The Supplementary File of "Neural Net-Enhanced Competitive Swarm Optimizer for Large-scale Multiobjective Optimization"

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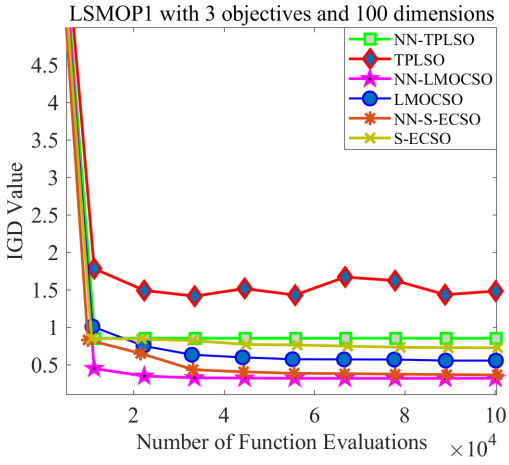

Fig. A. 1. The convergence profiles of six compared algorithms on LSMOP1 with 3 objectives and 100 decision variables.

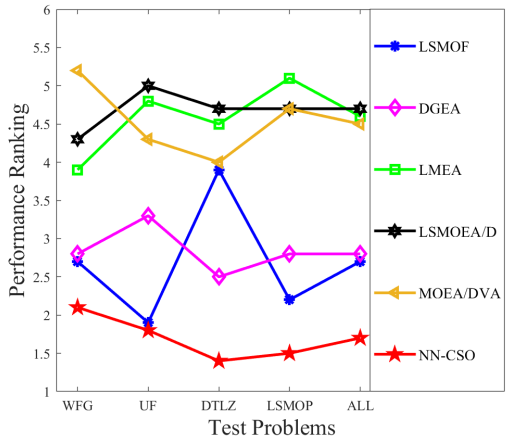

Fig. A. 2. The illustration of the average performance ranks over different test problems.

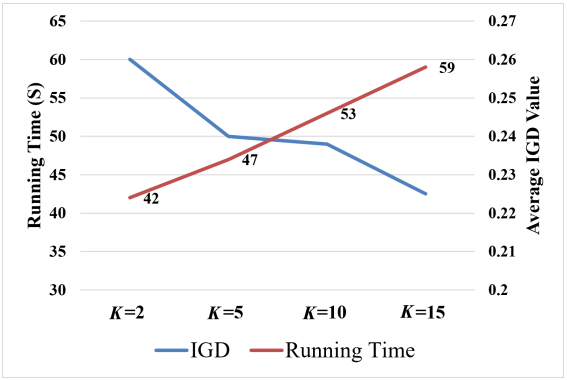

Fig. A. 3. The average IGD values and running time of NN-CSO with different values of K in solving 2-objective UF1 with 100 decision variables.

TABLE A. 1
THE IGD COMPARISON RESULTS OF EMBEDDING NN MODEL INTO THREE WELL-KNOWN CSOS ON LSMOP1-LSMOP9 TEST PROBLEMS WITH 2-3 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	S-ECSO	NN-SECSO	LMOCSO	NN-LMOCSO	TPLSO	NN-TPLSO
LSMOP1	2	100	4.9281e-1 (6.00e-17) -	**2.4965e-1 (1.10e-2)**	3.9189e-1 (2.75e-2) -	**2.0217e-1 (1.04e-2)**	1.7703e+1 (2.05e+1) -	**8.3237e-1 (2.81e-1)**
		200	4.7126e-1 (1.20e-16) -	**2.7370e-1 (6.00e-17)**	7.7353e-1 (4.47e-2) -	**2.8176e-1 (1.72e-2)**	4.3795e+1 (1.91e+1) -	**1.7725e+0 (7.88e-1)**
		500	6.7103e-1 (1.20e-16) -	**3.2231e-1 (0.00e+0)**	1.2798e+0 (3.43e-2) -	**3.2321e-1 (1.40e-2)**	3.1437e+1 (2.81e+1) =	**2.6745e+0 (5.88e-1)**
		1000	6.0144e-1 (0.00e+0) -	**3.0638e-1 (6.00e-17)**	1.4229e+0 (4.44e-2) -	**3.3104e-1 (8.72e-3)**	4.1556e+1 (1.82e+1) -	**3.4219e+0 (9.06e-1)**
	3	100	7.2792e-1 (0.00e+0) -	**3.8855e-1 (0.00e+0)**	5.6849e-1 (4.86e-2) -	**3.2358e-1 (1.05e-2)**	1.1175e+1 (1.96e+1) -	**9.4742e-1 (2.22e-1)**
		200	7.8406e-1 (1.20e-16) -	**3.6304e-1 (6.00e-17)**	9.5857e-1 (6.23e-2) -	**3.4195e-1 (9.75e-3)**	3.9253e+1 (3.20e+1) -	**2.6618e+0 (1.02e+0)**
		500	7.3470e-1 (1.20e-16) -	**3.7186e-1 (6.00e-17)**	1.2326e+0 (6.20e-2) -	**3.5389e-1 (1.61e-2)**	3.8365e+1 (3.02e+1) -	**2.8171e+0 (7.07e-1)**
		1000	8.1602e-1 (1.20e-16) -	**3.6947e-1 (6.00e-17)**	1.3595e+0 (4.99e-2) -	**3.7023e-1 (1.53e-2)**	2.4618e+1 (3.19e+1) =	**4.1011e+0 (5.68e-1)**
LSMOP2	2	100	1.1105e-1 (1.50e-17) -	**5.0583e-2 (9.14e-4)**	1.5164e-1 (4.34e-3) -	**4.2763e-2 (1.64e-3)**	5.7959e-1 (1.14e-1) -	**1.0026e-1 (1.14e-2)**
		200	5.7750e-2 (7.49e-18) -	**2.9179e-2 (0.00e+0)**	9.3398e-2 (9.33e-4) -	**2.8407e-2 (1.27e-3)**	4.5286e-1 (7.11e-2) -	**5.0742e-2 (1.37e-3)**
		500	3.0162e-2 (3.75e-18) -	**1.4998e-2 (1.87e-18)**	4.2894e-2 (2.55e-4) -	**1.3729e-2 (7.39e-4)**	3.6700e-1 (1.12e-2) -	**6.0205e-2 (3.26e-3)**
		1000	1.8005e-2 (3.75e-18) -	**1.0393e-2 (0.00e+0)**	2.3692e-2 (2.10e-4) -	**8.1902e-3 (2.42e-4)**	3.9549e-1 (5.98e-2) -	**4.1278e-2 (7.80e-3)**
	3	100	2.1480e-1 (3.00e-17) -	**1.0697e-1 (1.50e-17)**	1.2877e-1 (2.73e-3) -	**8.4013e-2 (3.28e-3)**	5.5027e-1 (8.32e-2) -	**1.5674e-1 (8.57e-3)**
		200	1.2266e-1 (1.50e-17) -	**8.1996e-2 (1.50e-17)**	7.9826e-2 (7.70e-4) -	**5.7013e-2 (1.60e-3)**	4.1925e-1 (2.20e-2) -	**1.1699e-1 (7.33e-3)**
		500	6.7825e-2 (0.00e+0) -	**5.6603e-2 (7.49e-18)**	4.4514e-2 (3.87e-4) -	**3.8768e-2 (1.43e-3)**	**4.3110e-1 (3.70e-2) =**	4.5411e-1 (7.14e-2)
		1000	5.2379e-2 (7.49e-18) -	**4.6413e-2 (7.49e-18)**	3.2330e-2 (2.89e-4) -	**2.9433e-2 (1.36e-3)**	4.3152e-1 (4.16e-2) -	**6.8964e-2 (1.61e-2)**
LSMOP3	2	100	1.5105e+0 (0.00e+0) -	**1.5070e+0 (2.68e-3)**	1.0093e+1 (3.17e+0) -	**1.5170e+0 (4.71e-1)**	1.3150e+5 (8.07e+4) -	**2.8751e+0 (3.58e+0)**
		200	1.5492e+0 (0.00e+0) -	**1.5447e+0 (2.40e-16)**	1.7224e+1 (2.62e+0) -	**1.9101e+0 (4.24e-1)**	1.7343e+5 (8.61e+4) -	**8.7627e+0 (1.91e+1)**
		500	1.5707e+0 (0.00e+0) -	**1.5629e+0 (2.40e-16)**	2.3149e+1 (1.08e+0) -	**3.1135e+0 (1.72e+0)**	1.5923e+5 (9.51e+4) -	**1.1207e+4 (2.38e+4)**
		1000	1.5762e+0 (2.40e-16) -	**1.5704e+0 (2.40e-16)**	2.7303e+1 (1.23e+0) -	**2.2104e+0 (1.65e+0)**	2.2555e+5 (4.47e+4) -	**1.2339e+4 (2.93e+4)**
	3	100	8.6072e-1 (1.20e-16) =	**8.6072e-1 (1.20e-16)**	7.4883e+0 (6.95e-1) -	**8.5877e-1 (5.15e-3)**	8.7374e+3 (1.31e+4) -	**1.9389e+0 (2.85e+0)**
		200	8.6072e-1 (1.20e-16) =	**8.6072e-1 (1.20e-16)**	9.1855e+0 (6.24e-1) -	**8.6072e-1 (1.20e-16)**	6.6958e+3 (4.81e+3) -	**4.4397e+1 (3.78e+1)**
		500	8.6072e-1 (1.20e-16) =	**8.6072e-1 (1.20e-16)**	1.0876e+1 (4.73e-1) -	**8.6072e-1 (1.20e-16)**	1.2634e+4 (7.52e+3) -	**1.3144e+3 (2.39e+3)**
		1000	8.6072e-1 (1.20e-16) =	**8.6072e-1 (1.20e-16)**	1.1252e+1 (2.94e-1) -	**8.6072e-1 (1.20e-16)**	3.4175e+3 (3.48e+3) -	**4.1667e+1 (3.81e+1)**
LSMOP4	2	100	2.3568e-1 (0.00e+0) -	**1.5393e-1 (2.44e-3)**	1.7410e-1 (1.81e-2) -	**6.7048e-2 (2.28e-2)**	1.1937e+0 (4.80e-1) -	**2.0595e-1 (1.15e-2)**
		200	1.3341e-1 (0.00e+0) -	**9.1144e-2 (1.50e-17)**	1.5665e-1 (4.21e-3) -	**8.3159e-2 (6.00e-3)**	6.2199e-1 (1.79e-1) -	**1.4837e-1 (4.30e-2)**
		500	6.6433e-2 (0.00e+0) -	**4.1727e-2 (7.49e-18)**	8.8124e-2 (8.56e-4) -	**4.4418e-2 (9.30e-4)**	3.9186e-1 (2.43e-2) -	**1.0683e-1 (4.70e-3)**
		1000	3.9109e-2 (0.00e+0) -	**2.3091e-2 (3.75e-18)**	5.1425e-2 (3.41e-4) -	**2.2817e-2 (5.77e-4)**	3.9892e-1 (3.37e-2) -	**6.6456e-2 (4.32e-3)**
	3	100	4.3000e-1 (6.00e-17) -	**3.1882e-1 (0.00e+0)**	3.9018e-1 (9.52e-3) -	**2.9903e-1 (1.40e-2)**	1.0646e+0 (3.19e-1) -	**5.5828e-1 (6.62e-2)**
		200	2.8344e-1 (0.00e+0) -	**2.1170e-1 (0.00e+0)**	2.6839e-1 (4.05e-3) -	**1.9584e-1 (7.70e-3)**	8.4668e-1 (2.04e-1) -	**3.6629e-1 (3.42e-2)**
		500	1.5840e-1 (3.00e-17) -	**1.2228e-1 (0.00e+0)**	1.4544e-1 (7.94e-4) -	**1.0064e-1 (2.13e-3)**	5.4529e-1 (1.31e-1) =	**5.1923e-1 (7.44e-2)**
		1000	1.0435e-1 (3.00e-17) -	**8.1371e-2 (0.00e+0)**	8.7226e-2 (3.58e-4) -	**6.1411e-2 (2.39e-3)**	4.1997e-1 (2.86e-2) -	**1.3990e-1 (2.31e-2)**
LSMOP5	2	100	7.4209e-1 (1.20e-16) -	**7.1334e-1 (9.95e-3)**	7.6183e-1 (5.71e-2) -	**6.9839e-1 (3.87e-2)**	9.1987e+1 (4.13e+1) -	**9.3602e-1 (3.97e-1)**
