Supplementary File for "Effects of Initialization Methods on the Performance of Surrogate-based Multiobjective Evolutionary Algorithms"

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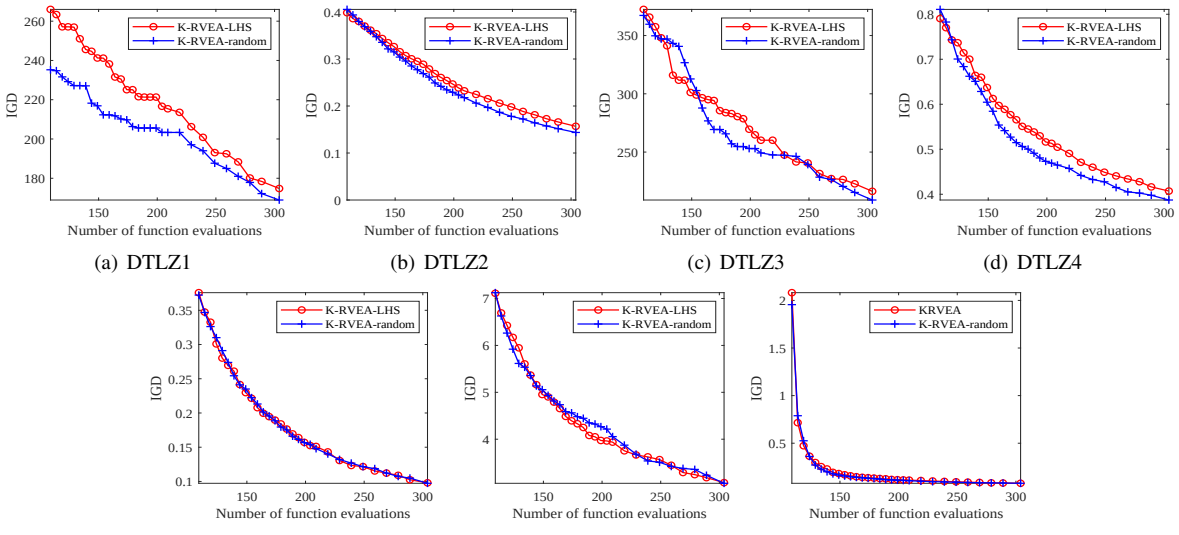
A. *Three used Initialization Methods in Section III-B*

- The improved Latin hypercube sampling (LHSmax) method: As an improvement of Latin hypercube sampling, the main difference of LHSmax is to maximize the minimum distance between sampled solutions. In this way, the sampled solutions can cover the sampling space well.
- The Sobol sequence (Sobol) method: Sobol sequence is a kind of low discrepancy sequences. It uses a base of two to divide the unit interval into successively finer uniform region. Then, the solutions are sampled in each region.
- The opposition-based learning (OBL) method: Let $\mathbf{x} = \{x_1, x_2, \cdots, x_d\}$ be a d-dimensional solution, where $x_i \in [x_i^l, x_i^u]$, $i = 1, \cdots, d$. Then, the opposite solution $\hat{\mathbf{x}} = \{\hat{x}_1, \hat{x}_2, \cdots, \hat{x}_d\}$ is defined as

$$\hat{x}_i = x_i^l + x_i^u - x_i.$$



(a) DTLZ1 (b) DTLZ2 (c) DTLZ3 (d) DTLZ4

(e) DTLZ5 (f) DTLZ6 (g) DTLZ7

Fig. S1. The mean IGD values versus the number of function evaluations obtained by K-RVEA-LHS and K-RVEA-random on DTLZ1–7.

TABLE S1

THE $mean(std)$ IGD VALUES OF THE COMPARED ALGORITHMS WHEN THE NUMBER OF INITIAL SOLUTIONS EQUALS TO THE POPULATION SIZE.

Problem	M	d	MOEA/D-EGO-LHS	MOEA/D-EGO-random	K-RVEA-LHS	K-RVEA-random	EDN-ARMOEA-LHS	EDN-ARMOEA-random
DTLZ1	3	10	1.5996e+2 (3.67e+1) ≈	1.5760e+2 (2.45e+1)	1.6513e+2 (3.43e+1) ≈	1.6681e+2 (2.09e+1)	2.1676e+2 (3.80e+1) ≈	1.9819e+2 (4.33e+1)
DTLZ2	3	10	3.6594e-1 (3.30e-2) −	3.4247e-1 (2.42e-2)	3.0365e-1 (3.32e-2) ≈	3.2114e-1 (4.02e-2)	3.2814e-1 (3.47e-2) ≈	3.2230e-1 (3.66e-2)
DTLZ3	3	10	1.8607e+2 (1.83e+1) ≈	1.8755e+2 (1.43e+1)	1.9776e+2 (2.60e+1) ≈	2.0342e+2 (3.32e+1)	3.1502e+2 (4.07e+1) ≈	3.1958e+2 (5.77e+1)
DTLZ4	3	10	6.3135e-1 (9.26e-2) ≈	6.7261e-1 (6.70e-2)	4.8311e-1 (5.69e-2) ≈	4.7890e-1 (8.11e-2)	3.5737e-1 (1.16e-1) ≈	4.1431e-1 (2.03e-1)
DTLZ5	3	10	3.2665e-1 (4.33e-2) +	3.5711e-1 (3.97e-2)	2.4999e-1 (7.83e-2) ≈	2.4504e-1 (6.36e-2)	2.2552e-1 (4.07e-2) ≈	2.1120e-1 (4.11e-2)
DTLZ6	3	10	2.6059e+0 (9.06e-1) ≈	2.1746e+0 (7.60e-1)	3.3683e+0 (5.15e-1) +	3.7050e+0 (5.75e-1)	6.1235e+0 (3.69e-1) ≈	6.1694e+0 (3.58e-1)
DTLZ7	3	10	2.0636e-1 (8.53e-2) ≈	2.5063e-1 (9.55e-2)	7.9490e-2 (1.30e-2) ≈	7.6863e-2 (1.20e-2)	5.7214e-1 (1.54e-1) ≈	5.4837e-1 (1.54e-1)
WFG1	3	10	8.8930e-1 (6.88e-2) ≈	8.6917e-1 (4.81e-2)	6.9265e-1 (4.38e-2) ≈	7.0082e-1 (3.96e-2)	7.7912e-1 (2.78e-2) ≈	7.8680e-1 (2.51e-2)
WFG2	3	10	2.3395e-1 (2.18e-2) ≈	2.3288e-1 (1.97e-2)	2.1461e-1 (2.69e-2) ≈	2.0778e-1 (1.98e-2)	2.0711e-1 (1.70e-2) ≈	2.0302e-1 (1.67e-2)
WFG3	3	10	3.1713e-1 (2.41e-2) ≈	3.1404e-1 (2.47e-2)	2.4547e-1 (4.99e-2) ≈	2.6462e-1 (3.90e-2)	3.1594e-1 (2.22e-2) ≈	3.0786e-1 (2.24e-2)
WFG4	3	10	1.6259e-1 (9.90e-3) ≈	1.6373e-1 (1.11e-2)	1.6255e-1 (8.85e-3) ≈	1.6416e-1 (9.94e-3)	1.4475e-1 (5.91e-3) ≈	1.4736e-1 (9.50e-3)
WFG5	3	10	1.5531e-1 (9.03e-3) ≈	1.5366e-1 (8.48e-3)	1.0137e-1 (1.04e-2) ≈	1.0112e-1 (9.33e-3)	1.7823e-1 (9.67e-3) ≈	1.7590e-1 (9.59e-3)
WFG6	3	10	2.3161e-1 (1.06e-2) ≈	2.2901e-1 (1.43e-2)	2.0766e-1 (1.33e-2) ≈	2.0851e-1 (1.56e-2)	2.4359e-1 (6.63e-3) ≈	2.4677e-1 (6.21e-3)
WFG7	3	10	1.9368e-1 (9.05e-3) ≈	1.9405e-1 (6.78e-3)	2.0340e-1 (7.81e-3) ≈	1.9827e-1 (1.07e-2)	1.9790e-1 (6.55e-3) ≈	1.9631e-1 (6.60e-3)
WFG8	3	10	2.6209e-1 (6.98e-3) ≈	2.6552e-1 (9.70e-3)	2.1796e-1 (8.99e-3) ≈	2.1950e-1 (1.00e-2)	2.4331e-1 (1.28e-2) ≈	2.4130e-1 (1.21e-2)
WFG9	3	10	2.3476e-1 (1.72e-2) ≈	2.3239e-1 (2.74e-2)	2.2318e-1 (2.15e-2) +	2.3733e-1 (2.40e-2)	2.0472e-1 (2.17e-2) ≈	2.1002e-1 (2.14e-2)
$+/-/\approx$			1/1/14		2/0/14		0/0/16	
Problem	M	D	CSEA-LHS	CSEA-random	MCEA/D-LHS	MCEA/D-random	DFC-SMS-EMOA-LHS	DFC-SMS-EMOA-random
DTLZ1	3	10	9.3414e+1 (2.86e+1) ≈	9.9692e+1 (2.40e+1)	1.1055e+2 (3.18e+1) ≈	1.0436e+2 (3.94e+1)	1.4894e+2 (4.41e+1) ≈	1.4546e+2 (2.73e+1)
DTLZ2	3	10	2.1554e-1 (1.88e-2) ≈	2.1747e-1 (1.95e-2)	1.9222e-1 (2.90e-2) ≈	2.0630e-1 (2.78e-2)	2.1291e-1 (2.69e-2) ≈	2.1710e-1 (2.24e-2)
DTLZ3	3	10	1.3527e+2 (3.15e+1) ≈	1.3046e+2 (2.61e+1)	1.1235e+2 (5.64e+1) ≈	1.2762e+2 (4.64e+1)	1.7638e+2 (3.91e+1) ≈	1.9573e+2 (4.46e+1)
DTLZ4	3	10	4.8188e-1 (1.71e-1) ≈	4.6518e-1 (1.70e-1)	7.5071e-1 (1.87e-1) ≈	7.7508e-1 (1.60e-1)	5.3027e-1 (1.97e-1) ≈	6.3947e-1 (2.44e-1)
DTLZ5	3	10	1.3098e-1 (3.63e-2) ≈	1.1853e-1 (2.99e-2)	7.5301e-2 (2.07e-2) ≈	7.6663e-2 (2.27e-2)	1.4245e-1 (3.94e-2) ≈	1.4360e-1 (3.26e-2)
DTLZ6	3	10	5.6853e+0 (7.64e-1) ≈	5.5077e+0 (7.56e-1)	2.5536e+0 (8.38e-1) ≈	2.6018e+0 (6.94e-1)	6.0056e+0 (4.62e-1) ≈	6.0219e+0 (5.76e-1)
DTLZ7	3	10	7.3741e-1 (2.22e-1) ≈	7.4879e-1 (2.35e-1)	9.3401e-1 (2.65e-1) ≈	9.1956e-1 (3.32e-1)	1.0842e+0 (1.85e-1) ≈	1.0095e+0 (2.83e-1)
WFG1	3	10	6.2564e-1 (3.65e-2) ≈	6.3555e-1 (5.00e-2)	8.2699e-1 (1.79e-2) ≈	8.2528e-1 (2.14e-2)	7.8395e-1 (5.50e-2) +	8.3367e-1 (7.49e-2)
WFG2	3	10	1.7087e-1 (1.92e-2) ≈	1.7189e-1 (1.72e-2)	1.9112e-1 (2.79e-2) ≈	1.9422e-1 (2.35e-2)	1.7731e-1 (2.47e-2) ≈	1.8488e-1 (2.41e-2)
WFG3	3	10	2.5082e-1 (3.07e-2) ≈	2.5228e-1 (3.01e-2)	2.2378e-1 (4.14e-2) ≈	2.3151e-1 (3.82e-2)	2.1650e-1 (3.04e-2) ≈	2.1735e-1 (2.40e-2)
WFG4	3	10	1.2825e-1 (1.16e-2) ≈	1.2452e-1 (1.16e-2)	1.4602e-1 (1.25e-2) ≈	1.4275e-1 (1.01e-2)	1.1992e-1 (1.05e-2) ≈	1.2717e-1 (1.30e-2)
WFG5	3	10	1.2641e-1 (1.22e-2) ≈	1.2491e-1 (1.06e-2)	1.2647e-1 (1.34e-2) ≈	1.3299e-1 (1.91e-2)	1.6468e-1 (7.91e-3) +	1.7533e-1 (1.38e-2)
WFG6	3	10	1.9611e-1 (1.50e-2) ≈	1.9039e-1 (1.45e-2)	2.0892e-1 (1.20e-2) ≈	2.0898e-1 (1.24e-2)	1.9760e-1 (1.46e-2) ≈	2.0047e-1 (1.90e-2)
WFG7	3	10	1.6274e-1 (8.92e-3) ≈	1.6171e-1 (1.13e-2)	1.5128e-1 (1.07e-2) +	1.6452e-1 (1.30e-2)	1.5252e-1 (9.17e-3) ≈	1.5172e-1 (1.23e-2)
WFG8	3	10	2.2366e-1 (2.08e-2) ≈	2.2278e-1 (2.02e-2)	2.4433e-1 (1.44e-2) ≈	2.4179e-1 (2.30e-2)	2.1949e-1 (1.54e-2) ≈	2.2023e-1 (1.86e-2)
WFG9	3	10	1.8601e-1 (2.41e-2) ≈	1.9702e-1 (2.78e-2)	1.7061e-1 (2.55e-2) ≈	1.7283e-1 (2.24e-2)	1.6235e-1 (2.11e-2) ≈	1.7072e-1 (2.30e-2)
$+/-/\approx$			0/0/16		1/0/15		2/0/14	

