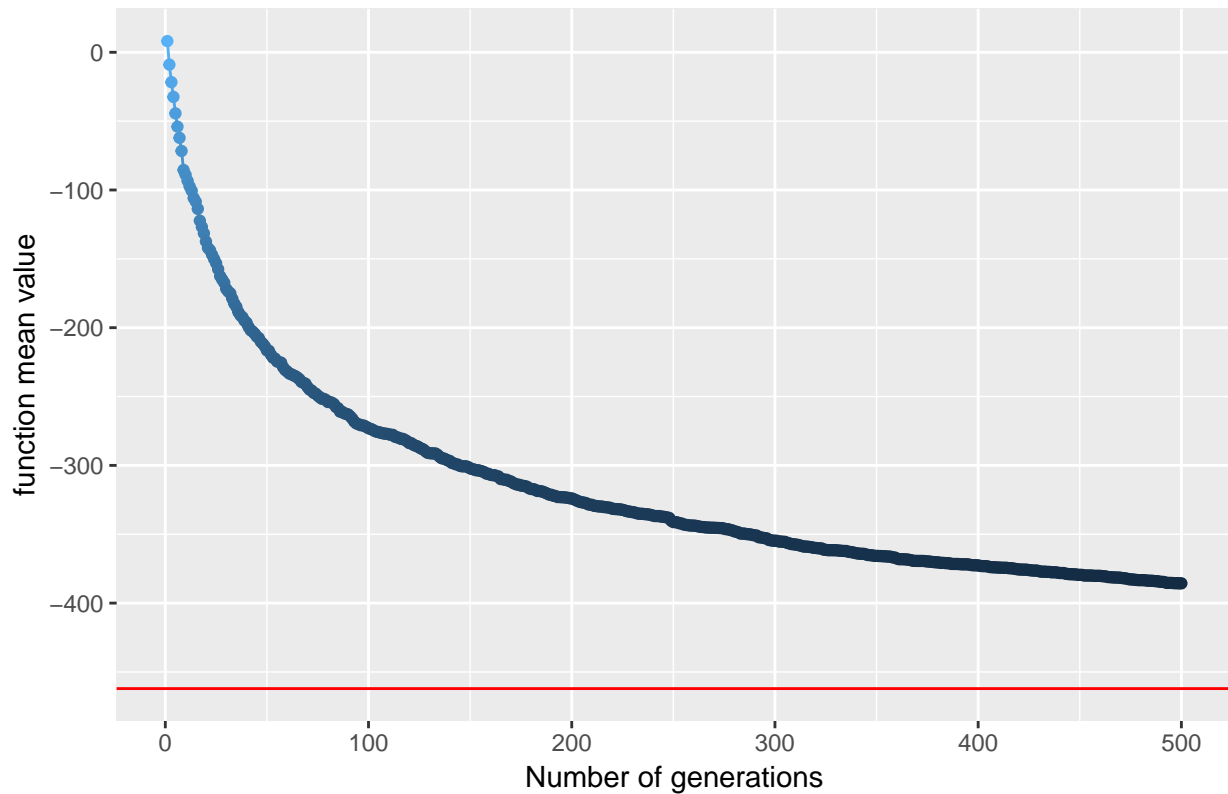
F1 with last gen mean: 81.235405 and target value: 79.48000001



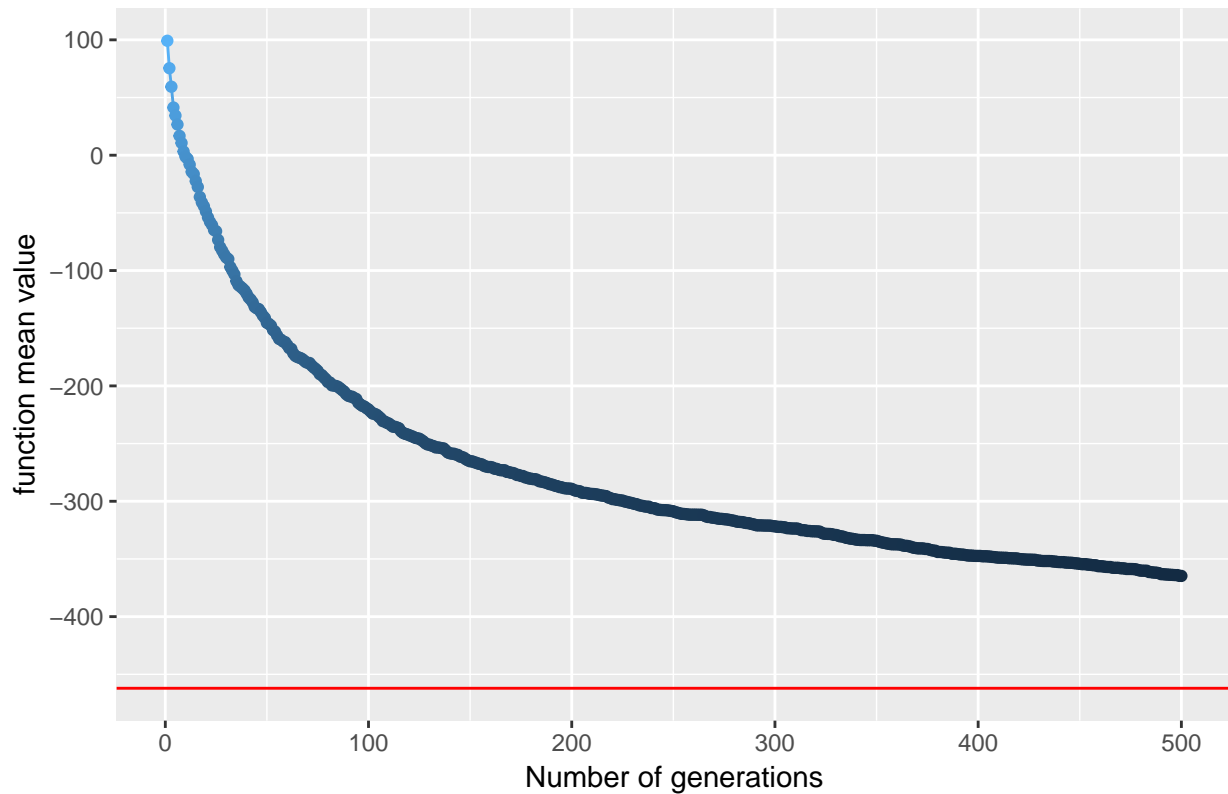
F2 with last gen mean: 9565.82575 and target value: -209.87999999



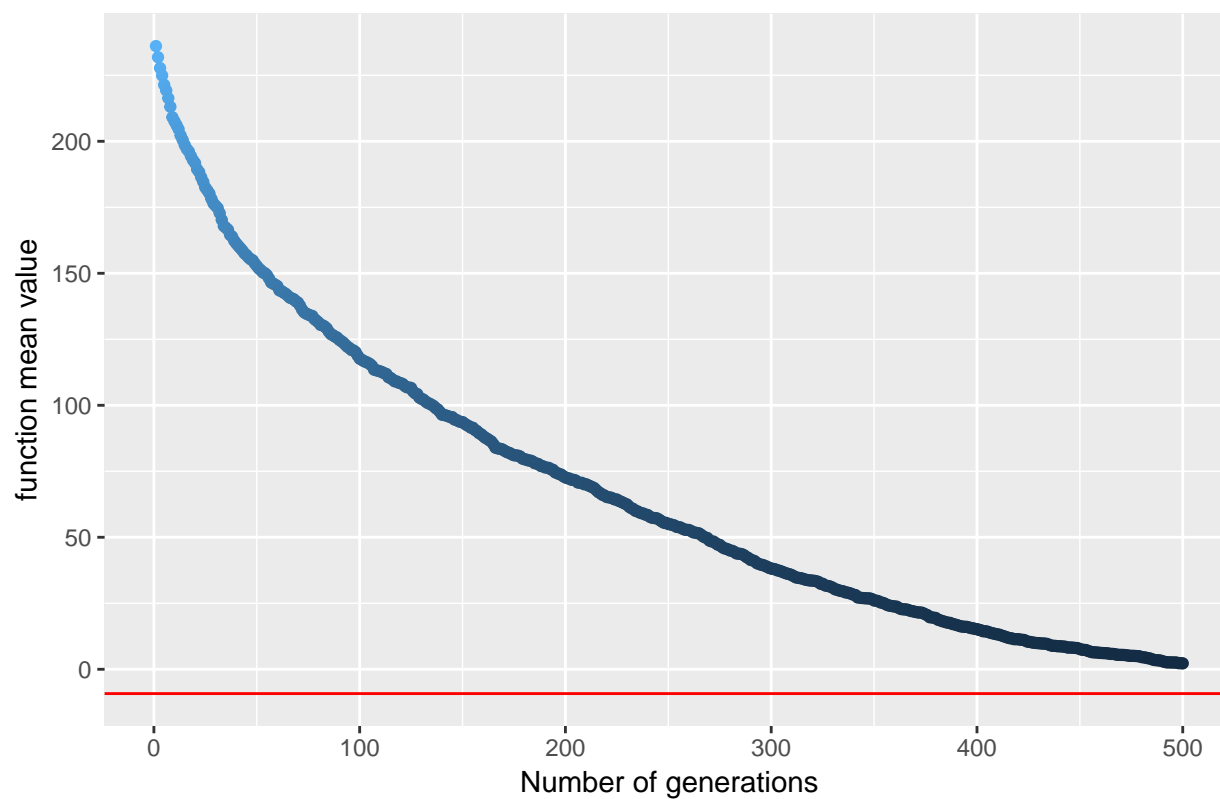
F3 with last gen mean: -385.670425 and target value: -462.08999999



