HNCO
Affine OneMax Benchmark

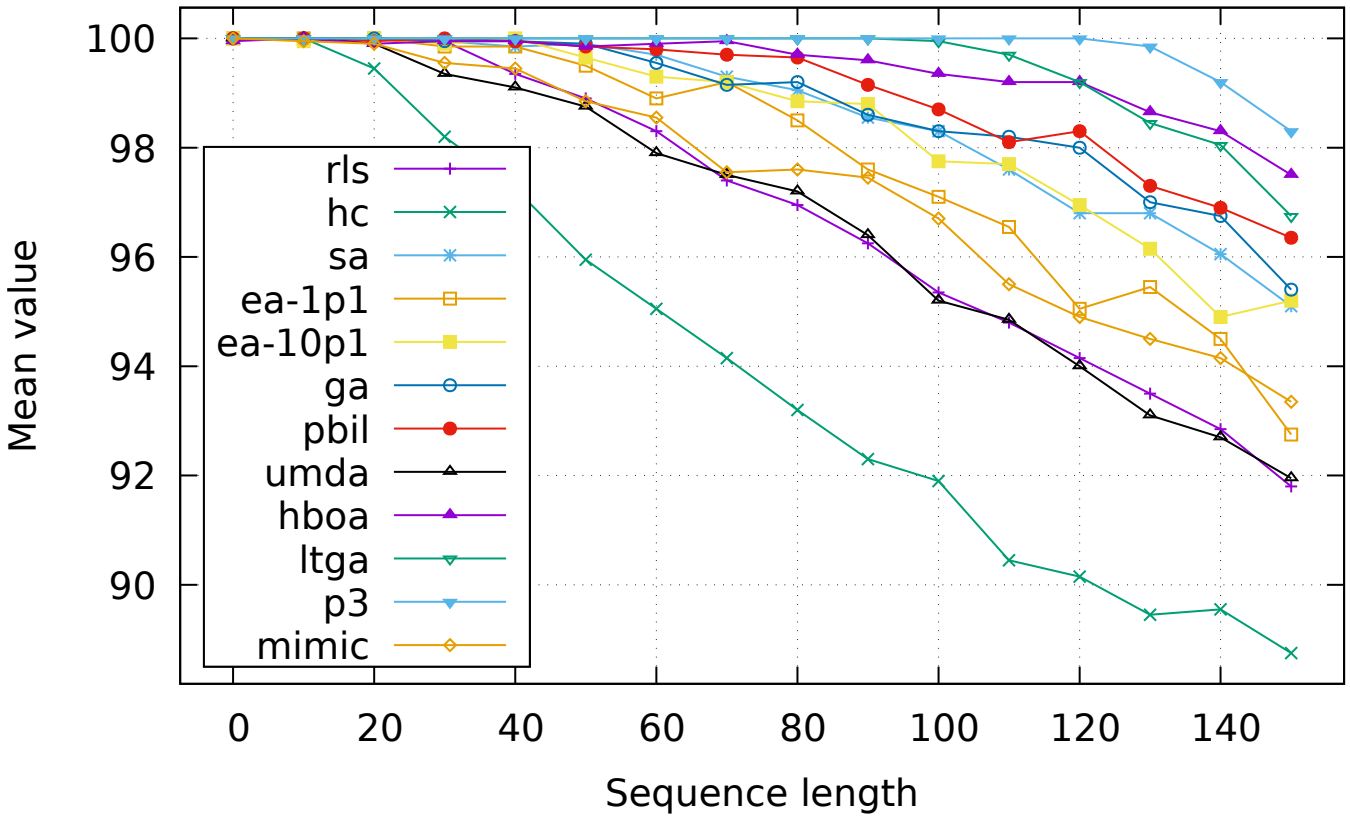
July 17, 2021

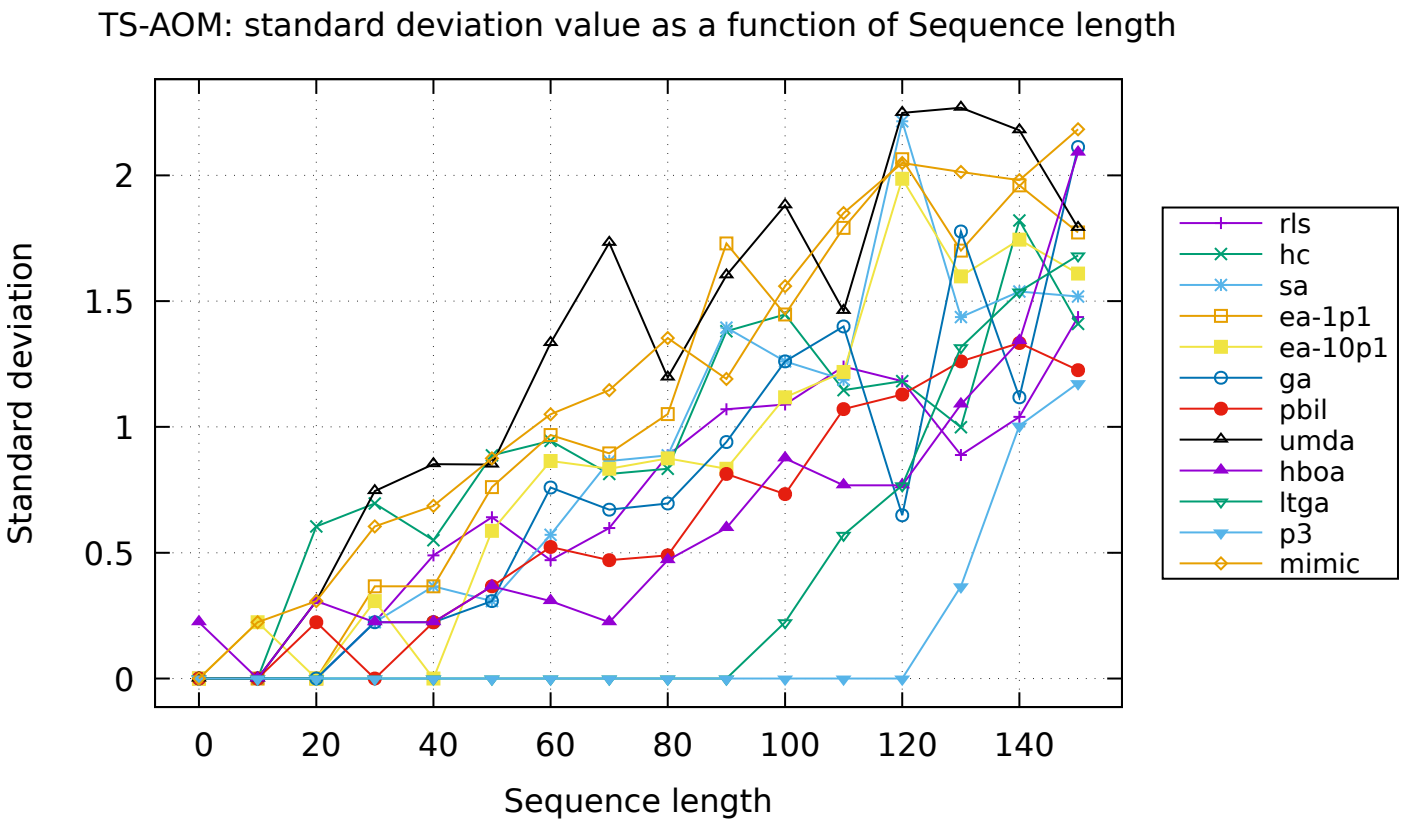
Abstract

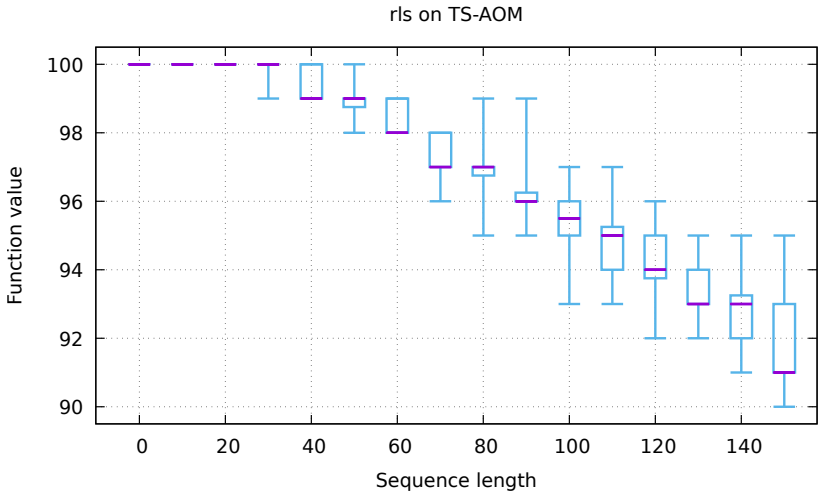
This benchmark is a stress test for random search heuristics as proposed in Berny [2021]. Starting with OneMax, the function to maximize is submitted to an increasing number of perturbations called transvections. Resulting functions are called transvection sequence affine OneMax functions (TS-AOM). At some point, most algorithms fail to find the maximum. The sequence length at which a particular algorithm fails is an indicator of its robustness. In this experiment, the dimension of the search space is $n = 100$ and the maximum is always 100.