TABLE S2

THE $mean(std)$ IGD VALUES OF MOEA/D-EGO WITH DIFFERENT INITIALIZATION METHODS WHEN THE NUMBER OF INITIAL SOLUTIONS IS $11d-1$.

Problem	M	D	MOEA/D-EGO-random	MOEA/D-EGO-LHSmax	MOEA/D-EGO-Sobol	MOEA/D-EGO-OBL	MOEA/D-EGO-LHS
DTLZ1	3	10	1.5931e+2 (3.29e+1) ≈	1.6290e+2 (2.12e+1) ≈	4.1672e-1 (1.14e-16) +	1.7231e+2 (2.05e+1) ≈	1.7170e+2 (3.95e+1)
DTLZ2	3	10	3.2168e-1 (2.42e-2) ≈	3.3716e-1 (2.28e-2) ≈	3.5296e-1 (1.91e-2) −	3.2985e-1 (2.79e-2) ≈	3.3145e-1 (2.69e-2)
DTLZ3	3	10	2.0740e+2 (2.88e+1) ≈	1.9044e+2 (1.16e+1) ≈	5.6205e-1 (0.00e+0) +	2.0216e+2 (1.86e+1) ≈	1.9679e+2 (2.12e+1)
DTLZ4	3	10	6.4940e-1 (9.19e-2) ≈	6.2677e-1 (8.44e-2) ≈	6.5475e-1 (6.97e-2) ≈	6.4224e-1 (7.30e-2) ≈	6.2757e-1 (6.38e-2)
DTLZ5	3	10	3.2335e-1 (4.37e-2) ≈	3.1664e-1 (4.33e-2) ≈	2.7186e-1 (2.59e-2) +	3.3144e-1 (5.14e-2) ≈	3.3433e-1 (4.86e-2)
DTLZ6	3	10	2.1658e+0 (7.15e-1) ≈	2.2306e+0 (9.38e-1) ≈	7.8385e-1 (1.18e-1) +	2.2986e+0 (7.82e-1) ≈	2.4845e+0 (7.26e-1)
DTLZ7	3	10	1.9386e-1 (9.77e-2) ≈	1.8169e-1 (8.12e-2) ≈	1.9470e-1 (8.04e-2) ≈	1.6820e-1 (7.35e-2) ≈	1.6368e-1 (5.51e-2)
WFG1	3	10	8.7119e-1 (5.90e-2) ≈	8.5251e-1 (5.26e-2) ≈	7.9486e-1 (2.66e-2) +	8.9561e-1 (6.08e-2) ≈	8.6936e-1 (6.67e-2)
WFG2	3	10	2.1934e-1 (1.68e-2) ≈	2.1992e-1 (1.30e-2) ≈	2.2775e-1 (1.24e-2) ≈	2.1706e-1 (1.90e-2) ≈	2.2665e-1 (1.30e-2)
WFG3	3	10	2.9843e-1 (1.85e-2) ≈	2.9004e-1 (2.27e-2) ≈	2.5641e-1 (1.38e-2) +	2.9529e-1 (2.62e-2) ≈	2.9572e-1 (1.98e-2)
WFG4	3	10	1.5287e-1 (9.92e-3) ≈	1.5481e-1 (5.17e-3) ≈	1.5600e-1 (5.21e-3) ≈	1.5747e-1 (8.35e-3) ≈	1.5440e-1 (3.97e-3)
WFG5	3	10	1.5679e-1 (8.24e-3) ≈	1.5516e-1 (9.04e-3) ≈	1.5628e-1 (9.88e-3) ≈	1.5740e-1 (7.95e-3) ≈	1.5608e-1 (8.63e-3)
WFG6	3	10	2.1396e-1 (1.29e-2) ≈	2.1559e-1 (1.03e-2) ≈	2.0440e-1 (8.63e-3) +	2.1682e-1 (1.08e-2) ≈	2.1414e-1 (8.52e-3)
WFG7	3	10	1.8731e-1 (6.38e-3) ≈	1.8520e-1 (5.27e-3) +	1.8456e-1 (4.53e-3) +	1.8670e-1 (4.96e-3) ≈	1.8979e-1 (5.23e-3)
WFG8	3	10	2.4856e-1 (1.08e-2) ≈	2.4887e-1 (9.52e-3) ≈	2.4941e-1 (5.24e-3) ≈	2.4809e-1 (9.04e-3) ≈	2.5283e-1 (1.01e-2)
WFG9	3	10	2.2583e-1 (1.70e-2) ≈	2.1968e-1 (1.98e-2) ≈	2.0357e-1 (1.32e-2) +	2.2445e-1 (1.70e-2) ≈	2.2651e-1 (1.41e-2)
$+/-/\approx$			0/0/16	1/0/15	9/1/6	0/0/16	

TABLE S3
THE $mean(std)$ IGD VALUES OF K-RVEA WITH DIFFERENT INITIALIZATION METHODS WHEN THE NUMBER OF INITIAL SOLUTIONS IS $11d-1$.