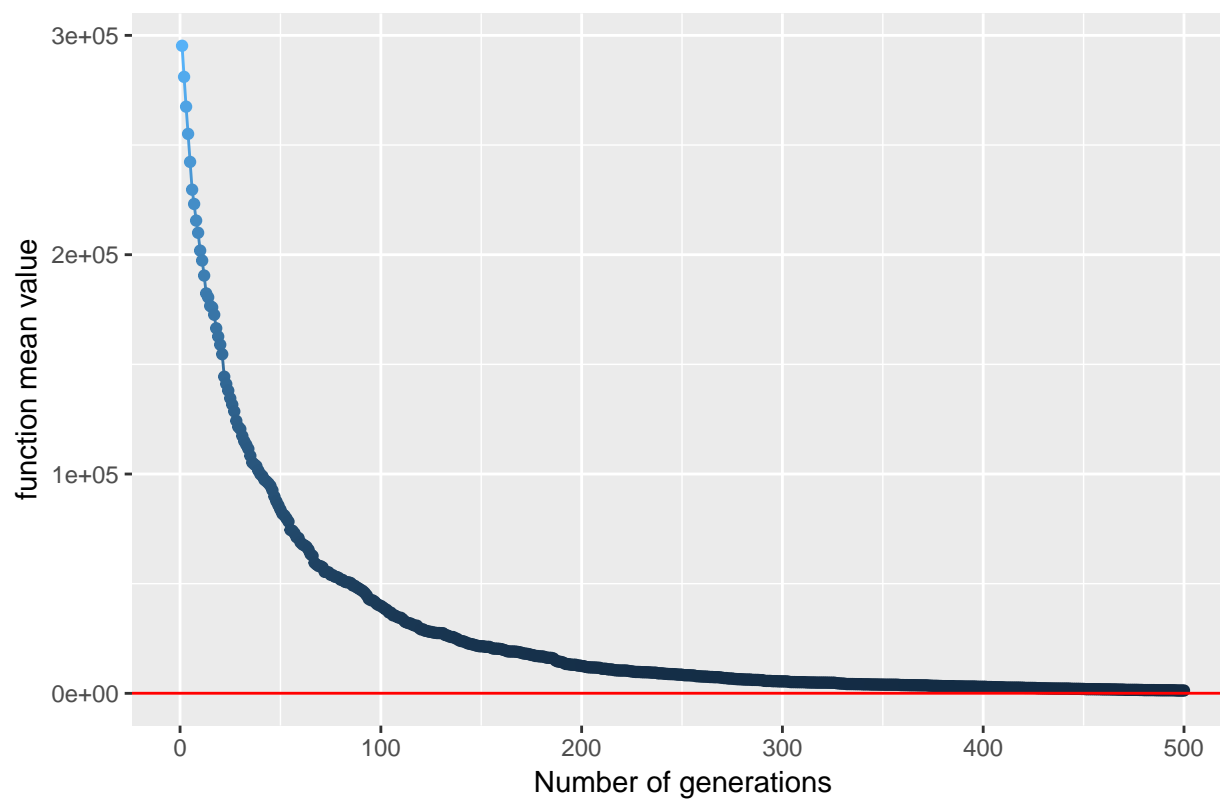
F4 with last gen mean: -364.703825 and target value: -462.08999999



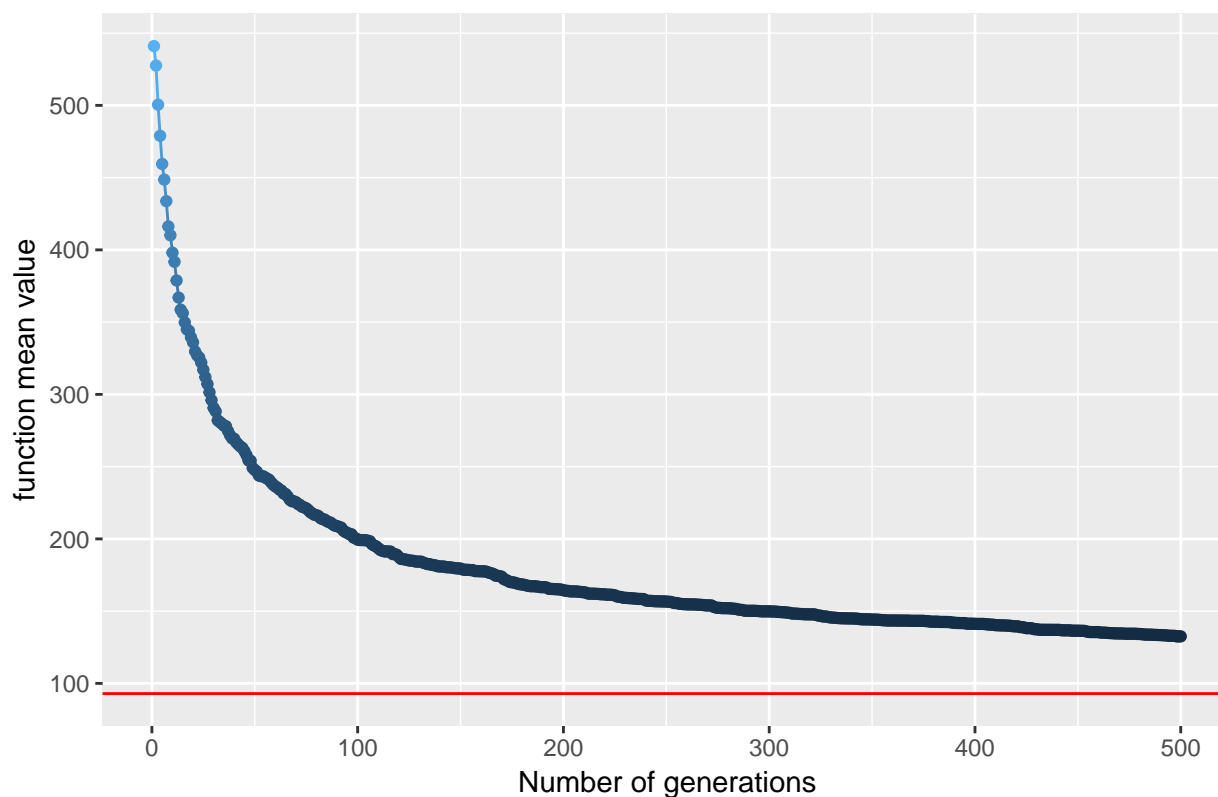
F5 with last gen mean: 2.2424075 and target value: -9.20999999



