Supplementary File for "A Global and Local Search-Assisted Evolutionary Algorithm for Large-scale Constrained Multiobjective Optimisation"

CONTENTS

LIST OF TABLES

TABLE S-I

THE IGD RESULTS OBTAINED BY GLCMEA AND SIX COMPARED ALGORITHMS ON LIRCMOP TEST SUITE

Problem	D	CCMO	MTCMO	C_LMEA	C_LMOCSO	DPSEA	POCEA	GLCMEA
LIRCMOP1	100	3.1383e-1 (2.40e-2) -	2.5271e-1 (3.93e-3) -	3.4685e-1 (7.87e-3) -	1.3440e-2 (1.14e-3) +	3.0249e-1 (1.80e-2) -	4.9748e-2 (1.83e-2) =	4.9450e-2 (9.58e-3)
	200	3.2046e-1 (1.73e-2) -	2.8792e-1 (3.50e-3) -	NaN (0.00%) -	1.3867e-2 (1.10e-3) +	3.1636e-1 (1.36e-2) -	5.2148e-2 (2.81e-2) +	7.3324e-2 (1.59e-2)
	500	3.2950e-1 (9.60e-3) -	3.1574e-1 (1.89e-3) -	NaN (0.00%) -	2.6215e-2 (3.67e-2) +	3.2082e-1 (1.13e-2) -	1.7252e-1 (9.24e-2) -	1.3319e-1 (3.34e-2)
	1000	3.3847e-1 (7.17e-3) -	3.3054e-1 (1.06e-3) -	NaN (0.00%) -	1.3581e-1 (1.05e-1) =	3.2775e-1 (8.62e-3) -	3.4755e-1 (7.57e-3) -	1.8303e-1 (4.53e-2)
LIRCMOP2	100	2.3702e-1 (2.69e-2) -	2.1987e-1 (3.11e-3) -	3.0652e-1 (5.42e-3) -	1.5217e-2 (9.79e-4) +	2.6222e-1 (1.74e-2) -	5.7454e-2 (2.18e-2) -	3.0733e-2 (4.39e-3)
	200	2.6288e-1 (1.68e-2) -	2.5035e-1 (2.33e-3) -	NaN (0.00%) -	1.5545e-2 (1.37e-3) +	2.7866e-1 (1.39e-2) -	5.0823e-2 (1.77e-2) -	3.9048e-2 (5.96e-3)
	500	2.8846e-1 (1.17e-2) -	2.7735e-1 (1.40e-3) -	NaN (0.00%) -	1.5886e-2 (1.30e-3) +	2.7912e-1 (9.55e-3) -	7.9303e-2 (5.29e-2) =	6.6126e-2 (1.78e-2)
	1000	2.8913e-1 (7.13e-3) -	2.9092e-1 (1.25e-3) -	NaN (0.00%) -	2.7834e-1 (1.10e-2) -	2.8730e-1 (7.65e-3) -	3.1309e-1 (9.64e-3) -	7.7415e-2 (2.08e-2)
LIRCMOP3	100	3.0266e-1 (2.83e-2) -	2.4517e-1 (2.09e-2) -	3.4134e-1 (4.35e-3) -	1.6854e-1 (1.22e-1) -	3.1835e-1 (2.31e-2) -	NaN (96.67%) -	2.4964e-2 (1.01e-2)
	200	3.2079e-1 (2.14e-2) -	3.2890e-1 (6.60e-4) -	NaN (0.00%) -	3.3130e-1 (1.73e-3) -	3.3063e-1 (1.57e-2) -	NaN (96.67%) -	3.5257e-2 (1.23e-2)
	500	3.4013e-1 (1.04e-2) -	3.2979e-1 (1.52e-3) -	NaN (0.00%) -	3.3185e-1 (2.49e-3) -	3.3630e-1 (5.37e-3) -	NaN (96.67%) -	5.1600e-2 (1.52e-2)
	1000	3.4106e-1 (7.54e-3) -	3.3526e-1 (3.50e-3) -	NaN (0.00%) -	3.3213e-1 (2.30e-3) -	3.3614e-1 (6.24e-3) -	3.4231e-1 (7.06e-3) -	8.3270e-2 (4.54e-2)
LIRCMOP4	100	2.8471e-1 (3.19e-2) -	2.3394e-1 (1.71e-2) -	3.1629e-1 (4.97e-3) -	2.1173e-1 (8.42e-2) -	3.0051e-1 (1.93e-2) -	NaN (93.33%) -	2.4573e-2 (7.63e-3)
	200	3.0092e-1 (2.08e-2) -	2.9755e-1 (1.90e-2) -	NaN (0.00%) -	3.0756e-1 (2.32e-2) -	3.0765e-1 (1.11e-2) -	NaN (96.67%) -	4.0084e-2 (1.63e-2)
	500	3.1079e-1 (1.63e-2) -	3.0788e-1 (1.71e-3) -	NaN (0.00%) -	3.0812e-1 (2.15e-3) -	3.0937e-1 (9.40e-3) -	NaN (86.67%) -	7.3788e-2 (3.10e-2)
	1000	3.1518e-1 (5.83e-3) -	3.1329e-1 (3.61e-3) -	NaN (0.00%) -	3.0874e-1 (2.22e-3) -	3.1147e-1 (4.80e-3) -	3.1845e-1 (6.15e-3) -	8.2616e-2 (2.71e-2)
LIRCMOP5	100	3.6569e-1 (3.35e-2) -	8.1975e-1 (4.35e-1) -	6.2762e-1 (4.79e-1) -	1.2184e+0 (2.53e-3) -	3.6505e-1 (2.42e-2) -	1.1973e+0 (1.61e-1) -	1.2488e-1 (3.96e-2)
	200	3.6360e-1 (1.94e-2) -	8.7818e-1 (4.23e-1) -	9.9926e-1 (7.21e-1) -	1.2172e+0 (1.97e-3) -	3.6306e-1 (1.99e-2) -	1.2256e+0 (4.61e-3) -	1.7798e-1 (7.96e-2)
	500	3.7236e-1 (1.79e-2) +	1.2236e+0 (1.91e-3) -	1.9444e+0 (7.33e-1) -	1.2186e+0 (1.04e-3) -	3.7403e-1 (1.37e-2) +	1.2252e+0 (3.07e-3) -	3.8259e-1 (3.45e-1)
	1000	3.7496e-1 (1.20e-2) +	1.2258e+0 (1.25e-3) -	1.8438e+0 (5.74e-1) -	1.2193e+0 (9.94e-4) -	3.7028e-1 (9.84e-3) +	1.2274e+0 (3.26e-3) =	9.8283e-1 (4.20e-1)
LIRCMOP6	100	4.2154e-1 (5.16e-2) -	7.7084e-1 (4.47e-1) -	7.4578e-1 (4.36e-1) -	1.3484e+0 (1.06e-3) -	4.1177e-1 (3.85e-2) -	1.3497e+0 (1.40e-3) -	1.2337e-1 (6.38e-2)
	200	4.2739e-1 (2.86e-2) -	9.5990e-1 (4.49e-1) -	1.0512e+0 (4.67e-1) -	1.3476e+0 (9.39e-4) -	4.3157e-1 (3.04e-2) -	1.3496e+0 (1.31e-3) -	2.2614e-1 (8.08e-2)
	500	4.2944e-1 (2.84e-2) +	1.3450e+0 (1.22e-4) -	1.4391e+0 (5.59e-1) -	1.3475e+0 (6.92e-4) -	4.3113e-1 (2.36e-2) +	1.3491e+0 (1.75e-3) -	7.4292e-1 (4.78e-1)
	1000	4.3440e-1 (1.91e-2) +	1.3451e+0 (1.12e-4) -	1.2979e+0 (5.06e-1) -	1.3470e+0 (5.66e-4) -	4.3489e-1 (1.74e-2) +	1.3488e+0 (1.52e-3) -	1.0514e+0 (4.66e-1)
LIRCMOP7	100	1.4738e-1 (1.82e-2) -	1.4684e-1 (1.85e-2) -	7.3518e-1 (5.77e-1) -	1.6854e+0 (1.41e-3) -	1.4576e-1 (1.25e-2) -	9.8008e-1 (7.70e-1) -	1.2624e-1 (4.81e-1)
	200	1.5314e-1 (1.56e-2) -	1.6055e-1 (1.17e-2) -	1.0512e+0 (5.83e-1) -	1.6844e+0 (1.00e-3) -	1.5013e-1 (1.09e-2) -	1.4386e+0 (5.67e-1) -	1.4850e-1 (4.42e-1)
	500	1.5341e-1 (7.68e-3) +	1.6928e-1 (7.72e-3) +	1.4771e+0 (5.29e-1) -	1.6844e+0 (8.54e-4) -	1.5248e-1 (1.01e-2) +	1.6382e+0 (2.75e-1) -	1.9604e-1 (4.84e-1)
	1000	1.5541e-1 (7.28e-3) -	1.7125e-1 (6.40e-3) -	1.9458e+0 (3.27e-1) -	1.6834e+0 (7.60e-4) -	1.5213e-1 (5.72e-3) -	1.6876e+0 (2.71e-1) -	1.1866e-1 (3.05e-2)