Problem	M	D	K-RVEA-random	K-RVEA-LHSmax	K-RVEA-Sobol	K-RVEA-OBL	K-RVEA-LHS
DTLZ1	3	10	1.6499e+2 (3.84e+1) ≈	1.6592e+2 (2.99e+1) ≈	4.1672e-1 (1.14e-16) +	1.6190e+2 (3.14e+1) ≈	1.7478e+2 (3.90e+1)
DTLZ2	3	10	1.4351e-1 (3.47e-2) ≈	1.4605e-1 (2.33e-2) ≈	1.4622e-1 (3.05e-2) ≈	1.4473e-1 (2.33e-2) ≈	1.5677e-1 (2.71e-2)
DTLZ3	3	10	2.1780e+2 (4.22e+1) ≈	2.1224e+2 (4.36e+1) ≈	5.6205e-1 (0.00e+0) +	2.3400e+2 (4.72e+1) ≈	2.1631e+2 (3.68e+1)
DTLZ4	3	10	3.7859e-1 (8.11e-2) ≈	4.2004e-1 (9.73e-2) ≈	2.9254e-1 (8.95e-2) +	3.8366e-1 (8.99e-2) ≈	4.0708e-1 (9.31e-2)
DTLZ5	3	10	9.7750e-2 (2.65e-2) ≈	1.0240e-1 (3.30e-2) ≈	9.2691e-2 (1.93e-2) ≈	9.0452e-2 (2.56e-2) ≈	9.7996e-2 (2.56e-2)
DTLZ6	3	10	3.1184e+0 (6.08e-1) ≈	3.1622e+0 (4.35e-1) ≈	7.2611e-1 (1.45e-1) +	3.1555e+0 (4.41e-1) ≈	3.0742e+0 (4.81e-1)
DTLZ7	3	10	8.5212e-2 (1.34e-2) ≈	8.0942e-2 (1.04e-2) ≈	7.3576e-2 (1.04e-2) +	8.0404e-2 (7.67e-3) ≈	7.9201e-2 (1.00e-2)
WFG1	3	10	6.7678e-1 (4.53e-2) ≈	6.9434e-1 (3.95e-2) −	6.8508e-1 (3.90e-2) ≈	6.8590e-1 (3.97e-2) −	6.6011e-1 (4.80e-2)
WFG2	3	10	1.4136e-1 (3.02e-2) ≈	1.3533e-1 (3.06e-2) ≈	1.3114e-1 (2.96e-2) ≈	1.3906e-1 (3.00e-2) ≈	1.3068e-1 (2.68e-2)
WFG3	3	10	1.9915e-1 (3.66e-2) ≈	1.9549e-1 (3.13e-2) ≈	1.7180e-1 (1.84e-2) ≈	1.8888e-1 (4.14e-2) ≈	1.8915e-1 (3.83e-2)
WFG4	3	10	1.4180e-1 (6.38e-3) ≈	1.4168e-1 (5.97e-3) ≈	1.4892e-1 (8.90e-3) −	1.3791e-1 (7.54e-3) +	1.4366e-1 (6.29e-3)
WFG5	3	10	9.4900e-2 (9.47e-3) ≈	9.4575e-2 (1.10e-2) ≈	1.0009e-1 (8.71e-3) ≈	9.3618e-2 (1.05e-2) ≈	9.5690e-2 (9.37e-3)
WFG6	3	10	2.1201e-1 (1.27e-2) ≈	2.1955e-1 (8.55e-3) ≈	2.0918e-1 (1.40e-2) ≈	2.1084e-1 (1.36e-2) ≈	2.1628e-1 (7.27e-3)
WFG7	3	10	1.8150e-1 (8.88e-3) ≈	1.8033e-1 (7.38e-3) +	1.8699e-1 (6.34e-3) ≈	1.8367e-1 (9.19e-3) ≈	1.8453e-1 (6.39e-3)
WFG8	3	10	2.1019e-1 (7.52e-3) ≈	2.1241e-1 (1.23e-2) ≈	2.1547e-1 (6.09e-3) ≈	2.1052e-1 (1.10e-2) ≈	2.1067e-1 (1.05e-2)
WFG9	3	10	1.9741e-1 (2.11e-2) ≈	1.9948e-1 (2.45e-2) ≈	2.0897e-1 (1.72e-2) ≈	2.0816e-1 (2.29e-2) ≈	2.0105e-1 (1.96e-2)
$+/-/\approx$			0/0/16	1/1/14	5/1/10	1/1/14	

TABLE S4
THE $mean(std)$ IGD VALUES OF CSEA WITH DIFFERENT INITIALIZATION METHODS WHEN THE NUMBER OF INITIAL SOLUTIONS IS $11d-1$.

Problem	M	D	CSEA-random	CSEA-LHSmax	CSEA-Sobol	CSEA-OBL	CSEA-LHS
DTLZ1	3	10	1.1829e+2 (2.33e+1) ≈	9.9460e+1 (2.98e+1) ≈	4.1580e-1 (3.10e-3) +	1.1430e+2 (3.53e+1) ≈	1.1134e+2 (3.76e+1)
DTLZ2	3	10	2.2881e-1 (3.42e-2) ≈	2.2742e-1 (2.78e-2) ≈	2.2561e-1 (4.41e-2) ≈	2.3063e-1 (3.37e-2) ≈	2.2791e-1 (3.15e-2)
DTLZ3	3	10	1.4775e+2 (4.36e+1) ≈	1.4904e+2 (3.94e+1) ≈	5.5978e-1 (9.85e-3) +	1.6052e+2 (3.64e+1) ≈	1.4681e+2 (3.92e+1)
DTLZ4	3	10	4.5935e-1 (1.66e-1) ≈	3.6779e-1 (1.23e-1)≈	-	-	3.8930e-1 (1.21e-1)
DTLZ5	3	10	1.5331e-1 (3.81e-2) ≈	1.5351e-1 (4.55e-2) ≈	1.0998e-1 (3.68e-2) +	1.6095e-1 (3.94e-2) ≈	1.5189e-1 (2.86e-2)
DTLZ6	3	10	6.0515e+0 (4.94e-1) ≈	5.9186e+0 (7.61e-1) ≈	3.3752e-1 (1.85e-1) +	6.1371e+0 (8.19e-1) ≈	6.0482e+0 (6.11e-1)
DTLZ7	3	10	7.4885e-1 (2.96e-1) ≈	7.0926e-1 (2.13e-1) ≈	4.4306e-1 (1.61e-1) +	7.4576e-1 (1.93e-1) ≈	7.2587e-1 (2.17e-1)
WFG1	3	10	6.6501e-1 (5.48e-2) ≈	6.5500e-1 (5.58e-2) ≈	6.3712e-1 (4.63e-2) +	6.7970e-1 (6.50e-2) ≈	6.6952e-1 (3.52e-2)
WFG2	3	10	1.8469e-1 (2.02e-2) −	1.6638e-1 (2.15e-2) ≈	1.6747e-1 (1.27e-2) ≈	1.7858e-1 (1.73e-2) ≈	1.7167e-1 (1.88e-2)
WFG3	3	10	2.4738e-1 (2.01e-2) ≈	2.5826e-1 (2.17e-2) ≈	2.2153e-1 (2.02e-2) +	2.6144e-1 (2.06e-2) ≈	2.5575e-1 (1.92e-2)
WFG4	3	10	1.3246e-1 (1.04e-2) ≈	1.3618e-1 (1.11e-2) ≈	1.2619e-1 (5.72e-3) +	1.3449e-1 (8.91e-3) ≈	1.3339e-1 (7.96e-3)
WFG5	3	10	1.3400e-1 (1.14e-2) ≈	1.4020e-1 (1.18e-2) ≈	1.3417e-1 (1.08e-2) ≈	1.3081e-1 (1.02e-2) +	1.3866e-1 (1.13e-2)
WFG6	3	10	2.1245e-1 (1.44e-2) −	2.0453e-1 (1.18e-2) ≈	2.0373e-1 (1.04e-2) ≈	2.0826e-1 (8.57e-3) ≈	2.0191e-1 (1.18e-2)
WFG7	3	10	1.6605e-1 (9.44e-3) ≈	1.7173e-1 (8.55e-3) −	1.6376e-1 (1.02e-2) ≈	1.6371e-1 (9.96e-3) ≈	1.6518e-1 (9.82e-3)
WFG8	3	10	2.3565e-1 (1.32e-2) ≈	2.3549e-1 (1.44e-2) ≈	2.4097e-1 (5.93e-3) ≈	2.3706e-1 (1.25e-2) ≈	2.3651e-1 (1.03e-2)
WFG9	3	10	1.9751e-1 (2.49e-2) ≈	1.9805e-1 (1.97e-2) ≈	1.8074e-1 (1.97e-2) ≈	1.8693e-1 (2.29e-2) ≈	1.9332e-1 (3.11e-2)
$+/-/\approx$			0/2/14	0/1/15	8/0/7	1/0/14	

TABLE S5
THE $mean(std)$ IGD VALUES OF MCEA/D WITH DIFFERENT INITIALIZATION METHODS WHEN THE NUMBER OF INITIAL SOLUTIONS IS $11d-1$.

Problem	M	D	MCEA/D-random	MCEA/D-LHSmax	MCEA/D-Sobol	MCEA/D-OBL	MCEA/D-LHS
DTLZ1	3	10	1.2230e+2 (4.21e+1) ≈	1.1855e+2 (4.57e+1) ≈	4.1167e-1 (1.02e-2) +	1.2228e+2 (3.45e+1) +	1.3901e+2 (4.37e+1)
DTLZ2	3	10	2.2239e-1 (3.79e-2) ≈	2.1954e-1 (2.86e-2) ≈	2.1146e-1 (2.19e-2) ≈	2.1420e-1 (2.44e-2) ≈	2.1922e-1 (3.12e-2)
DTLZ3	3	10	1.4043e+2 (5.51e+1) ≈	1.3829e+2 (5.42e+1) ≈	5.5862e-1 (1.38e-2) +	1.6167e+2 (3.02e+1) ≈	1.5813e+2 (2.50e+1)
DTLZ4	3	10	6.3977e-1 (1.76e-1) ≈	7.0455e-1 (1.65e-1) ≈	9.1252e-1 (7.15e-2) −	7.2464e-1 (1.23e-1) ≈	7.0096e-1 (1.64e-1)
DTLZ5	3	10	9.8916e-2 (2.57e-2) ≈	9.3807e-2 (2.07e-2) ≈	9.1400e-2 (1.92e-2) ≈	1.0317e-1 (2.14e-2) ≈	9.9108e-2 (2.51e-2)
DTLZ6	3	10	2.9853e+0 (7.34e-1) ≈	3.0272e+0 (8.34e-1) ≈	5.4656e-1 (2.97e-1) +	3.0083e+0 (9.60e-1) ≈	2.9375e+0 (9.67e-1)
DTLZ7	3	10	9.5360e-1 (3.02e-1) ≈	1.0127e+0 (3.69e-1) ≈	5.8390e-1 (8.27e-2) +	1.1368e+0 (3.72e-1) −	9.4096e-1 (3.30e-1)
WFG1	3	10	8.4161e-1 (2.46e-2) ≈	8.4180e-1 (1.81e-2) ≈	8.4218e-1 (1.69e-2) ≈	8.3679e-1 (2.17e-2) ≈	8.3935e-1 (2.14e-2)
WFG2	3	10	1.9997e-1 (2.15e-2) ≈	2.0400e-1 (1.61e-2) ≈	2.0311e-1 (2.18e-2) ≈	2.0927e-1 (2.30e-2) ≈	2.0961e-1 (2.72e-2)
WFG3	3	10	2.3914e-1 (2.89e-2) ≈	2.4004e-1 (2.92e-2) ≈	2.3185e-1 (2.53e-2) ≈	2.3706e-1 (3.64e-2) ≈	2.2948e-1 (3.03e-2)
WFG4	3	10	1.4930e-1 (1.09e-2) ≈	1.4314e-1 (7.21e-3) +	1.5017e-1 (9.91e-3) ≈	1.4565e-1 (1.06e-2) ≈	1.4839e-1 (1.03e-2)
WFG5	3	10	1.4835e-1 (1.54e-2) ≈	1.4241e-1 (1.82e-2) ≈	1.3473e-1 (1.18e-2) ≈	1.3706e-1 (1.41e-2) ≈	1.4212e-1 (1.60e-2)
WFG6	3	10	2.0809e-1 (1.27e-2) ≈	2.1009e-1 (1.24e-2) ≈	2.0588e-1 (1.12e-2) ≈	2.1097e-1 (1.34e-2) ≈	2.0560e-1 (1.15e-2)
WFG7	3	10	1.6149e-1 (1.05e-2) ≈	1.6032e-1 (1.20e-2) ≈	1.5707e-1 (8.10e-3) ≈	1.6006e-1 (1.21e-2) ≈	1.5818e-1 (8.95e-3)
WFG8	3	10	2.3917e-1 (1.62e-2) +	2.4344e-1 (1.40e-2) ≈	2.5230e-1 (9.23e-3) ≈	2.4302e-1 (1.34e-2) ≈	2.5020e-1 (1.55e-2)
WFG9	3	10	1.7493e-1 (1.28e-2) ≈	1.7098e-1 (2.49e-2) ≈	1.6443e-1 (1.37e-2) +	1.7127e-1 (1.95e-2) ≈	1.7943e-1 (1.81e-2)
+/ − / ≈			1/0/15	1/0/15	5/1/10	1/1/14	