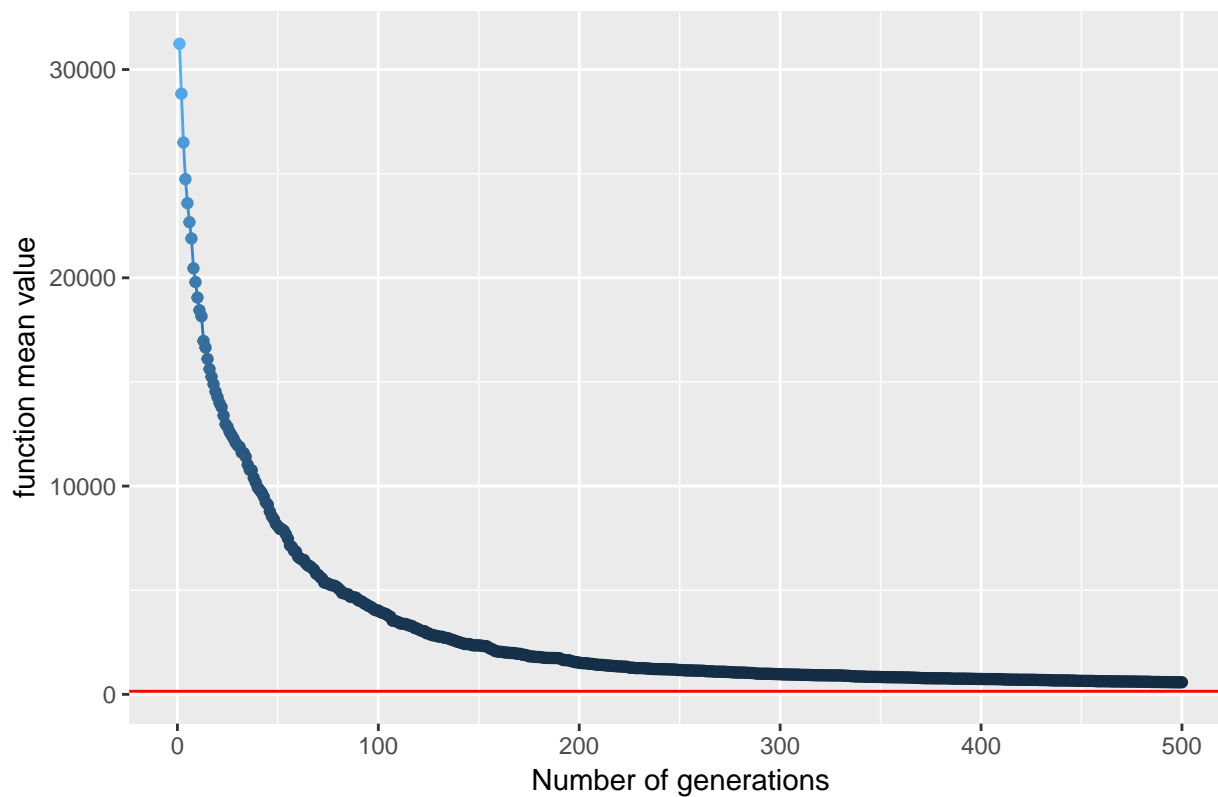
F6 with last gen mean: 1278.83411 and target value: 35.90000001



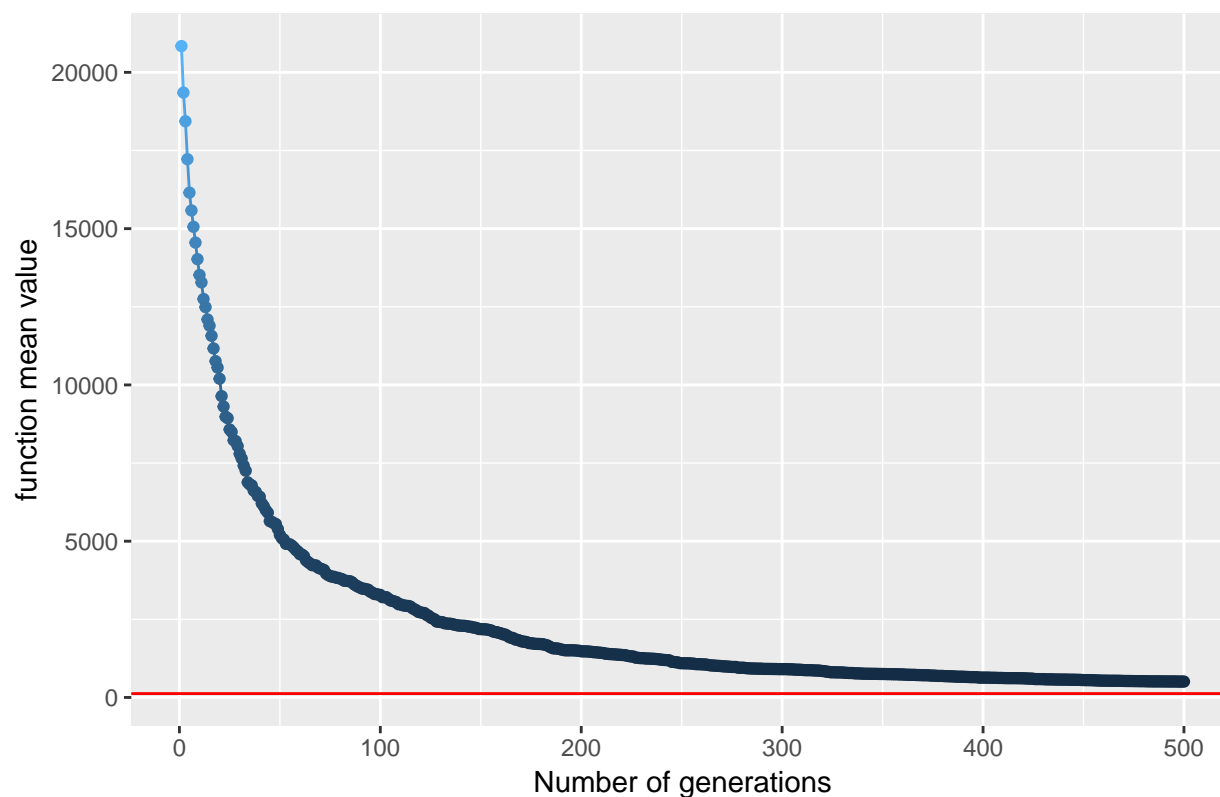
F7 with last gen mean: 132.525825 and target value: 92.94000001



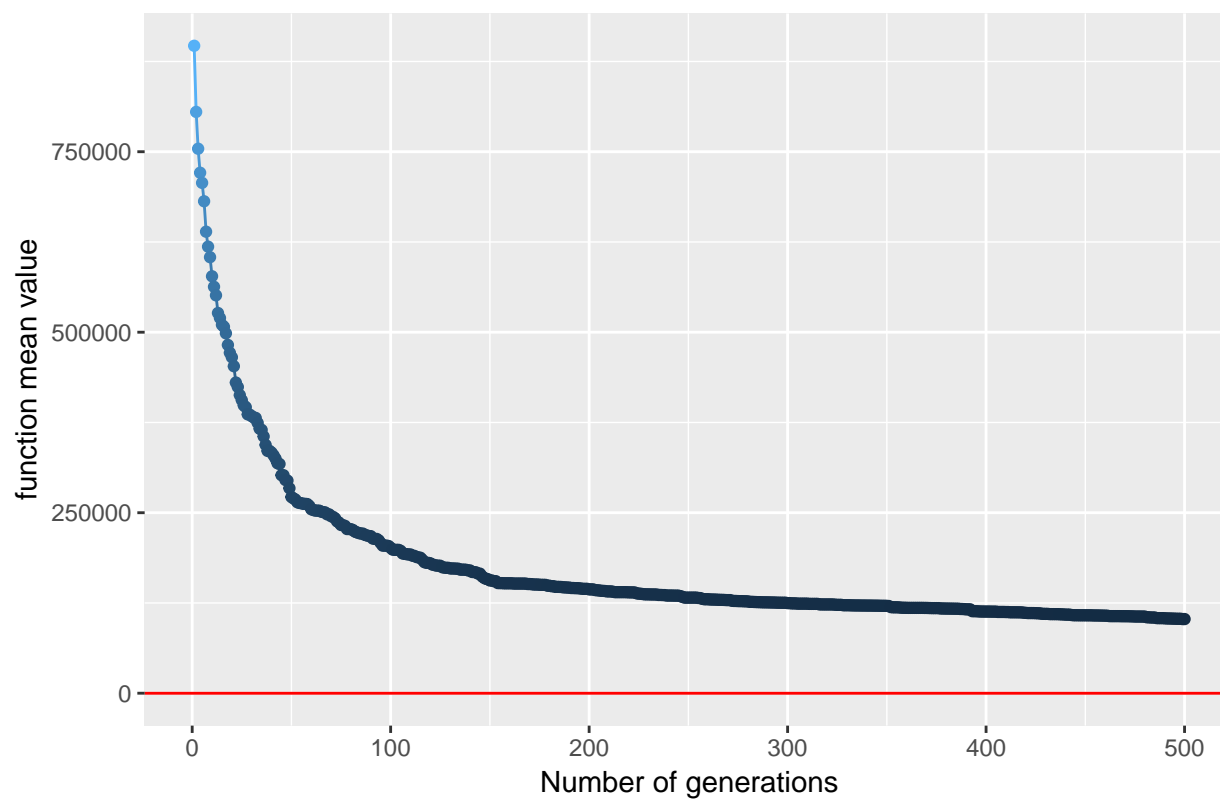
F8 with last gen mean: 579.9307 and target value: 149.15000001