LIRCMOP8	100	2.5314e-1 (2.30e-2) -	2.5457e-1 (3.30e-2) -	9.5931e-1 (5.52e-1) -	1.6849e+0 (1.37e-3) -	2.4428e-1 (1.82e-2) -	1.4066e+0 (5.74e-1) -	7.2234e-2 (8.60e-2)
	200	2.4689e-1 (1.44e-2) -	2.6102e-1 (1.48e-2) -	1.0901e+0 (5.46e-1) -	1.6843e+0 (9.24e-4) -	2.5237e-1 (1.28e-2) -	1.6876e+0 (2.46e-3) -	8.7930e-2 (4.92e-2)
	500	2.5627e-1 (1.08e-2) -	2.7327e-1 (1.11e-2) -	1.7674e+0 (2.43e-1) -	1.6840e+0 (8.76e-4) -	2.5398e-1 (9.76e-3) -	1.6873e+0 (2.67e-3) -	1.4588e-1 (5.84e-2)
	1000	2.5626e-1 (8.55e-3) =	2.8308e-1 (7.58e-3) -	2.2202e+0 (6.91e-1) -	1.6831e+0 (5.99e-4) -	2.5531e-1 (8.68e-3) -	1.6867e+0 (2.41e-3) -	2.3934e-1 (8.75e-2)
LIRCMOP9	100	1.1733e+0 (1.35e-1) -	1.0410e+0 (1.32e-1) -	4.3870e-1 (9.33e-2) -	5.2134e-1 (9.36e-2) -	1.0449e+0 (2.53e-1) -	9.9688e-1 (3.10e-1) -	1.0477e-1 (2.91e-2)
	200	1.2838e+0 (1.37e-2) -	1.1947e+0 (1.33e-1) -	4.6378e-1 (9.76e-2) -	4.8488e-1 (4.76e-2) -	1.2831e+0 (6.04e-3) -	1.2671e+0 (6.81e-2) -	1.3141e-1 (4.32e-2)
	500	1.2938e+0 (7.13e-4) -	1.2891e+0 (1.56e-3) -	5.6564e-1 (1.78e-1) -	7.6122e-1 (3.36e-1) -	1.2914e+0 (4.40e-3) -	1.2985e+0 (2.46e-3) -	2.6483e-1 (1.05e-1)
	1000	1.2940e+0 (6.52e-4) -	1.2901e+0 (1.81e-3) -	6.6682e-1 (2.51e-1) -	1.2014e+0 (2.37e-1) -	1.2933e+0 (3.22e-3) -	1.2394e+0 (6.62e-2) -	4.4066e-1 (1.90e-1)
LIRCMOP10	100	2.8239e-1 (1.27e-2) -	4.1256e-1 (1.29e-1) -	3.4595e-1 (1.37e-1) -	6.3813e-1 (9.65e-2) -	4.1866e-1 (1.78e-1) -	8.1466e-1 (2.24e-1) -	2.9075e-2 (1.93e-2)
	200	4.5481e-1 (1.51e-1) -	4.7624e-1 (1.61e-1) -	4.7875e-1 (1.23e-1) -	9.0466e-1 (1.87e-1) -	6.4776e-1 (2.73e-1) -	8.0465e-1 (1.90e-1) -	5.9388e-2 (2.90e-2)
	500	5.1722e-1 (1.84e-1) -	5.6207e-1 (1.50e-1) -	6.4407e-1 (2.46e-1) -	1.0787e+0 (2.40e-2) -	9.6993e-1 (1.71e-1) -	7.9970e-1 (1.44e-1) -	1.7475e-1 (9.38e-2)
	1000	6.0599e-1 (1.98e-1) -	7.4029e-1 (1.52e-1) -	6.2525e-1 (1.07e-1) -	1.0698e+0 (3.46e-2) -	9.6363e-1 (1.66e-1) -	7.6487e-1 (9.94e-2) -	3.5842e-1 (1.61e-1)
LIRCMOP11	100	1.5742e-1 (7.78e-2) -	4.9603e-1 (3.24e-1) -	4.4562e-1 (1.40e-1) -	5.3729e-1 (1.22e-1) -	6.1132e-1 (1.06e-1) -	1.0297e+0 (1.06e-1) -	6.0970e-3 (2.36e-3)
	200	3.0988e-1 (2.60e-1) -	4.0089e-1 (2.69e-1) -	4.0096e-1 (1.11e-1) -	6.9534e-1 (2.32e-1) -	3.8169e-1 (3.23e-1) -	1.1080e+0 (9.30e-2) -	1.1437e-2 (6.44e-3)
	500	6.5255e-1 (3.20e-1) -	7.8102e-1 (3.12e-1) -	5.2153e-1 (1.94e-1) -	1.0947e+0 (4.93e-3) -	9.2085e-1 (2.70e-1) -	1.1472e+0 (8.60e-2) -	1.4396e-1 (2.51e-1)
	1000	6.8826e-1 (2.17e-1) -	8.3455e-1 (2.80e-1) -	5.9107e-1 (2.79e-1) -	1.1415e+0 (9.01e-2) -	9.9043e-1 (2.02e-1) -	1.1753e+0 (1.03e-1) -	1.6695e-1 (1.88e-1)
LIRCMOP12	100	8.5846e-1 (1.11e-1) -	7.3862e-1 (6.72e-2) -	4.5012e-1 (1.66e-1) -	2.6524e-1 (2.31e-2) -	8.5684e-1 (1.08e-1) -	7.4566e-1 (2.70e-1) -	4.5125e-2 (1.78e-1)
	200	9.5194e-1 (4.53e-3) -	8.2000e-1 (9.07e-2) -	4.6057e-1 (1.69e-1) -	2.7412e-1 (3.61e-2) -	9.4034e-1 (5.85e-3) -	9.5095e-1 (1.09e-1) -	6.0073e-2 (1.42e-1)
	500	9.5515e-1 (4.67e-3) -	9.4921e-1 (1.03e-3) -	5.2735e-1 (2.16e-1) -	4.5207e-1 (3.06e-1) -	9.5135e-1 (1.91e-3) -	9.7364e-1 (1.95e-2) -	1.1493e-1 (1.96e-1)
	1000	9.5586e-1 (2.04e-3) -	9.5052e-1 (8.20e-4) -	6.1676e-1 (2.40e-1) -	7.6967e-1 (3.04e-1) -	9.5193e-1 (1.04e-1) -	9.8014e-1 (2.00e-2) -	2.0543e-1 (1.40e-1)
LIRCMOP13	100	9.3070e-2 (9.70e-4) =	1.3147e+0 (1.97e-3) -	9.2176e-2 (1.01e-3) +	1.3015e+0 (1.02e-4) -	9.3084e-2 (1.20e-3) -	4.9351e-1 (5.68e-1) -	9.3096e-2 (1.16e-3)
	200	9.3384e-2 (9.21e-4) =	1.3156e+0 (1.70e-3) -	9.2024e-2 (1.05e-3) +	1.3013e+0 (1.18e-4) -	9.3064e-2 (1.02e-3) =	4.9141e-1 (5.72e-1) -	9.3164e-2 (8.95e-4)
	500	9.3519e-2 (1.18e-3) =	1.3149e+0 (1.71e-3) -	9.1843e-2 (9.68e-4) +	1.3012e+0 (3.69e-5) -	9.3232e-2 (9.77e-4) -	1.9442e-1 (3.15e-1) -	9.3509e-2 (9.75e-4)
	1000	9.4163e-2 (1.04e-3) =	1.3152e+0 (1.85e-3) -	9.1948e-2 (9.27e-4) +	1.3012e+0 (2.19e-5) -	9.2631e-2 (9.30e-4) +	1.5361e-1 (2.78e-1) -	9.3829e-2 (9.69e-4)
LIRCMOP14	100	9.5799e-2 (9.26e-4) -	1.2719e+0 (1.94e-3) -	1.3214e-1 (1.05e-2) -	1.2577e+0 (1.69e-4) -	9.6263e-2 (7.27e-4) -	5.2538e-1 (5.66e-1) -	9.5092e-2 (1.48e-3)
	200	9.5750e-2 (1.08e-3) -	1.2720e+0 (1.53e-3) -	1.4312e-1 (1.25e-2) -	1.2575e+0 (1.74e-4) -	9.5811e-2 (1.00e-3) -	4.3785e-1 (5.36e-1) -	9.5047e-2 (1.20e-3)
	500	9.5634e-2 (1.02e-3) -	1.2720e+0 (1.74e-3) -	1.5082e-1 (1.88e-2) -	1.2573e+0 (5.96e-5) -	9.6035e-2 (1.00e-3) -	1.0795e-1 (1.50e-2) -	9.4729e-2 (7.73e-4)
	1000	9.5419e-2 (8.60e-4) -	1.2711e+0 (1.88e-3) -	1.4551e-1 (1.96e-2) -	1.2573e+0 (2.35e-5) -	9.5667e-2 (7.84e-4) -	1.0006e-1 (1.33e-3) -	9.4685e-2 (9.05e-4)
+/-/=		5/46/5	1/54/1	4/52/0	6/49/1	6/46/4	1/52/3	