TABLE S6
THE $mean$ IGD VALUES OF MOEA/D-EGO WITH $20, 40, 60, 80, 100, 11d-1(109), 120, 140, 160, 180, 200, 220, 240, 260, 280, 300$ INITIAL SOLUTIONS WHEN $d=10$ AND THE MAXIMUM NUMBER OF FUNCTION EVALUATIONS IS 300.

Problem	20	40	60	80	100	$11d-1$	120	140	160	180	200	220	240	260	280	300
DTLZ1	1.3966e+2[1]	1.4615e+2[2]	1.6023e+2[3]	1.6743e+2[5]	1.7049e+2[6]	1.7170e+2[7]	1.8095e+2[12]	1.7655e+2[10]	1.6126e+2[4]	1.7324e+2[9]	1.8508e+2[13]	1.8016e+2[11]	1.8987e+2[14]	1.7221e+2[8]	2.1398e+2[15]	2.2402e+2[16]
DTLZ2	4.0405e-1[16]	3.5776e-1[15]	3.4102e-1[14]	3.3134e-1[8]	3.3724e-1[12]	3.3145e-1[9]	3.3108e-1[7]	3.3179e-1[10]	3.1728e-1[1]	3.2082e-1[2]	3.2498e-1[4]	3.2534e-1[5]	3.2586e-1[6]	3.2374e-1[3]	3.3838e-1[13]	3.3349e-1[11]
DTLZ3	1.7805e+2[1]	1.8693e+2[2]	1.9062e+2[3]	1.9336e+2[4]	2.0738e+2[10]	1.9679e+2[5]	2.0292e+2[7]	2.0031e+2[6]	2.0960e+2[11]	2.0495e+2[8]	2.0502e+2[9]	2.3993e+2[12]	2.4631e+2[13]	2.5637e+2[14]	2.8147e+2[15]	3.2785e+2[16]
DTLZ4	6.5602e-1[16]	6.5383e-1[15]	6.3748e-1[13]	6.0446e-1[2]	6.1912e-1[6]	6.2757e-1[9]	6.1740e-1[4]	6.3282e-1[10]	6.2583e-1[8]	6.1790e-1[5]	6.1682e-1[3]	5.9380e-1[1]	6.2345e-1[7]	6.3406e-1[11]	6.3459e-1[12]	6.4586e-1[14]
DTLZ5	3.9690e-1[16]	3.5763e-1[15]	3.4961e-1[14]	3.2303e-1[11]	3.3037e-1[12]	3.3433e-1[13]	3.1135e-1[6]	3.1736e-1[10]	3.1597e-1[7]	3.1630e-1[8]	3.0296e-1[5]	3.1710e-1[9]	2.9859e-1[3]	2.8779e-1[2]	2.7990e-1[1]	3.0101e-1[4]
DTLZ6	2.4143e+0[5]	2.5171e+0[9]	2.2300e+0[2]	2.2492e+0[3]	2.4615e+0[6]	2.4845e+0[7]	2.3524e+0[4]	2.5477e+0[10]	2.1845e+0[1]	2.6026e+0[11]	2.5125e+0[8]	2.6411e+0[12]	3.0055e+0[13]	3.3991e+0[14]	3.8681e+0[15]	7.0255e+0[16]
DTLZ7	1.1677e+0[15]	4.0136e-1[12]	1.8351e-1[5]	1.3887e-1[1]	1.4974e-1[2]	1.6368e-1[4]	1.6011e-1[3]	1.8571e-1[6]	2.0351e-1[7]	2.4550e-1[9]	2.2552e-1[8]	2.9664e-1[11]	2.8050e-1[10]	4.3025e-1[13]	8.5429e-1[14]	1.8080e+0[16]
mean rank	10.00	10.00	7.71	4.86	7.71	7.71	6.14	8.86	5.57	7.43	7.14	8.71	9.43	9.29	12.14	13.29
WFG1	8.2925e-1[1]	8.4969e-1[3]	8.5341e-1[4]	8.7972e-1[8]	8.4911e-1[2]	8.6936e-1[6]	8.7401e-1[7]	8.6610e-1[5]	9.0264e-1[10]	9.0819e-1[14]	8.9621e-1[9]	9.1040e-1[15]	9.0440e-1[12]	9.0811e-1[13]	9.0426e-1[11]	1.0588e+0[16]
WFG2	2.6280e-1[16]	2.4162e-1[14]	2.3191e-1[11]	2.1697e-1[2]	2.1591e-1[1]	2.2665e-1[8]	2.1937e-1[3]	2.2621e-1[7]	2.2161e-1[4]	2.2281e-1[5]	2.2903e-1[9]	2.2952e-1[10]	2.2502e-1[6]	2.3917e-1[12]	2.4066e-1[13]	2.4858e-1[15]
WFG3	3.5031e-1[16]	3.1548e-1[15]	3.0053e-1[14]	2.9435e-1[11]	2.9644e-1[13]	2.9572e-1[12]	2.9053e-1[9]	2.8165e-1[3]	2.8115e-1[2]	2.8789e-1[8]	2.8773e-1[7]	2.9412e-1[10]	2.8615e-1[5]	2.8244e-1[4]	2.8744e-1[6]	2.7882e-1[1]
WFG4	1.7567e-1[16]	1.6862e-1[15]	1.5913e-1[11]	1.5738e-1[10]	1.5476e-1[7]	1.5440e-1[4]	1.5357e-1[2]	1.5430e-1[3]	1.5086e-1[1]	1.5449e-1[6]	1.5447e-1[5]	1.5611e-1[8]	1.5696e-1[9]	1.6020e-1[12]	1.6054e-1[13]	1.6515e-1[14]
WFG5	1.5852e-1[5]	1.5533e-1[2]	1.5840e-1[4]	1.5519e-1[1]	1.5978e-1[7]	1.5608e-1[3]	1.5896e-1[6]	1.6035e-1[8]	1.6180e-1[9]	1.6705e-1[10]	1.7148e-1[11]	1.7484e-1[12]	1.7934e-1[13]	1.8672e-1[14]	1.9491e-1[15]	2.1768e-1[16]
WFG6	2.4298e-1[15]	2.3011e-1[13]	2.2133e-1[10]	2.2000e-1[9]	2.1422e-1[4]	2.1414e-1[3]	2.1310e-1[2]	2.1534e-1[7]	2.1434e-1[5]	2.1214e-1[1]	2.1435e-1[6]	2.1984e-1[8]	2.2224e-1[11]	2.2864e-1[12]	2.3522e-1[14]	2.4354e-1[16]
WFG7	2.0972e-1[16]	1.9623e-1[15]	1.9280e-1[14]	1.8845e-1[12]	1.8509e-1[6]	1.8979e-1[13]	1.8767e-1[11]	1.8588e-1[8]	1.8493e-1[5]	1.8340e-1[1]	1.8423e-1[3]	1.8462e-1[4]	1.8376e-1[2]	1.8514e-1[7]	1.8677e-1[10]	1.8639e-1[9]
WFG8	2.8183e-1[16]	2.6499e-1[15]	2.6159e-1[14]	2.5326e-1[12]	2.4910e-1[8]	2.5283e-1[11]	2.4868e-1[7]	2.4686e-1[2]	2.4854e-1[5]	2.4741e-1[4]	2.4428e-1[1]	2.4727e-1[3]	2.4857e-1[6]	2.4962e-1[9]	2.5182e-1[10]	2.5466e-1[13]
WFG9	2.4812e-1[16]	2.3025e-1[14]	2.2773e-1[12]	2.1928e-1[3]	2.2641e-1[9]	2.2651e-1[10]	2.1589e-1[1]	2.1959e-1[4]	2.2334e-1[6]	2.2656e-1[11]	2.2293e-1[5]	2.1813e-1[2]	2.2469e-1[7]	2.2492e-1[8]	2.2929e-1[13]	2.3591e-1[15]
mean rank	13.00	11.78	10.44	7.56	6.33	7.78	5.33	5.22	5.22	6.67	6.22	8.00	7.89	10.11	11.67	12.78

TABLE S7
THE $mean$ IGD VALUES OF K-RVEA WITH $20, 40, 60, 80, 100, 11d-1(109), 120, 140, 160, 180, 200, 220, 240, 260, 280, 300$ INITIAL SOLUTIONS WHEN $d=10$ AND THE MAXIMUM NUMBER OF FUNCTION EVALUATIONS IS 300.