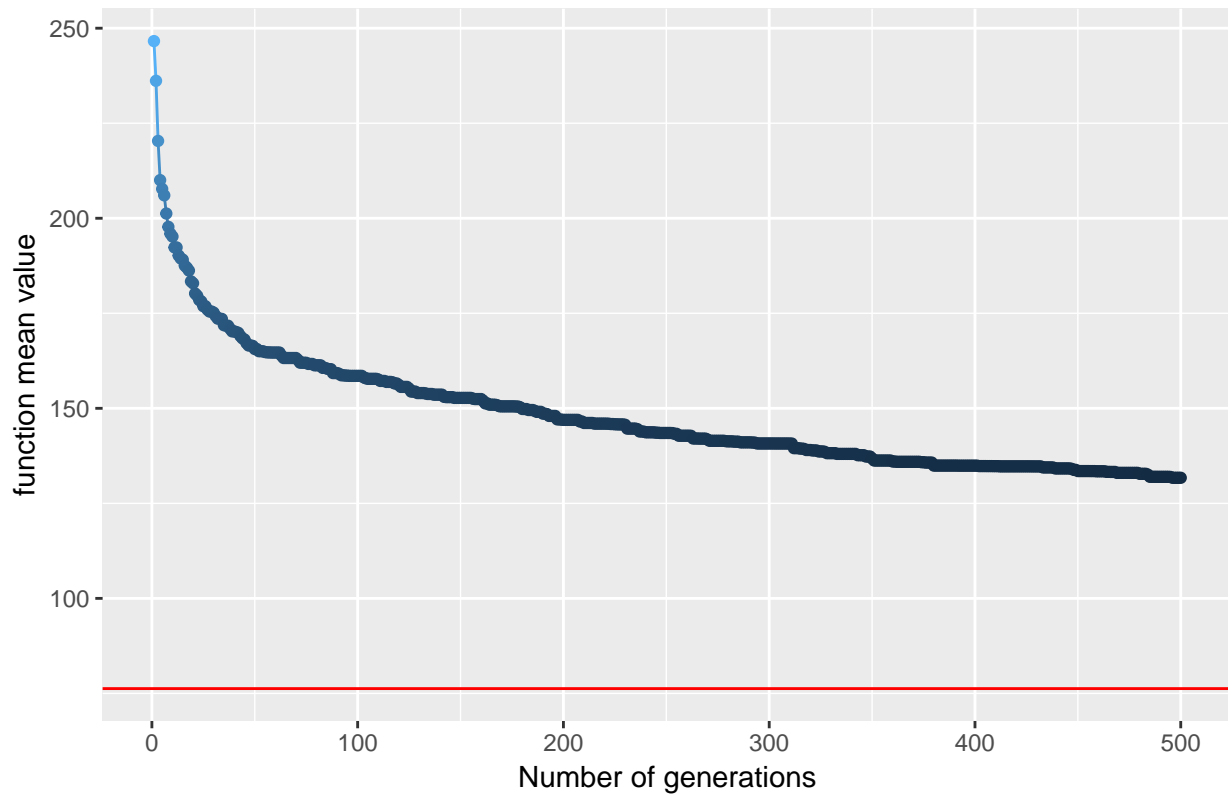
F9 with last gen mean: 507.859175 and target value: 123.83000001



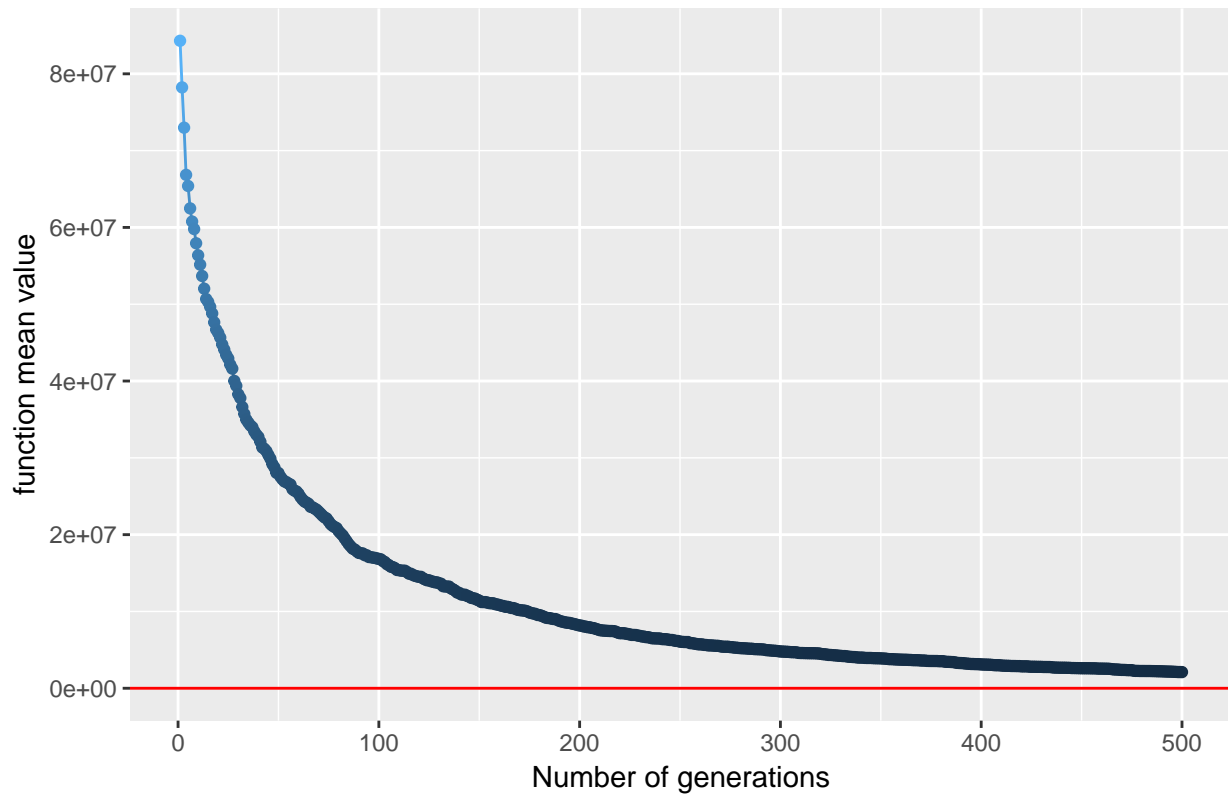
F10 with last gen mean: 102706.755 and target value: -54.93999999



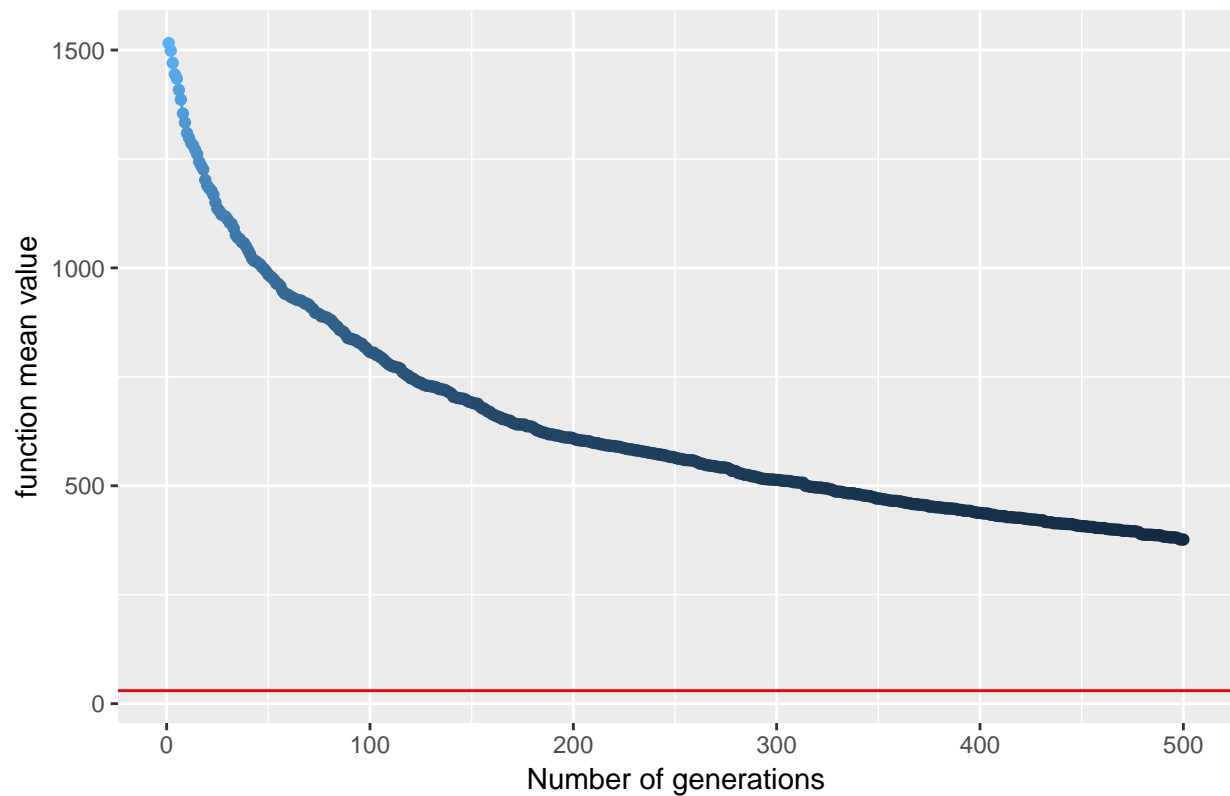
F11 with last gen mean: 131.729125 and target value: 76.27000001



