

Abs distance is  $abs[final\ solution - global\ minimum]$ . The budget for most functions is 10,000. The budget for F8 and F9 is 40,000. The budget for F4 and F10 is 300,000. The budget for three algorithms is always the same. For each function and each parameter combination, we have 20 runs, and this means we have 20 abs distance. Max min distance is calculated as  $(x - x.min())/(x.max() - x.min())$ , while z-score distance is  $(x - x.mean())/(x.std())$ . And then sum together.

Figure 1 sum of abs distance for 20 runs (most functions)

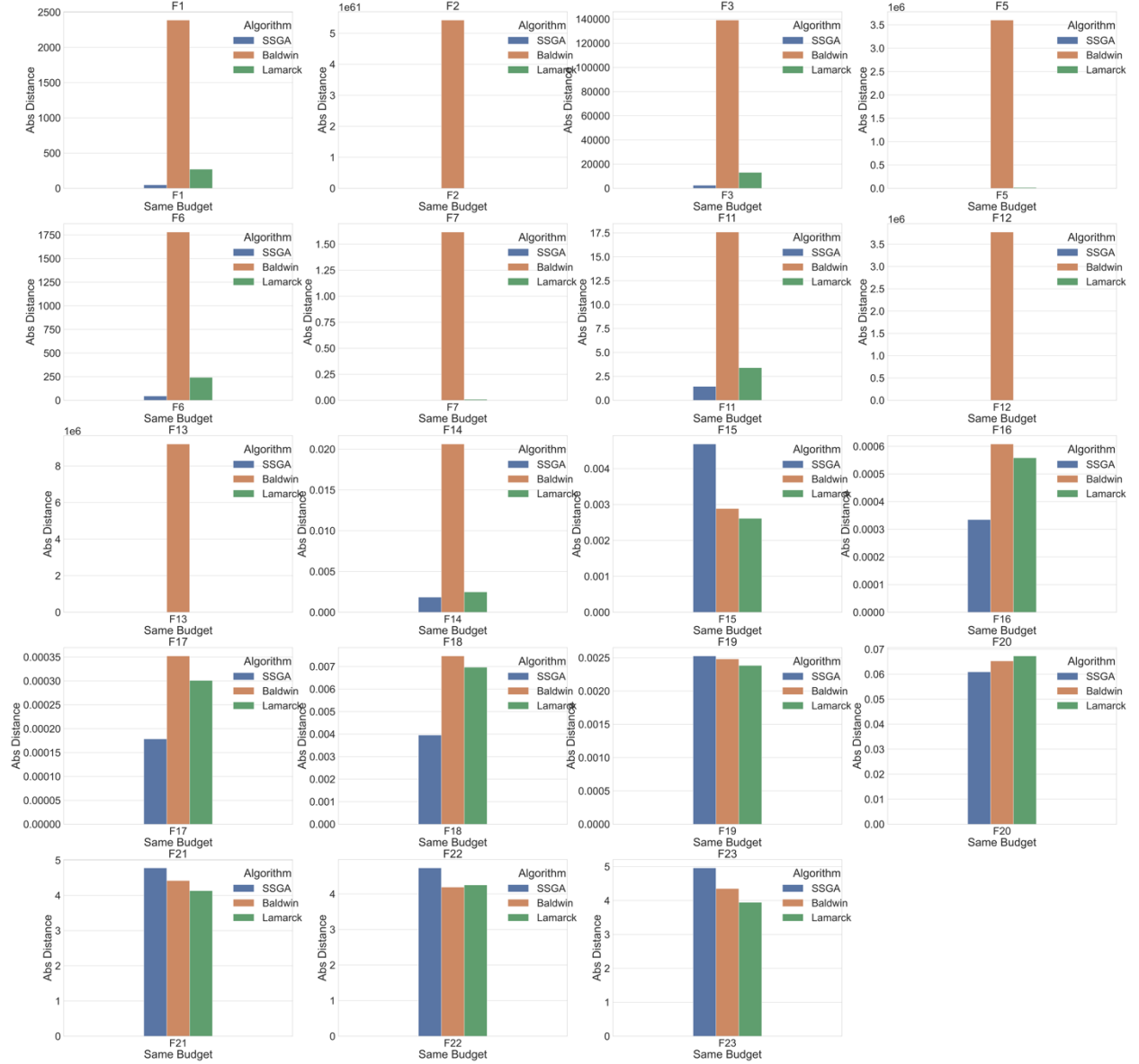


Figure 2 sum of abs distance for 20 runs( F8 and F9)