		200	7.4209e-1 (1.20e-16) -	**7.4209e-1 (1.20e-16)**	1.9068e+0 (7.25e-2) -	**7.4209e-1 (1.20e-16)**	4.9951e+1 (5.09e+1) =	**8.9395e+0 (2.10e+0)**
		500	7.4209e-1 (1.20e-16) =	**7.4209e-1 (1.20e-16)**	2.7384e+0 (1.29e-1) -	**7.4209e-1 (3.92e-7)**	1.1332e+2 (1.55e+1) -	**8.8321e+0 (3.11e+0)**
		1000	7.4209e-1 (1.20e-16) =	**7.4209e-1 (1.20e-16)**	2.8923e+0 (7.01e-2) -	**7.4209e-1 (1.20e-16)**	1.1979e+2 (2.07e+1) -	**1.2889e+1 (5.49e+0)**
	3	100	4.9284e-1 (6.00e-17) -	**4.1324e-1 (6.00e-17)**	8.2434e-1 (1.45e-1) -	**3.8292e-1 (3.63e-2)**	8.5442e+1 (2.08e+1) -	**1.2072e+0 (6.01e-1)**
		200	5.5421e-1 (1.20e-16) -	**4.5516e-1 (0.00e+0)**	2.1603e+0 (1.33e-1) -	**4.7438e-1 (1.44e-2)**	1.0039e+2 (2.44e+1) -	**7.4014e+0 (1.95e+0)**
		500	5.7303e-1 (0.00e+0) -	**4.4293e-1 (6.00e-17)**	**2.7360e+0 (2.25e-1) -**	**5.1560e-1 (1.36e-2)**	1.0354e+2 (1.30e+1) -	**5.8685e+0 (3.98e+0)**
		1000	5.4756e-1 (0.00e+0) -	**4.6464e-1 (0.00e+0)**	2.9914e+0 (1.40e-1) -	**5.1962e-1 (4.01e-3)**	7.4732e+1 (4.12e+1) -	**1.1984e+1 (7.91e+0)**
LSMOP6	2	100	2.9785e-1 (6.00e-17) -	**2.2150e-1 (2.76e-3)**	8.4682e-1 (4.27e-2) -	**7.3329e-1 (1.95e-2)**	1.4398e+5 (4.32e+4) -	**1.2153e+0 (3.36e-1)**
		200	2.9550e-1 (0.00e+0) -	**2.4937e-1 (3.00e-17)**	8.6313e-1 (2.15e-2) -	**7.5911e-1 (5.40e-3)**	2.5096e+5 (8.79e+4) -	**5.0882e+2 (1.31e+3)**
		500	6.6594e-1 (1.20e-16) -	**1.9458e-1 (0.00e+0)**	8.0319e-1 (9.18e-3) -	**7.5233e-1 (9.55e-4)**	3.3901e+5 (1.37e+5) -	**5.2394e+2 (1.38e+3)**
		1000	**1.8151e-1 (3.00e-17) +**	1.8647e-1 (0.00e+0)	**7.3024e-1 (1.13e-1) +**	7.5010e-1 (1.79e-3)	4.2942e+5 (1.10e+5) -	**4.7739e+4 (9.42e+4)**
	3	100	1.1164e+0 (0.00e+0) -	**7.0211e-1 (0.00e+0)**	5.8326e+0 (2.75e+0) -	**9.8301e-1 (1.86e-1)**	2.1166e+4 (4.41e+4) -	**1.4892e+0 (8.32e-3)**
		200	1.2296e+0 (0.00e+0) -	**7.9934e-1 (1.20e-16)**	4.7678e+1 (1.74e+1) -	**1.2356e+0 (1.98e-3)**	3.8443e+5 (7.06e+5) =	**7.5235e+3 (6.59e+3)**
		500	1.2932e+0 (0.00e+0) -	**7.9218e-1 (1.20e-16)**	1.6032e+2 (3.23e+1) -	**1.2959e+0 (3.85e-4)**	7.8085e+4 (1.95e+5) -	**2.1073e+3 (1.46e+3)**
		1000	1.3137e+0 (0.00e+0) -	**9.5277e-1 (1.20e-16)**	3.2570e+2 (6.76e+1) -	**1.3168e+0 (1.48e-3)**	3.0925e+4 (5.62e+4) =	**1.9602e+4 (1.41e+4)**
LSMOP7	2	100	1.4525e+0 (0.00e+0) -	**1.4456e+0 (5.78e-4)**	1.5336e+1 (2.37e+0) -	**1.4577e+0 (7.35e-4)**	3.8320e+4 (8.43e+4) -	**1.4956e+0 (9.31e-2)**
		200	1.4892e+0 (2.40e-16) -	**1.4868e+0 (0.00e+0)**	1.4712e+2 (2.01e+1) -	**1.4916e+0 (5.54e-4)**	1.7010e+5 (1.70e+5) =	**6.2242e+3 (1.40e+3)**
		500	1.5063e+0 (2.40e-16) -	**1.5058e+0 (0.00e+0)**	5.3070e+2 (3.89e+1) -	**1.5109e+0 (1.83e-3)**	7.1037e+4 (1.04e+5) =	**1.2130e+4 (4.38e+3)**
		1000	1.5122e+0 (2.40e-16) -	**1.5114e+0 (2.40e-16)**	6.9017e+2 (3.09e+1) -	**1.5156e+0 (2.36e-3)**	4.5189e+4 (8.23e+4) =	**1.2226e+4 (5.94e+3)**
	3	100	1.0551e+0 (0.00e+0) -	**1.0128e+0 (0.00e+0)**	1.1817e+0 (2.84e-1) =	**9.1842e-1 (9.45e-2)**	1.9666e+5 (7.81e+4) -	**1.6932e+0 (2.58e-1)**
		200	9.6224e-1 (1.20e-16) -	**9.3829e-1 (0.00e+0)**	1.3861e+0 (1.08e-1) -	**1.0253e+0 (5.64e-2)**	2.0937e+5 (6.18e+4) -	**1.7604e+0 (2.98e-1)**
		500	**8.8607e-1 (0.00e+0) +**	9.0102e-1 (1.20e-16)	1.1727e+0 (3.68e-2) -	**9.2035e-1 (8.90e-2)**	2.8266e+5 (6.72e+4) -	**6.9584e+4 (4.97e+4)**
		1000	8.5404e-1 (0.00e+0) -	**7.5817e-1 (1.20e-16)**	1.0547e+0 (1.82e-2) -	**9.5474e-1 (2.46e-2)**	2.2596e+5 (8.99e+4) -	**2.5884e+4 (6.00e+4)**
LSMOP8	2	100	7.4209e-1 (1.20e-16) -	**6.8302e-1 (4.31e-3)**	4.8960e-1 (1.33e-1) -	**2.9998e-1 (5.28e-2)**	3.7057e+1 (1.56e+1) -	**8.8840e-1 (3.39e-1)**
		200	7.4209e-1 (1.20e-16) =	**7.4209e-1 (1.20e-16)**	1.2261e+0 (1.30e-1) -	**6.5133e-1 (6.66e-2)**	3.9945e+1 (3.89e+0) -	**3.7061e+0 (2.18e+0)**
		500	7.4209e-1 (1.20e-16) =	**7.4209e-1 (1.20e-16)**	1.8998e+0 (7.52e-2) -	**7.4209e-1 (1.20e-16)**	3.7846e+1 (1.33e+1) -	**7.3759e+0 (2.41e+0)**
		1000	7.4209e-1 (1.20e-16) =	**7.4209e-1 (1.20e-16)**	2.1493e+0 (6.18e-2) -	**7.4209e-1 (1.20e-16)**	3.9088e+1 (1.69e+1) -	**6.7657e+0 (1.02e+0)**
	3	100	3.3293e-1 (6.00e-17) -	**2.1409e-1 (3.00e-17)**	6.9062e-1 (2.33e-2) -	**2.2384e-1 (2.52e-2)**	2.7022e+1 (6.19e+0) -	**6.6111e-1 (4.75e-2)**
		200	3.3004e-1 (0.00e+0) -	**2.1709e-1 (0.00e+0)**	6.2168e-1 (3.77e-2) -	**1.6963e-1 (1.16e-2)**	3.9854e+1 (1.11e+1) -	**9.4899e-1 (8.25e-2)**
		500	2.9704e-1 (6.00e-17) -	**1.3784e-1 (3.00e-17)**	5.4697e-1 (7.39e-3) -	**1.5592e-1 (1.80e-2)**	4.5812e+1 (1.33e+1) -	**1.9801e+1 (1.15e+1)**
		1000	3.2267e-1 (0.00e+0) -	**9.8708e-2 (1.50e-17)**	5.3239e-1 (1.08e-2) -	**1.6270e-1 (3.69e-2)**	3.8762e+1 (8.61e+0) -	**3.0909e+0 (3.20e+0)**
LSMOP9	2	100	8.1004e-1 (0.00e+0) =	**8.1004e-1 (0.00e+0)**	**6.6243e-1 (5.98e-2) +**	8.1004e-1 (5.64e-16)	5.4380e+1 (1.76e+1) -	**8.1140e-1 (3.59e-3)**
		200	8.1004e-1 (0.00e+0) =	**8.1004e-1 (0.00e+0)**	**5.2370e-1 (2.68e-2) +**	8.0603e-1 (5.30e-3)	6.9717e+1 (1.50e+1) -	**2.7705e+0 (2.36e+0)**
		500	8.1004e-1 (0.00e+0) =	**8.1004e-1 (0.00e+0)**	9.8356e-1 (6.58e-2) -	**6.6887e-1 (1.24e-1)**	8.1691e+1 (1.97e+1) -	**1.4433e+1 (7.11e+0)**
		1000	6.6102e-1 (0.00e+0) -	**3.3542e-2 (0.00e+0)**	2.0274e+0 (5.77e-1) -	**6.6516e-1 (7.38e-2)**	8.9887e+1 (1.75e+1) -	**1.3884e+1 (8.31e+0)**
	3	100	7.8445e-1 (0.00e+0) -	**6.6450e-1 (1.20e-16)**	8.7886e-1 (1.57e-1) -	**5.9295e-1 (2.15e-3)**	1.1261e+2 (1.85e+1) -	**1.5379e+0 (7.47e-6)**
		200	**9.2054e-1 (1.20e-16) +**	9.7553e-1 (1.20e-16)	1.3020e+0 (2.83e-1) -	**6.7195e-1 (2.09e-1)**	1.4692e+2 (4.24e+1) -	**3.4512e+0 (4.70e+0)**
		500	**5.9161e-1 (0.00e+0) +**	5.9282e-1 (1.20e-16)	1.5168e+0 (9.85e-2) -	**5.8631e-1 (1.58e-2)**	1.6372e+2 (3.73e+1) =	**1.1557e+2 (5.44e+1)**
		1000	1.5379e+0 (2.40e-16) -	**5.9079e-1 (0.00e+0)**	2.0343e+1 (1.59e+1) -	**2.5451e+0 (1.34e+0)**	1.5828e+2 (3.36e+1) -	**6.4018e+1 (2.68e+1)**