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the compared algorithm is significantly better than, worse than, and similar to the proposed algorithm, respectively. "NaN " indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-II

THE HV RESULTS OBTAINED BY GLCMEA AND SIX COMPARED ALGORITHMS ON LIRCMOP TEST SUITE

Problem	D	CCMO	MTCMO	C_LMEA	C_LMOCSO	DPSEA	POCEA	GLCMEA
LIRCMOP1	100	1.0892e-1 (6.12e-3) -	1.2794e-1 (3.85e-3) -	9.8663e-2 (2.33e-3) -	2.3143e-1 (8.81e-4) +	1.1154e-1 (6.29e-3) -	2.0879e-1 (1.16e-2) +	2.0494e-1 (6.32e-3)
	200	1.0570e-1 (5.69e-3) -	1.1681e-1 (2.99e-3) -	NaN (0.00%) -	2.3100e-1 (7.61e-4) +	1.0785e-1 (4.76e-3) -	2.0643e-1 (1.51e-2) +	1.9213e-1 (8.04e-3)
	500	1.0398e-1 (3.00e-3) -	1.0802e-1 (1.82e-3) -	NaN (0.00%) -	2.2709e-1 (1.08e-2) +	1.0604e-1 (3.43e-3) -	1.5264e-1 (3.15e-2) -	1.6382e-1 (1.45e-2)
	1000	1.0149e-1 (2.12e-3) -	1.0345e-1 (1.14e-3) -	NaN (0.00%) -	1.7635e-1 (4.75e-2) =	1.0411e-1 (2.92e-3) -	9.6458e-2 (2.80e-3) -	1.4586e-1 (1.61e-2)
LIRCMOP2	100	2.3735e-1 (1.26e-2) -	2.4714e-1 (4.84e-3) -	2.0950e-1 (5.14e-3) -	3.5284e-1 (6.44e-4) +	2.2659e-1 (9.44e-3) -	3.3116e-1 (1.18e-2) -	3.4688e-1 (2.11e-3)
	200	2.2511e-1 (9.26e-3) -	2.3255e-1 (2.97e-3) -	NaN (0.00%) -	3.5248e-1 (7.49e-4) +	2.2184e-1 (7.07e-3) -	3.3411e-1 (8.51e-3) -	3.3960e-1 (4.16e-3)
	500	2.1679e-1 (5.20e-3) -	2.2159e-1 (2.52e-3) -	NaN (0.00%) -	3.5196e-1 (7.95e-4) +	2.2015e-1 (4.42e-3) -	3.2174e-1 (2.45e-2) =	3.2153e-1 (1.08e-2)
	1000	2.1651e-1 (3.55e-3) -	2.1588e-1 (1.58e-3) -	NaN (0.00%) -	2.2201e-1 (4.93e-3) -	2.1685e-1 (3.49e-3) -	2.1235e-1 (3.66e-3) -	3.1380e-1 (1.58e-2)
LIRCMOP3	100	1.0360e-1 (9.43e-3) -	1.1837e-1 (7.12e-3) -	9.1012e-2 (3.18e-3) -	1.4465e-1 (4.50e-2) -	9.9696e-2 (7.67e-3) -	NaN (96.67%) -	1.9898e-1 (3.53e-3)
	200	9.7855e-2 (5.59e-3) -	9.7035e-2 (2.15e-3) -	NaN (0.00%) -	9.5297e-2 (7.40e-4) -	9.5421e-2 (4.01e-3) -	NaN (96.67%) -	1.9358e-1 (4.97e-3)
	500	9.3192e-2 (2.41e-3) -	9.6730e-2 (2.24e-3) -	NaN (0.00%) -	9.4837e-2 (9.25e-4) -	9.4298e-2 (2.76e-3) -	NaN (96.67%) -	1.8547e-1 (6.50e-3)
	1000	9.3056e-2 (3.28e-3) -	9.5183e-2 (1.24e-3) -	NaN (0.00%) -	9.4747e-2 (9.80e-4) -	9.4828e-2 (2.20e-3) -	9.2160e-2 (1.73e-3) -	1.7196e-1 (1.28e-2)
LIRCMOP4	100	1.9367e-1 (1.41e-2) -	2.1639e-1 (8.46e-3) -	1.8105e-1 (3.95e-3) -	2.2524e-1 (3.59e-2) -	1.8830e-1 (9.02e-3) -	NaN (93.33%) -	3.0767e-1 (3.24e-3)
	200	1.8778e-1 (9.64e-3) -	1.9002e-1 (9.40e-3) -	NaN (0.00%) -	1.8117e-1 (1.12e-3) -	1.8505e-1 (6.48e-3) -	NaN (96.67%) -	2.9983e-1 (7.42e-3)
	500	1.8397e-1 (7.72e-3) -	1.8420e-1 (2.03e-3) -	NaN (0.00%) -	1.8041e-1 (1.37e-3) -	1.8440e-1 (5.40e-3) -	NaN (86.67%) -	2.8471e-1 (1.68e-2)
	1000	1.8144e-1 (1.74e-3) -	1.8254e-1 (2.05e-3) -	NaN (0.00%) -	1.8005e-1 (1.46e-3) -	1.8333e-1 (2.91e-3) -	1.7668e-1 (2.79e-3) -	2.8124e-1 (1.24e-2)
LIRCMOP5	100	1.3283e-1 (1.39e-2) -	6.1797e-2 (6.75e-2) -	1.1443e-1 (5.23e-2) -	0.0000e+0 (0.00e+0) -	1.3243e-1 (9.60e-3) -	4.5452e-3 (2.49e-2) -	2.2938e-1 (1.99e-2)
	200	1.3224e-1 (6.78e-3) -	5.2137e-2 (6.53e-2) -	7.5818e-2 (8.46e-2) -	0.0000e+0 (0.00e+0) -	1.3405e-1 (8.06e-3) -	0.0000e+0 (0.00e+0) -	2.0842e-1 (3.15e-2)
	500	1.2914e-1 (6.94e-3) -	0.0000e+0 (0.00e+0) -	1.1512e-2 (4.38e-2) -	0.0000e+0 (0.00e+0) -	1.2894e-1 (4.97e-3) -	0.0000e+0 (0.00e+0) -	1.5858e-1 (6.82e-2)
	1000	1.2941e-1 (4.71e-3) +	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	1.3056e-1 (3.31e-3) +	0.0000e+0 (0.00e+0) -	4.7506e-2 (8.07e-2)
LIRCMOP6	100	9.1261e-2 (1.65e-3) -	5.7863e-2 (4.49e-2) -	6.0616e-2 (4.23e-2) -	0.0000e+0 (0.00e+0) -	9.0904e-2 (1.33e-3) -	0.0000e+0 (0.00e+0) -	1.5201e-1 (1.38e-2)
	200	8.9873e-2 (6.40e-4) -	3.8562e-2 (4.49e-2) -	3.0581e-2 (4.18e-2) -	0.0000e+0 (0.00e+0) -	8.9285e-2 (6.20e-4) -	0.0000e+0 (0.00e+0) -	1.2791e-1 (1.56e-2)
	500	8.8516e-2 (6.18e-4) +	0.0000e+0 (0.00e+0) -	1.0841e-2 (2.82e-2) -	0.0000e+0 (0.00e+0) -	8.8440e-2 (4.67e-4) +	0.0000e+0 (0.00e+0) -	6.0166e-2 (4.90e-2)
	1000	8.8274e-2 (3.93e-4) +	0.0000e+0 (0.00e+0) -	1.6741e-2 (3.49e-2) =	0.0000e+0 (0.00e+0) -	8.8232e-2 (3.64e-4) +	0.0000e+0 (0.00e+0) -	2.9186e-2 (4.73e-2)
LIRCMOP7	100	2.4070e-1 (5.08e-3) -	2.4074e-1 (5.60e-3) -	1.3173e-1 (8.01e-2) -	0.0000e+0 (0.00e+0) -	2.4089e-1 (3.57e-3) -	1.0916e-1 (1.19e-1) -	2.6738e-1 (5.08e-2)
	200	2.3904e-1 (4.36e-3) -	2.3739e-1 (3.32e-3) -	8.4208e-2 (7.34e-2) -	0.0000e+0 (0.00e+0) -	2.3980e-1 (3.35e-3) -	3.7821e-2 (8.61e-2) -	2.5878e-1 (5.59e-2)
	500	2.3921e-1 (2.19e-3) -	2.3505e-1 (2.20e-3) -	3.5301e-2 (6.11e-2) -	0.0000e+0 (0.00e+0) -	2.3890e-1 (2.76e-3) -	7.6825e-3 (4.21e-2) -	2.4682e-1 (5.42e-2)
	1000	2.3858e-1 (2.07e-3) -	2.3453e-1 (1.89e-3) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	2.3912e-1 (1.26e-3) -	0.0000e+0 (0.00e+0) -	2.5322e-1 (9.49e-3)
LIRCMOP8	100	2.1979e-1 (8.88e-4) -	2.2106e-1 (3.04e-3) -	1.0169e-1 (7.66e-2) -	0.0000e+0 (0.00e+0) -	2.2121e-1 (1.64e-3) -	4.3126e-2 (8.77e-2) -	2.6791e-1 (2.14e-2)
	200	2.1949e-1 (2.89e-4) -	2.1912e-1 (9.82e-4) -	8.3803e-2 (7.26e-2) -	0.0000e+0 (0.00e+0) -	2.1923e-1 (3.86e-4) -	0.0000e+0 (0.00e+0) -	2.6357e-1 (1.07e-2)
	500	2.1895e-1 (2.22e-4) -	2.1567e-1 (7.06e-4) -	5.1843e-3 (2.84e-2) -	0.0000e+0 (0.00e+0) -	2.1887e-1 (1.15e-4) -	0.0000e+0 (0.00e+0) -	2.5015e-1 (1.12e-2)
	1000	2.1879e-1 (1.39e-4) -	2.1380e-1 (3.98e-4) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	2.1877e-1 (9.77e-5) -	0.0000e+0 (0.00e+0) -	2.3215e-1 (1.61e-2)
LIRCMOP9	100	1.9768e-1 (2.45e-2) -	1.9590e-1 (3.75e-2) -	4.1199e-1 (4.55e-2) -	3.4332e-1 (6.58e-2) -	2.1027e-1 (4.65e-2) -	2.0212e-1 (7.96e-2) -	5.2700e-1 (1.16e-2)
	200	1.6351e-1 (5.92e-3) -	1.7591e-1 (8.36e-3) -	3.9211e-1 (5.42e-2) -	3.6552e-1 (3.75e-2) -	1.6138e-1 (1.67e-3) -	1.5313e-1 (2.26e-3) -	5.1558e-1 (1.53e-2)
	500	1.5450e-1 (1.18e-3) -	1.6203e-1 (1.55e-3) -	3.3918e-1 (8.94e-2) -	2.6743e-1 (1.03e-1) -	1.5343e-1 (1.35e-3) -	1.4626e-1 (3.58e-3) -	4.6309e-1 (4.23e-2)
	1000	1.5411e-1 (1.09e-3) -	1.5986e-1 (6.18e-4) -	2.8599e-1 (1.16e-1) -	1.6951e-1 (5.87e-2) -	1.5160e-1 (1.25e-3) -	1.1339e-1 (1.82e-2) -	3.7407e-1 (1.02e-1)
LIRCMOP10	100	5.5373e-1 (1.06e-2) -	4.7049e-1 (1.01e-1) -	5.1292e-1 (4.42e-2) -	2.4765e-1 (8.49e-2) -	4.6801e-1 (1.29e-1) -	1.8677e-1 (1.18e-1) -	6.8969e-1 (7.72e-3)
	200	4.4473e-1 (1.25e-1) -	4.1954e-1 (1.37e-1) -	4.3007e-1 (6.88e-2) -	1.3491e-1 (4.92e-2) -	3.1263e-1 (1.95e-1) -	1.9397e-1 (9.88e-2) -	6.7170e-1 (1.31e-2)
	500	3.8439e-1 (1.62e-1) -	3.4525e-1 (1.18e-1) -	3.2644e-1 (1.28e-1) -	9.3969e-2 (7.28e-4) -	1.1936e-1 (9.67e-2) -	2.0848e-1 (7.21e-2) -	5.9973e-1 (6.09e-2)
	1000	3.3955e-1 (1.71e-1) -	2.4177e-1 (1.24e-1) -	2.9057e-1 (8.25e-2) -	9.3942e-2 (4.03e-4) -	1.1700e-1 (8.82e-2) -	2.2916e-1 (4.93e-2) -	4.7844e-1 (1.16e-1)
LIRCMOP11	100	5.9549e-1 (4.03e-2) -	4.0932e-1 (1.61e-1) -	4.1722e-1 (6.51e-2) -	3.1569e-1 (8.34e-2) -	5.9414e-1 (5.87e-2) -	1.7273e-1 (7.54e-2) -	6.9103e-1 (1.60e-2)
	200	4.7490e-1 (1.85e-1) -	4.5306e-1 (1.39e-1) -	4.5053e-1 (4.68e-2) -	2.4498e-1 (7.90e-2) -	4.3997e-1 (1.84e-1) -	1.8385e-1 (8.81e-2) -	6.8773e-1 (4.55e-3)
	500	2.8817e-1 (1.89e-1) -	2.3546e-1 (1.67e-1) -	3.7770e-1 (8.54e-2) -	1.2585e-1 (2.03e-3) -	1.7262e-1 (1.35e-1) -	2.2741e-1 (9.16e-2) -	6.3315e-1 (9.05e-2)
	1000	2.5348e-1 (1.74e-1) -	2.2093e-1 (1.51e-1) -	3.3627e-1 (1.09e-1) -	1.1519e-1 (1.10e-2) -	1.4034e-1 (9.78e-2) -	2.0236e-1 (1.00e-1) -	6.2281e-1 (6.78e-2)
LIRCMOP12	100	3.8220e-1 (1.66e-2) -	3.8672e-1 (1.39e-2) -	3.8749e-1 (7.85e-2) -	4.9672e-1 (1.54e-2) -	3.8072e-1 (1.03e-2) -	3.8633e-1 (2.88e-2) -	6.0622e-1 (5.14e-2)
	200	3.6686e-1 (3.95e-3) -	3.7483e-1 (3.05e-3) -	3.7568e-1 (8.21e-2) -	4.8879e-1 (2.47e-2) -	3.7321e-1 (3.01e-3) -	3.6677e-1 (9.85e-3) -	5.9937e-1 (3.82e-2)
	500	3.6421e-1 (4.18e-3) -	3.6933e-1 (8.29e-4) -	3.7522e-1 (9.72e-2) -	4.5871e-1 (5.90e-2) -	3.6746e-1 (1.53e-3) -	3.6022e-1 (4.89e-3) -	5.7829e-1 (5.64e-2)
	1000	3.6353e-1 (1.78e-3) -	3.6826e-1 (6.79e-4) -	3.3244e-1 (9.75e-2) -	4.0124e-1 (5.68e-2) -	3.6708e-1 (8.92e-4) -	3.5637e-1 (6.14e-3) -	5.3343e-1 (4.93e-2)
LIRCMOP13	100	5.5462e-1 (1.57e-3) -	1.3419e-4 (1.28e-4) -	5.6032e-1 (1.88e-3) +	4.5389e-4 (3.71e-7) -	5.5573e-1 (1.46e-3) =	3.5841e-1 (2.40e-1) -	5.5541e-1 (1.26e-3)
	200	5.5462e-1 (1.48e-3) =	1.7608e-4 (1.35e-4) -	5.6062e-1 (1.10e-3) +	4.5405e-4 (1.72e-7) -	5.5601e-1 (1.29e-3) +	3.6275e-1 (2.42e-1) -	5.5454e-1 (1.34e-3)
	500	5.5406e-1 (1.19e-3) =	1.3507e-4 (1.09e-4) -	5.6085e-1 (9.83e-4) +	4.5412e-4 (1.64e-8) -	5.5564e-1 (1.36e-3) -	4.9657e-1 (1.37e-1) -	5.5380e-1 (1.51e-3)
	1000	5.5211e-1 (1.84e-3) -	1.7362e-4 (1.17e-4) -	5.6065e-1 (9.06e-4) +	4.5413e-4 (1.87e-9) -	5.5591e-1 (1.27e-3) -	5.2853e-1 (8.61e-2) -	5.5317e-1 (1.54e-3)
LIRCMOP14	100	5.5439e-1 (1.47e-3) =	6.4007e-4 (2.63e-4) -	5.3369e-1 (8.77e-3) -	1.0066e-3 (7.17e-7) -	5.5391e-1 (1.26e-3) -	3.4073e-1 (2.47e-1) -	5.5498e-1 (1.37e-3)
	200	5.5395e-1 (1.30e-3) -	6.6733e-4 (3.23e-4) -	5.3156e-1 (9.19e-3) -	1.0069e-3 (9.87e-8) -	5.5399e-1 (1.22e-3) -	3.8562e-1 (2.40e-1) -	5.5549e-1 (1.24e-3)
	500	5.5423e-1 (1.11e-3) -	4.7685e-4 (3.64e-4) -	5.2666e-1 (1.23e-2) -	1.0070e-3 (1.47e-8) -	5.5372e-1 (1.38e-3) -	5.4109e-1 (1.54e-2) -	5.5561e-1 (1.22e-3)
	1000	5.5451e-1 (1.12e-3) -	5.6921e-4 (2.70e-4) -	5.2998e-1 (8.94e-3) -	1.0070e-3 (3.69e-8) -	5.5465e-1 (1.20e-3) -	5.4980e-1 (8.98e-4) -	5.5598e-1 (1.22e-3)
+/-/=		3/50/3	0/56/0	4/51/1	6/49/1	6/49/1	2/53/1	

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the compared algorithm is significantly better than, worse than, and similar to the proposed algorithm, respectively. "NaN " indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-III
THE IGD RESULTS OBTAINED BY GLCMEA AND SIX COMPARED ALGORITHMS ON MW TEST SUITE