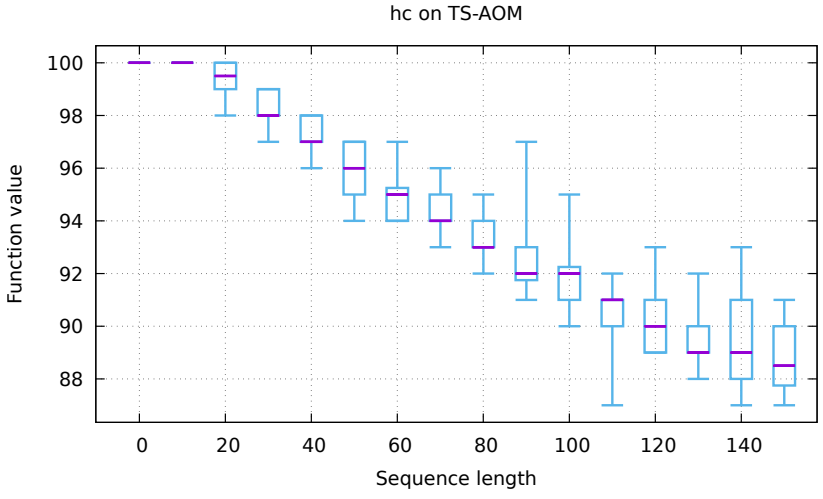
Contents

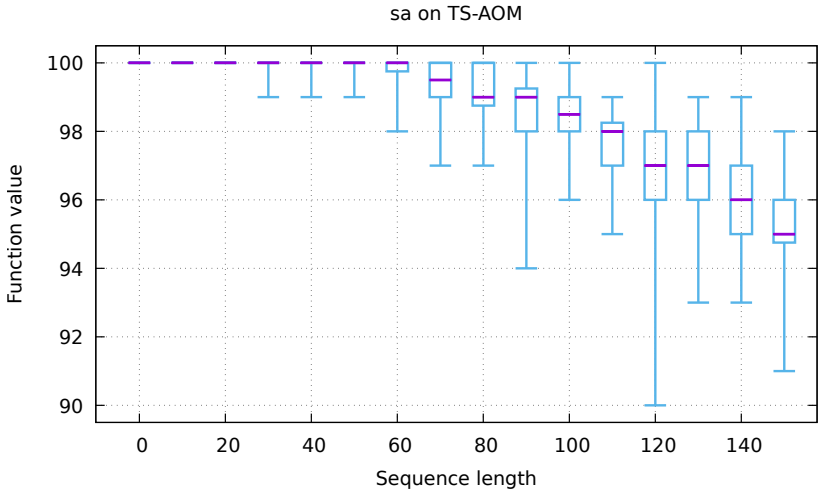
1 Function TS-AOM

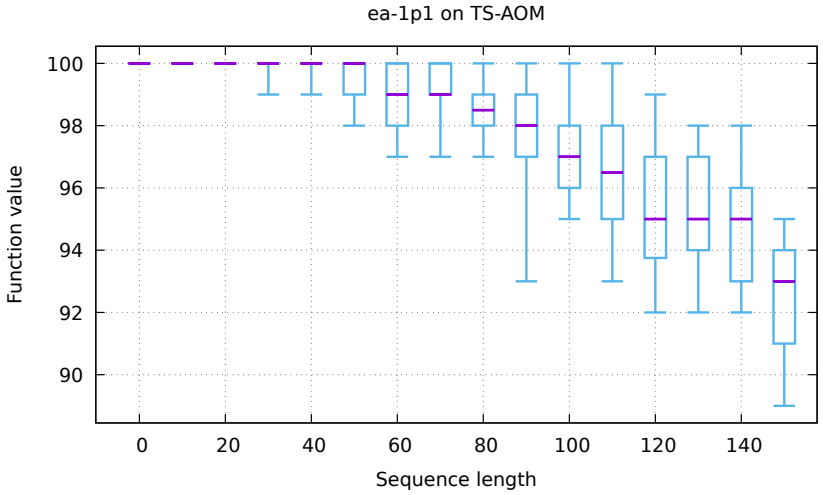


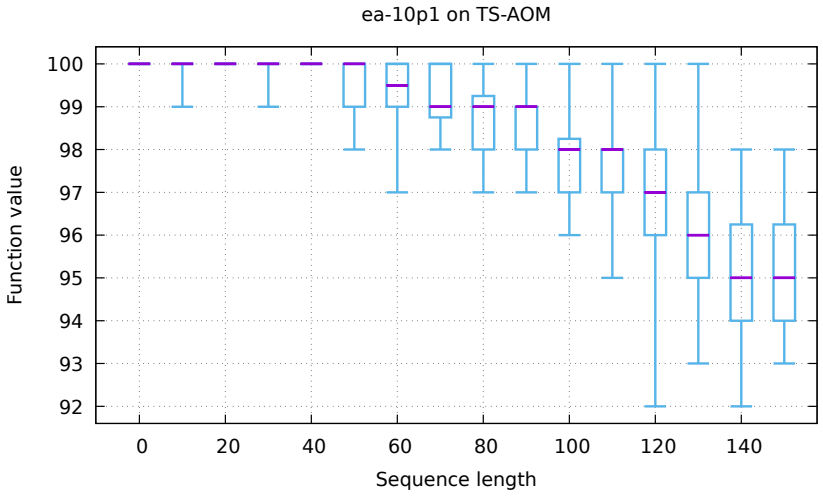

TS-AOM: standard deviation value as a function of Sequence length