+/-/=			4/55/13	——	3/68/1	——	0/61/11	——

TABLE A. 2
THE IGD COMPARISON RESULTS OF EMBEDDING NN MODEL INTO THREE WELL-KNOWN CSOS ON UF1-UF10 TEST PROBLEMS WITH 2-3 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	S-ECSO	NN-SECSO	LMOCSO	NN-LMOCSO	TPLSO	NN-TPLSO
UF1	2	100	2.7767e-1 (6.00e-17) -	**1.5004e-1 (8.05e-3)**	4.3227e-1 (1.02e-1) -	**2.4318e-1 (1.16e-2)**	1.3293e+0 (8.16e-2) -	**5.3793e-1 (1.12e-1)**
		200	6.8069e-1 (0.00e+0) -	**2.1947e-1 (0.00e+0)**	9.3333e-1 (7.43e-2) -	**5.0663e-1 (6.26e-1)**	1.4299e+0 (8.70e-2) -	**9.1826e-1 (1.77e-1)**
		500	9.6696e-1 (1.20e-16) -	**2.4656e-1 (3.00e-17)**	1.2596e+0 (2.58e-2) -	**2.8877e-1 (4.73e-3)**	1.4901e+0 (1.72e-2) =	**1.3702e+0 (1.27e-1)**
		1000	1.1464e+0 (2.40e-16) -	**2.6651e-1 (0.00e+0)**	1.3440e+0 (1.27e-2) -	**2.9360e-1 (5.83e-3)**	1.4573e+0 (2.80e-2) -	**1.1978e+0 (8.41e-2)**
UF2	2	100	**1.0418e-1 (1.50e-17) +**	1.0737e-1 (3.79e-16)	9.6931e-2 (4.29e-3) -	**8.3317e-2 (4.18e-3)**	3.5019e-1 (4.15e-3) -	**1.9961e-1 (2.78e-2)**
		200	**1.2616e-1 (3.00e-17) +**	1.2745e-1 (0.00e+0)	1.2577e-1 (3.13e-3) -	**1.1017e-1 (4.73e-2)**	3.8327e-1 (4.45e-2) -	**2.1185e-1 (3.71e-2)**
		500	1.3181e-1 (0.00e+0) -	**1.3095e-1 (0.00e+0)**	1.4446e-1 (2.31e-3) -	**9.2597e-2 (3.54e-3)**	**3.8499e-1 (1.89e-2) =**	4.5739e-1 (1.37e-1)
		1000	1.3608e-1 (0.00e+0) -	**1.3324e-1 (0.00e+0)**	1.5013e-1 (2.26e-3) -	**9.6263e-2 (4.00e-3)**	3.6869e-1 (8.11e-3) -	**2.6458e-1 (9.07e-2)**
UF3	2	100	**2.2227e-1 (0.00e+0) +**	2.2306e-1 (2.14e-13)	2.3434e-1 (7.81e-3) -	**1.8399e-1 (7.77e-3)**	4.2276e-1 (7.65e-3) -	**2.3409e-1 (5.97e-3)**
		200	1.8220e-1 (3.00e-17) -	**1.7934e-1 (3.00e-17)**	2.4819e-1 (4.51e-3) -	**1.5620e-1 (3.36e-3)**	4.0538e-1 (5.93e-3) -	**1.8749e-1 (8.97e-3)**
		500	1.5452e-1 (0.00e+0) -	**1.5322e-1 (0.00e+0)**	2.9174e-1 (5.61e-3) -	**1.3442e-1 (1.11e-3)**	3.9247e-1 (3.22e-3) -	**3.8234e-1 (4.18e-3)**
		1000	1.4609e-1 (0.00e+0) -	**1.4466e-1 (3.00e-17)**	3.2107e-1 (3.19e-3) -	**1.2473e-1 (7.05e-4)**	3.9053e-1 (1.49e-3) =	**3.3499e-1 (1.44e-1)**
UF4	2	100	8.8048e-2 (0.00e+0) -	**6.0168e-2 (2.26e-3)**	1.1709e-1 (3.34e-3) -	**5.8690e-2 (1.95e-4)**	5.0950e-1 (1.18e-2) -	**1.6123e-1 (1.61e-2)**
		200	1.0927e-1 (1.50e-17) -	**5.9350e-2 (7.49e-18)**	1.2692e-1 (3.46e-3) -	**5.9575e-2 (5.51e-4)**	5.2456e-1 (3.46e-2) -	**1.7091e-1 (2.06e-2)**
		500	1.2983e-1 (0.00e+0) -	**6.0084e-2 (7.49e-18)**	1.3324e-1 (1.78e-3) -	**6.1020e-2 (1.79e-3)**	5.1904e-1 (2.62e-2) =	**5.1298e-1 (5.24e-2)**
		1000	1.3462e-1 (0.00e+0) -	**6.7637e-2 (0.00e+0)**	1.3453e-1 (1.96e-3) -	**6.0001e-2 (5.24e-4)**	5.1421e-1 (2.58e-2) -	**2.0133e-1 (1.37e-2)**
UF5	2	100	2.1814e+0 (4.80e-16) -	**2.0164e+0 (8.74e-3)**	2.4396e+0 (3.02e-1) -	**1.1267e+0 (1.73e-1)**	5.0672e+0 (1.11e-1) -	**3.3533e+0 (2.92e-1)**
		200	3.2064e+0 (4.80e-16) -	**2.6166e+0 (4.80e-16)**	3.1744e+0 (3.29e-1) -	**2.3209e+0 (3.11e-1)**	5.2051e+0 (1.84e-1) -	**4.1857e+0 (4.42e-1)**
		500	4.3456e+0 (0.00e+0) -	**2.8916e+0 (4.80e-16)**	4.4265e+0 (3.43e-1) -	**3.0021e+0 (6.99e-2)**	**5.3495e+0 (7.11e-2) +**	5.5828e+0 (1.82e-1)
		1000	4.7957e+0 (0.00e+0) -	**2.9851e+0 (0.00e+0)**	5.0455e+0 (2.67e-1) -	**3.0914e+0 (6.43e-2)**	5.4747e+0 (9.98e-2) -	**4.7815e+0 (4.52e-1)**
UF6	2	100	1.2282e+0 (0.00e+0) -	**5.7319e-1 (4.49e-2)**	**5.0983e-1 (5.26e-2) =**	5.1688e-1 (9.19e-2)	4.7766e+0 (2.14e-1) -	**1.6452e+0 (1.87e-1)**
		200	2.7402e+0 (4.80e-16) -	**8.1212e-1 (1.20e-16)**	1.9724e+0 (1.46e-1) -	**7.1853e-1 (2.07e-1)**	5.3293e+0 (2.74e-1) -	**3.2343e+0 (1.10e+0)**
		500	3.5589e+0 (4.80e-16) -	**9.7202e-1 (1.20e-16)**	4.1239e+0 (1.69e-1) -	**1.1645e+0 (6.83e-2)**	5.5181e+0 (1.12e-1) =	**5.1312e+0 (5.26e-1)**
		1000	4.6431e+0 (0.00e+0) -	**1.0401e+0 (0.00e+0)**	5.0234e+0 (2.55e-1) -	**1.1917e+0 (4.72e-2)**	5.6845e+0 (7.38e-2) -	**5.0618e+0 (8.41e-1)**
UF7	2	100	2.5015e-1 (6.00e-17) -	**1.5828e-1 (2.13e-3)**	5.2836e-1 (1.24e-1) -	**3.5681e-1 (3.58e-1)**	1.3947e+0 (7.19e-2) -	**5.0603e-1 (6.63e-2)**
		200	4.5348e-1 (0.00e+0) -	**2.2781e-1 (0.00e+0)**	9.6944e-1 (7.65e-2) -	**2.6931e-1 (1.08e-2)**	1.4383e+0 (3.89e-2) -	**8.6521e-1 (1.46e-1)**
		500	9.6546e-1 (1.20e-16) -	**2.5504e-1 (0.00e+0)**	1.3137e+0 (2.72e-2) -	**3.0180e-1 (6.16e-3)**	1.5581e+0 (9.65e-2) =	**1.4410e+0 (1.75e-1)**
		1000	1.1596e+0 (2.40e-16) -	**2.7819e-1 (0.00e+0)**	1.3950e+0 (1.68e-2) -	**3.0113e-1 (1.01e-2)**	1.5491e+0 (2.29e-2) -	**1.2384e+0 (2.59e-1)**
UF8	3	100	**5.4070e-1 (0.00e+0) +**	5.4091e-1 (0.00e+0)	**3.4625e-1 (1.43e-2) =**	3.4881e-1 (1.46e-2)	7.4071e-1 (5.78e-2) -	**6.5623e-1 (3.42e-2)**
		200	5.4109e-1 (0.00e+0) -	**5.4033e-1 (1.20e-16)**	4.3478e-1 (2.54e-2) =	**4.1731e-1 (3.11e-2)**	**7.5722e-1 (2.64e-2) =**	7.6013e-1 (1.04e-1)
		500	5.4409e-1 (1.20e-16) -	**5.4188e-1 (0.00e+0)**	5.0121e-1 (1.91e-2) -	**4.8100e-1 (1.45e-2)**	**7.8375e-1 (3.52e-2) =**	8.5866e-1 (1.97e-1)
		1000	5.4619e-1 (0.00e+0) -	**5.4530e-1 (1.20e-16)**	5.2899e-1 (6.76e-3) =	**4.9542e-1 (2.93e-2)**	**7.7331e-1 (3.09e-2) +**	9.7375e-1 (1.37e-1)
UF9	3	100	**7.2863e-1 (1.20e-16) +**	7.3860e-1 (0.00e+0)	**5.0372e-1 (4.06e-2) =**	5.0989e-1 (4.59e-3)	7.6222e-1 (6.08e-2) =	**7.2748e-1 (5.94e-2)**
		200	8.3139e-1 (0.00e+0) -	**7.7337e-1 (0.00e+0)**	5.8528e-1 (2.11e-2) -	**5.6101e-1 (7.41e-3)**	7.9747e-1 (3.10e-2) =	**7.6732e-1 (1.06e-1)**
		500	**8.8950e-1 (0.00e+0) =**	8.8950e-1 (0.00e+0)	6.9416e-1 (9.90e-3) -	**6.1365e-1 (1.26e-2)**	**8.3073e-1 (2.33e-2) =**	8.7738e-1 (1.46e-1)
		1000	**8.8950e-1 (0.00e+0) =**	8.8950e-1 (0.00e+0)	7.6722e-1 (1.35e-2) -	**6.6051e-1 (1.66e-2)**	**8.1963e-1 (3.83e-2) +**	1.2086e+0 (3.54e-1)
UF10	3	100	**5.0030e-1 (0.00e+0) +**	5.0218e-1 (9.06e-17)	1.9738e+0 (3.04e-1) =	**1.8287e+0 (1.87e-1)**	**4.2100e+0 (4.14e-1) =**	4.5354e+0 (4.63e-1)