Problem	20	40	60	80	100	$11d-1$	120	140	160	180	200	220	240	260	280	300
DTLZ1	1.7122e+2[6]	1.6668e+2[2]	1.6531e+2[1]	1.6944e+2[5]	1.6943e+2[4]	1.7478e+2[7]	1.7524e+2[8]	1.7604e+2[9]	1.7696e+2[10]	1.6779e+2[3]	1.9275e+2[12]	1.8551e+2[11]	1.9886e+2[13]	2.0700e+2[14]	2.2206e+2[16]	2.1442e+2[15]
DTLZ2	4.8532e-1[16]	3.2671e-1[15]	2.6749e-1[13]	2.2647e-1[11]	1.7996e-1[10]	1.5677e-1[8]	1.4260e-1[6]	1.3410e-1[4]	1.2472e-1[2]	1.2166e-1[1]	1.3390e-1[3]	1.4151e-1[5]	1.4897e-1[7]	1.7666e-1[9]	2.5333e-1[12]	3.2470e-1[14]
DTLZ3	2.3237e+2[11]	2.1362e+2[3]	2.0739e+2[1]	2.1181e+2[2]	2.2321e+2[8]	2.1631e+2[5]	2.1595e+2[4]	2.2216e+2[7]	2.2913e+2[10]	2.2726e+2[9]	2.1996e+2[6]	2.5248e+2[12]	2.6324e+2[13]	3.0451e+2[15]	2.8328e+2[14]	3.2413e+2[16]
DTLZ4	7.1474e-1[16]	5.3151e-1[12]	4.5552e-1[8]	4.2262e-1[4]	4.5549e-1[7]	4.0708e-1[1]	4.0941e-1[2]	4.6654e-1[9]	4.3118e-1[5]	4.2193e-1[3]	4.4931e-1[6]	4.7601e-1[10]	5.0479e-1[11]	5.5900e-1[13]	6.2644e-1[14]	6.6321e-1[15]
DTLZ5	4.7686e-1[16]	2.6914e-1[14]	1.8734e-1[13]	1.2593e-1[11]	1.1851e-1[9]	9.7996e-2[7]	9.5443e-2[6]	8.0382e-2[1]	9.1223e-2[5]	8.4274e-2[2]	8.7345e-2[3]	9.0564e-2[4]	1.0440e-1[8]	1.2258e-1[10]	1.5504e-1[12]	3.0678e-1[15]
DTLZ6	4.4458e+0[14]	3.4606e+0[8]	3.0986e+0[5]	3.0666e+0[2]	3.0669e+0[3]	3.0742e+0[4]	2.9050e+0[1]	3.1155e+0[6]	3.1441e+0[7]	3.6139e+0[9]	3.7326e+0[11]	3.7700e+0[12]	3.7060e+0[10]	4.2987e+0[13]	5.3095e+0[15]	7.0231e+0[16]
DTLZ7	8.3488e-2[6]	7.9521e-2[3]	7.9610e-2[4]	7.8449e-2[1]	8.0392e-2[5]	7.9201e-2[2]	8.4461e-2[7]	8.7169e-2[8]	9.3651e-2[9]	9.7318e-2[10]	1.1079e-1[11]	1.1261e-1[12]	1.3894e-1[13]	1.6332e-1[14]	2.9900e-1[15]	1.9064e+0[16]
mean rank	12.14	8.14	6.43	5.14	6.57	4.86	4.86	6.29	6.86	5.29	7.43	9.43	10.71	12.57	14.00	15.29
WFG1	7.3000e-1[10]	6.9456e-1[5]	7.0604e-1[7]	6.9996e-1[6]	6.8368e-1[3]	6.6011e-1[1]	6.7150e-1[2]	7.1754e-1[8]	6.8590e-1[4]	7.1817e-1[9]	7.6867e-1[12]	7.6085e-1[11]	7.8975e-1[13]	8.1587e-1[14]	8.8598e-1[15]	1.0499e+0[16]
WFG2	2.8004e-1[16]	2.2399e-1[14]	1.8602e-1[12]	1.5833e-1[10]	1.2721e-1[1]	1.3068e-1[2]	1.3877e-1[6]	1.3143e-1[3]	1.3223e-1[4]	1.3429e-1[5]	1.4175e-1[7]	1.5266e-1[8]	1.5301e-1[9]	1.8160e-1[11]	2.2260e-1[13]	2.4846e-1[15]
WFG3	3.3634e-1[16]	2.6936e-1[14]	2.3899e-1[12]	2.1187e-1[9]	2.0055e-1[7]	1.8915e-1[2]	1.8974e-1[3]	1.8650e-1[1]	2.0086e-1[8]	1.9492e-1[4]	1.9768e-1[5]	1.9811e-1[6]	2.2407e-1[10]	2.2922e-1[11]	2.6600e-1[13]	2.8494e-1[15]
WFG4	1.9642e-1[16]	1.6594e-1[14]	1.5425e-1[13]	1.4711e-1[10]	1.4633e-1[9]	1.4366e-1[6]	1.4269e-1[4]	1.4247e-1[3]	1.4203e-1[1]	1.4314e-1[5]	1.4243e-1[2]	1.4465e-1[8]	1.4391e-1[7]	1.4850e-1[11]	1.5336e-1[12]	1.6715e-1[15]
WFG5	1.0534e-1[9]	1.0191e-1[8]	9.7913e-2[5]	9.4787e-2[2]	9.4592e-2[1]	9.5690e-2[3]	9.6387e-2[4]	9.8893e-2[6]	9.9733e-2[7]	1.0716e-1[10]	1.1712e-1[11]	1.1848e-1[12]	1.3384e-1[13]	1.5010e-1[14]	1.7392e-1[15]	2.1681e-1[16]
WFG6	1.9000e-1[1]	2.0341e-1[2]	2.0825e-1[3]	2.0965e-1[4]	2.1117e-1[5]	2.1628e-1[7]	2.2066e-1[11]	2.1458e-1[6]	2.1663e-1[8]	2.1711e-1[9]	2.1906e-1[10]	2.2071e-1[12]	2.2540e-1[13]	2.2676e-1[14]	2.3346e-1[15]	2.4454e-1[16]
WFG7	2.3417e-1[16]	2.0850e-1[15]	1.9573e-1[14]	1.9128e-1[13]	1.8544e-1[11]	1.8453e-1[10]	1.8403e-1[8]	1.8304e-1[6]	1.8242e-1[3]	1.8105e-1[2]	1.8261e-1[4]	1.8055e-1[1]	1.8411e-1[9]	1.8280e-1[5]	1.8401e-1[7]	1.8952e-1[12]
WFG8	2.3068e-1[14]	2.2410e-1[12]	2.1500e-1[7]	2.1247e-1[6]	2.1139e-1[5]	2.1067e-1[4]	2.0907e-1[3]	2.0900e-1[2]	2.1522e-1[8]	2.0718e-1[1]	2.1525e-1[9]	2.1751e-1[10]	2.2290e-1[11]	2.2728e-1[13]	2.3751e-1[15]	2.5192e-1[16]
WFG9	2.6054e-1[16]	2.3479e-1[14]	2.1738e-1[11]	2.0202e-1[4]	2.0481e-1[5]	2.0105e-1[3]	1.9996e-1[2]	2.0672e-1[7]	1.9757e-1[1]	2.0727e-1[8]	2.0933e-1[9]	2.0662e-1[6]	2.1582e-1[10]	2.2325e-1[12]	2.3015e-1[13]	2.3667e-1[15]
mean rank	12.67	10.89	9.33	7.11	5.22	4.22	4.78	4.67	4.89	5.89	7.67	8.22	10.56	11.67	13.11	15.11

TABLE S8
THE *mean* IGD VALUES OF CSEA WITH $20, 40, 60, 80, 100, 11d-1(109), 120, 140, 160, 180, 200, 220, 240, 260, 280, 300$ INITIAL SOLUTIONS WHEN $d = 10$ AND THE MAXIMUM NUMBER OF FUNCTION EVALUATIONS IS 300.