Problem	D	CCMO	MTCMO	C_LMEA	C_LMOCSO	DPSEA	POCEA	GLCMEA
MW1	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	1.6091e-3 (1.09e-5)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (83.33%)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (3.33%)
	1000	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%)
MW2	100	NaN (80.00%) -	NaN (66.67%) -	NaN (0.00%) -	NaN (0.00%) -	1.8007e-1 (8.40e-2) -	NaN (0.00%) -	5.6942e-3 (5.97e-4)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (26.67%) -	NaN (0.00%) -	5.7855e-3 (9.75e-4)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	6.2154e-3 (1.16e-3)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	6.8191e-3 (1.14e-3)
MW3	100	7.0578e-3 (9.58e-4) -	7.9312e-3 (1.22e-3) -	NaN (0.00%) -	1.4690e-2 (2.02e-3) -	6.2192e-3 (7.43e-4) -	1.8451e-2 (3.58e-3) -	5.4699e-3 (2.24e-4)
	200	9.8846e-3 (1.63e-3) -	1.0881e-2 (1.50e-3) -	NaN (0.00%) -	1.6454e-2 (1.76e-3) -	8.0027e-3 (9.88e-4) -	2.1332e-2 (4.01e-3) -	6.3542e-3 (3.28e-4)
	500	1.8566e-2 (2.06e-3) -	2.2926e-2 (7.77e-3) -	NaN (0.00%) -	2.0030e-2 (2.09e-3) -	1.3993e-2 (1.42e-3) -	3.8745e-2 (3.62e-3) -	1.0816e-2 (1.01e-3)
	1000	4.6083e-2 (3.40e-3) -	4.8049e-2 (4.45e-3) -	NaN (0.00%) -	2.6688e-2 (3.39e-3) -	2.9131e-2 (8.28e-3) -	5.2365e-2 (5.69e-3) -	1.6374e-2 (8.37e-4)
MW4	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	4.8342e-2 (1.61e-3)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	4.7882e-2 (2.02e-3)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (13.33%)
	1000	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%)
MW5	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (93.33%)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (73.33%)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (26.67%)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (6.67%)
MW6	100	NaN (93.33%) -	NaN (83.33%) -	NaN (0.00%) -	NaN (0.00%) -	6.6688e-1 (2.48e-1) -	NaN (0.00%) -	2.7454e-3 (2.80e-5)
	200	NaN (10.00%) -	NaN (10.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (40.00%) -	NaN (0.00%) -	2.7541e-3 (2.68e-5)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	2.7484e-3 (2.36e-5)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	2.7600e-3 (3.02e-5)
MW7	100	5.4022e-3 (5.55e-4) -	7.0863e-3 (6.75e-4) -	NaN (0.00%) -	7.8428e-3 (8.97e-4) -	5.0997e-3 (5.42e-4) -	1.5554e-2 (2.48e-3) -	4.5148e-3 (2.16e-4)
	200	6.8534e-3 (6.70e-4) -	9.8548e-3 (1.43e-3) -	NaN (0.00%) -	1.0513e-2 (1.06e-3) -	6.6945e-3 (5.20e-4) -	1.5912e-2 (2.57e-3) -	5.5500e-3 (3.50e-4)
	500	1.0466e-2 (1.07e-3) =	1.6645e-2 (1.25e-3) -	NaN (0.00%) -	1.0978e-2 (6.29e-4) -	9.3380e-3 (5.45e-4) +	1.6512e-2 (2.25e-3) -	1.0011e-2 (7.52e-4)
	1000	1.4672e-2 (9.02e-4) +	2.2940e-2 (8.09e-4) -	NaN (0.00%) -	1.2272e-2 (8.15e-4) +	1.3318e-2 (1.03e-3) +	1.7964e-2 (6.65e-3) =	1.9258e-2 (6.81e-3)
MW8	100	NaN (36.67%) -	NaN (40.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (73.33%) -	NaN (0.00%) -	4.2930e-2 (5.77e-4)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (10.00%) -	NaN (0.00%) -	4.2961e-2 (6.06e-4)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	4.2944e-2 (6.34e-4)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	4.2906e-2 (4.70e-4)
MW9	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (93.33%)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (50.00%)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (16.67%)
	1000	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%)
MW10	100	NaN (10.00%) -	NaN (3.33%) =	NaN (0.00%) -	NaN (0.00%) -	NaN (30.00%) -	NaN (0.00%) -	3.4078e-3 (4.88e-5)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	3.4148e-3 (3.45e-5)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (83.33%)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (63.33%)
MW11	100	5.9070e-3 (1.06e-4) =	5.8588e-3 (9.42e-5) =	NaN (0.00%) -	3.3560e-2 (6.32e-3) -	5.8256e-3 (8.82e-5) +	4.6217e-2 (1.04e-2) -	5.9115e-3 (1.16e-4)
	200	5.9304e-3 (8.64e-5) =	5.8693e-3 (9.97e-5) =	NaN (0.00%) -	3.9370e-2 (8.83e-3) -	5.8499e-3 (7.84e-5) +	4.9159e-2 (1.10e-2) -	5.8960e-3 (6.08e-5)
	500	5.9261e-3 (8.44e-5) =	5.8748e-3 (1.16e-4) =	NaN (0.00%) -	5.7857e-2 (8.92e-3) -	5.8795e-3 (9.59e-5) =	5.1242e-2 (1.26e-2) -	5.8888e-3 (1.07e-4)
	1000	5.9424e-3 (1.22e-4) =	5.8853e-3 (1.14e-4) =	NaN (0.00%) -	7.0396e-2 (6.95e-3) -	5.9095e-3 (1.00e-4) =	8.8258e-2 (2.29e-2) -	5.8880e-3 (1.17e-4)
MW12	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (93.33%)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (63.33%)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (33.33%)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (3.33%)
MW13	100	7.4912e-1 (3.32e-1) -	7.8854e-1 (3.72e-1) -	NaN (0.00%) -	3.2219e+0 (7.01e-1) -	3.7674e-1 (2.75e-1) -	2.9857e+0 (1.02e+0) -	1.0715e-2 (1.66e-4)
	200	1.6380e+0 (3.75e-1) -	1.7183e+0 (4.50e-1) -	NaN (0.00%) -	6.3719e+0 (1.35e+0) -	1.2179e+0 (3.76e-1) -	NaN (96.67%) -	1.0810e-2 (5.31e-4)
	500	4.8775e+0 (8.93e-1) -	5.2530e+0 (1.41e+0) -	NaN (0.00%) -	NaN (0.00%) -	3.6807e+0 (9.08e-1) -	NaN (0.00%) -	1.1046e-2 (9.41e-4)
	1000	NaN (30.00%) -	NaN (3.33%) =	NaN (0.00%) -	NaN (0.00%) -	NaN (83.33%) -	NaN (0.00%) -	1.1175e-2 (6.08e-4)
MW14	100	3.3012e-1 (1.17e-1) -	3.1556e-1 (1.22e-1) -	1.5484e+0 (2.65e-1) -	1.7470e+0 (3.61e-1) -	3.3302e-1 (1.37e-1) -	3.7976e-1 (2.01e-1) -	9.7530e-2 (2.06e-3)
	200	5.8032e-1 (3.66e-2) -	5.2354e-1 (5.05e-2) -	2.1627e+0 (5.47e-1) -	2.3821e+0 (4.30e-1) -	6.3509e-1 (5.60e-2) -	9.7991e-1 (3.14e-1) -	9.8581e-2 (1.57e-3)
	500	1.0047e+0 (1.11e-1) -	8.9421e-1 (7.98e-2) -	NaN (93.33%) -	2.4374e+0 (4.20e-1) -	1.0315e+0 (1.05e-1) -	1.2151e+0 (4.59e-1) -	1.8848e-1 (7.71e-2)
	1000	1.5418e+0 (1.29e-1) -	1.4643e+0 (8.47e-2) -	NaN (0.00%) -	2.4618e+0 (3.75e-1) -	1.5196e+0 (7.74e-2) -	1.5457e+0 (9.60e-1) -	3.3623e-1 (1.10e-1)
+/-/=		1/47/8	0/47/9	0/53/3	1/52/3	4/47/5	0/52/4	

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the compared algorithm is significantly better than, worse than, and similar to the proposed algorithm, respectively. "NaN" indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-IV
THE HV RESULTS OBTAINED BY GLCMEA AND SIX COMPARED ALGORITHMS ON MW TEST SUITE

Problem	D	CCMO	MTCMO	C_LMEA	C_LMOCSO	DPSEA	POCEA	GLCMEA
MW1	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	4.9012e-1 (2.76e-5)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (83.33%)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (3.33%)
	1000	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%)
MW2	100	NaN (80.00%) -	NaN (66.67%) -	NaN (0.00%) -	NaN (0.00%) -	3.5721e-1 (8.80e-2) -	NaN (0.00%) -	5.8002e-1 (7.15e-4)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (26.67%) -	NaN (0.00%) -	5.7986e-1 (1.27e-3)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.7934e-1 (1.44e-3)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.7859e-1 (1.43e-3)
MW3	100	5.4010e-1 (1.44e-3) -	5.3866e-1 (1.94e-3) -	NaN (0.00%) -	5.3014e-1 (2.71e-3) -	5.4137e-1 (1.25e-3) -	5.2249e-1 (5.60e-3) -	5.4334e-1 (3.70e-4)
	200	5.3571e-1 (2.41e-3) -	5.3416e-1 (2.19e-3) -	NaN (0.00%) -	5.2722e-1 (2.59e-3) -	5.3846e-1 (1.58e-3) -	5.1781e-1 (5.83e-3) -	5.4139e-1 (5.44e-4)
	500	5.2325e-1 (2.89e-3) -	5.1545e-1 (1.39e-2) -	NaN (0.00%) -	5.2152e-1 (3.35e-3) -	5.2967e-1 (2.02e-3) -	4.8981e-1 (4.95e-3) -	5.3431e-1 (1.46e-3)
	1000	4.7621e-1 (4.77e-3) -	4.7344e-1 (6.27e-3) -	NaN (0.00%) -	5.0935e-1 (5.91e-3) -	5.0452e-1 (1.56e-3) -	4.7156e-1 (8.25e-3) -	5.2628e-1 (1.17e-3)
MW4	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	8.3514e-1 (1.56e-3)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	8.3555e-1 (1.83e-3)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (13.33%)
	1000	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%)
MW5	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (93.33%)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (73.33%)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (26.67%)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (6.67%)
MW6	100	NaN (93.33%) -	NaN (83.33%) -	NaN (0.00%) -	NaN (0.00%) -	6.2550e-2 (5.96e-2) -	NaN (0.00%) -	3.2851e-1 (1.85e-5)
	200	NaN (10.00%) -	NaN (10.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (40.00%) -	NaN (0.00%) -	3.2848e-1 (1.32e-4)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	3.2845e-1 (1.41e-4)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	3.2840e-1 (1.42e-4)
MW7	100	4.0960e-1 (1.07e-3) -	4.0654e-1 (1.16e-3) -	NaN (0.00%) -	4.0463e-1 (1.69e-3) -	4.1016e-1 (9.12e-4) -	3.9744e-1 (2.76e-3) -	4.1158e-1 (3.93e-3)
	200	4.0700e-1 (1.16e-3) -	4.0189e-1 (2.33e-3) -	NaN (0.00%) -	4.0023e-1 (1.88e-3) -	4.0728e-1 (8.89e-4) -	3.9684e-1 (3.76e-3) -	4.0923e-1 (6.65e-4)
	500	4.0088e-1 (1.78e-3) =	3.9095e-1 (1.89e-3) -	NaN (0.00%) -	3.9967e-1 (1.15e-3) -	4.0272e-1 (9.02e-4) +	3.9559e-1 (3.24e-3) -	4.0164e-1 (1.26e-3)
	1000	3.9406e-1 (1.42e-3) +	3.8161e-1 (1.18e-3) -	NaN (0.00%) -	3.9706e-1 (1.58e-3) +	3.9620e-1 (1.63e-3) +	3.9300e-1 (8.94e-3) +	3.8978e-1 (6.38e-3)
MW8	100	NaN (36.67%) -	NaN (40.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (73.33%) -	NaN (0.00%) -	5.5212e-1 (9.56e-4)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (10.00%) -	NaN (0.00%) -	5.5227e-1 (8.80e-4)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.5218e-1 (8.62e-4)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.5234e-1 (8.67e-4)
MW9	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (93.33%)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (50.00%)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (16.67%)
	1000	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%) =	NaN (0.00%)
MW10	100	NaN (10.00%) -	NaN (3.33%) =	NaN (0.00%) -	NaN (0.00%) -	NaN (30.00%) -	NaN (0.00%) -	4.5492e-1 (2.89e-4)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	4.5499e-1 (2.16e-4)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (83.33%)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (63.33%)
MW11	100	4.4833e-1 (5.01e-5) +	4.4840e-1 (5.21e-5) +	NaN (0.00%) -	4.3857e-1 (2.57e-3) -	4.4831e-1 (5.17e-5) +	4.2628e-1 (5.32e-3) -	4.4823e-1 (9.15e-5)
	200	4.4841e-1 (3.86e-5) -	4.4845e-1 (3.60e-5) +	NaN (0.00%) -	4.3588e-1 (3.41e-3) -	4.4842e-1 (3.84e-5) +	4.2694e-1 (4.53e-3) -	4.4837e-1 (5.52e-5)
	500	4.4843e-1 (2.91e-5) +	4.4845e-1 (4.12e-5) +	NaN (0.00%) -	4.2966e-1 (3.03e-3) -	4.4845e-1 (4.84e-5) +	4.2695e-1 (5.02e-3) -	4.4841e-1 (4.50e-5)
	1000	4.4844e-1 (3.63e-5) =	4.4843e-1 (4.55e-5) =	NaN (0.00%) -	4.2546e-1 (2.54e-3) -	4.4846e-1 (3.72e-5) =	4.1178e-1 (1.05e-2) -	4.4845e-1 (3.22e-5)
MW12	100	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (93.33%)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (63.33%)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (33.33%)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (3.33%)
MW13	100	1.6228e-1 (7.01e-2) -	1.5393e-1 (9.00e-2) -	NaN (0.00%) -	0.0000e+0 (0.00e+0) -	2.9008e-1 (9.30e-2) -	3.6944e-3 (1.42e-2) -	4.7665e-1 (1.89e-4)
	200	9.3544e-3 (2.44e-2) -	1.6457e-2 (4.16e-2) -	NaN (0.00%) -	0.0000e+0 (0.00e+0) -	6.1535e-2 (6.11e-2) -	NaN (96.67%) -	4.7656e-1 (3.13e-4)
	500	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	NaN (0.00%) -	NaN (0.00%) -	0.0000e+0 (0.00e+0) -	NaN (0.00%) -	4.7643e-1 (6.12e-4)
	1000	NaN (30.00%) -	NaN (3.33%) =	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (83.33%) -	4.7642e-1 (3.45e-4)
MW14	100	3.8477e-1 (5.61e-2) -	3.9052e-1 (5.16e-2) -	3.4988e-2 (5.15e-3) -	5.5107e-2 (7.04e-2) -	3.8952e-1 (5.29e-2) -	3.3031e-1 (6.77e-2) -	4.7232e-1 (1.53e-3)
	200	2.5228e-1 (2.37e-2) -	2.8674e-1 (3.06e-2) -	2.4322e-2 (7.46e-3) -	1.8964e-2 (1.55e-2) -	2.2898e-1 (2.36e-2) -	1.6133e-1 (8.38e-2) -	4.6980e-1 (1.99e-3)
	500	1.5783e-1 (1.92e-2) -	1.7736e-1 (1.57e-2) -	NaN (93.33%) -	1.7245e-2 (1.52e-2) -	1.5495e-1 (1.85e-2) -	1.1996e-1 (7.53e-2) -	4.4728e-1 (1.76e-2)
	1000	6.7415e-2 (3.26e-2) -	4.7315e-2 (2.04e-2) -	NaN (0.00%) -	1.6203e-2 (1.43e-2) -	8.2841e-2 (2.13e-2) -	1.0272e-1 (6.86e-2) -	3.7763e-1 (5.05e-2)
+/-/=		3/47/6	3/47/6	0/53/3	1/52/3	5/47/4	1/52/3	