		200	6.9022e-1 (1.20e-16) -	**5.1564e-1 (1.20e-16)**	3.4774e+0 (4.29e-1) =	**3.1637e+0 (3.38e-1)**	**4.6197e+0 (3.89e-1) =**	4.8671e+0 (3.87e-1)
		500	**5.3874e-1 (0.00e+0) +**	5.4396e-1 (1.20e-16)	3.4774e+0 (4.29e-1) =	**3.1637e+0 (3.38e-1)**	**5.0241e+0 (4.75e-1) =**	6.2307e+0 (1.25e+0)
		1000	**5.4029e-1 (0.00e+0) +**	5.4370e-1 (0.00e+0)	4.3418e+0 (2.98e-1) -	**3.7282e+0 (2.54e-1)**	**4.9915e+0 (3.54e-1) +**	8.0570e+0 (2.02e+0)
+/-/=			8/30/2	——	0/32/8	——	4/22/14	——

TABLE A. 3
THE IGD COMPARISON RESULTS OF EMBEDDING NN MODEL INTO THREE WELL-KNOWN CSOS ON DTLZ1-DTLZ7 TEST PROBLEMS WITH 5-10 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	S_ECSO	NN-SECSO	LMOCSO	NN-LMOCSO	TPLSO	NN-TPLSO
DTLZ1	5	100	5.8154e+2 (0.00e+0) -	**1.4012e-1 (1.11e-2)**	3.1214e+2 (4.18e+1) -	**1.6925e+2 (1.38e+2)**	2.0757e+3 (6.70e+2) -	**8.7038e+2 (6.55e+2)**
		200	1.3259e+3 (2.46e-13) -	**6.7617e+0 (0.00e+0)**	6.9953e+2 (2.32e+1) -	**2.6128e+2 (2.57e+2)**	4.8962e+3 (3.89e+2) -	**2.9406e+3 (6.30e+2)**
		500	3.5849e+3 (0.00e+0) -	**2.0963e-1 (0.00e+0)**	1.5820e+3 (3.07e+2) -	**1.2046e+2 (2.56e+2)**	1.2181e+4 (1.76e+3) -	**9.0397e+3 (1.71e+3)**
		1000	8.8038e+3 (0.00e+0) -	**8.8037e+3 (1.96e-12)**	8.3434e+3 (7.54e+2) -	**2.2002e+2 (2.22e+2)**	2.5198e+4 (2.80e+3) -	**1.9425e+4 (2.92e+3)**
	8	100	5.6534e+2 (0.00e+0) -	**3.3784e-1 (6.00e-17)**	2.8892e+2 (6.51e+1) =	**2.4699e+2 (6.08e+1)**	1.7860e+3 (2.54e+2) -	**1.0650e+3 (6.04e+2)**
		200	1.2723e+3 (2.46e-13) -	**6.8328e-1 (0.00e+0)**	6.6358e+2 (1.06e+2) -	**4.6851e+2 (1.64e+2)**	4.2642e+3 (5.89e+2) -	**3.2013e+3 (5.92e+2)**
		500	3.7356e+3 (0.00e+0) -	**1.6196e+3 (2.46e-13)**	1.6431e+3 (2.92e+2) -	**4.2218e+2 (6.81e+2)**	1.1408e+4 (9.41e+2) -	**9.3994e+3 (1.32e+3)**
		1000	8.7711e+3 (0.00e+0) -	**6.7373e+2 (1.23e-13)**	7.5354e+3 (1.04e+3) -	**6.8877e+2 (8.48e+2)**	2.1743e+4 (1.99e+3) =	**1.9462e+4 (1.39e+3)**
	10	100	5.9543e+2 (1.23e-13) -	**8.2911e-1 (1.20e-16)**	2.7020e+2 (2.78e+1) =	**1.9673e+2 (1.55e+2)**	1.8150e+3 (2.78e+2) -	**1.2936e+3 (2.60e+2)**
		200	1.3472e+3 (2.46e-13) -	**2.7250e-1 (0.00e+0)**	6.6286e+2 (9.88e+1) =	**5.3201e+2 (1.79e+2)**	4.2835e+3 (6.08e+2) -	**3.1887e+3 (4.27e+2)**
		500	3.7054e+3 (0.00e+0) -	**8.1397e+2 (1.23e-13)**	1.6630e+3 (2.18e+2) -	**2.7571e+2 (2.80e+2)**	1.0735e+4 (6.69e+2) -	**8.5541e+3 (8.22e+2)**
		1000	8.7596e+3 (1.96e-12) -	**8.6852e+3 (0.00e+0)**	8.1627e+3 (4.59e+2) -	**3.2814e+2 (5.18e+2)**	2.1856e+4 (1.78e+3) -	**1.8671e+4 (2.00e+3)**
DTLZ2	5	100	1.4944e+1 (0.00e+0) -	**1.4850e+1 (1.92e-15)**	**4.3847e-1 (2.35e-2) +**	4.9801e-1 (4.04e-2)	9.6434e-1 (1.67e-1) -	**7.7497e-1 (4.76e-2)**
		200	3.8588e+1 (0.00e+0) -	**3.8335e+1 (7.67e-15)**	7.9854e-1 (4.73e-2) -	**5.6523e-1 (6.63e-2)**	**1.2328e+0 (3.85e-1) =**	2.5003e+0 (1.47e+0)
		500	**1.1255e+2 (0.00e+0) +**	1.1312e+2 (1.53e-14)	1.7491e+0 (1.20e-1) -	**6.9030e-1 (6.45e-2)**	8.4612e+0 (1.22e+1) =	**5.4578e+0 (3.14e+0)**
		1000	**2.4770e+2 (3.07e-14) +**	2.4804e+2 (3.07e-14)	4.3532e+0 (5.67e-1) -	**8.2565e-1 (3.53e-2)**	**5.8078e+0 (4.48e+0) +**	1.5449e+1 (1.26e+1)
	8	101	**1.4953e+1 (1.92e-15) +**	1.4997e+1 (0.00e+0)	**6.7127e-1 (3.58e-2) +**	8.8452e-1 (3.41e-2)	1.2248e+0 (1.42e-1) =	**1.1350e+0 (3.36e-1)**
		201	**3.8265e+1 (0.00e+0) +**	3.9396e+1 (0.00e+0)	1.0435e+0 (7.38e-2) =	**1.0250e+0 (2.93e-2)**	**1.6763e+0 (6.35e-1) +**	3.3744e+0 (1.16e+0)
		501	1.2229e+2 (1.53e-14) -	**1.2202e+2 (1.53e-14)**	2.3982e+0 (4.02e-1) -	**9.8507e-1 (4.22e-2)**	**2.7410e+0 (2.10e+0) =**	6.3136e+0 (3.89e+0)
		1001	**2.4696e+2 (6.14e-14) +**	2.4737e+2 (3.07e-14)	4.3099e+0 (8.91e-1) -	**9.8649e-1 (2.51e-2)**	**3.3436e+0 (1.05e+0) +**	1.3724e+1 (6.86e+0)
	10	101	**1.5021e+1 (1.92e-15) +**	1.5449e+1 (1.92e-15)	**8.5911e-1 (3.99e-2) +**	9.9078e-1 (2.74e-2)	1.6303e+0 (4.79e-1) -	**1.2585e+0 (6.48e-1)**
		201	3.8730e+1 (0.00e+0) -	**3.8363e+1 (0.00e+0)**	1.1109e+0 (3.02e-2) =	**1.0680e+0 (5.82e-2)**	**2.3249e+0 (2.01e+0) +**	4.0251e+0 (1.22e+0)
		501	1.2187e+2 (3.07e-14) -	**1.2164e+2 (1.53e-14)**	1.8366e+0 (8.08e-2) -	**1.0921e+0 (9.10e-2)**	**4.0002e+0 (4.42e+0) =**	6.9432e+0 (3.39e+0)
		1001	2.4679e+2 (0.00e+0) -	**2.4664e+2 (0.00e+0)**	3.8430e+0 (3.89e-1) -	**1.0579e+0 (3.91e-2)**	**3.9745e+0 (1.14e+0) +**	2.0856e+1 (1.03e+1)
DTLZ3	5	100	**2.1744e+3 (4.91e-13) +**	2.1837e+3 (0.00e+0)	1.1884e+3 (7.79e+1) -	**7.6616e+2 (4.86e+2)**	7.7218e+3 (7.04e+2) -	**2.2614e+3 (1.57e+3)**
		200	**4.7016e+3 (9.82e-13) +**	4.7073e+3 (0.00e+0)	2.6380e+3 (1.00e+2) -	**7.4980e+2 (1.01e+3)**	1.7398e+4 (7.79e+2) -	**7.7793e+3 (1.70e+3)**
		500	**1.2192e+4 (1.96e-12) +**	1.2238e+4 (1.96e-12)	6.2067e+3 (7.05e+2) -	**3.8409e+2 (6.12e+2)**	4.8685e+4 (1.71e+3) -	**2.1380e+4 (7.25e+3)**
		1000	2.4877e+4 (3.93e-12) -	**2.4862e+4 (3.93e-12)**	2.5336e+4 (1.54e+2) -	**1.3701e+3 (1.40e+3)**	9.6755e+4 (2.56e+3) -	**5.8277e+4 (9.49e+3)**
	8	101	**2.1127e+3 (0.00e+0) +**	2.1588e+3 (4.91e-13)	1.2838e+3 (1.08e+2) =	**1.0390e+3 (2.46e+2)**	7.5174e+3 (6.51e+2) -	**2.3580e+3 (6.20e+1)**
		201	4.6247e+3 (0.00e+0) -	**4.5528e+3 (9.82e-13)**	2.6434e+3 (2.63e+2) -	**1.6571e+3 (8.85e+2)**	1.7467e+4 (6.67e+2) -	**7.8124e+3 (1.68e+3)**
		501	**1.2276e+4 (0.00e+0) +**	1.2286e+4 (1.96e-12)	1.2368e+4 (6.58e+1) -	**4.8984e+2 (4.86e+2)**	4.6905e+4 (1.06e+3) -	**2.5616e+4 (1.23e+4)**
		1001	**2.4796e+4 (0.00e+0) +**	2.4799e+4 (0.00e+0)	2.4050e+4 (2.82e+3) -	**4.2066e+2 (4.91e+2)**	9.8128e+4 (3.25e+3) -	**4.7449e+4 (1.78e+4)**
	10	101	**2.0363e+3 (4.91e-13) +**	2.0732e+3 (4.91e-13)	1.2000e+3 (2.80e+2) =	**1.1943e+3 (1.02e+2)**	7.5317e+3 (6.93e+2) -	**2.1444e+3 (1.56e+3)**
		201	**4.5890e+3 (9.82e-13) +**	4.6107e+3 (9.82e-13)	2.7406e+3 (3.82e+2) =	**1.8951e+3 (1.32e+3)**	1.7645e+4 (1.13e+3) -	**6.5672e+3 (1.01e+3)**