Problem	20	40	60	80	100	$11d-1$	120	140	160	180	200	220	240	260	280	300
DTLZ1	9.4683e+1[1]	9.4737e+1[2]	1.0069e+2[3]	1.1638e+2[8]	1.0536e+2[4]	1.1134e+2[7]	1.1117e+2[6]	1.1653e+2[9]	1.2921e+2[10]	1.1034e+2[5]	1.4741e+2[11]	1.6608e+2[13]	1.6124e+2[12]	1.8112e+2[14]	1.9421e+2[15]	2.2028e+2[16]
DTLZ2	2.0103e-1[1]	2.2230e-1[4]	2.2054e-1[2]	2.2210e-1[3]	2.3104e-1[6]	2.2791e-1[5]	2.4434e-1[7]	2.4710e-1[9]	2.4469e-1[8]	2.6615e-1[10]	2.7358e-1[11]	2.9349e-1[13]	2.9234e-1[12]	3.0242e-1[14]	3.1686e-1[15]	3.3279e-1[16]
DTLZ3	1.2868e+2[2]	1.1717e+2[1]	1.3064e+2[3]	1.5087e+2[6]	1.4441e+2[4]	1.4681e+2[5]	1.7860e+2[9]	1.5659e+2[7]	1.6962e+2[8]	1.8928e+2[10]	1.9968e+2[11]	2.2610e+2[12]	2.4470e+2[13]	2.6114e+2[14]	2.8458e+2[15]	3.1793e+2[16]
DTLZ4	4.6879e-1[10]	4.6913e-1[11]	4.7482e-1[12]	3.8511e-1[1]	4.1670e-1[7]	3.8930e-1[2]	3.9081e-1[3]	4.0759e-1[6]	4.1856e-1[8]	4.0175e-1[4]	4.0536e-1[5]	4.3836e-1[9]	4.7997e-1[13]	5.3461e-1[14]	5.7848e-1[15]	6.6051e-1[16]
DTLZ5	1.2352e-1[2]	1.1448e-1[1]	1.2835e-1[3]	1.3669e-1[4]	1.5602e-1[6]	1.5189e-1[5]	1.5806e-1[7]	1.7031e-1[8]	1.7943e-1[9]	1.9900e-1[10]	2.1773e-1[11]	2.2801e-1[12]	2.4559e-1[13]	2.5882e-1[14]	2.8019e-1[15]	2.9563e-1[16]
DTLZ6	4.5078e+0[1]	5.0628e+0[2]	5.6316e+0[3]	5.8470e+0[5]	5.7321e+0[4]	6.0482e+0[7]	6.0094e+0[6]	6.2581e+0[8]	6.3362e+0[10]	6.3215e+0[9]	6.5368e+0[11]	6.5985e+0[12]	6.7805e+0[14]	6.7279e+0[13]	6.9288e+0[15]	7.0209e+0[16]
DTLZ7	7.1922e-1[4]	7.3403e-1[6]	7.1753e-1[3]	6.6045e-1[1]	6.7732e-1[2]	7.2587e-1[5]	8.2882e-1[7]	8.9090e-1[8]	9.1230e-1[9]	1.0342e+0[10]	1.0373e+0[11]	1.1585e+0[12]	1.2574e+0[13]	1.3153e+0[14]	1.7040e+0[15]	1.8882e+0[16]
mean rank	3.00	3.86	4.14	4.00	4.71	5.14	6.43	7.86	8.86	8.29	10.14	11.86	12.86	13.86	15.00	16.00
WFG1	6.4499e-1[4]	6.3628e-1[2]	6.4231e-1[3]	6.3026e-1[1]	6.4955e-1[5]	6.6952e-1[8]	6.6714e-1[6]	6.6851e-1[7]	7.2339e-1[9]	7.3617e-1[10]	7.5391e-1[11]	7.7205e-1[12]	8.2956e-1[13]	8.6244e-1[14]	9.3712e-1[15]	1.0730e+0[16]
WFG2	1.5165e-1[1]	1.5693e-1[2]	1.6318e-1[3]	1.6691e-1[4]	1.6736e-1[5]	1.7167e-1[6]	1.7469e-1[7]	1.8361e-1[9]	1.8002e-1[8]	1.9037e-1[10]	1.9921e-1[11]	2.0735e-1[12]	2.0924e-1[13]	2.2148e-1[14]	2.3399e-1[15]	2.4931e-1[16]
WFG3	2.4952e-1[3]	2.6546e-1[11]	2.4456e-1[1]	2.4719e-1[2]	2.5351e-1[5]	2.5575e-1[7]	2.6182e-1[10]	2.6157e-1[9]	2.5364e-1[6]	2.5236e-1[4]	2.6067e-1[8]	2.6561e-1[12]	2.7299e-1[14]	2.6568e-1[13]	2.8144e-1[15]	2.8364e-1[16]
WFG4	1.2491e-1[1]	1.2954e-1[2]	1.3076e-1[3]	1.3222e-1[5]	1.3213e-1[4]	1.3339e-1[6]	1.3712e-1[10]	1.3374e-1[7]	1.3630e-1[8]	1.3663e-1[9]	1.3958e-1[11]	1.4516e-1[13]	1.4453e-1[12]	1.5228e-1[15]	1.5220e-1[14]	1.6585e-1[16]
WFG5	1.2410e-1[1]	1.2719e-1[2]	1.2789e-1[3]	1.2937e-1[4]	1.3142e-1[5]	1.3866e-1[6]	1.4166e-1[8]	1.3970e-1[7]	1.5243e-1[9]	1.5835e-1[10]	1.6428e-1[11]	1.7388e-1[12]	1.8220e-1[13]	1.9404e-1[14]	2.0548e-1[15]	2.1627e-1[16]
WFG6	1.8551e-1[1]	1.9136e-1[2]	2.0140e-1[3]	2.0376e-1[6]	2.0145e-1[4]	2.0191e-1[5]	2.0525e-1[7]	2.0705e-1[8]	2.1334e-1[10]	2.1167e-1[9]	2.1852e-1[11]	2.2275e-1[13]	2.2185e-1[12]	2.2720e-1[14]	2.3167e-1[15]	2.4068e-1[16]
WFG7	1.6281e-1[1]	1.6312e-1[2]	1.6378e-1[4]	1.6480e-1[5]	1.6324e-1[3]	1.6518e-1[6]	1.7086e-1[10]	1.6791e-1[7]	1.6809e-1[8]	1.7029e-1[9]	1.7367e-1[12]	1.7147e-1[11]	1.7832e-1[13]	1.7871e-1[14]	1.8286e-1[15]	1.9056e-1[16]
WFG8	2.2638e-1[2]	2.2035e-1[1]	2.3191e-1[4]	2.3734e-1[7]	2.2784e-1[3]	2.3651e-1[6]	2.3460e-1[5]	2.3962e-1[11]	2.3752e-1[9]	2.3818e-1[10]	2.3743e-1[8]	2.4072e-1[12]	2.4509e-1[13]	2.4674e-1[15]	2.4648e-1[14]	2.5641e-1[16]
WFG9	1.9809e-1[7]	1.9586e-1[5]	1.9426e-1[4]	1.8862e-1[2]	1.9877e-1[8]	1.9332e-1[3]	1.9775e-1[6]	1.8686e-1[1]	1.9913e-1[9]	2.0855e-1[11]	2.0789e-1[10]	2.1797e-1[12]	2.2377e-1[14]	2.1905e-1[13]	2.2736e-1[15]	2.3456e-1[16]
mean rank	2.33	3.22	3.11	4.00	4.67	5.89	7.67	7.33	8.44	9.11	10.33	12.11	13.00	14.00	14.78	16.00

TABLE S9
THE *mean* IGD VALUES OF MCEA/D WITH $20, 40, 60, 80, 100, 11d-1(109), 120, 140, 160, 180, 200, 220, 240, 260, 280, 300$ INITIAL SOLUTIONS WHEN $d = 10$ AND THE MAXIMUM NUMBER OF FUNCTION EVALUATIONS IS 300.

Problem	20	40	60	80	100	$11d-1$	120	140	160	180	200	220	240	260	280	300
DTLZ1	7.5130e+1[1]	1.0451e+2[2]	1.0564e+2[3]	1.1847e+2[4]	1.2821e+2[5]	1.3901e+2[8]	1.3500e+2[7]	1.2972e+2[6]	1.5198e+2[9]	1.5467e+2[10]	1.6107e+2[11]	1.6978e+2[12]	1.8142e+2[13]	1.9496e+2[15]	1.9389e+2[14]	2.1059e+2[16]
DTLZ2	2.7141e-1[12]	1.9751e-1[3]	1.9546e-1[1]	1.9666e-1[2]	2.0100e-1[4]	2.1922e-1[6]	2.1908e-1[5]	2.2909e-1[8]	2.2645e-1[7]	2.3930e-1[9]	2.5132e-1[10]	2.5390e-1[11]	2.8224e-1[13]	2.9441e-1[14]	3.1492e-1[15]	3.4240e-1[16]
DTLZ3	5.6825e+1[1]	1.0084e+2[2]	1.3961e+2[5]	1.2780e+2[3]	1.3307e+2[4]	1.5813e+2[7]	1.4794e+2[6]	1.6616e+2[8]	1.8118e+2[10]	1.7239e+2[9]	1.9205e+2[12]	1.8495e+2[11]	2.0280e+2[13]	2.3272e+2[14]	2.6262e+2[15]	3.2682e+2[16]
DTLZ4	8.4188e-1[16]	7.8648e-1[15]	7.7822e-1[14]	6.7388e-1[8]	7.3103e-1[13]	7.0096e-1[12]	6.6830e-1[6]	6.8284e-1[10]	6.7311e-1[7]	6.9335e-1[11]	6.4392e-1[3]	6.3392e-1[1]	6.4430e-1[4]	6.3625e-1[2]	6.5025e-1[5]	6.7805e-1[9]
DTLZ5	1.4201e-1[11]	8.1084e-2[2]	6.7476e-2[1]	8.1950e-2[3]	8.5946e-2[4]	9.9108e-2[6]	9.4070e-2[5]	1.1049e-1[7]	1.1338e-1[8]	1.2626e-1[9]	1.3660e-1[10]	1.6098e-1[12]	1.9247e-1[13]	2.0697e-1[14]	2.4352e-1[15]	3.0303e-1[16]
DTLZ6	2.7032e+0[1]	2.7364e+0[2]	2.8441e+0[3]	2.9964e+0[5]	3.0188e+0[6]	2.9375e+0[4]	3.0523e+0[8]	3.0409e+0[7]	3.2577e+0[9]	3.4399e+0[11]	3.6625e+0[12]	3.3729e+0[10]	4.1881e+0[13]	4.5654e+0[14]	5.1739e+0[15]	6.9785e+0[16]
DTLZ7	1.0615e+0[8]	9.0081e-1[1]	9.8035e-1[4]	9.9152e-1[5]	9.2626e-1[2]	9.4096e-1[3]	1.0045e+0[6]	1.0424e+0[7]	1.0795e+0[9]	1.2388e+0[11]	1.2076e+0[10]	1.3525e+0[12]	1.3864e+0[13]	1.5595e+0[14]	1.7684e+0[15]	1.7782e+0[16]
mean rank	7.14	3.86	4.43	4.29	5.43	6.57	6.14	7.57	8.43	10.00	9.71	9.86	11.71	12.43	13.43	15.00
WFG1	8.3957e-1[6]	8.1893e-1[1]	8.2106e-1[2]	8.3460e-1[4]	8.4206e-1[7]	8.3935e-1[5]	8.3432e-1[3]	8.4506e-1[9]	8.4401e-1[8]	8.5282e-1[11]	8.4784e-1[10]	8.5675e-1[12]	8.5772e-1[13]	8.6634e-1[14]	9.3616e-1[15]	1.0647e+0[16]
WFG2	2.3452e-1[12]	1.9851e-1[4]	1.9091e-1[2]	1.8790e-1[1]	1.9656e-1[3]	2.0961e-1[8]	2.0705e-1[6]	2.0509e-1[5]	2.0815e-1[7]	2.2316e-1[10]	2.1653e-1[9]	2.3132e-1[11]	2.3844e-1[13]	2.4007e-1[14]	2.4503e-1[15]	2.4550e-1[16]
WFG3	2.7056e-1[13]	2.2637e-1[3]	2.3944e-1[7]	2.2296e-1[2]	2.3699e-1[6]	2.2948e-1[4]	2.2257e-1[1]	2.4419e-1[8]	2.2962e-1[5]	2.4784e-1[9]	2.4960e-1[10]	2.6292e-1[11]	2.7182e-1[14]	2.6397e-1[12]	2.8501e-1[15]	2.8772e-1[16]
WFG4	1.7543e-1[16]	1.4423e-1[4]	1.4332e-1[2]	1.4307e-1[1]	1.4383e-1[3]	1.4839e-1[6]	1.4787e-1[5]	1.4875e-1[7]	1.4930e-1[8]	1.5154e-1[9]	1.5232e-1[10]	1.5250e-1[11]	1.5749e-1[13]	1.5710e-1[12]	1.6217e-1[14]	1.6436e-1[15]
WFG5	1.5557e-1[8]	1.3461e-1[2]	1.2827e-1[1]	1.3809e-1[3]	1.4400e-1[5]	1.4212e-1[4]	1.5027e-1[6]	1.5411e-1[7]	1.5577e-1[9]	1.6667e-1[10]	1.7171e-1[11]	1.7831e-1[12]	1.8596e-1[13]	1.9340e-1[14]	2.0548e-1[15]	2.1708e-1[16]
WFG6	2.2580e-1[11]	2.0991e-1[5]	2.0385e-1[1]	2.0711e-1[3]	2.1003e-1[6]	2.0560e-1[2]	2.0858e-1[4]	2.1264e-1[7]	2.1602e-1[8]	2.2087e-1[9]	2.2496e-1[10]	2.2589e-1[12]	2.2996e-1[13]	2.3518e-1[14]	2.3897e-1[15]	2.4098e-1[16]
WFG7	1.9278e-1[16]	1.5763e-1[5]	1.5293e-1[1]	1.5696e-1[3]	1.5621e-1[2]	1.5818e-1[6]	1.5723e-1[4]	1.5877e-1[7]	1.6190e-1[8]	1.7092e-1[9]	1.7109e-1[10]	1.7389e-1[11]	1.8001e-1[12]	1.8106e-1[13]	1.8539e-1[14]	1.8891e-1[15]
WFG8	2.9261e-1[16]	2.5192e-1[12]	2.3762e-1[1]	2.3957e-1[2]	2.4122e-1[3]	2.5020e-1[11]	2.4239e-1[4]	2.4257e-1[5]	2.4415e-1[6]	2.4504e-1[7]	2.4876e-1[8]	2.4956e-1[10]	2.5859e-1[15]	2.4950e-1[9]	2.5806e-1[14]	2.5660e-1[13]
WFG9	1.9455e-1[10]	1.6749e-1[3]	1.6351e-1[1]	1.6608e-1[2]	1.7654e-1[4]	1.7943e-1[6]	1.7981e-1[8]	1.7949e-1[7]	1.7767e-1[5]	1.8833e-1[9]	1.9849e-1[11]	2.0856e-1[12]	2.1859e-1[14]	2.1635e-1[13]	2.2405e-1[15]	2.2771e-1[16]
mean rank	12.00	4.33	2.00	2.33	4.33	5.78	4.56	6.89	7.11	9.22	9.89	11.33	13.33	12.78	14.67	15.44

