Table 1: Algorithm Efficiency Matrix: Mean Function Evaluations for Successful Runs

Problem Family	Adam	GD	L-BFGS	QQN	Trust Region
Ackley	N/A	N/A	24 ± 28	26 ± 16	27 ± 0
Barrier	N/A	N/A	N/A	N/A	N/A
Beale	1540 ± 160	96 ± 83	129 ± 63	263 ± 187	816 ± 712
Booth	1886 ± 74	80 ± 16	84 ± 72	87 ± 46	923 ± 76
GoldsteinPrice	N/A	N/A	72 ± 6	287 ± 119	N/A
Griewank	N/A	N/A	N/A	395 ± 0	N/A
Himmelblau	1744 ± 36	36 ± 8	113 ± 101	79 ± 42	1217 ± 820
IllConditionedRosenbrock	N/A	N/A	1133 ± 784	1282 ± 689	N/A
Levi	N/A	N/A	68 ± 62	138 ± 217	N/A
Levy	2167 ± 182	1334 ± 344	274 ± 287	147 ± 112	N/A
Matyas	324 ± 339	206 ± 252	26 ± 10	54 ± 45	N/A
Michalewicz	409 ± 333	321 ± 408	1123 ± 744	1237 ± 806	N/A
Neural Networks	1063 ± 749	N/A	1577 ± 712	1179 ± 975	N/A
NoisySphere	10 ± 7	8 ± 5	78 ± 94	62 ± 50	N/A
PenaltyI	N/A	N/A	N/A	N/A	N/A
Rastrigin	403 ± 297	18 ± 7	96 ± 153	82 ± 53	661 ± 750
Regression	213 ± 23	230 ± 113	192 ± 179	91 ± 46	N/A
Rosenbrock	1352 ± 886	43 ± 16	693 ± 1032	552 ± 751	1682 ± 233
SVM	1295 ± 708	186 ± 90	62 ± 40	93 ± 60	N/A
Schwefel	N/A	N/A	N/A	62 ± 54	N/A
SparseQuadratic	1630 ± 111	229 ± 128	107 ± 141	66 ± 42	N/A
SparseRosenbrock	N/A	N/A	1544 ± 800	1492 ± 544	N/A
Sphere	1448 ± 761	62 ± 64	49 ± 66	19 ± 13	549 ± 796
StyblinskiTang	1128 ± 875	55 ± 19	130 ± 103	140 ± 170	848 ± 749
Trigonometric	1074 ± 652	258 ± 169	446 ± 597	473 ± 491	N/A
Zakharov	2095 ± 174	367 ± 138	464 ± 566	151 ± 63	N/A

Purpose: Shows mean function evaluations ± standard deviation for successful runs only across problem families. Lower values indicate higher efficiency.