		501	**1.2229e+4 (1.96e-12) +**	1.2236e+4 (0.00e+0)	1.2339e+4 (8.17e+1) -	**1.0827e+3 (1.58e+3)**	4.6846e+4 (2.42e+3) -	**1.9983e+4 (5.54e+3)**
		1001	2.4744e+4 (3.93e-12) -	**2.4740e+4 (3.93e-12)**	2.4199e+4 (1.23e+3) -	**2.2712e+3 (1.98e+3)**	9.9585e+4 (2.39e+3) -	**4.0912e+4 (9.52e+3)**
DTLZ4	5	100	7.9337e-1 (1.20e-16) -	**4.1048e-1 (1.97e-2)**	**6.7391e-1 (2.03e-1) =**	9.0123e-1 (2.29e-1)	2.4689e+0 (8.30e-1) -	**1.2446e+0 (1.12e-1)**
		200	2.1390e+0 (0.00e+0) -	**4.9910e-1 (6.00e-17)**	1.3057e+0 (3.38e-1) =	**1.1041e+0 (7.73e-3)**	5.6322e+0 (3.91e+0) -	**1.8214e+0 (3.51e-1)**
		500	5.7025e+0 (9.59e-16) -	**9.1238e-1 (2.40e-16)**	3.6440e+0 (4.96e-1) -	**1.1081e+0 (7.96e-7)**	8.5718e+0 (6.42e+0) =	**4.0822e+0 (1.72e+0)**
		1000	1.8210e+1 (3.84e-15) -	**1.1088e+0 (0.00e+0)**	9.6230e+0 (1.32e+0) -	**1.2318e+0 (3.14e-2)**	1.5048e+1 (3.20e+0) -	**8.4090e+0 (3.69e+0)**
	8	100	2.9257e+0 (0.00e+0) -	**2.3141e+0 (0.00e+0)**	**9.0120e-1 (6.96e-2) +**	1.1920e+0 (1.04e-2)	2.3009e+0 (4.53e-1) -	**1.4614e+0 (2.48e-1)**
		200	2.8234e+0 (0.00e+0) -	**1.2140e+0 (0.00e+0)**	1.6314e+0 (1.56e-1) -	**1.2133e+0 (2.39e-3)**	3.8470e+0 (2.58e+0) =	**2.7884e+0 (9.23e-1)**
		500	**5.4576e+0 (9.59e-16) +**	6.8211e+0 (9.59e-16)	4.5056e+0 (5.83e-1) -	**1.3757e+0 (7.06e-2)**	9.9425e+0 (4.50e+0) =	**5.5812e+0 (2.31e+0)**
		1000	1.8206e+1 (0.00e+0) -	**1.2148e+0 (0.00e+0)**	9.6390e+0 (1.10e+0) -	**1.3439e+0 (3.91e-2)**	1.1482e+1 (7.99e+0) =	**1.0308e+1 (6.26e+0)**
	10	100	**1.8208e+0 (2.40e-16) +**	4.3507e+0 (0.00e+0)	**1.0375e+0 (8.82e-2) +**	1.2250e+0 (1.20e-2)	2.2130e+0 (6.22e-1) -	**1.4207e+0 (9.99e-2)**
		200	1.0311e+1 (0.00e+0) -	**6.0934e+0 (9.59e-16)**	1.6510e+0 (1.31e-1) -	**1.3963e+0 (1.14e-1)**	5.4886e+0 (2.50e+0) -	**2.9568e+0 (7.87e-1)**
		500	4.2916e+0 (9.59e-16) -	**1.2437e+0 (0.00e+0)**	4.1124e+0 (3.23e-1) -	**1.3750e+0 (8.46e-2)**	1.1174e+1 (6.53e+0) =	**4.9468e+0 (2.04e+0)**
		1000	2.0021e+1 (0.00e+0) -	**1.3142e+0 (2.40e-16)**	8.8109e+0 (1.07e+0) -	**1.3390e+0 (6.47e-2)**	2.2685e+1 (1.39e+1) -	**8.9945e+0 (3.60e+0)**
DTLZ5	5	100	3.6554e-1 (6.00e-17) -	**1.7817e-1 (9.22e-2)**	3.9857e-1 (4.40e-2) -	**3.1277e-1 (1.93e-2)**	1.2414e+0 (4.36e-1) -	**4.6998e-1 (1.85e-1)**
		200	3.1222e-1 (0.00e+0) -	**1.8848e-1 (0.00e+0)**	7.7006e-1 (1.13e-1) -	**3.5304e-1 (2.71e-2)**	**1.7007e+0 (1.90e+0) =**	2.4190e+0 (1.20e+0)
		500	**7.9092e-2 (0.00e+0) +**	8.6882e-2 (1.50e-17)	1.8086e+0 (1.07e-1) -	**3.7765e-1 (2.68e-2)**	**3.4259e+0 (4.88e+0) +**	7.0683e+0 (3.26e+0)
		1000	5.8581e+0 (0.00e+0) -	**1.2528e-1 (0.00e+0)**	4.8741e+0 (7.95e-1) -	**4.8973e-1 (3.81e-2)**	**7.6654e+0 (1.10e+1) =**	9.7319e+0 (4.63e+0)
	8	100	1.0314e+0 (0.00e+0) -	**3.6309e-1 (6.00e-17)**	4.8647e-1 (7.84e-2) -	**3.1610e-1 (2.27e-2)**	1.5430e+0 (1.10e+0) =	**5.8315e-1 (2.55e-1)**
		200	5.5003e-1 (0.00e+0) -	**2.7692e-1 (0.00e+0)**	8.6025e-1 (1.96e-1) -	**3.7485e-1 (1.02e-2)**	**1.7493e+0 (1.62e+0) =**	2.2607e+0 (1.26e+0)
		500	**4.9556e-1 (6.00e-17) +**	3.0600e+0 (4.80e-16)	2.4553e+0 (2.18e-1) -	**3.9319e-1 (2.00e-2)**	**2.4104e+0 (1.35e+0) +**	6.8778e+0 (3.65e+0)
		1000	1.7749e+1 (0.00e+0) -	**3.8405e+0 (0.00e+0)**	3.9433e+0 (5.84e-1) -	**4.4120e-1 (5.98e-2)**	**1.0514e+1 (1.38e+1) =**	1.4867e+1 (6.86e+0)
	10	100	4.8513e+0 (0.00e+0) -	**2.5213e+0 (0.00e+0)**	3.5665e-1 (1.80e-1) =	**3.3800e-1 (4.47e-2)**	1.9053e+0 (1.06e+0) =	**1.2038e+0 (5.39e-1)**
		200	2.0110e+1 (3.84e-15) -	**4.0218e+0 (0.00e+0)**	8.4073e-1 (1.44e-1) -	**4.5488e-1 (3.23e-2)**	**1.9851e+0 (1.51e+0) =**	2.5073e+0 (8.63e-1)
		500	4.7319e+0 (9.59e-16) -	**9.6563e-1 (1.20e-16)**	2.5040e+0 (3.71e-1) -	**5.1257e-1 (7.28e-2)**	**2.7328e+0 (1.68e+0) =**	5.2946e+0 (2.74e+0)
		1000	3.8172e+0 (0.00e+0) -	**7.9785e-1 (1.20e-16)**	4.3453e+0 (5.12e-1) -	**5.0542e-1 (5.40e-2)**	**6.8548e+0 (8.74e+0) =**	1.2591e+1 (4.78e+0)
DTLZ6	5	100	1.1599e+0 (0.00e+0) -	**1.1067e+0 (0.00e+0)**	2.7917e+1 (6.28e+0) -	**1.1439e+0 (1.24e-1)**	8.8161e+1 (1.61e-1) -	**2.2209e+1 (2.66e+1)**
		200	1.1964e+0 (0.00e+0) -	**1.0484e+0 (0.00e+0)**	7.0379e+1 (9.75e+0) -	**7.4977e+0 (1.30e+1)**	1.8065e+2 (1.43e+0) -	**1.0154e+2 (1.75e+1)**
		500	1.2964e+0 (2.40e-16) -	**1.2043e+0 (0.00e+0)**	2.1585e+2 (6.25e+0) -	**1.2555e+2 (6.86e+1)**	4.6042e+2 (1.23e+0) -	**3.1040e+2 (4.97e+1)**
		1000	1.2964e+0 (0.00e+0) -	**1.2964e+0 (2.40e-16)**	4.8198e+2 (1.18e+1) =	**4.4290e+2 (5.97e+1)**	9.2429e+2 (3.56e+0) -	**6.3197e+2 (7.11e+1)**
	8	100	1.7992e+0 (2.40e-16) -	**1.7353e+0 (0.00e+0)**	3.3768e+1 (3.27e+0) -	**1.4865e+0 (1.14e-1)**	8.4960e+1 (2.13e-1) -	**2.8806e+1 (2.14e+1)**
		200	2.1004e+0 (0.00e+0) -	**1.9384e+0 (2.40e-16)**	7.2958e+1 (4.81e+0) -	**5.5756e+0 (9.93e+0)**	1.7817e+2 (5.79e-1) -	**8.9864e+1 (2.83e+1)**
		500	2.0245e+0 (0.00e+0) -	**1.9312e+0 (0.00e+0)**	2.3351e+2 (6.68e+0) -	**1.8481e+2 (8.36e+1)**	4.5777e+2 (7.50e-1) -	**2.7142e+2 (3.46e+1)**
		1000	**2.0245e+0 (4.80e-16) +**	2.0245e+0 (0.00e+0)	4.8364e+2 (1.28e+1) =	**4.6411e+2 (2.03e+1)**	9.2237e+2 (8.82e-1) -	**5.2713e+2 (9.38e+1)**
	10	100	2.5196e+0 (4.80e-16) -	**2.4278e+0 (0.00e+0)**	3.1211e+1 (3.14e+0) -	**1.8316e+0 (1.90e-1)**	8.3236e+1 (2.78e-1) -	**1.3775e+1 (1.64e+1)**
		200	**2.1578e+0 (0.00e+0) +**	3.0000e+0 (0.00e+0)	7.5626e+1 (3.16e+0) -	**3.4666e+0 (2.95e+0)**	1.7566e+2 (7.63e-1) -	**9.8957e+1 (2.28e+1)**
		500	**2.2783e+0 (0.00e+0) +**	2.4365e+0 (0.00e+0)	2.2663e+2 (5.84e+0) =	**1.9093e+2 (8.34e+1)**	4.5522e+2 (9.73e-1) -	**2.7026e+2 (3.21e+1)**
		1000	2.4365e+0 (4.80e-16) -	**2.4365e+0 (0.00e+0)**	**4.7349e+2 (7.49e+0) =**	4.7408e+2 (1.61e+1)	9.1740e+2 (4.75e+0) -	**6.0092e+2 (7.90e+1)**
DTLZ7	5	100	3.9318e-1 (6.00e-17) -	**3.6743e-1 (1.60e-3)**	1.0579e+0 (2.93e-1) -	**5.2470e-1 (4.62e-3)**	2.1597e+1 (3.14e-1) -	**3.0007e+0 (6.44e-4)**