Standard deviation
Sequence length
0
0.5
1
1.5
2
0
20
40
60
80
100
120
140
rls
hc
sa
ea-1p1
ea-10p1
ga
pbil
umda
hboa
ltga
p3
mimic

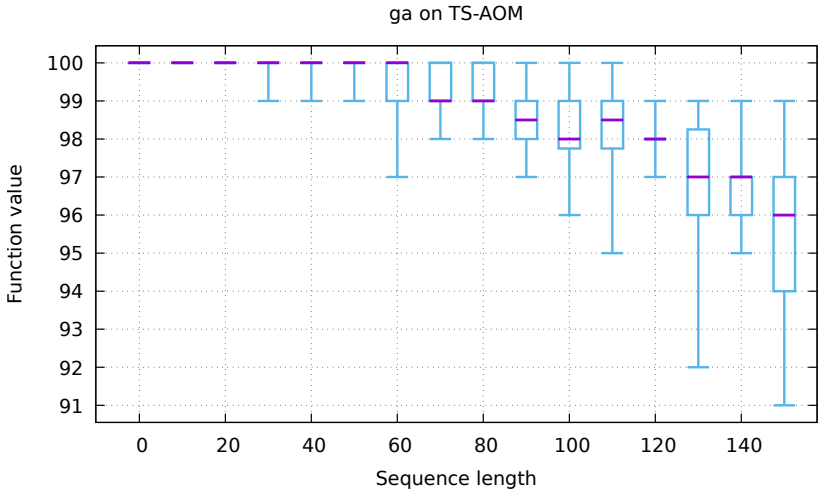

rls on TS-AOM
Function value
Sequence length
90
92
94
96
98
100
0
20
40
60
80
100
120
140