TABLE S10
THE *mean* IGD VALUES OF K-RVEA WITH $100, 150, 200, 250, 300, 11d-1(329), 350, 400, 450, 500$ INITIAL SOLUTIONS WHEN $d = 30$ AND THE MAXIMUM NUMBER OF FUNCTION EVALUATIONS IS 500.

Problem	100	150	200	250	300	$11d-1$	350	400	450	500
DTLZ1	9.8547e+2[2]	9.4112e+2[1]	9.8952e+2[3]	1.0378e+3[5]	1.0218e+3[4]	1.0717e+3[7]	1.0700e+3[6]	1.1242e+3[8]	1.2038e+3[9]	1.2662e+3[10]
DTLZ2	1.4839e+0[10]	1.3414e+0[7]	1.1747e+0[2]	1.2056e+0[3]	1.1521e+0[1]	1.2172e+0[4]	1.2455e+0[5]	1.3407e+0[6]	1.4005e+0[8]	1.4093e+0[9]
DTLZ3	1.4022e+3[2]	1.4701e+3[4]	1.3763e+3[1]	1.4026e+3[3]	1.5107e+3[5]	1.5366e+3[6]	1.6233e+3[7]	1.6380e+3[8]	1.7898e+3[9]	1.9107e+3[10]
DTLZ4	1.6720e+0[9]	1.5130e+0[6]	1.4951e+0[5]	1.3745e+0[1]	1.3875e+0[2]	1.4409e+0[3]	1.4532e+0[4]	1.5649e+0[7]	1.5788e+0[8]	1.7759e+0[10]
DTLZ5	1.4789e+0[8]	1.3198e+0[6]	1.1744e+0[3]	1.1308e+0[2]	1.1142e+0[1]	1.2000e+0[4]	1.2704e+0[5]	1.4508e+0[7]	1.5275e+0[9]	1.5868e+0[10]
DTLZ6	1.7869e+1[4]	1.7640e+1[3]	1.7411e+1[2]	1.7292e+1[1]	1.8289e+1[5]	1.9026e+1[6]	1.9204e+1[7]	2.0866e+1[8]	2.2174e+1[9]	2.4811e+1[10]
DTLZ7	8.0926e-2[1]	9.0663e-2[2]	9.1125e-2[3]	1.0001e-1[4]	1.2058e-1[5]	1.4502e-1[6]	1.6218e-1[7]	2.5037e-1[8]	4.2751e-1[9]	2.6681e+0[10]
mean rank	5.14	4.14	2.71	2.71	3.29	5.14	5.86	7.43	8.71	9.86
WFG1	6.7007e-1[4]	6.7112e-1[5]	6.4602e-1[2]	6.3748e-1[1]	6.6153e-1[3]	6.8165e-1[6]	6.8508e-1[7]	7.1710e-1[8]	7.8976e-1[9]	1.0510e+0[10]
WFG2	2.6457e-1[10]	2.5380e-1[7]	2.4829e-1[4]	2.4904e-1[5]	2.4527e-1[1]	2.4622e-1[2]	2.4647e-1[3]	2.5198e-1[6]	2.6224e-1[8]	2.6406e-1[9]
WFG3	3.5784e-1[8]	3.5374e-1[7]	3.5050e-1[5]	3.4631e-1[2]	3.4926e-1[4]	3.4684e-1[3]	3.4560e-1[1]	3.5134e-1[6]	3.5833e-1[9]	3.6336e-1[10]
WFG4	1.6915e-1[9]	1.6353e-1[8]	1.5904e-1[6]	1.5814e-1[5]	1.5710e-1[4]	1.5436e-1[1]	1.5699e-1[3]	1.5660e-1[2]	1.6066e-1[7]	1.7226e-1[10]
WFG5	1.3241e-1[1]	1.3342e-1[2]	1.4107e-1[3]	1.5060e-1[4]	1.6745e-1[5]	1.7968e-1[6]	1.8229e-1[7]	2.0012e-1[8]	2.2102e-1[9]	2.3631e-1[10]
WFG6	2.1422e-1[1]	2.1821e-1[2]	2.3203e-1[3]	2.4038e-1[4]	2.4800e-1[5]	2.5380e-1[6]	2.5887e-1[7]	2.6511e-1[8]	2.7347e-1[9]	2.7995e-1[10]
WFG7	2.2162e-1[10]	2.1465e-1[9]	2.1127e-1[8]	2.1107e-1[7]	2.0831e-1[4]	2.0887e-1[5]	2.0771e-1[3]	2.0673e-1[1]	2.0696e-1[2]	2.0958e-1[6]
WFG8	2.1058e-1[6]	2.0399e-1[2]	2.0409e-1[3]	2.0222e-1[1]	2.0651e-1[4]	2.1002e-1[5]	2.1318e-1[7]	2.1952e-1[8]	2.2937e-1[9]	2.4586e-1[10]
WFG9	2.8778e-1[10]	2.8153e-1[7]	2.7072e-1[3]	2.7140e-1[4]	2.6860e-1[1]	2.6873e-1[2]	2.7761e-1[6]	2.7495e-1[5]	2.8194e-1[8]	2.8414e-1[9]
mean rank	6.56	5.44	4.11	3.67	3.44	4.00	4.89	5.78	7.78	9.33

TABLE S11
THE $mean$ IGD VALUES OF K-RVEA WITH $100, 150, 200, 250, 300, 350, 400, 450, 500, 11d-1(549), 600, 650, 700, 750, 800$ INITIAL SOLUTIONS WHEN $d = 50$ AND THE MAXIMUM NUMBER OF FUNCTION EVALUATIONS IS 800.