		200	4.0986e-1 (0.00e+0) -	**3.6101e-1 (6.00e-17)**	5.9248e+0 (2.61e+0) -	**5.2269e-1 (9.85e-3)**	2.2745e+1 (2.44e-1) -	**1.0267e+1 (2.06e+0)**
		500	4.0213e-1 (0.00e+0) -	**3.9909e-1 (6.00e-17)**	1.3412e+1 (2.21e+0) -	**5.3577e-1 (5.48e-2)**	2.3657e+1 (3.92e-1) -	**1.5187e+1 (3.80e+0)**
		1000	**1.3057e+0 (0.00e+0) +**	1.6914e+0 (2.40e-16)	1.8375e+1 (3.99e-1) -	**1.0133e+0 (1.57e-1)**	2.3364e+1 (4.82e-1) -	**1.8834e+1 (1.43e+0)**
	8	100	8.7559e-1 (1.20e-16) -	**8.3839e-1 (1.20e-16)**	3.3232e+0 (1.86e+0) -	**1.6240e+0 (2.70e-2)**	3.6314e+1 (9.38e-1) -	**5.3263e+0 (5.65e-4)**
		200	8.8937e-1 (1.20e-16) -	**8.4415e-1 (1.20e-16)**	6.0767e+0 (5.21e+0) -	**1.7672e+0 (4.05e-1)**	3.6591e+1 (3.74e-1) -	**2.3250e+1 (4.17e+0)**
		500	**2.4096e+0 (4.80e-16) +**	2.5429e+0 (0.00e+0)	3.0442e+1 (3.32e+0) -	**1.9336e+0 (3.03e-1)**	3.8006e+1 (3.88e-1) -	**2.8340e+1 (5.24e+0)**
		1000	**2.6884e+0 (4.80e-16) +**	3.7687e+0 (4.80e-16)	3.1414e+1 (1.07e+0) -	**3.3249e+0 (7.49e-1)**	3.8454e+1 (3.39e-1) -	**3.1184e+1 (2.83e+0)**
	10	100	1.2942e+0 (0.00e+0) -	**1.2233e+0 (0.00e+0)**	**1.7905e+0 (1.83e-1) +**	2.5731e+0 (7.75e-1)	4.5337e+1 (1.43e+0) -	**6.5225e+0 (2.54e-2)**
		200	1.2552e+0 (2.40e-16) -	**1.2006e+0 (2.40e-16)**	**1.9084e+0 (1.58e-1) =**	1.9409e+0 (2.96e-1)	4.6610e+1 (5.96e-1) -	**2.3685e+1 (8.46e+0)**
		500	4.3329e+0 (9.59e-16) -	**3.3804e+0 (0.00e+0)**	3.5226e+1 (1.04e+0) -	**2.6103e+0 (7.30e-1)**	4.7504e+1 (8.55e-1) -	**3.5197e+1 (4.22e+0)**
		1000	**3.0398e+0 (0.00e+0) +**	4.7455e+0 (0.00e+0)	3.5821e+1 (2.54e+0) -	**3.1208e+0 (1.39e+0)**	4.8093e+1 (3.71e-1) -	**3.9525e+1 (2.31e+0)**
+/-/=			26/58/0	——	6/62/16	——	7/57/20	——

TABLE A. 4
THE IGD COMPARISON RESULTS OF EMBEDDING NN MODEL INTO THREE WELL-KNOWN CSOS ON WFG1-WFG9 TEST PROBLEMS WITH 5-10 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	S-ECSO	NN-SECSO	LMOCSO	NN-LMOCSO	TPLSO	NN-TPLSO
WFG1	5	100	2.2982e+0 (4.80e-16) -	**2.2392e+0 (2.35e-2)**	**1.9695e+0 (3.30e-2) +**	2.0110e+0 (2.93e-2)	3.0838e+0 (5.99e-1) -	**2.3281e+0 (3.90e-2)**
		200	2.3441e+0 (6.03e-5) -	**2.2442e+0 (5.45e-2)**	2.0480e+0 (4.78e-2) =	**2.0071e+0 (1.28e-2)**	3.3023e+0 (1.26e+0) -	**2.5644e+0 (1.45e-1)**
		500	2.3500e+0 (0.00e+0) -	**2.1083e+0 (0.00e+0)**	2.0314e+0 (3.14e-2) =	**2.0096e+0 (2.30e-2)**	2.8578e+0 (1.22e-1) -	**2.5445e+0 (1.77e-1)**
		1000	2.3985e+0 (0.00e+0) -	**2.3846e+0 (4.80e-16)**	2.2087e+0 (4.20e-2) =	**2.1607e+0 (3.70e-2)**	2.8758e+0 (7.74e-2) -	**2.7675e+0 (7.18e-2)**
	8	100	2.9082e+0 (4.80e-16) -	**2.7536e+0 (4.80e-16)**	**2.6186e+0 (2.99e-2) +**	2.6508e+0 (2.50e-2)	4.3975e+0 (2.64e+0) -	**2.9254e+0 (6.82e-2)**
		200	2.8779e+0 (4.80e-16) -	**2.7804e+0 (4.80e-16)**	**2.6507e+0 (2.54e-2) =**	2.6401e+0 (2.00e-2)	3.4364e+0 (1.18e-1) -	**3.1399e+0 (7.95e-2)**
		500	2.9969e+0 (0.00e+0) -	**2.9591e+0 (7.68e-2)**	**2.6710e+0 (2.84e-2) =**	2.6538e+0 (3.33e-2)	3.4044e+0 (4.84e-2) -	**3.2649e+0 (6.15e-2)**
		1000	2.9914e+0 (4.80e-16) -	**2.9206e+0 (4.80e-16)**	**2.7933e+0 (3.22e-2) =**	2.8140e+0 (5.60e-2)	3.3829e+0 (5.23e-2) -	**3.2004e+0 (7.83e-2)**
	10	100	3.3333e+0 (5.47e-2) -	**3.1430e+0 (0.00e+0)**	**3.0162e+0 (2.55e-2) =**	3.0278e+0 (2.83e-2)	3.6545e+0 (4.19e-2) -	**3.3157e+0 (6.20e-2)**
		200	3.3437e+0 (0.00e+0) -	**3.2303e+0 (0.00e+0)**	3.0698e+0 (2.70e-2) =	**3.0462e+0 (2.01e-2)**	3.6761e+0 (9.75e-2) -	**3.4590e+0 (5.70e-2)**
		500	3.3242e+0 (4.80e-16) -	**3.2406e+0 (4.80e-16)**	3.0783e+0 (3.36e-2) =	**3.0566e+0 (2.62e-2)**	3.6512e+0 (5.81e-2) -	**3.5284e+0 (8.78e-2)**
		1000	3.3303e+0 (0.00e+0) -	**3.2923e+0 (9.59e-16)**	3.2273e+0 (3.62e-2) =	**3.1995e+0 (4.98e-2)**	3.6315e+0 (7.99e-2) -	**3.5110e+0 (8.25e-2)**
WFG2	5	100	1.2471e+0 (0.00e+0) -	**6.9406e-1 (1.59e-2)**	5.2601e-1 (2.05e-2) =	**5.0634e-1 (1.48e-2)**	4.4484e+0 (1.98e+0) -	**1.6161e+0 (2.38e-1)**
		200	1.3469e+0 (2.40e-16) -	**7.0951e-1 (1.20e-16)**	5.9276e-1 (2.37e-2) -	**5.5282e-1 (1.92e-2)**	7.1982e+0 (2.37e+0) -	**1.4324e+0 (2.58e-1)**
		500	1.3787e+0 (0.00e+0) -	**8.3332e-1 (0.00e+0)**	6.5085e-1 (1.89e-2) -	**5.7927e-1 (1.76e-2)**	5.9764e+0 (2.49e+0) -	**1.5391e+0 (3.26e-1)**
		1000	1.3821e+0 (2.40e-16) -	**1.1949e+0 (2.40e-16)**	7.6442e-1 (2.33e-2) -	**7.2980e-1 (2.70e-2)**	4.9653e+0 (1.78e+0) -	**1.3747e+0 (1.98e-1)**
	8	101	2.0775e+0 (0.00e+0) -	**1.4912e+0 (0.00e+0)**	1.3257e+0 (4.02e-2) -	**1.1968e+0 (2.06e-2)**	1.0817e+1 (3.41e+0) -	**2.3578e+0 (3.18e-1)**
		201	2.1289e+0 (4.80e-16) -	**1.2313e+0 (0.00e+0)**	1.3467e+0 (8.16e-2) -	**1.2357e+0 (2.93e-2)**	1.0409e+1 (3.10e+0) -	**2.1125e+0 (3.16e-1)**
		501	2.2819e+0 (0.00e+0) -	**2.0552e+0 (0.00e+0)**	1.4102e+0 (4.59e-2) -	**1.2865e+0 (3.89e-2)**	8.7587e+0 (3.47e+0) -	**2.6990e+0 (5.57e-1)**
		1001	2.1172e+0 (0.00e+0) -	**2.0078e+0 (0.00e+0)**	1.5680e+0 (1.05e-1) -	**1.3762e+0 (4.31e-2)**	8.8071e+0 (2.79e+0) -	**2.7136e+0 (4.11e-1)**
	10	101	2.5336e+0 (0.00e+0) -	**1.7268e+0 (2.40e-16)**	1.4481e+0 (6.87e-2) =	**1.4342e+0 (4.64e-2)**	1.4641e+1 (4.17e+0) -	**2.9027e+0 (3.52e-1)**
		201	2.5875e+0 (4.80e-16) -	**2.1155e+0 (4.80e-16)**	1.5226e+0 (6.77e-2) =	**1.4897e+0 (6.34e-2)**	1.4073e+1 (5.55e+0) -	**3.1718e+0 (6.40e-1)**
		501	2.7132e+0 (4.80e-16) -	**2.2817e+0 (0.00e+0)**	1.6409e+0 (7.04e-2) =	**1.5601e+0 (8.69e-2)**	1.1299e+1 (5.84e+0) -	**3.3966e+0 (8.81e-1)**
		1001	2.7439e+0 (0.00e+0) -	**2.3443e+0 (0.00e+0)**	1.9789e+0 (1.71e-1) -	**1.7821e+0 (1.27e-1)**	1.0130e+1 (4.81e+0) -	**3.5339e+0 (9.22e-1)**
WFG3	5	100	1.2720e+0 (2.40e-16) -	**6.4761e-1 (1.64e-2)**	8.5789e-1 (4.08e-2) -	**5.9375e-1 (3.14e-2)**	3.0118e+0 (2.15e-1) -	**9.3995e-1 (8.16e-2)**
		200	1.2843e+0 (0.00e+0) -	**6.4929e-1 (0.00e+0)**	9.1730e-1 (5.78e-2) -	**6.3256e-1 (4.62e-2)**	3.0774e+0 (3.36e-1) -	**8.9353e-1 (8.79e-2)**