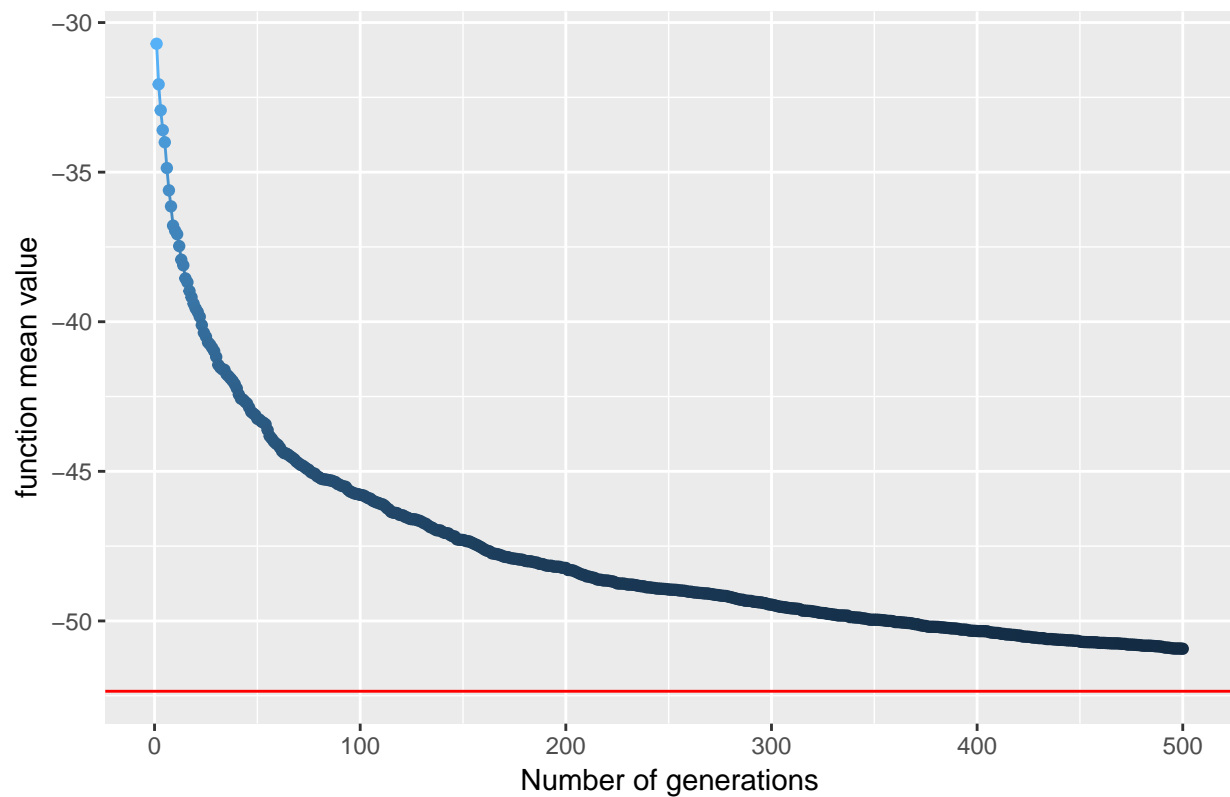
F12 with last gen mean: 2105092 and target value: -621.10999999



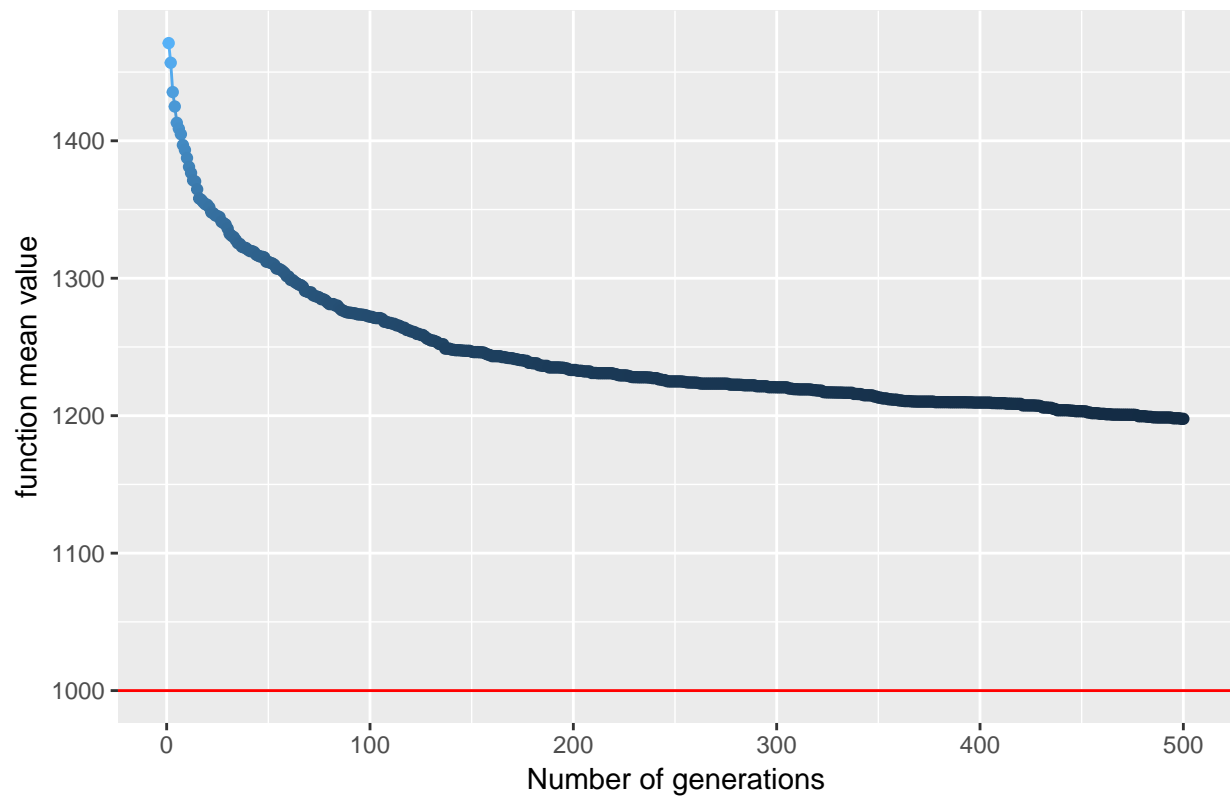
F13 with last gen mean: 376.530875 and target value: 29.97000001