Problem	100	150	200	250	300	350	400	450	500	$11d-1$	600	650	700	750	800
DTLZ1	1.9714e+3[9]	1.8694e+3[6]	1.8053e+3[3]	1.7882e+3[1]	1.7927e+3[2]	1.8614e+3[4]	1.8621e+3[5]	1.9222e+3[7]	1.9697e+3[8]	2.0104e+3[10]	2.1142e+3[11]	2.1458e+3[12]	2.2023e+3[13]	2.2691e+3[14]	2.3402e+3[15]
DTLZ2	2.8563e+0[15]	2.5763e+0[11]	2.4102e+0[8]	2.3530e+0[7]	2.1657e+0[2]	2.2294e+0[5]	2.1222e+0[1]	2.1661e+0[3]	2.2161e+0[4]	2.3457e+0[6]	2.4746e+0[9]	2.5043e+0[10]	2.6280e+0[12]	2.6645e+0[14]	2.6636e+0[13]
DTLZ3	2.8942e+3[8]	2.7767e+3[7]	2.5869e+3[1]	2.6337e+3[3]	2.6124e+3[2]	2.6929e+3[4]	2.7495e+3[6]	2.6977e+3[5]	2.9023e+3[9]	2.9895e+3[10]	3.1285e+3[11]	3.2286e+3[12]	3.3239e+3[13]	3.4914e+3[14]	3.6077e+3[15]
DTLZ4	3.0651e+0[15]	2.8667e+0[12]	2.7778e+0[9]	2.7532e+0[8]	2.5917e+0[5]	2.5454e+0[3]	2.5849e+0[4]	2.5306e+0[2]	2.4296e+0[1]	2.5932e+0[6]	2.6025e+0[7]	2.8162e+0[11]	2.8079e+0[10]	2.9142e+0[13]	2.9825e+0[14]
DTLZ5	3.1411e+0[15]	2.6378e+0[10]	2.5227e+0[8]	2.3220e+0[4]	2.3023e+0[3]	2.3726e+0[5]	2.2241e+0[1]	2.2671e+0[2]	2.3763e+0[6]	2.3820e+0[7]	2.5830e+0[9]	2.7107e+0[11]	2.8812e+0[13]	2.9015e+0[14]	2.8800e+0[12]
DTLZ6	3.5893e+1[10]	3.4061e+1[7]	3.3571e+1[5]	3.2914e+1[3]	3.2371e+1[1]	3.2970e+1[4]	3.2862e+1[2]	3.3936e+1[6]	3.4606e+1[8]	3.5245e+1[9]	3.6931e+1[11]	3.7588e+1[12]	3.8911e+1[13]	3.9861e+1[14]	4.2739e+1[15]
DTLZ7	8.5990e-2[1]	8.8185e-2[2]	9.5601e-2[3]	1.0508e-1[4]	1.1151e-1[5]	1.2061e-1[6]	1.4030e-1[7]	1.6521e-1[8]	1.8821e-1[9]	2.3108e-1[10]	2.6045e-1[11]	3.5391e-1[12]	4.9339e-1[13]	7.8777e-1[14]	2.8397e+0[15]
mean rank	10.43	7.86	5.29	4.29	2.86	4.43	3.71	4.71	6.43	8.29	9.86	11.43	12.43	13.86	14.14
WFG1	6.6862e-1[11]	6.3926e-1[8]	6.4490e-1[9]	6.2027e-1[4]	6.2743e-1[5]	6.1178e-1[3]	6.1129e-1[2]	6.0586e-1[1]	6.3086e-1[7]	6.2947e-1[6]	6.4662e-1[10]	6.7216e-1[12]	7.0141e-1[13]	8.0520e-1[14]	1.0426e+0[15]
WFG2	2.8456e-1[15]	2.7310e-1[14]	2.6926e-1[13]	2.6047e-1[7]	2.6163e-1[8]	2.5680e-1[4]	2.5478e-1[2]	2.5825e-1[5]	2.5165e-1[1]	2.5665e-1[3]	2.5826e-1[6]	2.6395e-1[9]	2.6446e-1[10]	2.6627e-1[12]	2.6551e-1[11]
WFG3	3.7893e-1[15]	3.7002e-1[7]	3.6825e-1[5]	3.6706e-1[1]	3.6744e-1[2]	3.6929e-1[6]	3.6786e-1[3]	3.6797e-1[4]	3.7433e-1[11]	3.7380e-1[10]	3.7373e-1[9]	3.7321e-1[8]	3.7720e-1[14]	3.7511e-1[12]	3.7581e-1[13]
WFG4	1.7552e-1[15]	1.6930e-1[14]	1.6509e-1[12]	1.6244e-1[10]	1.6078e-1[9]	1.5871e-1[7]	1.5867e-1[6]	1.5783e-1[3]	1.5739e-1[2]	1.5805e-1[4]	1.5695e-1[1]	1.5814e-1[5]	1.5928e-1[8]	1.6362e-1[11]	1.6705e-1[13]
WFG5	1.4924e-1[4]	1.4273e-1[1]	1.4483e-1[2]	1.4968e-1[5]	1.4913e-1[3]	1.5236e-1[6]	1.6430e-1[7]	1.6735e-1[8]	1.7976e-1[9]	1.8708e-1[10]	1.9841e-1[11]	2.0772e-1[12]	2.1739e-1[13]	2.2862e-1[14]	2.3863e-1[15]
WFG6	2.1430e-1[1]	2.1999e-1[2]	2.2621e-1[3]	2.3368e-1[4]	2.3670e-1[5]	2.4784e-1[6]	2.4802e-1[7]	2.5446e-1[8]	2.5631e-1[9]	2.6267e-1[10]	2.6643e-1[11]	2.7174e-1[12]	2.7569e-1[13]	2.8128e-1[14]	2.8819e-1[15]
WFG7	2.2764e-1[15]	2.2361e-1[14]	2.1868e-1[13]	2.1815e-1[12]	2.1520e-1[11]	2.1431e-1[10]	2.1371e-1[9]	2.1178e-1[7]	2.1149e-1[6]	2.1204e-1[8]	2.1136e-1[5]	2.1103e-1[4]	2.1090e-1[2]	2.1087e-1[1]	2.1096e-1[3]
WFG8	2.2761e-1[14]	2.1134e-1[9]	2.1118e-1[8]	2.0696e-1[6]	2.0683e-1[5]	2.0232e-1[1]	2.0415e-1[2]	2.0484e-1[4]	2.0471e-1[3]	2.0891e-1[7]	2.1326e-1[10]	2.1554e-1[11]	2.2058e-1[12]	2.2727e-1[13]	2.3693e-1[15]
WFG9	3.1199e-1[15]	3.0257e-1[14]	2.9727e-1[13]	2.8783e-1[10]	2.8664e-1[9]	2.8114e-1[4]	2.8001e-1[2]	2.7920e-1[1]	2.8353e-1[5]	2.8016e-1[3]	2.8446e-1[6]	2.8613e-1[8]	2.8497e-1[7]	2.9293e-1[11]	2.9385e-1[12]
mean rank	11.67	9.22	8.67	6.56	6.33	5.22	4.44	4.56	5.89	6.78	7.67	9.00	10.22	11.33	12.44

TABLE S12
THE $mean$ IGD VALUES OF MCEA/D WITH $20, 40, 60, 80, 100, 250, 11d-1(329), 400, 500$ INITIAL SOLUTIONS WHEN $d = 30$ AND THE MAXIMUM NUMBER OF FUNCTION EVALUATIONS IS 500.

Problem	20	40	60	80	100	250	$11d-1$	400	500
DTLZ1	1.3266e+02[1]	3.2129e+02[3]	3.6331e+02[5]	3.1534e+02[2]	3.4694e+02[4]	6.1187e+02[6]	7.6403e+02[7]	9.3014e+02[8]	1.2587e+03[9]
DTLZ2	5.3914e-01[7]	4.2646e-01[3]	4.1898e-01[1]	4.2000e-01[2]	4.3810e-01[4]	4.9690e-01[6]	4.8577e-01[5]	6.2367e-01[8]	1.4089e+00[9]
DTLZ3	2.7301e+02[1]	4.1922e+02[3]	4.9147e+02[5]	4.7970e+02[4]	4.1430e+02[2]	6.4477e+02[6]	8.5454e+02[7]	1.0797e+03[8]	1.9273e+03[9]
DTLZ4	9.4172e-01[3]	9.3802e-01[2]	9.4233e-01[4]	9.3620e-01[1]	9.6311e-01[5]	9.9350e-01[6]	1.0121e+00[7]	1.0456e+00[8]	1.8113e+00[9]
DTLZ5	3.3465e-01[5]	2.5905e-01[1]	3.0153e-01[3]	2.6727e-01[2]	3.0329e-01[4]	3.3517e-01[6]	3.9504e-01[7]	5.2333e-01[8]	1.5688e+00[9]
DTLZ6	1.0962e+01[1]	1.1535e+01[2]	1.1828e+01[3]	1.1939e+01[4]	1.2084e+01[5]	1.2984e+01[6]	1.3897e+01[7]	1.7280e+01[8]	2.4776e+01[9]
DTLZ7	2.1097e+00[1]	2.1830e+00[2]	2.3116e+00[6]	2.2637e+00[4]	2.2352e+00[3]	2.2694e+00[5]	2.3945e+00[7]	2.5086e+00[8]	2.7145e+00[9]
mean rank	2.71	2.29	3.86	2.71	3.86	5.86	6.71	8.00	9.00
WFG1	8.1807e-01[5]	7.9185e-01[1]	7.9692e-01[2]	8.0930e-01[4]	7.9976e-01[3]	8.3856e-01[6]	8.4887e-01[7]	8.7045e-01[8]	1.0570e+00[9]
WFG2	2.4385e-01[8]	2.1566e-01[5]	1.9727e-01[2]	1.9502e-01[1]	2.0473e-01[3]	2.1142e-01[4]	2.2469e-01[6]	2.3637e-01[7]	2.6343e-01[9]
WFG3	3.1806e-01[8]	2.7411e-01[3]	2.7204e-01[2]	2.7551e-01[4]	2.6964e-01[1]	2.8425e-01[5]	2.9441e-01[6]	2.9902e-01[7]	3.6407e-01[9]
WFG4	1.8211e-01[9]	1.4712e-01[4]	1.4349e-01[3]	1.4300e-01[2]	1.4067e-01[1]	1.4854e-01[5]	1.5529e-01[6]	1.5922e-01[7]	1.7088e-01[8]
WFG5	1.6220e-01[6]	1.2535e-01[2]	1.2501e-01[1]	1.2972e-01[4]	1.2800e-01[3]	1.5919e-01[5]	1.7802e-01[7]	1.9865e-01[8]	2.3574e-01[9]
WFG6	2.4056e-01[5]	2.2111e-01[1]	2.2454e-01[2]	2.3385e-01[4]	2.3298e-01[3]	2.4213e-01[6]	2.4857e-01[7]	2.5992e-01[8]	2.8032e-01[9]
WFG7	2.0978e-01[9]	1.7208e-01[2]	1.6843e-01[1]	1.7244e-01[3]	1.7305e-01[4]	1.7703e-01[5]	1.8214e-01[6]	1.8963e-01[7]	2.0796e-01[8]
WFG8	2.7319e-01[9]	2.4267e-01[7]	2.2460e-01[1]	2.3171e-01[4]	2.2725e-01[2]	2.3008e-01[3]	2.3399e-01[5]	2.3818e-01[6]	2.4549e-01[8]
WFG9	2.3439e-01[8]	1.8704e-01[3]	1.7656e-01[1]	1.8858e-01[4]	1.8066e-01[2]	2.0474e-01[5]	2.1556e-01[6]	2.3284e-01[7]	2.8441e-01[9]
mean rank	7.44	3.11	1.67	3.33	2.44	4.89	6.22	7.22	8.67