		500	1.2550e+0 (2.40e-16) -	**6.2183e-1 (0.00e+0)**	1.0334e+0 (9.02e-2) -	**6.8104e-1 (9.27e-2)**	3.0437e+0 (2.53e-1) -	**9.5294e-1 (6.75e-2)**
		1000	1.3470e+0 (0.00e+0) -	**7.4661e-1 (1.20e-16)**	1.2626e+0 (5.67e-2) -	**9.2953e-1 (3.72e-2)**	2.2713e+0 (3.68e-1) -	**9.8579e-1 (1.73e-1)**
	8	101	1.9041e+0 (0.00e+0) -	**1.3779e+0 (0.00e+0)**	3.8600e+0 (2.58e+0) =	**2.2319e+0 (5.89e-2)**	5.0300e+0 (6.63e-1) -	**1.4144e+0 (2.32e-1)**
		201	1.8244e+0 (4.80e-16) -	**1.2483e+0 (2.40e-16)**	3.3553e+0 (2.27e+0) -	**2.1652e+0 (1.93e-1)**	5.0500e+0 (4.18e-1) -	**1.1898e+0 (1.46e-1)**
		501	1.7334e+0 (0.00e+0) -	**1.2984e+0 (2.40e-16)**	3.4533e+0 (2.38e+0) -	**2.0726e+0 (1.50e-1)**	4.0465e+0 (2.22e-1) -	**1.2518e+0 (9.89e-2)**
		1001	1.7921e+0 (0.00e+0) -	**1.2187e+0 (0.00e+0)**	3.6361e+0 (2.40e+0) =	**2.5123e+0 (6.40e-2)**	4.1822e+0 (1.07e+0) -	**1.2778e+0 (1.65e-1)**
	10	101	2.4063e+0 (0.00e+0) -	**1.8621e+0 (0.00e+0)**	3.3679e+0 (1.34e-1) -	**3.0854e+0 (1.81e-1)**	6.0816e+0 (6.08e-1) -	**1.4911e+0 (1.50e-1)**
		201	2.2400e+0 (0.00e+0) -	**1.5018e+0 (2.40e-16)**	3.3341e+0 (1.61e-1) =	**3.0089e+0 (3.13e-1)**	6.4149e+0 (1.06e+0) -	**1.4254e+0 (1.60e-1)**
		501	2.1088e+0 (0.00e+0) -	**1.5580e+0 (2.40e-16)**	3.3644e+0 (4.62e-1) -	**2.8836e+0 (2.04e-1)**	5.7684e+0 (7.54e-1) -	**1.4509e+0 (1.40e-1)**
		1001	2.1572e+0 (0.00e+0) -	**1.6784e+0 (4.80e-16)**	3.3933e+0 (4.13e-1) =	**3.0806e+0 (1.78e-1)**	5.7701e+0 (8.10e-1) -	**1.3761e+0 (1.80e-1)**
WFG4	5	100	1.3524e+0 (2.40e-16) -	**1.2656e+0 (8.80e-3)**	**1.0531e+0 (5.51e-3) =**	1.0561e+0 (5.97e-3)	5.5063e+0 (4.37e-1) -	**2.2349e+0 (1.38e-1)**
		200	1.3417e+0 (2.40e-16) -	**1.2869e+0 (0.00e+0)**	1.0594e+0 (6.66e-3) =	**1.0542e+0 (6.35e-3)**	5.4732e+0 (4.58e-1) -	**2.1364e+0 (5.05e-1)**
		500	1.3669e+0 (2.40e-16) -	**1.2408e+0 (0.00e+0)**	**1.0642e+0 (6.50e-3) =**	1.1859e+0 (3.20e-1)	5.6420e+0 (7.35e-1) -	**2.1003e+0 (2.84e-1)**
		1000	1.4032e+0 (0.00e+0) -	**1.3214e+0 (2.40e-16)**	**1.1268e+0 (1.08e-2) =**	1.1353e+0 (1.69e-2)	4.8420e+0 (3.16e-1) -	**2.2417e+0 (2.83e-1)**
	8	100	**3.3713e+0 (0.00e+0) +**	3.4394e+0 (4.80e-16)	3.1809e+0 (3.53e-2) =	**3.1920e+0 (3.04e-2)**	1.1666e+1 (7.40e-1) -	**5.1018e+0 (3.41e-1)**
		200	3.4035e+0 (9.59e-16) -	**3.3751e+0 (4.80e-16)**	**3.1995e+0 (3.76e-2) =**	3.2079e+0 (2.39e-2)	1.1952e+1 (1.31e+0) -	**4.6585e+0 (4.49e-1)**
		500	**3.4025e+0 (9.59e-16) +**	3.4769e+0 (4.80e-16)	3.2094e+0 (1.55e-2) -	**3.1822e+0 (1.84e-2)**	9.7661e+0 (4.87e-1) -	**5.3885e+0 (6.24e-1)**
		1000	**3.3879e+0 (4.80e-16) +**	3.4073e+0 (4.80e-16)	3.2899e+0 (6.89e-2) =	**3.2678e+0 (4.27e-2)**	1.0135e+1 (1.01e+0) -	**5.9105e+0 (1.14e+0)**
	10	100	**4.9528e+0 (9.59e-16) +**	5.0841e+0 (0.00e+0)	4.8867e+0 (2.23e-1) =	**4.7190e+0 (1.23e-1)**	1.5224e+1 (1.34e+0) -	**7.0807e+0 (5.52e-1)**
		200	**4.9020e+0 (0.00e+0) +**	5.0509e+0 (9.59e-16)	4.7849e+0 (8.82e-2) -	**4.6203e+0 (9.04e-2)**	1.5768e+1 (1.29e+0) -	**6.5846e+0 (6.38e-1)**
		500	4.9659e+0 (9.59e-16) -	**4.9038e+0 (9.59e-16)**	4.9058e+0 (1.99e-1) -	**4.6596e+0 (9.84e-2)**	1.4520e+1 (7.15e-1) -	**7.3433e+0 (9.10e-1)**
		1000	5.0287e+0 (9.59e-16) -	**4.9405e+0 (9.59e-16)**	4.6017e+0 (4.82e-2) -	**4.5209e+0 (3.49e-2)**	1.3830e+1 (1.58e+0) -	**7.4552e+0 (1.47e+0)**
WFG5	5	100	1.3247e+0 (0.00e+0) -	**1.2748e+0 (1.91e-2)**	1.0137e+0 (2.18e-3) =	**1.0132e+0 (1.34e-3)**	5.8071e+0 (6.96e-1) -	**1.9285e+0 (1.16e-1)**
		200	1.3034e+0 (2.40e-16) -	**1.2519e+0 (2.40e-16)**	**1.0143e+0 (3.30e-3) =**	1.0150e+0 (3.04e-3)	6.2578e+0 (1.13e+0) -	**1.6836e+0 (1.57e-1)**
		500	1.2811e+0 (0.00e+0) -	**1.2338e+0 (0.00e+0)**	1.0137e+0 (3.24e-3) =	**1.0134e+0 (3.75e-3)**	**1.7102e+0 (4.77e-2) =**	1.7267e+0 (9.86e-2)
		1000	**1.3782e+0 (2.40e-16) +**	1.3897e+0 (2.40e-16)	1.1240e+0 (1.50e-2) =	**1.1103e+0 (1.31e-2)**	3.8753e+0 (6.19e-1) -	**1.9894e+0 (3.01e-1)**
	8	100	3.7182e+0 (0.00e+0) -	**3.6865e+0 (4.80e-16)**	**2.9906e+0 (2.37e-2) +**	3.0526e+0 (4.36e-2)	1.1272e+1 (1.56e+0) -	**4.1708e+0 (1.98e-1)**
		200	3.8461e+0 (9.59e-16) -	**3.8040e+0 (0.00e+0)**	**3.0403e+0 (4.69e-2) =**	3.0415e+0 (4.23e-2)	1.0554e+1 (1.14e+0) -	**4.3292e+0 (1.86e-1)**
		500	4.3595e+0 (0.00e+0) -	**4.0549e+0 (0.00e+0)**	3.0819e+0 (6.57e-2) =	**3.0802e+0 (7.22e-2)**	7.4106e+0 (3.52e-1) -	**4.8696e+0 (9.57e-1)**
		1000	4.2952e+0 (9.59e-16) -	**4.0921e+0 (9.59e-16)**	3.4914e+0 (6.11e-2) =	**3.4457e+0 (2.78e-2)**	6.8596e+0 (5.23e-1) -	**4.5208e+0 (4.41e-1)**
	10	100	5.4438e+0 (9.59e-16) -	**5.2635e+0 (0.00e+0)**	**4.3653e+0 (6.10e-2) =**	4.3701e+0 (5.38e-2)	1.2195e+1 (1.52e+0) -	**5.9483e+0 (4.40e-1)**
		200	5.6043e+0 (9.59e-16) -	**5.5215e+0 (9.59e-16)**	**4.3604e+0 (4.31e-2) =**	4.4166e+0 (6.79e-2)	1.4423e+1 (2.19e+0) -	**6.0945e+0 (5.04e-1)**
		500	6.0519e+0 (0.00e+0) -	**5.8067e+0 (9.59e-16)**	**4.4110e+0 (5.74e-2) +**	4.5010e+0 (3.98e-2)	9.0437e+0 (8.24e-1) -	**6.2460e+0 (6.75e-1)**
		1000	6.6456e+0 (9.59e-16) -	**5.7111e+0 (9.59e-16)**	**4.9757e+0 (7.17e-2) =**	4.9927e+0 (7.12e-2)	8.8401e+0 (7.02e-1) -	**6.1808e+0 (5.71e-1)**
WFG6	5	100	1.3949e+0 (2.40e-16) -	**1.2561e+0 (1.39e-2)**	**1.0590e+0 (5.38e-3) =**	1.0606e+0 (8.55e-3)	5.1134e+0 (5.34e-1) -	**2.1218e+0 (1.97e-1)**
		200	1.5283e+0 (2.40e-16) -	**1.3221e+0 (2.40e-16)**	**1.0622e+0 (8.95e-3) =**	1.0734e+0 (2.12e-2)	5.1664e+0 (5.63e-1) -	**2.1936e+0 (2.69e-1)**
		500	1.5921e+0 (2.40e-16) -	**1.4532e+0 (2.40e-16)**	**1.0700e+0 (9.28e-3) =**	1.0849e+0 (2.12e-2)	5.1900e+0 (5.16e-1) -	**2.2328e+0 (2.25e-1)**
		1000	2.3031e+0 (4.80e-16) -	**1.9136e+0 (0.00e+0)**	1.5838e+0 (4.95e-2) -	**1.3864e+0 (3.03e-2)**	5.1336e+0 (5.13e-1) -	**2.4301e+0 (2.53e-1)**
	8	100	3.4417e+0 (0.00e+0) -	**3.4178e+0 (0.00e+0)**	3.2835e+0 (6.52e-2) -	**3.1393e+0 (8.91e-2)**	1.0507e+1 (1.29e+0) -	**5.3815e+0 (7.58e-1)**