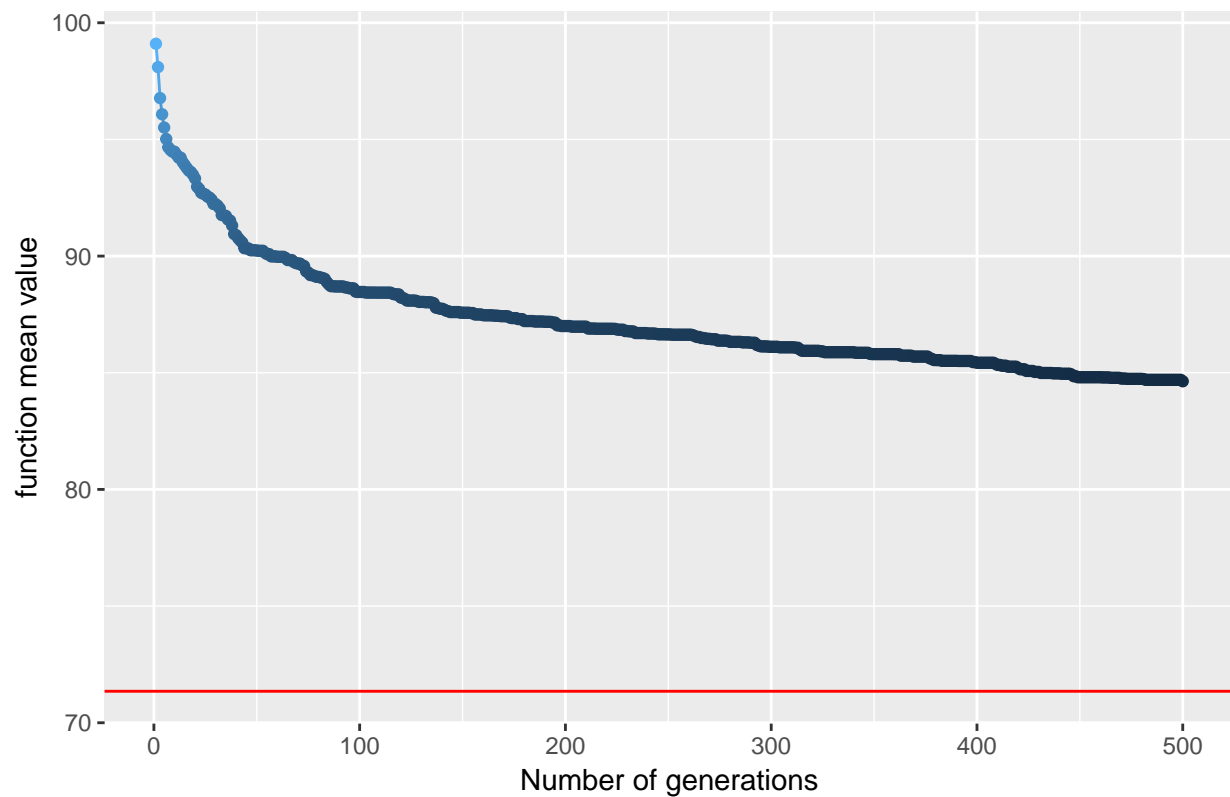
F14 with last gen mean: -50.929 and target value: -52.34999999



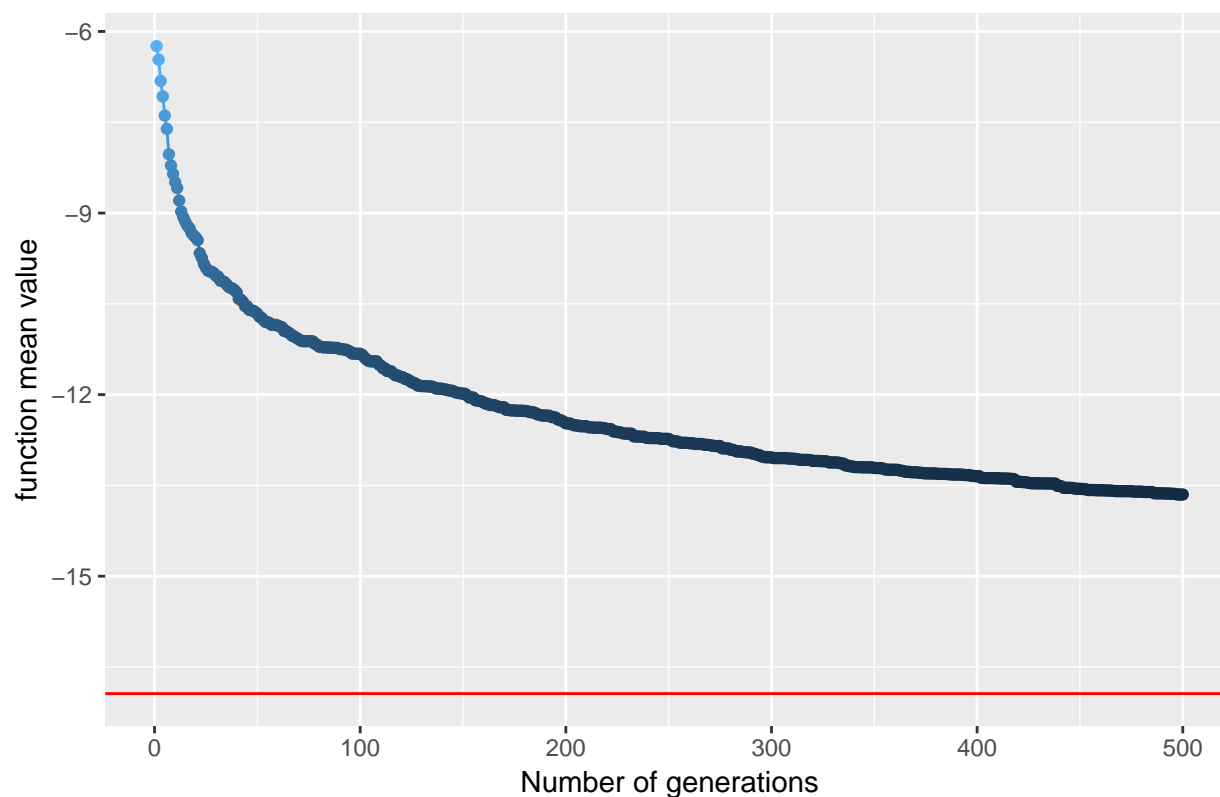
F15 with last gen mean: 1197.7335 and target value: 1000.00000001



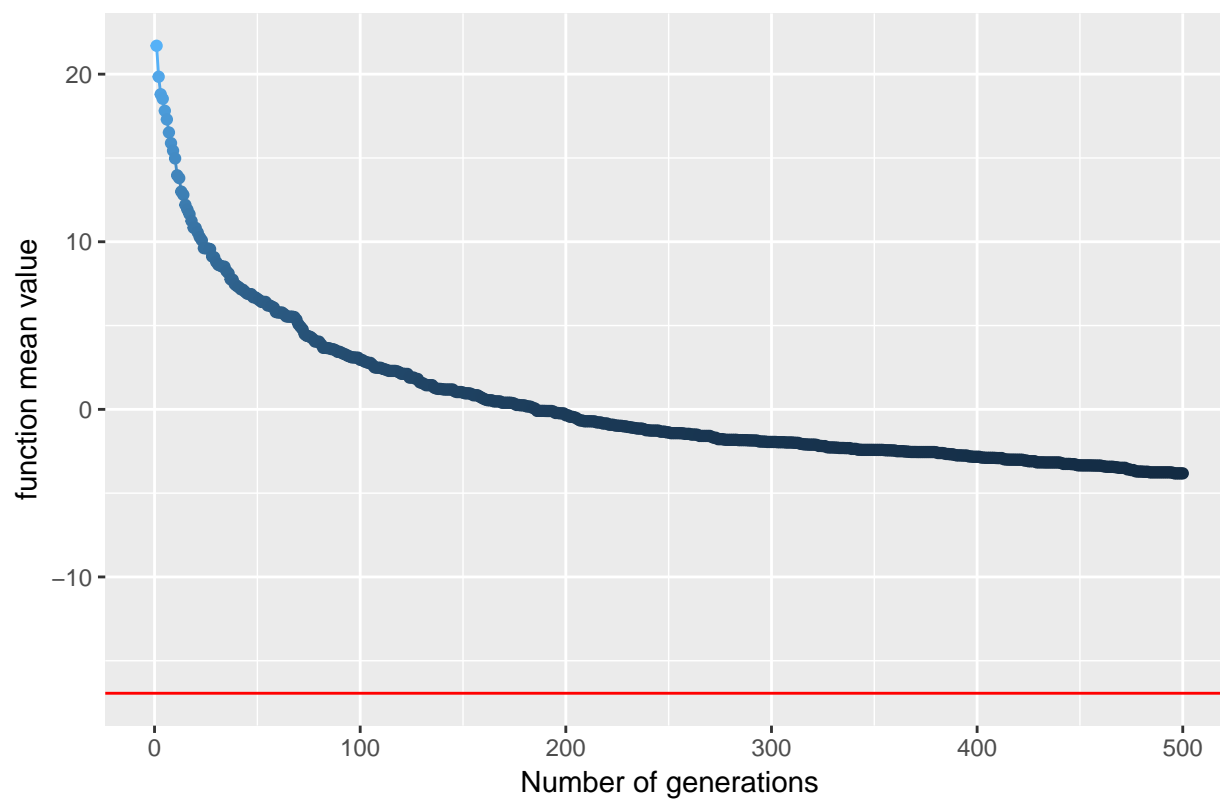
F16 with last gen mean: 84.63501 and target value: 71.35000001