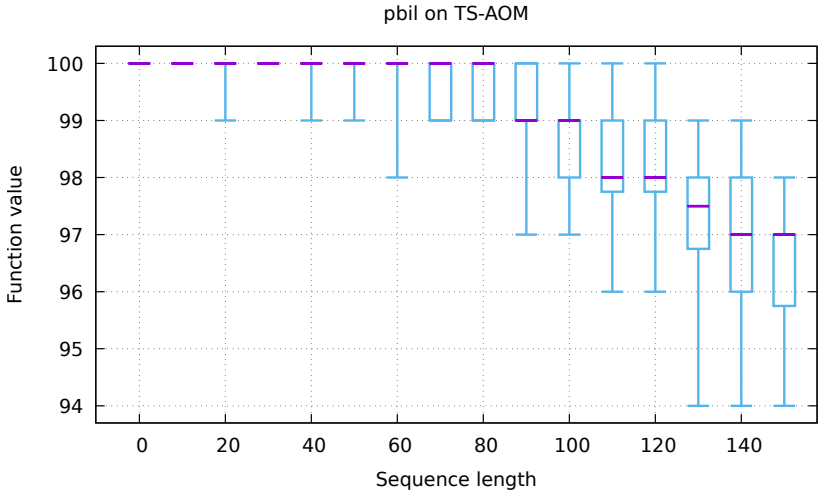

hc on TS-AOM
Function value
Sequence length
88
90
92
94
96
98
100
0
20
40
60
80
100
120
140

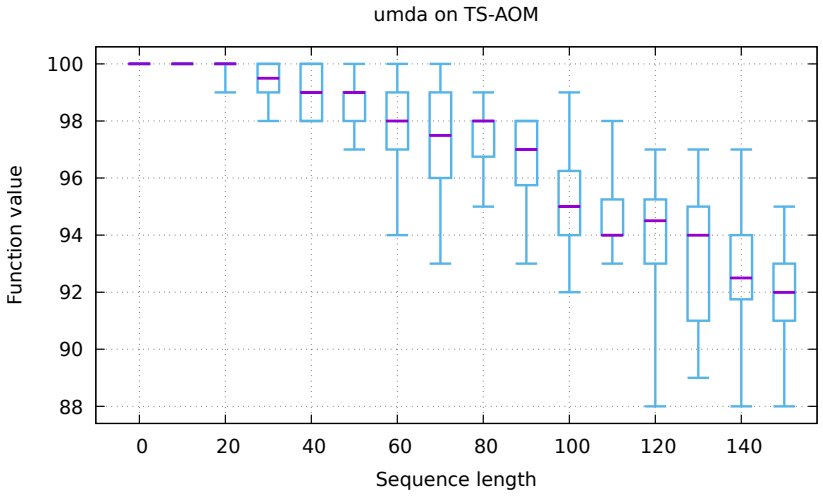

sa on TS-AOM
Function value
Sequence length
100
98
96
94
92
90
0
20
40
60
80
100
120
140

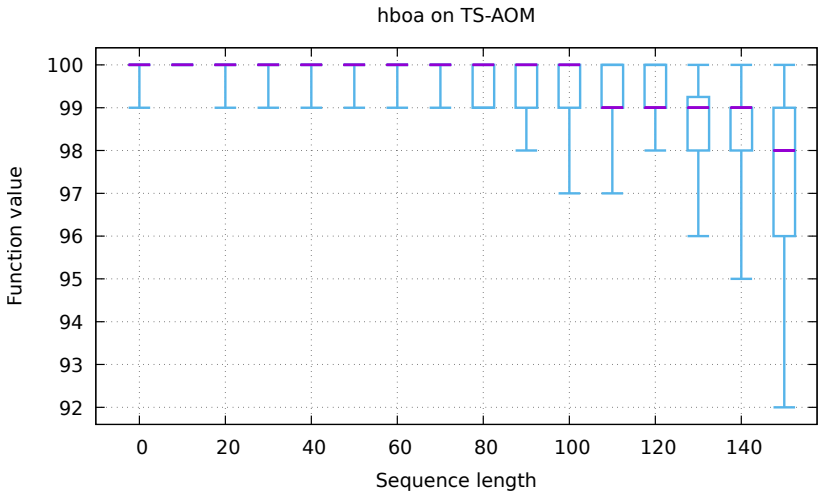

ea-1p1 on TS-AOM
Function value
Sequence length
100
98
96
94
92
90
0
20
40
60
80
100
120
140