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the compared algorithm is significantly better than, worse than, and similar to the proposed algorithm, respectively. "NaN " indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-V
THE HV RESULTS OBTAINED BY GLCMEA AND SIX COMPARED ALGORITHMS ON DTLZ TEST SUITE

Problem	D	CCMO	MTCMO	C_LMEA	C_LMOCSO	DPSEA	POCEA	GLCMEA
C1_DTLZ1	100	6.9274e-1 (4.22e-2) -	7.4228e-1 (2.91e-2) -	NaN (0.00%) -	NaN (0.00%) -	5.9356e-1 (6.24e-2) -	NaN (0.00%) -	8.0829e-1 (8.19e-3)
	200	6.7855e-1 (3.35e-2) -	7.1666e-1 (2.76e-2) -	NaN (0.00%) -	NaN (0.00%) -	5.2786e-1 (5.23e-2) -	NaN (0.00%) -	8.0191e-1 (1.40e-2)
	500	5.9413e-1 (5.23e-2) -	6.3908e-1 (2.61e-2) -	NaN (0.00%) -	NaN (0.00%) -	3.6835e-1 (4.22e-2) -	NaN (0.00%) -	7.3110e-1 (2.41e-2)
	1000	6.3699e-1 (3.91e-2) =	6.2589e-1 (2.14e-2) -	NaN (0.00%) -	NaN (0.00%) -	4.7455e-1 (3.57e-2) -	NaN (0.00%) -	6.5063e-1 (4.25e-2)
C1_DTLZ3	100	5.4992e-1 (3.61e-3) -	0.0000e+0 (0.00e+0) -	5.5996e-1 (7.71e-4) -	0.0000e+0 (0.00e+0) -	4.4578e-1 (1.20e-1) -	0.0000e+0 (0.00e+0) -	5.6085e-1 (1.04e-3)
	200	5.4436e-1 (3.57e-3) -	0.0000e+0 (0.00e+0) -	5.5966e-1 (1.01e-3) -	0.0000e+0 (0.00e+0) -	4.9356e-1 (7.46e-2) -	0.0000e+0 (0.00e+0) -	5.6128e-1 (8.10e-4)
	500	3.5571e-1 (1.46e-1) -	0.0000e+0 (0.00e+0) -	5.5888e-1 (8.74e-4) -	0.0000e+0 (0.00e+0) -	1.2258e-1 (1.44e-1) -	0.0000e+0 (0.00e+0) -	5.6084e-1 (8.57e-4)
	1000	3.7705e-1 (1.44e-1) -	0.0000e+0 (0.00e+0) -	5.5777e-1 (8.60e-4) -	0.0000e+0 (0.00e+0) -	1.2917e-1 (1.84e-1) -	0.0000e+0 (0.00e+0) -	5.6040e-1 (1.14e-3)
C2_DTLZ2	100	5.1581e-1 (1.44e-3) -	5.1732e-1 (1.54e-3) =	NaN (13.33%) -	5.1260e-1 (1.16e-4) -	5.1609e-1 (1.30e-3) =	5.0110e-1 (5.89e-3) -	5.1665e-1 (1.62e-3)
	200	5.1402e-1 (1.63e-3) -	5.1684e-1 (1.14e-3) =	NaN (0.00%) -	5.1273e-1 (9.69e-5) -	5.1522e-1 (1.82e-3) -	5.0287e-1 (4.10e-3) -	5.1683e-1 (1.69e-3)
	500	5.1403e-1 (1.93e-3) -	5.1650e-1 (1.40e-3) =	NaN (0.00%) -	5.1252e-1 (8.92e-5) -	5.1474e-1 (1.80e-3) -	4.9977e-1 (3.83e-3) -	5.1607e-1 (1.68e-3)
	1000	5.1244e-1 (2.17e-3) -	5.1574e-1 (1.35e-3) =	NaN (0.00%) -	5.1275e-1 (7.66e-5) -	5.1353e-1 (1.32e-3) -	5.0119e-1 (3.19e-3) -	5.1607e-1 (1.44e-3)
C3_DTLZ4	100	7.4864e-1 (9.55e-2) =	7.7376e-1 (6.39e-2) -	6.0206e-1 (1.15e-1) -	7.8432e-1 (3.58e-2) +	7.8162e-1 (4.59e-2) =	7.8221e-1 (2.22e-3) +	7.8187e-1 (4.60e-2)
	200	7.4870e-1 (9.56e-2) =	7.7412e-1 (6.40e-2) -	6.7760e-1 (8.13e-2) -	7.9617e-1 (3.70e-5) +	7.9017e-1 (1.38e-3) -	7.7461e-1 (4.86e-2) -	7.9072e-1 (1.21e-3)
	500	7.7406e-1 (6.40e-2) =	7.7370e-1 (6.39e-2) -	7.1675e-1 (4.74e-2) -	7.7740e-1 (7.15e-2) -	7.6473e-1 (7.67e-2) -	7.8454e-1 (1.66e-3) -	7.9045e-1 (1.28e-3)
	1000	7.8278e-1 (4.61e-2) +	7.8136e-1 (4.58e-2) =	7.2646e-1 (8.28e-2) -	7.9622e-1 (6.91e-6) +	7.8982e-1 (1.69e-3) -	7.7738e-1 (4.86e-2) +	7.7328e-1 (6.38e-2)
DC1_DTLZ1	100	4.8560e-1 (1.27e-1) -	5.7072e-1 (1.43e-2) -	6.2468e-1 (4.37e-3) -	0.0000e+0 (0.00e+0) -	5.1241e-1 (3.01e-2) -	1.2698e-2 (6.96e-2) -	6.3044e-1 (2.01e-3)
	200	3.6143e-1 (1.31e-1) -	5.1224e-1 (2.36e-2) -	6.2121e-1 (7.08e-3) -	0.0000e+0 (0.00e+0) -	2.0427e-1 (1.73e-1) -	6.2132e-3 (3.40e-2) -	6.2670e-1 (3.07e-3)
	500	7.8289e-4 (4.29e-3) -	2.8187e-1 (6.08e-2) -	6.1458e-1 (6.88e-3) =	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	6.1456e-1 (5.36e-3)
	1000	0.0000e+0 (0.00e+0) -	1.8078e-1 (6.70e-2) -	6.0665e-1 (8.70e-3) +	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	6.0305e-1 (8.53e-3)
DC1_DTLZ3	100	4.6358e-1 (2.95e-3) -	4.6710e-1 (2.46e-3) -	4.7199e-1 (9.31e-4) -	0.0000e+0 (0.00e+0) -	4.6069e-1 (3.96e-3) -	0.0000e+0 (0.00e+0) -	4.7466e-1 (7.10e-4)
	200	4.5583e-1 (2.99e-3) -	4.6272e-1 (2.58e-3) -	4.7134e-1 (1.39e-3) -	0.0000e+0 (0.00e+0) -	4.5026e-1 (3.56e-3) -	3.2155e-4 (1.76e-3) -	4.7465e-1 (8.26e-4)
	500	3.8320e-1 (5.12e-2) -	4.4431e-1 (3.53e-3) -	4.7070e-1 (8.75e-4) -	0.0000e+0 (0.00e+0) -	2.0245e-1 (1.29e-1) -	0.0000e+0 (0.00e+0) -	4.7383e-1 (8.67e-4)
	1000	3.3438e-1 (7.12e-2) -	4.4573e-1 (2.87e-3) -	4.6906e-1 (9.08e-4) -	0.0000e+0 (0.00e+0) -	8.5612e-3 (2.71e-2) -	2.7269e-4 (1.42e-3) -	4.7292e-1 (9.38e-4)
DC2_DTLZ1	100	NaN (20.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	8.4095e-1 (1.17e-3)
	200	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	8.3799e-1 (1.72e-3)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.8544e-1 (1.64e-1)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	4.8013e-1 (9.96e-4)
DC2_DTLZ3	100	1.6713e-1 (2.38e-1) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.6149e-1 (5.74e-4)
	200	NaN (33.33%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.6125e-1 (9.73e-4)
	500	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.6033e-1 (1.10e-3)
	1000	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	NaN (0.00%) -	5.5913e-1 (1.03e-3)
DC3_DTLZ1	100	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	9.3985e-3 (2.88e-2) -	0.0000e+0 (0.00e+0) -	5.3353e-1 (2.29e-3)
	200	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	5.2664e-1 (3.94e-3)
	500	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	5.0734e-1 (6.79e-3)
	1000	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	3.5109e-1 (1.93e-1)
DC3_DTLZ3	100	9.8107e-3 (5.37e-2) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	3.6891e-1 (5.82e-4)
	200	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	3.6865e-1 (8.12e-4)
	500	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	3.6686e-1 (1.63e-3)
	1000	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	0.0000e+0 (0.00e+0) -	3.6429e-1 (1.76e-3)
+/-/=		1/35/4	0/32/8	1/38/1	3/37/0	0/36/4	2/38/0	

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the compared algorithm is significantly better than, worse than, and similar to the proposed algorithm, respectively. "NaN" indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-VI
THE IGD RESULTS OF GLCMEA WITH $\delta = 0.05$ AND DIFFERENT g VALUES