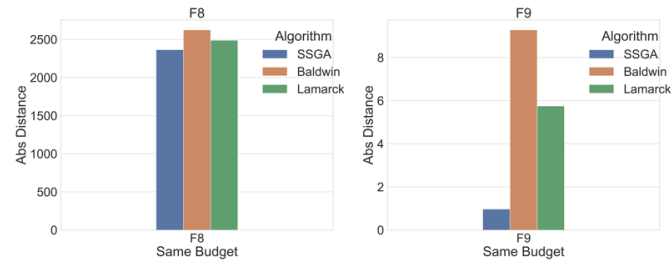


Figure 3 sum of abs distance for 20 runs (F4 and F10)

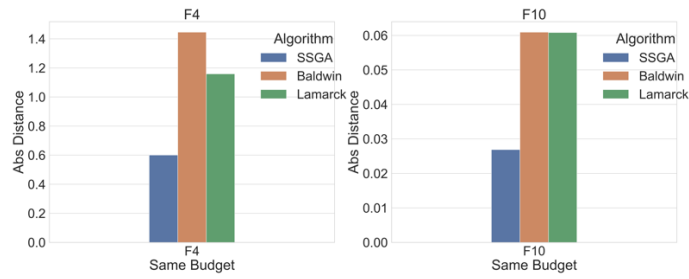


Figure 4 sum of max min distance for 20 runs( most functions)

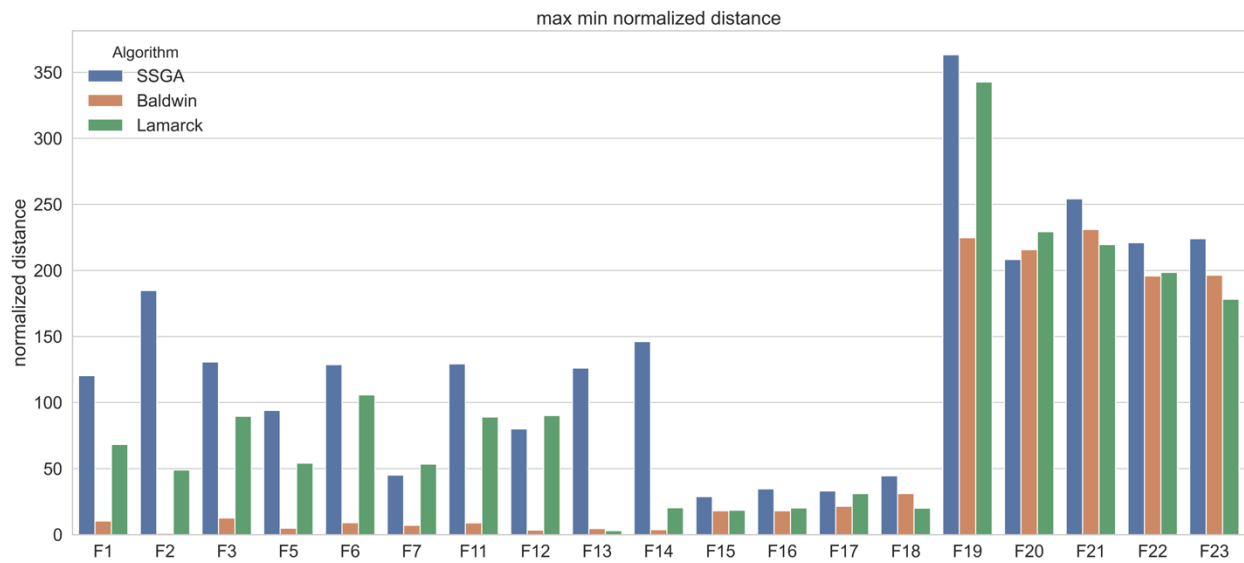


Figure 5 sum of max min distance for 20 runs (F4 and F10)