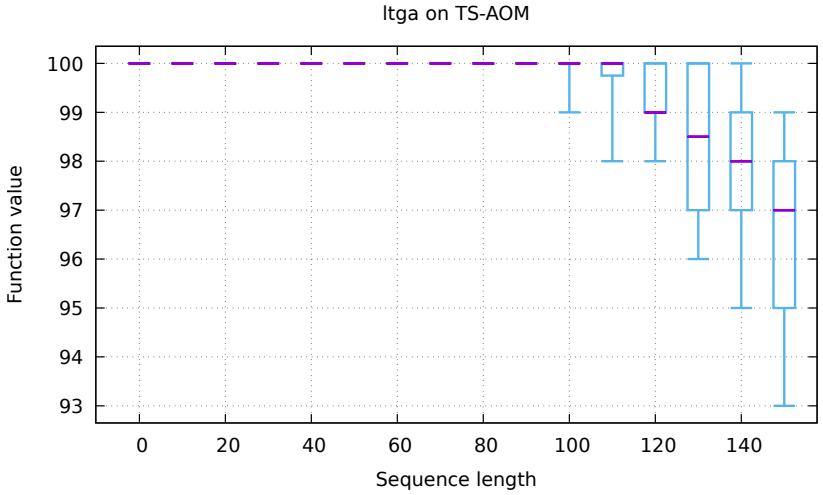

ea-10p1 on TS-AOM
Function value
Sequence length
100
99
98
97
96
95
94
93
92
0
20
40
60
80
100
120
140

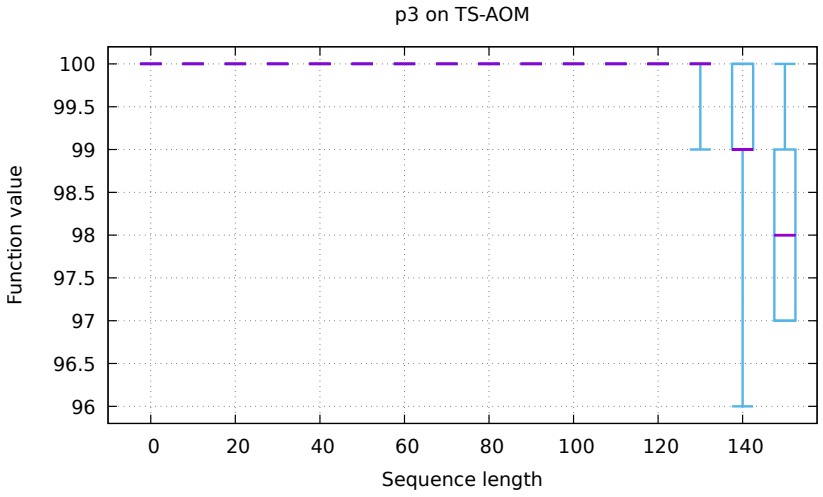

ga on TS-AOM
Function value
Sequence length
100
99
98
97
96
95
94
93
92
91
0
20
40
60
80
100
120
140

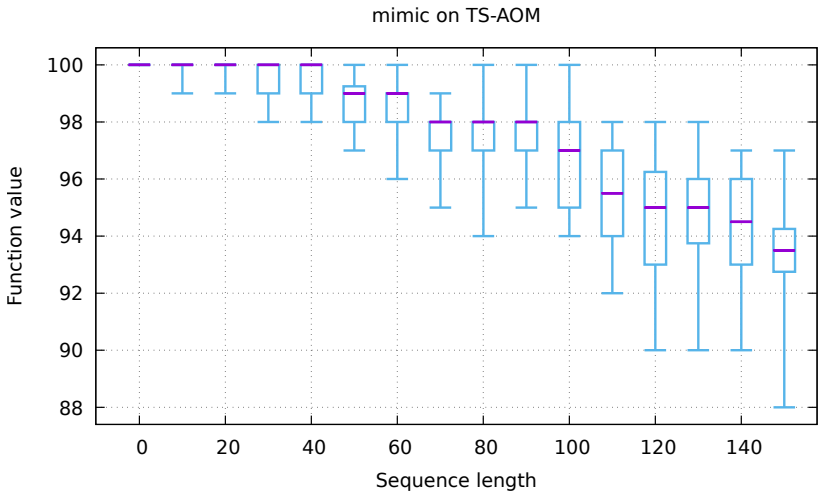

pbil on TS-AOM
Function value
Sequence length
100
99
98
97
96
95
94
0
20
40
60
80
100
120
140


umda on TS-AOM
Function value
Sequence length
100
98
96
94
92
90
88
0
20
40
60
80
100
120
140


hboa on TS-AOM
Function value
Sequence length
100
99
98
97
96
95
94
93
92
0
20
40
60
80
100
120
140


ltga on TS-AOM
Function value
Sequence length
100
99
98
97
96
95
94
93
0
20
40
60
80
100
120
140


p3 on TS-AOM
Function value
Sequence length
100
99.5
99
98.5
98
97.5
97
96.5
96
0
20
40
60
80
100
120
140



References

Arnaud Berny. Affine onemax. In *Proceedings of the Genetic and Evolutionary Computation Conference Companion*, GECCO '21, page 335–336, New York, NY, USA, 2021. Association for Computing Machinery. ISBN 9781450383516. doi: 10.1145/3449726.3459497. URL https://doi.org/10.1145/3449726.3459497.