Problem	$g = 5$ and $\delta = 0.05$	$g = 15$ and $\delta = 0.05$	$g = 25$ and $\delta = 0.05$	$g = 35$ and $\delta = 0.05$	$g = 45$ and $\delta = 0.05$
C1_DTLZ1	3.9030e-2 (9.97e-3) -	4.4978e-2 (1.34e-2) -	2.3397e-2 (6.70e-3) =	2.1656e-2 (7.64e-4)	2.1713e-2 (2.94e-4) =
C1_DTLZ3	6.6843e+0 (3.02e+0) -	5.8452e-1 (2.02e+0) =	5.3380e-2 (5.15e-4) =	5.3401e-2 (8.39e-4)	5.3316e-2 (6.19e-4) =
C2_DTLZ2	4.2617e-2 (5.32e-4) =	4.2610e-2 (6.19e-4) =	4.2674e-2 (5.37e-4) =	4.2478e-2 (3.72e-4)	4.2419e-2 (4.63e-4) =
C3_DTLZ4	1.1927e-1 (1.36e-1) =	9.4649e-2 (1.36e-3) =	1.1957e-1 (1.36e-1) =	1.1941e-1 (1.36e-1)	9.4438e-2 (1.32e-3) =
DC1_DTLZ1	2.8315e-2 (5.50e-3) -	2.1743e-2 (5.31e-3) -	1.2144e-2 (8.65e-4) -	1.1516e-2 (1.60e-4)	1.1427e-2 (1.24e-4) +
DC1_DTLZ3	3.4710e-2 (5.63e-4) -	3.4399e-2 (5.15e-4) -	3.3903e-2 (3.71e-4) =	3.3915e-2 (4.04e-4)	3.3734e-2 (4.30e-4) =
DC2_DTLZ1	NaN (0.00%) -	NaN (16.67%) -	4.9299e-2 (5.85e-2) -	2.0216e-2 (1.84e-4)	2.0132e-2 (1.34e-4) =
DC2_DTLZ3	NaN (6.67%) -	NaN (56.67%) -	8.6997e-2 (1.30e-1) -	5.2633e-2 (3.42e-4)	5.2703e-2 (4.04e-4) =
DC3_DTLZ1	9.3322e+0 (2.46e+0) -	9.1310e-1 (6.49e-1) -	8.1438e-3 (1.43e-3) -	6.9864e-3 (1.65e-4)	6.9100e-3 (1.33e-4) +
DC3_DTLZ3	9.1881e+0 (5.39e+0) -	8.1349e-1 (8.09e-1) -	1.9984e-2 (2.40e-4) =	1.9924e-2 (2.12e-4)	2.0018e-2 (2.09e-4) =
LIRCMOP1	6.4540e-2 (1.94e-2) -	5.5233e-2 (1.42e-2) =	5.6571e-2 (1.45e-2) =	4.9450e-2 (9.58e-3)	NaN (93.33%) -
LIRCMOP2	5.0605e-2 (1.77e-2) -	3.4057e-2 (5.47e-3) -	3.5638e-2 (6.21e-3) -	3.0733e-2 (4.39e-3)	3.0361e-2 (3.88e-3) =
LIRCMOP3	5.8278e-2 (2.47e-2) -	3.9536e-2 (1.46e-2) -	2.7342e-2 (8.08e-3) =	2.4964e-2 (1.01e-2)	NaN (80.00%) -
LIRCMOP4	8.0970e-2 (3.43e-2) -	3.6695e-2 (1.31e-2) -	2.5396e-2 (7.79e-3) -	2.4573e-2 (7.63e-3)	NaN (96.67%) -
LIRCMOP5	8.5466e-1 (4.92e-1) -	3.7155e-1 (3.92e-1) -	1.5868e-1 (5.36e-2) -	1.2488e-1 (3.96e-2)	1.0956e-1 (3.30e-2) =
LIRCMOP6	9.3532e-1 (5.15e-1) -	3.3357e-1 (2.41e-1) -	1.9881e-1 (9.89e-2) -	1.2337e-1 (6.38e-2)	1.2130e-1 (6.14e-2) =
LIRCMOP7	3.0643e-1 (5.49e-1) -	5.8753e-2 (2.68e-2) +	4.1953e-2 (1.82e-2) =	1.2624e-1 (4.81e-1)	NaN (96.67%) -
LIRCMOP8	1.9889e-1 (1.07e-1) -	1.0389e-1 (4.83e-2) -	8.4752e-2 (3.83e-2) =	7.2234e-2 (8.60e-2)	NaN (96.67%) -
LIRCMOP9	4.7043e-1 (2.65e-1) -	1.4956e-1 (8.74e-2) -	1.1025e-1 (3.05e-2) =	1.0477e-1 (2.91e-2)	9.9082e-2 (2.29e-2) =
LIRCMOP10	3.0497e-1 (1.33e-1) -	8.9363e-2 (6.24e-2) -	3.3781e-2 (2.03e-2) -	2.9075e-2 (1.93e-2)	2.4595e-2 (7.60e-3) =
LIRCMOP11	1.9910e-1 (2.18e-1) -	1.9535e-2 (2.23e-2) -	8.6784e-3 (6.39e-3) =	6.0970e-3 (2.36e-3)	7.7327e-2 (2.69e-1) =
LIRCMOP12	1.7780e-1 (2.15e-1) -	2.8672e-2 (1.58e-2) +	1.8059e-2 (7.63e-3) +	4.5125e-2 (1.78e-1)	7.4893e-2 (2.24e-1) =
LIRCMOP13	2.9703e-1 (4.64e-1) =	9.3074e-2 (9.05e-4) =	9.3421e-2 (9.63e-4) =	9.3096e-2 (1.16e-3)	9.3047e-2 (1.19e-3) =
LIRCMOP14	4.0903e-1 (5.29e-1) -	9.5154e-2 (1.02e-3) =	9.5119e-2 (9.94e-4) =	9.5092e-2 (1.48e-3)	9.5208e-2 (9.43e-4) =
MW1	2.5684e-3 (1.05e-3) -	1.7550e-3 (2.94e-4) -	1.6130e-3 (9.51e-6) =	1.6091e-3 (1.09e-5)	1.6131e-3 (1.17e-5) =
MW2	6.2620e-3 (2.86e-3) =	5.6069e-3 (5.37e-4) =	5.6570e-3 (9.03e-4) =	5.6942e-3 (5.97e-4)	5.6645e-3 (7.24e-4) =
MW3	6.1425e-3 (6.06e-4) -	5.7283e-3 (3.72e-4) -	5.6017e-3 (3.26e-4) =	5.4699e-3 (2.24e-4)	5.4166e-3 (3.00e-4) =
MW4	4.1991e-2 (2.68e-3) +	4.0588e-2 (1.15e-3) +	4.8852e-2 (1.46e-3) =	4.8342e-2 (1.61e-3)	4.8620e-2 (1.60e-3) =
MW5	NaN (66.67%) -	NaN (76.67%) -	NaN (90.00%) -	NaN (93.33%)	NaN (93.33%) =
MW6	1.0770e-2 (2.06e-2) -	2.7509e-3 (2.51e-5) =	2.7519e-3 (2.25e-5) =	2.7454e-3 (2.80e-5)	2.7541e-3 (1.97e-5) =
MW7	6.0524e-3 (8.55e-4) -	5.1882e-3 (3.69e-4) -	4.6162e-3 (2.49e-4) =	4.5148e-3 (2.16e-4)	4.4061e-3 (1.73e-4) +
MW8	4.3377e-2 (1.64e-3) =	4.2927e-2 (6.49e-4) =	4.2944e-2 (6.53e-4) =	4.2930e-2 (5.77e-4)	4.2852e-2 (5.70e-4) =
MW9	NaN (63.33%) -	NaN (83.33%) -	NaN (86.67%) -	NaN (93.33%)	NaN (83.33%) -
MW10	7.1587e-3 (1.01e-2) -	3.4105e-3 (4.23e-5) =	3.4176e-3 (3.31e-5) =	3.4078e-3 (4.88e-5)	3.4242e-3 (5.67e-5) =
MW11	5.8969e-3 (1.05e-4) =	5.9331e-3 (1.07e-4) =	5.8939e-3 (9.71e-5) =	5.9115e-3 (1.16e-4)	5.9404e-3 (1.12e-4) =
MW12	NaN (83.33%) -	NaN (80.00%) -	NaN (90.00%) -	NaN (93.33%)	NaN (86.67%) -
MW13	1.2660e-2 (8.92e-3) =	1.0654e-2 (1.67e-4) =	1.0816e-2 (8.91e-4) =	1.0715e-2 (1.66e-4)	1.0670e-2 (1.40e-4) =
MW14	1.2044e-1 (3.79e-2) -	9.8885e-2 (1.76e-3) =	9.8020e-2 (2.14e-3) =	9.7530e-2 (2.06e-3)	9.7031e-2 (1.96e-3) =
+/-/=	1/30/7	3/23/12	1/12/25		3/7/28

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the GLCMEA with $\delta = 0.05$ and different g value is significantly better than, worse than, and similar to the GLCMEA with $g = 35$ and $\delta = 0.05$, respectively. "NaN" indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-VII
THE IGD RESULTS OF GLCMEA WITH $g = 35$ AND DIFFERENT δ VALUES

Problem	$g = 35$ and $\delta = 0.001$	$g = 35$ and $\delta = 0.01$	$g = 35$ and $\delta = 0.05$	$g = 35$ and $\delta = 0.1$	$g = 35$ and $\delta = 1$
C1_DTLZ1	2.1670e-2 (2.86e-4) =	2.1700e-2 (1.91e-4) =	2.1656e-2 (7.64e-4)	2.0476e-2 (8.80e-4) +	2.0938e-2 (1.08e-3) +
C1_DTLZ3	5.3381e-2 (7.34e-4) =	5.3282e-2 (7.49e-4) =	5.3401e-2 (8.39e-4)	5.3218e-2 (5.84e-4) =	5.3339e-2 (6.07e-4) =
C2_DTLZ2	4.2672e-2 (5.14e-4) =	4.2494e-2 (6.05e-4) =	4.2478e-2 (3.72e-4)	4.2651e-2 (5.86e-4) =	4.2604e-2 (5.65e-4) =
C3_DTLZ4	NaN (83.33%) -	2.1885e-1 (2.83e-1) =	1.1941e-1 (1.36e-1)	1.1942e-1 (1.36e-1) =	1.1943e-1 (1.36e-1) =
DC1_DTLZ1	1.1404e-2 (8.85e-5) +	1.1389e-2 (9.59e-5) +	1.1516e-2 (1.60e-4)	1.1800e-2 (3.57e-4) -	1.1589e-2 (1.84e-4) =
DC1_DTLZ3	3.3750e-2 (3.78e-4) =	3.3914e-2 (3.31e-4) =	3.3915e-2 (4.04e-4)	3.3786e-2 (3.37e-4) =	3.3724e-2 (3.13e-4) +
DC2_DTLZ1	2.0048e-2 (1.20e-4) +	2.0082e-2 (1.26e-4) +	2.0216e-2 (1.84e-4)	2.0290e-2 (2.01e-4) =	2.0254e-2 (1.52e-4) =
DC2_DTLZ3	5.2762e-2 (4.14e-4) =	5.2667e-2 (3.38e-4) =	5.2633e-2 (3.42e-4)	5.2753e-2 (4.19e-4) =	5.2717e-2 (3.92e-4) =
DC3_DTLZ1	6.8620e-3 (5.63e-5) +	6.8634e-3 (4.95e-5) +	6.9864e-3 (1.65e-4)	7.2675e-3 (3.44e-4) -	7.1961e-3 (2.36e-4) -
DC3_DTLZ3	1.9919e-2 (3.22e-4) =	1.9879e-2 (2.45e-4) =	1.9924e-2 (2.12e-4)	1.9986e-2 (2.26e-4) =	2.0009e-2 (2.96e-4) =
LIRCMOP1	NaN (0.00%) -	NaN (46.67%) -	4.9450e-2 (9.58e-3)	5.4047e-2 (1.18e-2) =	5.7387e-2 (9.83e-3) -
LIRCMOP2	NaN (3.33%) =	NaN (60.00%) -	3.0733e-2 (4.39e-3)	3.2775e-2 (4.31e-3) -	3.4528e-2 (6.34e-3) -
LIRCMOP3	NaN (0.00%) -	NaN (6.67%) -	2.4964e-2 (1.01e-2)	2.6496e-2 (8.75e-3) =	2.7442e-2 (8.72e-3) =
LIRCMOP4	NaN (0.00%) -	NaN (60.00%) -	2.4573e-2 (7.63e-3)	2.8375e-2 (1.07e-2) =	2.8771e-2 (1.07e-2) =
LIRCMOP5	6.6187e-2 (1.99e-2) +	7.7009e-2 (2.10e-2) +	1.2488e-1 (3.96e-2)	1.6062e-1 (3.23e-2) -	1.7154e-1 (3.21e-2) -
LIRCMOP6	5.5998e-2 (1.71e-2) +	5.9993e-2 (2.28e-2) +	1.2337e-1 (6.38e-2)	1.5077e-1 (6.41e-2) =	1.9798e-1 (7.38e-2) -
LIRCMOP7	NaN (66.67%) -	NaN (63.33%) -	1.2624e-1 (4.81e-1)	4.7234e-2 (1.76e-2) =	4.8294e-2 (2.21e-2) +
LIRCMOP8	NaN (66.67%) -	NaN (66.67%) -	7.2234e-2 (8.60e-2)	7.7961e-2 (3.51e-2) -	5.9238e-2 (2.90e-2) =
LIRCMOP9	1.0923e-1 (3.42e-2) =	1.0540e-1 (2.75e-2) =	1.0477e-1 (2.91e-2)	1.0461e-1 (2.55e-2) =	1.4240e-1 (4.49e-2) -
LIRCMOP10	2.4283e-2 (5.93e-3) =	2.5122e-2 (5.98e-3) =	2.9075e-2 (1.93e-2)	4.1652e-2 (2.53e-2) -	4.4582e-2 (2.58e-2) -
LIRCMOP11	NaN (90.00%) -	4.7149e-1 (5.22e-1) -	6.0970e-3 (2.36e-3)	6.5715e-3 (3.35e-3) -	8.4674e-3 (4.20e-3) -
LIRCMOP12	NaN (96.67%) -	4.7063e-1 (4.70e-1) -	4.5125e-2 (1.78e-1)	1.7796e-2 (8.02e-3) +	2.2981e-2 (1.20e-2) +
LIRCMOP13	9.3726e-2 (1.32e-3) =	9.3239e-2 (1.03e-3) =	9.3096e-2 (1.16e-3)	9.3086e-2 (1.05e-3) =	9.3240e-2 (1.01e-3) =
LIRCMOP14	9.4891e-2 (7.48e-4) =	9.5209e-2 (1.07e-3) =	9.5092e-2 (1.48e-3)	9.5400e-2 (1.14e-3) =	9.5233e-2 (9.83e-4) =
MW1	1.6130e-3 (1.40e-5) =	1.6131e-3 (1.12e-5) =	1.6091e-3 (1.09e-5)	1.6093e-3 (9.68e-6) =	1.6114e-3 (9.20e-6) =
MW2	5.4098e-3 (7.12e-4) =	5.5330e-3 (7.30e-4) =	5.6942e-3 (5.97e-4)	5.4221e-3 (6.26e-4) =	5.6099e-3 (4.37e-4) =
MW3	3.7112e-2 (2.41e-2) -	5.4801e-3 (3.65e-4) =	5.4699e-3 (2.24e-4)	5.4935e-3 (2.28e-4) =	5.4310e-3 (2.66e-4) =
MW4	4.8517e-2 (1.76e-3) =	4.8350e-2 (1.86e-3) =	4.8342e-2 (1.61e-3)	4.8778e-2 (1.64e-3) =	4.8318e-2 (1.59e-3) =
MW5	NaN (90.00%) -	NaN (86.67%) -	NaN (93.33%)	2.7636e-2 (1.34e-1) =	NaN (76.67%) -
MW6	2.7490e-3 (1.88e-5) =	2.7548e-3 (2.87e-5) =	2.7454e-3 (2.80e-5)	2.7462e-3 (2.21e-5) =	2.7504e-3 (3.16e-5) =
MW7	2.0216e-1 (8.94e-2) -	1.1077e-2 (3.62e-2) =	4.5148e-3 (2.16e-4)	4.6159e-3 (2.36e-4) =	4.5194e-3 (2.14e-4) =
MW8	4.3156e-2 (5.42e-4) =	4.3006e-2 (6.66e-4) =	4.2930e-2 (5.77e-4)	4.2962e-2 (6.04e-4) =	4.2833e-2 (5.53e-4) =
MW9	NaN (90.00%) -	NaN (80.00%) -	NaN (93.33%)	NaN (90%) -	NaN (93.33%) -
MW10	3.3965e-3 (3.73e-5) =	3.4133e-3 (8.96e-5) =	3.4078e-3 (4.88e-5)	3.4193e-3 (4.13e-5) =	3.4238e-3 (4.30e-5) =
MW11	NaN (6.67%) -	NaN (83.33%) -	5.9115e-3 (1.16e-4)	5.9215e-3 (1.07e-4) =	5.8850e-3 (9.55e-5) =
MW12	NaN (76.67%) -	NaN (93.33%) =	NaN (93.33%)	NaN (86.67%) -	NaN (96.67%) -
MW13	1.0709e-2 (1.76e-4) =	1.0703e-2 (1.41e-4) =	1.0715e-2 (1.66e-4)	1.0743e-2 (1.17e-4) =	1.1021e-2 (1.21e-3) =
MW14	1.8491e-1 (4.20e-2) -	1.1483e-1 (3.97e-2) =	9.7530e-2 (2.06e-3)	9.8019e-2 (1.51e-3) =	9.7703e-2 (1.92e-3) =
+/-/=	5/15/18	5/11/22		2/8/28	4/11/23