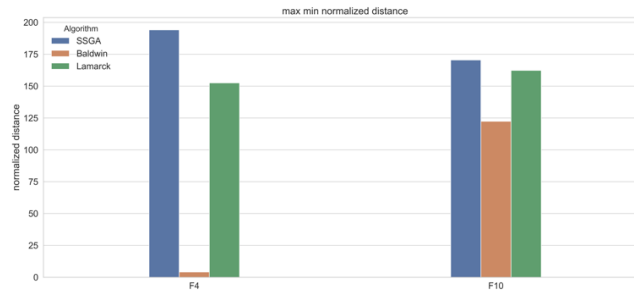


Figure 6 sum of max min distance for 20 runs (F8 and F9)

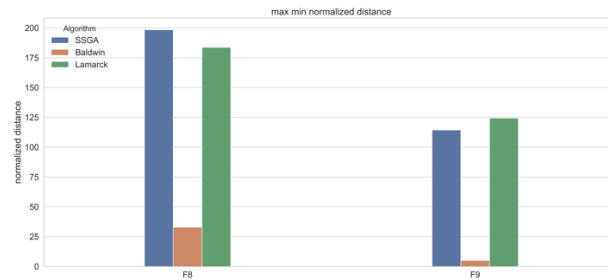


Figure 7 sum of z-score normalized distance for 20 runs (most functions)

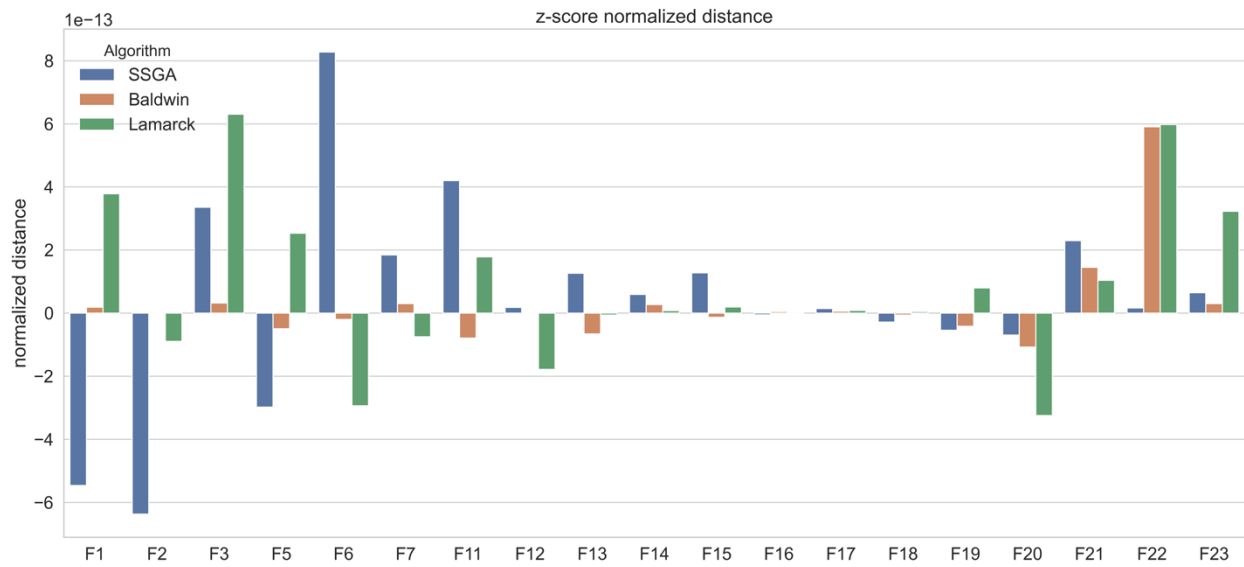


Figure 8 sum of z- score normalized distance for 20 runs (F4 and F10)

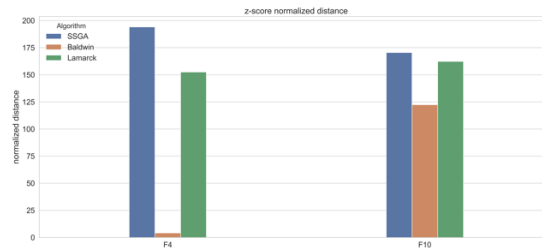


Figure 9 sum of z- score normalized distance for 20 runs (F8 and F9)

