

Table 1: Performance Results for Michalewicz\_10D\_m10 Problem

Optimizer	Mean Final Value	Std Dev	Best Value	Worst Value	Mean Func Evals	Success Rate (%)	Mean Time (s)
<b>QQN-CubicQuadraticInterpolation</b>	-3.34e0	1.51e0	-6.26e0	-9.35e-1	1730.8	0.0	0.073
QQN-StrongWolfe	-4.71e0	1.16e0	-6.27e0	-2.13e0	1916.5	5.0	0.063
QQN-Bisection-1	-4.24e0	1.09e0	-5.36e0	-2.14e0	2030.0	0.0	0.055
QQN-Bisection-2	-4.37e0	1.24e0	-6.26e0	-1.67e0	1808.5	5.0	0.047
QQN-GoldenSection	-4.14e0	1.08e0	-6.30e0	-2.32e0	2197.4	5.0	0.045
L-BFGS-Limited	-3.52e0	1.38e0	-5.59e0	-6.44e-1	3009.3	0.0	0.038
L-BFGS-Conservative	-4.54e0	9.46e-1	-6.26e0	-2.94e0	2566.8	0.0	0.037
L-BFGS-Aggressive	-1.30e0	9.34e-1	-3.26e0	3.39e-1	3050.9	0.0	0.021
L-BFGS-MoreThuente	-4.11e0	7.64e-1	-5.98e0	-2.73e0	925.2	0.0	0.020
Adam	-5.84e0	5.72e-1	-6.27e0	-4.65e0	508.9	20.0	0.012
Adam-AMSGrad	-5.74e0	6.30e-1	-6.28e0	-4.40e0	450.1	30.0	0.012
GD-WeightDecay	-4.56e0	7.54e-1	-6.26e0	-2.97e0	174.7	0.0	0.006
Trust Region-Conservative	-3.71e0	9.15e-1	-5.42e0	-2.14e0	644.0	0.0	0.005
Adam-WeightDecay	-5.31e0	5.80e-1	-6.25e0	-4.38e0	179.3	0.0	0.004
Adam-Robust	-5.03e0	7.58e-1	-6.26e0	-3.55e0	111.0	0.0	0.003
Adam-Fast	-6.12e0	4.94e-1	-6.77e0	-4.58e0	106.2	35.0	0.002
GD-Momentum	-3.79e0	1.08e0	-5.24e0	-1.13e0	37.3	0.0	0.001
GD-AdaptiveMomentum	-4.52e0	7.73e-1	-6.23e0	-2.85e0	27.6	0.0	0.001
L-BFGS	-3.66e-1	3.76e-1	-1.14e0	6.67e-2	64.8	0.0	0.001
Trust Region-Precise	-3.69e0	9.58e-1	-5.30e0	-2.10e0	114.2	0.0	0.001
GD-Nesterov	-3.74e0	1.19e0	-6.19e0	-1.81e0	26.9	0.0	0.001
GD	-3.59e0	7.26e-1	-5.04e0	-2.59e0	17.2	0.0	0.000
Trust Region-Adaptive	-3.26e0	9.04e-1	-5.27e0	-1.43e0	28.7	0.0	0.000
Trust Region-Standard	-2.49e0	1.15e0	-4.98e0	-5.97e-1	9.8	0.0	0.000
Trust Region-Aggressive	-1.68e0	6.53e-1	-3.16e0	-5.90e-1	5.3	0.0	0.000