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the GLCMEA with $g = 35$ and different δ value is significantly better than, worse than, and similar to the GLCMEA with $g = 35$ and $\delta = 0.05$, respectively. "NaN " indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-VIII
THE IGD RESULTS OF GLCMEA AND GLCMEA-LMEA

Problem	GLCMEA-LMEA	GLCMEA
C1_DTLZ1	2.3441e-2 (7.60e-4) -	2.1656e-2 (7.64e-4)
C1_DTLZ3	5.4406e-2 (6.64e-4) -	5.3401e-2 (8.39e-4)
C2_DTLZ2	5.6314e-2 (1.54e-3) -	4.2478e-2 (3.72e-4)
C3_DTLZ4	NaN (0.00%) -	1.1941e-1 (1.36e-1)
DC1_DTLZ1	2.0896e-2 (1.23e-3) -	1.1516e-2 (1.60e-4)
DC1_DTLZ3	5.6859e-2 (2.58e-3) -	3.3915e-2 (4.04e-4)
DC2_DTLZ1	2.1191e-2 (3.51e-4) -	2.0216e-2 (1.84e-4)
DC2_DTLZ3	5.5142e-2 (2.90e-3) -	5.2633e-2 (3.42e-4)
DC3_DTLZ1	3.0771e-2 (6.79e-3) -	6.9864e-3 (1.65e-4)
DC3_DTLZ3	6.2996e-2 (7.07e-3) -	1.9924e-2 (2.12e-4)
LIRCMOP1	NaN (0.00%) -	4.9450e-2 (9.58e-3)
LIRCMOP2	NaN (0.00%) -	3.0733e-2 (4.39e-3)
LIRCMOP3	NaN (0.00%) -	2.4964e-2 (1.01e-2)
LIRCMOP4	NaN (0.00%) -	2.4573e-2 (7.63e-3)
LIRCMOP5	1.6921e-1 (4.26e-2) -	1.2488e-1 (3.96e-2)
LIRCMOP6	1.9349e-1 (5.59e-2) -	1.2337e-1 (6.38e-2)
LIRCMOP7	NaN (0.00%) -	1.2624e-1 (4.81e-1)
LIRCMOP8	NaN (0.00%) -	7.2234e-2 (8.60e-2)
LIRCMOP9	1.5730e-1 (5.57e-2) -	1.0477e-1 (2.91e-2)
LIRCMOP10	6.7891e-2 (5.14e-2) -	2.9075e-2 (1.93e-2)
LIRCMOP11	5.6897e-1 (2.73e-1) -	6.0970e-3 (2.36e-3)
LIRCMOP12	NaN (56.67%) -	4.5125e-2 (1.78e-1)
LIRCMOP13	9.2198e-2 (1.15e-3) +	9.3096e-2 (1.16e-3)
LIRCMOP14	NaN (0.00%) -	9.5092e-2 (1.48e-3)
MW1	4.3662e-3 (1.45e-3) -	1.6091e-3 (1.09e-5)
MW2	4.2330e-3 (1.51e-4) +	5.6942e-3 (5.97e-4)
MW3	5.3557e-2 (1.84e-3) -	5.4699e-3 (2.24e-4)
MW4	4.9491e-2 (2.00e-3) -	4.8342e-2 (1.61e-3)
MW5	NaN (80.00%) -	NaN (93.33%)
MW6	5.5720e-3 (7.10e-4) -	2.7454e-3 (2.80e-5)
MW7	2.0875e-1 (4.53e-3) -	4.5148e-3 (2.16e-4)
MW8	6.0716e-2 (2.12e-3) -	4.2930e-2 (5.77e-4)
MW9	NaN (20.00%) -	NaN (93.33%)
MW10	NaN (96.67%) -	3.4078e-3 (4.88e-5)
MW11	NaN (0.00%) -	5.9115e-3 (1.16e-4)
MW12	NaN (30.00%) -	NaN (93.33%)
MW13	9.5734e-2 (4.83e-2) -	1.0715e-2 (1.66e-4)
MW14	1.1196e-1 (2.27e-2) -	9.7530e-2 (2.06e-3)
+/-/=	2/36/0	

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the GLCMEA-LMEA is significantly better than, worse than, and similar to the GLCMEA, respectively. "NaN " indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-IX
THE IGD RESULTS OF GLCMEA AND GLCMEA-UPF

Problem	GLCMEA-UPF	GLCMEA
C1_DTLZ1	2.1772e-2 (8.78e-4) =	2.1656e-2 (7.64e-4)
C1_DTLZ3	5.3360e-2 (7.22e-4) =	5.3401e-2 (8.39e-4)
C2_DTLZ2	4.2618e-2 (5.75e-4) =	4.2478e-2 (3.72e-4)
C3_DTLZ4	9.4637e-2 (1.63e-3) =	1.1941e-1 (1.36e-1)
DC1_DTLZ1	1.1583e-2 (2.59e-4) =	1.1516e-2 (1.60e-4)
DC1_DTLZ3	3.3798e-2 (2.68e-4) =	3.3915e-2 (4.04e-4)
DC2_DTLZ1	2.0338e-2 (3.68e-4) =	2.0216e-2 (1.84e-4)
DC2_DTLZ3	5.2709e-2 (3.25e-4) =	5.2633e-2 (3.42e-4)
DC3_DTLZ1	7.6371e-3 (2.45e-3) -	6.9864e-3 (1.65e-4)
DC3_DTLZ3	1.9947e-2 (2.32e-4) =	1.9924e-2 (2.12e-4)
LIRCMOP1	7.5703e-2 (3.08e-2) -	4.9450e-2 (9.58e-3)
LIRCMOP2	4.7472e-2 (1.46e-2) -	3.0733e-2 (4.39e-3)
LIRCMOP3	4.2959e-2 (1.52e-2) -	2.4964e-2 (1.01e-2)
LIRCMOP4	5.5334e-2 (1.25e-2) -	2.4573e-2 (7.63e-3)
LIRCMOP5	1.1445e-1 (3.27e-2) =	1.2488e-1 (3.96e-2)
LIRCMOP6	1.1883e-1 (5.95e-2) =	1.2337e-1 (6.38e-2)
LIRCMOP7	1.6780e-1 (4.45e-1) -	1.2624e-1 (4.81e-1)
LIRCMOP8	7.3040e-2 (3.94e-2) =	7.2234e-2 (8.60e-2)
LIRCMOP9	9.8108e-2 (1.76e-2) =	1.0477e-1 (2.91e-2)
LIRCMOP10	2.7911e-2 (1.64e-2) =	2.9075e-2 (1.93e-2)
LIRCMOP11	8.1480e-3 (1.20e-2) =	6.0970e-3 (2.36e-3)
LIRCMOP12	2.0741e-2 (1.83e-2) =	4.5125e-2 (1.78e-1)
LIRCMOP13	9.3184e-2 (1.10e-3) =	9.3096e-2 (1.16e-3)
LIRCMOP14	9.5146e-2 (1.09e-3) =	9.5092e-2 (1.48e-3)
MW1	1.6121e-3 (1.20e-5) =	1.6091e-3 (1.09e-5)
MW2	5.5009e-3 (3.32e-4) =	5.6942e-3 (5.97e-4)
MW3	5.3745e-3 (2.40e-4) =	5.4699e-3 (2.24e-4)
MW4	4.8631e-2 (1.73e-3) =	4.8342e-2 (1.61e-3)
MW5	NaN (86.67%) -	NaN (93.33%)
MW6	2.7523e-3 (2.64e-5) =	2.7454e-3 (2.80e-5)
MW7	4.4120e-3 (1.82e-4) =	4.5148e-3 (2.16e-4)
MW8	4.2973e-2 (4.08e-4) =	4.2930e-2 (5.77e-4)
MW9	NaN (80.00%) -	NaN (93.33%)
MW10	3.4146e-3 (4.45e-5) =	3.4078e-3 (4.88e-5)
MW11	5.9282e-3 (1.24e-4) =	5.9115e-3 (1.16e-4)
MW12	NaN (83.33%) -	NaN (93.33%)
MW13	1.0851e-2 (8.85e-4) =	1.0715e-2 (1.66e-4)
MW14	9.7588e-2 (1.85e-3) =	9.7530e-2 (2.06e-3)
+/-/=	0/9/29	

The best value in each row is marked in gray. The symbols "+", "-", and "="
indicate that the GLCMEA-UPF is significantly better than, worse than, and
similar to the GLCMEA, respectively. "NaN " indicates that the corresponding
algorithm cannot continuously obtain feasible solutions in 30 runs, and the
result is represented by "NaN (FR)".