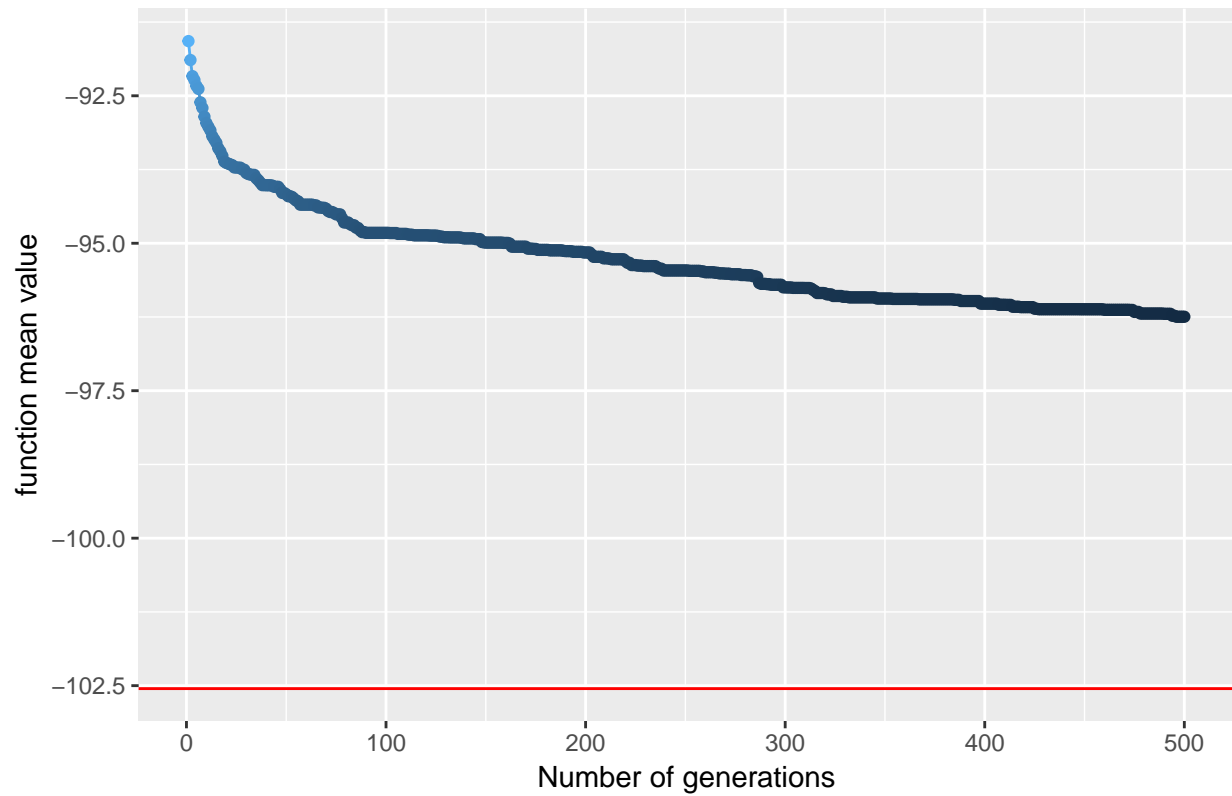
F17 with last gen mean: -13.650825 and target value: -16.93999999



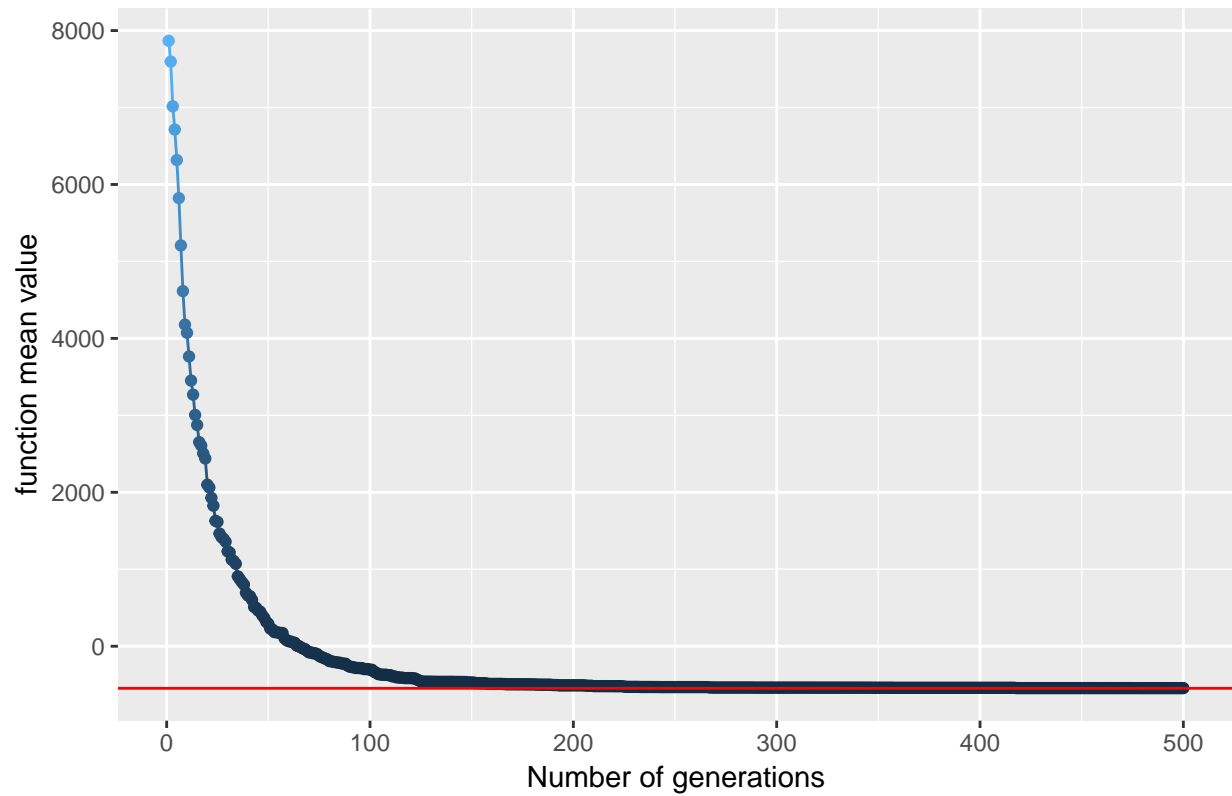
F18 with last gen mean: -3.82025845 and target value: -16.93999999