A Plan


```
{
    "exec": "hnco",
    "opt": "--print-results -s 100",
    "budget": 300000,
    "num_runs": 20,
    "parallel": true,
    "parameter": {
        "id": "map-ts-length",
        "name": "Sequence length",
        "values_perl": "map { 10 * $_ } (0 .. 15)"
    },
    "graphics": {
        "logscale": false,
        "mean": {
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            "font_size": 14,
            "title": false
        },
        "stddev": {
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        },
        "candlesticks": {
            "title": true,
            "boxwidth": 5
        }
    },
    "functions": [
        {
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            "name": "TS-AOM",
            "opt": "-F 0 --stop-on-maximum --map 6 --map-random"
        }
    ],
    "algorithms": [
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```

```
            "opt": "-A 100 --restart"
        },
        {
            "id": "hc",
            "opt": "-A 150 --restart"
        },
        {
            "id": "sa",
            "opt": "-A 200 --sa-beta-ratio 1.05 --sa-num-trials 10"
        },
        {
            "id": "ea-1p1",
            "opt": "-A 300"
        },
        {
            "id": "ea-10p1",
            "opt": "-A 310 --ea-mu 10 --ea-lambda 1"
        },
        {
            "id": "ga",
            "opt": "-A 400 --ea-mu 100"
        },
        {
            "id": "pbil",
            "opt": "-A 500 -l 5e-3"
        },
        {
            "id": "umda",
            "opt": "-A 600 -x 100 -y 10"
        },
        {
            "id": "hboa",
            "opt": "-A 1110 -x 500"
        },
        {
            "id": "ltga",
            "opt": "-A 1200 -x 100"
        },
        {
            "id": "p3",
            "opt": "-A 1300"
        },
        {
            "id": "mimic",
            "opt": "-A 1100 -x 200 -y 20"
        }
    ]
}
```


B Default parameters

```
# algorithm = 100
# bm_mc_reset_strategy = 1
# bm_num_gs_cycles = 1
# bm_num_gs_steps = 100
# bm_sampling = 1
# budget = 10000
# bv_size = 100
# description_path = description.txt
# ea_lambda = 100
# ea_mu = 10
# expression = x
```

```
# fn_name = noname
# fn_num_traps = 10
# fn_prefix_length = 2
# fn_threshold = 10
# fp_expression = (1-x)^2+100*(y-x^2)^2
# fp_lower_bound = -2
# fp_num_bits = 8
# fp_precision = 0.01
# fp_upper_bound = 2
# function = 0
# ga_crossover_bias = 0.5
# ga_crossover_probability = 0.5
# ga_tournament_size = 10
# hea_bit_herding = 0
# hea_num_seq_updates = 100
# hea_reset_period = 0
# hea_sampling_method = 0
# hea_weight = 1
# learning_rate = 0.001
# map = 0
# map_input_size = 100
# map_path = map.txt
# map_ts_length = 10
# map_ts_sampling_mode = 0
# mutation_rate = 1
# neighborhood = 0
# neighborhood_iterator = 0
# noise_stddev = 1
# num_iterations = 0
# num_threads = 1
# path = function.txt
# pn_mutation_rate = 1
# pn_neighborhood = 0
# pn_radius = 2
# population_size = 10
# pv_log_num_components = 5
# radius = 2
# rep_categorical_representation = 0
# results_path = results.json
# rls_patience = 50
# sa_beta_ratio = 1.2
# sa_initial_acceptance_probability = 0.6
# sa_num_transitions = 50
# sa_num_trials = 100
# seed = 0
# selection_size = 1
# solution_path = solution.txt
# target = 100
# print_defaults
# last_parameter
# exec_name = hnco
# version = 0.17
# Generated from hnco.json
```