TABLE S-X
THE IGD RESULTS OF GLCMEA, GLCMEA-RANDOM1, AND GLCMEA-RANDOM2

Problem	GLCMEA-random1	GLCMEA-random2	GLCMEA
C1_DTLZ1	2.1630e-2 (8.13e-4) =	2.1685e-2 (7.46e-4) =	2.1656e-2 (7.64e-4)
C1_DTLZ3	5.3464e-2 (6.16e-4) =	5.3432e-2 (8.02e-4) =	5.3401e-2 (8.39e-4)
C2_DTLZ2	4.2592e-2 (5.73e-4) =	4.2676e-2 (4.09e-4) -	4.2478e-2 (3.72e-4)
C3_DTLZ4	1.1910e-1 (1.36e-1) =	9.4422e-2 (1.38e-3) =	1.1941e-1 (1.36e-1)
DC1_DTLZ1	1.1554e-2 (2.27e-4) =	1.1595e-2 (2.75e-4) =	1.1516e-2 (1.60e-4)
DC1_DTLZ3	3.3867e-2 (3.62e-4) =	3.3940e-2 (3.88e-4) =	3.3915e-2 (4.04e-4)
DC2_DTLZ1	2.0238e-2 (2.29e-4) =	2.0195e-2 (2.37e-4) =	2.0216e-2 (1.84e-4)
DC2_DTLZ3	5.2776e-2 (3.73e-4) =	5.2682e-2 (3.28e-4) =	5.2633e-2 (3.42e-4)
DC3_DTLZ1	7.0316e-3 (1.87e-4) =	7.0410e-3 (4.08e-4) =	6.9864e-3 (1.65e-4)
DC3_DTLZ3	1.9939e-2 (1.82e-4) =	1.9936e-2 (1.89e-4) =	1.9924e-2 (2.12e-4)
LIRCMOP1	6.1079e-2 (1.49e-2) -	6.3579e-2 (1.69e-2) -	4.9450e-2 (9.58e-3)
LIRCMOP2	3.5019e-2 (5.42e-3) -	3.4410e-2 (7.96e-3) -	3.0733e-2 (4.39e-3)
LIRCMOP3	3.1555e-2 (1.23e-2) -	3.0753e-2 (8.16e-3) -	2.4964e-2 (1.01e-2)
LIRCMOP4	3.0828e-2 (1.12e-2) -	3.1739e-2 (8.06e-3) -	2.4573e-2 (7.63e-3)
LIRCMOP5	1.3151e-1 (4.10e-2) =	1.3342e-1 (4.13e-2) =	1.2488e-1 (3.96e-2)
LIRCMOP6	1.0410e-1 (5.42e-2) =	1.2622e-1 (5.51e-2) =	1.2337e-1 (6.38e-2)
LIRCMOP7	3.7998e-2 (1.65e-2) =	5.0644e-2 (2.57e-2) =	1.2624e-1 (4.81e-1)
LIRCMOP8	8.0821e-2 (1.20e-1) =	7.2723e-2 (3.94e-2) =	7.2234e-2 (8.60e-2)
LIRCMOP9	1.1258e-1 (3.55e-2) =	1.4298e-1 (4.95e-2) -	1.0477e-1 (2.91e-2)
LIRCMOP10	3.3359e-2 (2.34e-2) =	4.4116e-2 (2.81e-2) -	2.9075e-2 (1.93e-2)
LIRCMOP11	6.7313e-3 (3.39e-3) =	1.5014e-2 (2.21e-2) -	6.0970e-3 (2.36e-3)
LIRCMOP12	1.4594e-2 (6.83e-3) =	2.0024e-2 (1.74e-2) =	4.5125e-2 (1.78e-1)
LIRCMOP13	9.3264e-2 (1.11e-3) =	9.3275e-2 (1.22e-3) =	9.3096e-2 (1.16e-3)
LIRCMOP14	9.5292e-2 (7.63e-4) =	9.5245e-2 (1.01e-3) =	9.5092e-2 (1.48e-3)
MW1	1.6153e-3 (1.51e-5) =	1.6117e-3 (1.47e-5) =	1.6091e-3 (1.09e-5)
MW2	5.6226e-3 (7.21e-4) =	5.2578e-3 (7.21e-4) +	5.6942e-3 (5.97e-4)
MW3	5.3507e-3 (2.58e-4) =	5.3160e-3 (2.74e-4) +	5.4699e-3 (2.24e-4)
MW4	4.8245e-2 (1.73e-3) =	4.8400e-2 (1.74e-3) =	4.8342e-2 (1.61e-3)
MW5	NaN (86.67%) -	NaN (86.67%) -	NaN (93.33%)
MW6	2.7611e-3 (6.42e-5) =	2.7592e-3 (2.42e-5) =	2.7454e-3 (2.80e-5)
MW7	4.4396e-3 (2.25e-4) =	4.4242e-3 (1.95e-4) =	4.5148e-3 (2.16e-4)
MW8	4.2835e-2 (6.43e-4) =	4.2965e-2 (5.95e-4) =	4.2930e-2 (5.77e-4)
MW9	NaN (90.00%) -	NaN (83.33%) -	NaN (93.33%)
MW10	3.4290e-3 (3.49e-5) -	3.4130e-3 (4.89e-5) =	3.4078e-3 (4.88e-5)
MW11	5.9284e-3 (1.03e-4) =	5.9170e-3 (1.26e-4) =	5.9115e-3 (1.16e-4)
MW12	NaN (90.00%) -	NaN (83.33%) -	NaN (93.33%)
MW13	1.0666e-2 (1.80e-4) =	1.0671e-2 (1.66e-4) =	1.0715e-2 (1.66e-4)
MW14	9.8331e-2 (4.59e-3) =	9.7107e-2 (1.42e-3) =	9.7530e-2 (2.06e-3)
+/-/=	0/8/30	2/11/25	

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the compared algorithm is significantly better than, worse than, and similar to the GLCMEA, respectively. "NaN " indicates that the corresponding algorithm cannot continuously obtain feasible solutions in 30 runs, and the result is represented by "NaN (FR)".

TABLE S-XI
THE IGD RESULTS OF GLCMEA AND SIX COMPARED ALGORITHMS ON CLSMOP TEST SUITE

Problem	D	CCMO	MTCMO	C_LMEA	C_LMOCSO	DPSEA	POCEA	GLCMEA
CLSMOP1	100	9.3170e-1 (6.68e-2) -	9.2177e-1 (7.62e-2) -	6.9251e-1 (8.20e-2) =	7.0540e-1 (3.08e-4) +	9.2503e-1 (6.99e-2) -	7.0502e-1 (4.91e-3) +	7.4539e-1 (1.09e-1)
	200	9.5903e-1 (9.52e-3) -	9.5548e-1 (1.18e-2) -	7.2839e-1 (6.47e-2) =	7.0539e-1 (4.81e-4) +	9.6925e-1 (6.47e-3) -	6.9225e-1 (6.48e-2) +	7.5388e-1 (1.16e-1)
	500	9.5799e-1 (3.60e-3) -	9.5754e-1 (4.80e-3) -	6.5741e-1 (9.55e-2) =	7.0498e-1 (1.13e-3) +	9.6379e-1 (4.57e-3) -	6.8211e-1 (1.17e-1) +	7.4189e-1 (1.12e-1)
	1000	9.5693e-1 (3.90e-3) -	9.5502e-1 (3.82e-3) -	6.5053e-1 (1.21e-1) =	7.0416e-1 (7.50e-3) +	9.5408e-1 (3.64e-3) -	5.0216e-1 (1.48e-1) +	7.4160e-1 (1.09e-1)
CLSMOP2	100	4.2593e-2 (2.87e-3) =	4.1546e-2 (2.75e-3) =	9.6983e-2 (6.80e-2) -	4.6196e-2 (1.20e-2) =	4.5525e-2 (2.65e-3) -	3.1295e-2 (1.50e-2) +	3.9453e-2 (8.91e-3)
	200	4.9259e-2 (4.94e-3) -	4.8857e-2 (5.49e-3) -	7.5939e-2 (3.94e-2) -	2.0972e-2 (5.40e-3) +	3.5118e-2 (2.21e-3) -	2.6429e-2 (6.68e-3) +	3.7085e-2 (1.13e-2)
	500	2.5976e-2 (2.02e-4) -	2.5976e-2 (2.29e-4) -	5.0904e-2 (1.71e-2) -	1.5501e-2 (3.60e-3) +	2.5533e-2 (2.91e-4) -	2.1313e-2 (1.46e-3) +	2.3539e-2 (3.20e-3)
	1000	1.4932e-2 (1.21e-4) -	1.4960e-2 (1.24e-4) -	3.0629e-2 (7.89e-3) -	1.4322e-2 (1.68e-3) =	1.4452e-2 (1.28e-4) +	1.2816e-2 (5.95e-4) +	1.4933e-2 (4.77e-4)
CLSMOP3	100	1.0834e+0 (5.29e-2) -	1.0801e+0 (5.01e-2) -	8.2892e-1 (3.01e-1) -	4.7564e+0 (1.86e+1) -	1.0989e+0 (4.67e-2) -	9.9215e-1 (3.82e-2) -	7.4740e-1 (3.75e-1)
	200	1.0205e+0 (1.18e-2) -	1.0229e+0 (1.16e-2) -	2.3400e+0 (3.87e+0) -	1.4132e+0 (9.67e-1) =	1.0223e+0 (1.10e-2) -	9.7059e-1 (1.56e-1) -	8.7535e-1 (3.02e-1)
	500	1.0018e+0 (1.89e-3) -	1.0034e+0 (5.57e-3) -	1.1193e+0 (1.73e+0) -	1.5072e+1 (7.20e+1) -	1.0026e+0 (2.20e-3) -	9.8660e-1 (5.28e-2) -	9.7257e-1 (1.27e-1)
	1000	9.9904e-1 (5.30e-4) -	9.9933e-1 (1.39e-3) -	1.2454e+0 (1.40e+0) -	6.1884e+1 (2.32e+2) -	9.9967e-1 (2.36e-3) -	9.9939e-1 (1.41e-3) -	9.4428e-1 (1.67e-1)
CLSMOP4	100	6.1401e-1 (1.39e-2) =	6.1322e-1 (1.45e-2) =	5.6147e-1 (5.33e-2) +	6.8134e-1 (1.24e-3) -	6.0855e-1 (9.84e-3) =	6.9761e-1 (5.59e-3) -	6.1415e-1 (1.77e-2)
	200	6.1952e-1 (1.13e-2) +	6.2198e-1 (9.29e-3) +	6.4559e-1 (3.29e-2) -	6.9452e-1 (7.49e-4) -	6.2939e-1 (5.35e-3) +	7.0377e-1 (1.57e-3) -	6.3658e-1 (8.67e-3)
	500	6.2106e-1 (9.48e-3) +	6.2195e-1 (9.21e-3) +	6.7601e-1 (2.10e-2) -	7.0167e-1 (2.25e-4) -	6.6430e-1 (3.77e-3) =	7.0516e-1 (4.86e-4) -	6.6152e-1 (1.26e-2)
	1000	6.4849e-1 (8.64e-3) +	6.5131e-1 (9.78e-3) +	6.9131e-1 (1.26e-2) -	7.0442e-1 (1.81e-4) -	6.6447e-1 (2.43e-3) +	7.0627e-1 (2.44e-4) -	6.7345e-1 (1.40e-2)
CLSMOP5	100	3.4247e-1 (5.54e-5) -	3.4247e-1 (5.53e-5) -	4.5485e-1 (2.58e-1) -	5.4295e-2 (1.87e-1) +	3.4382e-1 (3.43e-1) -	5.3243e-1 (1.84e-1) -	1.6287e-1 (1.26e-1)
	200	3.4248e-1 (9.22e-5) -	3.4246e-1 (3.90e-5) -	4.9730e-1 (2.38e-1) -	5.3952e-2 (1.87e-1) +	3.4828e-1 (2.11e-2) -	5.9889e-1 (1.58e-1) -	2.2336e-1 (1.24e-1)
	500	3.4245e-1 (4.65e-5) -	3.4244e-1 (1.81e-5) -	4.8686e-1 (2.25e-1) -	2.5915e-1 (3.50e-1) +	3.4295e-1 (4.37e-4) -	7.4209e-1 (2.16e-5) -	2.9388e-1 (1.05e-1)
	1000	3.4240e-1 (2.24e-5) -	3.4240e-1 (1.69e-5) -	5.3818e-1 (1.81e-1) -	5.3612e-1 (3.19e-1) -	3.4252e-1 (1.04e-4) -	7.3808e-1 (2.20e-2) -	2.8330e-1 (1.14e-1)
+/-/=		3/11/6	3/13/4	1/14/5	9/8/3	3/13/4	8/11/1	

The best value in each row is marked in gray. The symbols "+", "-", and "=" indicate that the compared algorithm is significantly better than, worse than, and similar to the proposed algorithm, respectively.