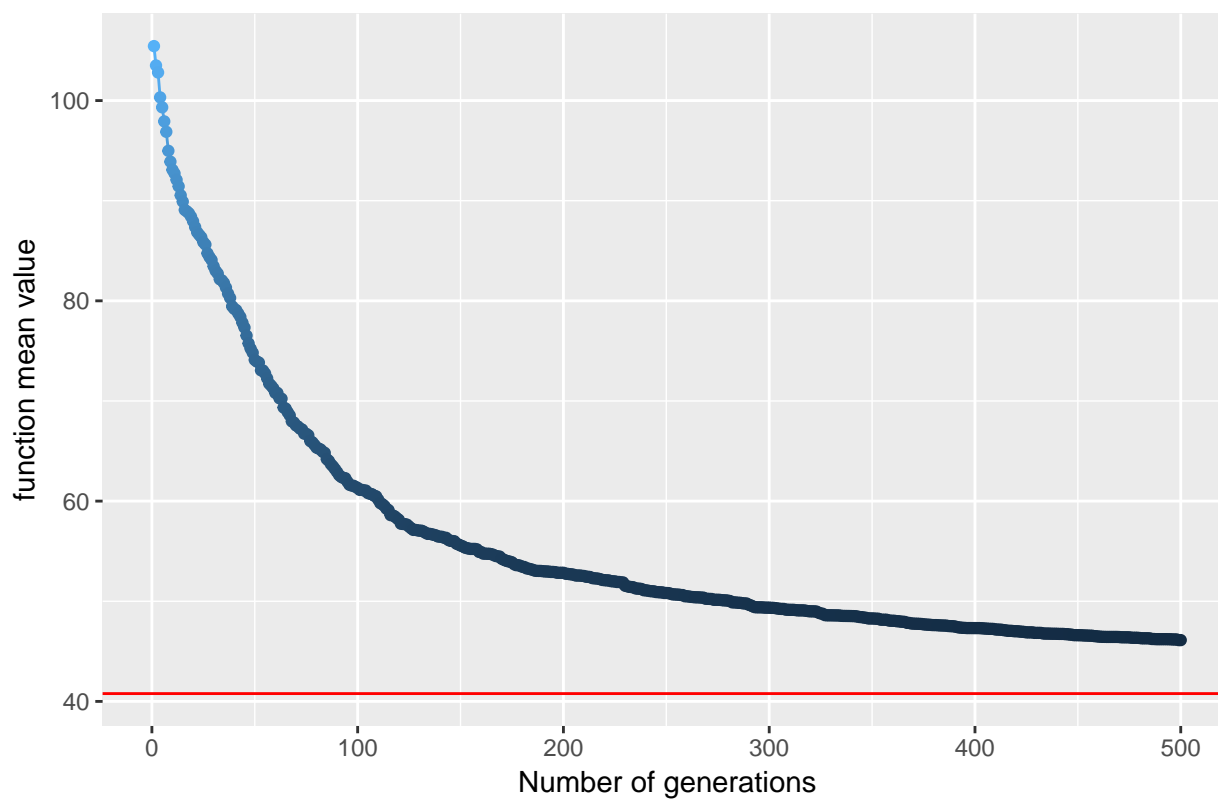
F19 with last gen mean: -96.2458025 and target value: -102.54999999



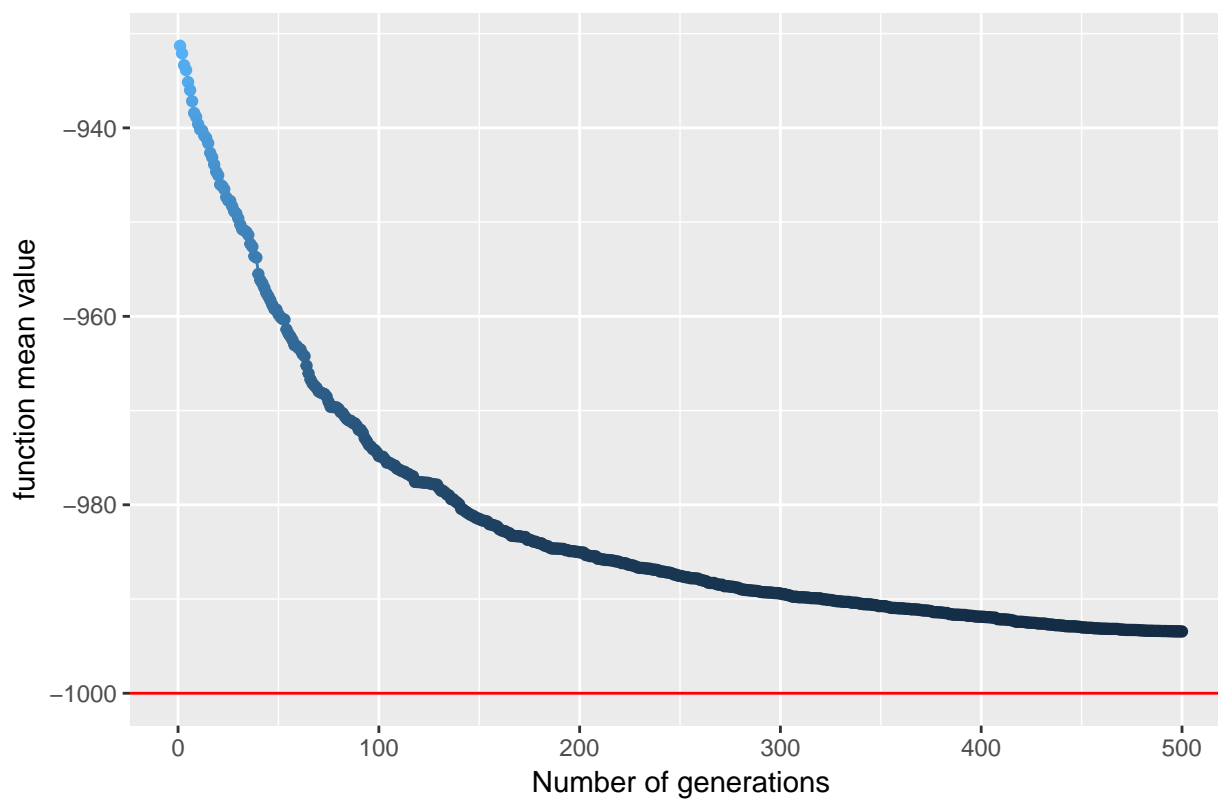
F20 with last gen mean: -544.12135 and target value: -546.49999999



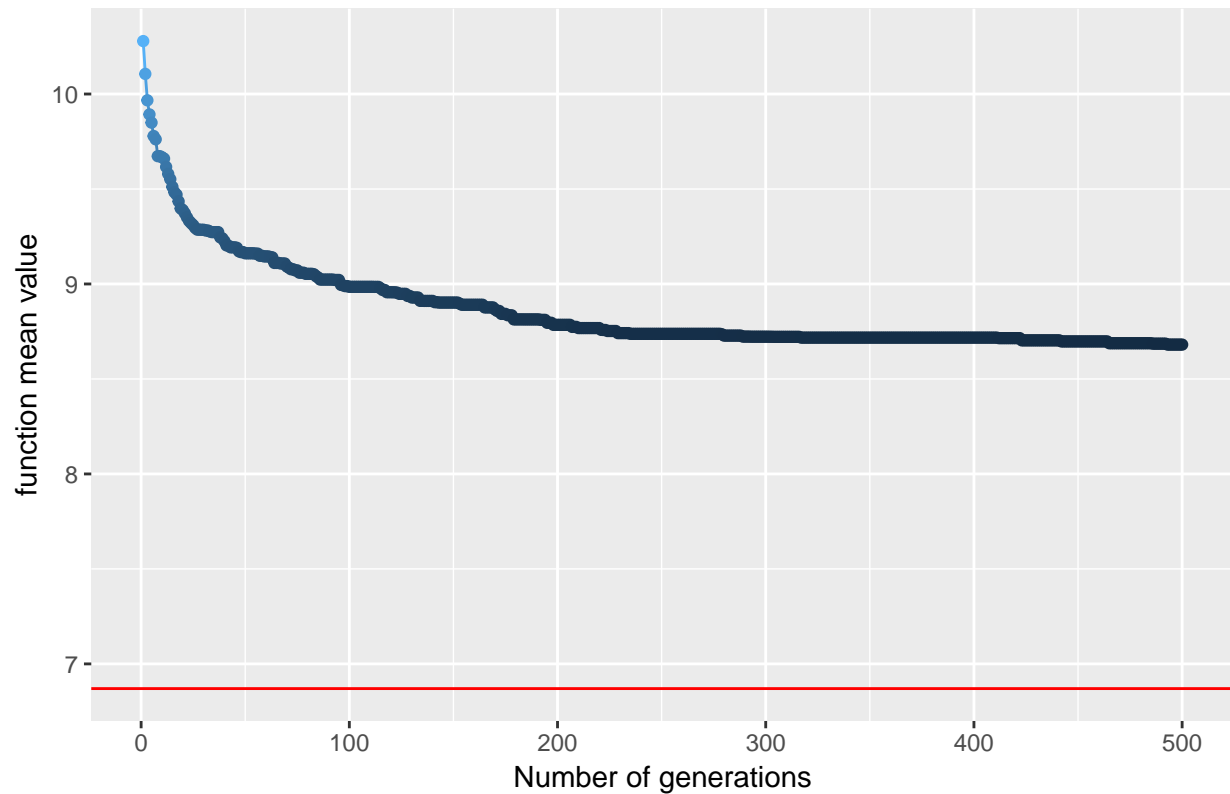
F21 with last gen mean: 46.1215025 and target value: 40.78000001



F22 with last gen mean: -993.44535 and target value: -999.99999999



F23 with last gen mean: 8.680885 and target value: 6.87000001



F24 with last gen mean: 311.100325 and target value: 102.61000001