		200	3.5345e+0 (4.80e-16) -	**3.4770e+0 (4.80e-16)**	3.2915e+0 (8.21e-2) -	**3.1595e+0 (8.56e-2)**	1.0699e+1 (5.81e-1) -	**5.2236e+0 (3.20e-1)**
		500	5.8389e+0 (0.00e+0) -	**4.8228e+0 (0.00e+0)**	3.2844e+0 (5.53e-2) -	**3.1892e+0 (5.75e-2)**	9.7830e+0 (7.64e-1) -	**5.9913e+0 (5.62e-1)**
		1000	**5.6952e+0 (9.59e-16) +**	6.1921e+0 (9.59e-16)	3.8969e+0 (2.62e-1) -	**3.4520e+0 (6.52e-2)**	1.0189e+1 (4.48e-1) -	**5.9202e+0 (4.67e-1)**
	10	100	5.1302e+0 (9.59e-16) -	**5.0566e+0 (9.59e-16)**	4.7055e+0 (7.04e-2) =	**4.6680e+0 (1.04e-1)**	1.3622e+1 (6.36e-1) -	**7.4573e+0 (9.42e-1)**
		200	**5.2255e+0 (0.00e+0) +**	5.4755e+0 (0.00e+0)	4.7835e+0 (1.79e-1) -	**4.5751e+0 (7.01e-2)**	1.3626e+1 (8.04e-1) -	**7.2712e+0 (7.01e-1)**
		500	7.7139e+0 (0.00e+0) -	**7.5884e+0 (0.00e+0)**	**4.6370e+0 (8.79e-2) =**	4.6990e+0 (1.56e-1)	1.3859e+1 (4.78e-1) -	**8.4610e+0 (8.94e-1)**
		1000	7.9653e+0 (0.00e+0) -	**7.0262e+0 (9.59e-16)**	5.1286e+0 (2.79e-1) =	**4.9120e+0 (2.16e-1)**	1.2832e+1 (7.03e-1) -	**8.6881e+0 (9.20e-1)**
WFG7	5	100	1.6056e+0 (2.40e-16) -	**1.4011e+0 (1.93e-2)**	1.1449e+0 (8.91e-3) -	**1.1053e+0 (6.00e-3)**	5.8770e+0 (9.26e-1) -	**2.9833e+0 (5.53e-1)**
		200	1.5735e+0 (2.40e-16) -	**1.4429e+0 (0.00e+0)**	1.1635e+0 (7.17e-3) -	**1.1238e+0 (7.95e-3)**	5.9621e+0 (8.06e-1) -	**2.2336e+0 (3.75e-1)**
		500	1.5707e+0 (0.00e+0) -	**1.4779e+0 (0.00e+0)**	1.1861e+0 (1.80e-2) -	**1.1375e+0 (6.22e-3)**	5.4560e+0 (7.88e-1) -	**2.0865e+0 (1.90e-1)**
		1000	**1.6496e+0 (2.40e-16) +**	1.6779e+0 (0.00e+0)	1.2868e+0 (8.89e-3) -	**1.2482e+0 (2.09e-2)**	4.8687e+0 (3.97e-1) -	**2.3755e+0 (3.88e-1)**
	8	100	3.5595e+0 (4.80e-16) -	**3.5590e+0 (0.00e+0)**	3.1562e+0 (1.82e-2) -	**3.1192e+0 (2.66e-2)**	1.0940e+1 (1.27e+0) -	**8.1203e+0 (9.27e-1)**
		200	3.5733e+0 (4.80e-16) -	**3.5559e+0 (9.59e-16)**	3.1903e+0 (2.65e-2) =	**3.1565e+0 (2.86e-2)**	1.1167e+1 (1.41e+0) -	**6.3015e+0 (8.06e-1)**
		500	**3.7430e+0 (0.00e+0) +**	3.9220e+0 (0.00e+0)	3.2262e+0 (4.25e-2) -	**3.1208e+0 (1.84e-2)**	1.0276e+1 (5.37e-1) -	**6.1287e+0 (9.27e-1)**
		1000	3.7269e+0 (9.59e-16) -	**3.6756e+0 (4.80e-16)**	3.5538e+0 (9.22e-2) -	**3.3300e+0 (4.05e-2)**	1.0652e+1 (8.79e-1) -	**5.6400e+0 (5.20e-1)**
	10	100	**5.0882e+0 (0.00e+0) +**	5.1056e+0 (9.59e-16)	4.5082e+0 (4.46e-2) =	**4.4828e+0 (4.43e-2)**	1.4561e+1 (9.70e-1) -	**1.0775e+1 (9.08e-1)**
		200	5.1090e+0 (0.00e+0) -	**5.0699e+0 (0.00e+0)**	4.5069e+0 (4.02e-2) =	**4.4663e+0 (5.14e-2)**	1.4092e+1 (1.43e+0) -	**8.7651e+0 (1.13e+0)**
		500	**5.3986e+0 (0.00e+0) +**	5.7015e+0 (9.59e-16)	5.0244e+0 (5.36e-1) -	**4.4638e+0 (1.18e-1)**	1.4045e+1 (1.43e+0) -	**8.3921e+0 (9.71e-1)**
		1000	5.4265e+0 (0.00e+0) -	**5.3593e+0 (0.00e+0)**	4.9586e+0 (2.37e-1) -	**4.6457e+0 (1.11e-1)**	1.3724e+1 (7.63e-1) -	**8.5385e+0 (7.44e-1)**
WFG8	5	100	1.5997e+0 (2.40e-16) -	**1.4255e+0 (2.40e-2)**	1.1548e+0 (1.59e-2) =	**1.1426e+0 (4.87e-3)**	5.3538e+0 (6.49e-1) -	**2.4988e+0 (1.54e-1)**
		200	1.6791e+0 (2.40e-16) -	**1.4210e+0 (2.40e-16)**	1.1848e+0 (1.77e-2) =	**1.1737e+0 (1.07e-2)**	5.2804e+0 (3.40e-1) -	**2.2028e+0 (2.91e-1)**
		500	1.7322e+0 (2.40e-16) -	**1.6305e+0 (2.40e-16)**	1.2109e+0 (2.01e-2) -	**1.1718e+0 (1.33e-2)**	5.3421e+0 (6.32e-1) -	**2.3871e+0 (3.14e-1)**
		1000	**2.2099e+0 (0.00e+0) +**	2.2671e+0 (0.00e+0)	1.3328e+0 (4.49e-2) =	**1.3015e+0 (1.09e-2)**	4.8314e+0 (4.06e-1) -	**2.1983e+0 (1.76e-1)**
	8	100	3.7693e+0 (0.00e+0) -	**3.6733e+0 (4.80e-16)**	**3.2325e+0 (5.31e-2) =**	3.2508e+0 (6.18e-2)	1.0840e+1 (5.66e-1) -	**5.5627e+0 (2.29e-1)**
		200	**3.9034e+0 (4.80e-16) +**	3.9079e+0 (0.00e+0)	**3.2252e+0 (1.33e-2) =**	3.2326e+0 (2.47e-2)	1.0089e+1 (6.22e-1) -	**5.7691e+0 (6.91e-1)**
		500	6.6102e+0 (0.00e+0) -	**6.2815e+0 (9.59e-16)**	3.2526e+0 (2.44e-2) -	**3.1741e+0 (4.80e-3)**	1.0015e+1 (1.11e+0) -	**5.8039e+0 (7.42e-1)**
		1000	6.5402e+0 (9.59e-16) -	**5.3579e+0 (9.59e-16)**	3.5711e+0 (6.99e-2) -	**3.4078e+0 (3.16e-2)**	1.0676e+1 (4.83e-1) -	**6.1945e+0 (4.52e-1)**
	10	100	5.2256e+0 (0.00e+0) -	**5.1787e+0 (9.59e-16)**	**4.5533e+0 (5.26e-2) =**	4.6268e+0 (9.97e-2)	1.3944e+1 (9.85e-1) -	**7.3616e+0 (4.19e-1)**
		200	5.5224e+0 (9.59e-16) -	**5.4163e+0 (0.00e+0)**	4.5744e+0 (8.73e-2) =	**4.5396e+0 (8.20e-2)**	1.3703e+1 (8.28e-1) -	**7.6362e+0 (7.20e-1)**
		500	**8.8712e+0 (0.00e+0) +**	9.0618e+0 (0.00e+0)	4.9886e+0 (2.29e-1) -	**4.7277e+0 (5.74e-2)**	1.3217e+1 (1.13e+0) -	**8.2270e+0 (8.96e-1)**
		1000	**8.3122e+0 (1.92e-15) +**	8.4577e+0 (1.92e-15)	4.9095e+0 (1.75e-1) -	**4.7367e+0 (1.34e-1)**	1.3909e+1 (5.95e-1) -	**9.6980e+0 (1.51e+0)**
WFG9	5	100	1.6479e+0 (4.80e-16) -	**1.2327e+0 (5.46e-3)**	1.0465e+0 (4.62e-3) =	**1.0434e+0 (9.91e-3)**	6.1724e+0 (8.77e-1) -	**1.7790e+0 (2.02e-1)**
		200	1.5864e+0 (2.40e-16) -	**1.1969e+0 (0.00e+0)**	**1.0518e+0 (1.21e-2) =**	1.0619e+0 (9.93e-3)	5.8348e+0 (1.25e+0) -	**1.7197e+0 (2.13e-1)**
		500	1.4773e+0 (0.00e+0) -	**1.2040e+0 (0.00e+0)**	**1.0707e+0 (1.88e-2) =**	1.0759e+0 (1.61e-2)	5.9941e+0 (8.87e-1) -	**1.8112e+0 (3.89e-1)**
		1000	1.7663e+0 (0.00e+0) -	**1.3882e+0 (0.00e+0)**	1.2258e+0 (3.23e-2) -	**1.1851e+0 (1.98e-2)**	3.6332e+0 (8.31e-1) -	**1.7219e+0 (2.06e-1)**
	8	100	4.2186e+0 (0.00e+0) -	**3.4774e+0 (0.00e+0)**	3.0530e+0 (3.95e-2) =	**3.0253e+0 (2.74e-2)**	1.1311e+1 (1.79e+0) -	**5.9506e+0 (1.12e+0)**
		200	4.3916e+0 (0.00e+0) -	**3.5301e+0 (4.80e-16)**	**3.0553e+0 (3.35e-2) =**	3.0798e+0 (3.05e-2)	1.1414e+1 (2.34e+0) -	**4.2765e+0 (2.05e-1)**
		500	4.8454e+0 (0.00e+0) -	**3.9756e+0 (9.59e-16)**	3.1083e+0 (6.30e-2) =	**3.0605e+0 (3.92e-2)**	7.0927e+0 (6.13e-1) -	**4.2020e+0 (2.51e-1)**
		1000	4.8297e+0 (0.00e+0) -	**3.9591e+0 (0.00e+0)**	3.6744e+0 (8.79e-2) -	**3.4628e+0 (6.34e-2)**	6.7029e+0 (5.93e-1) -	**4.0383e+0 (2.66e-1)**
	10	100	5.8096e+0 (0.00e+0) -	**4.9432e+0 (0.00e+0)**	**4.4941e+0 (1.34e-1) +**	4.6532e+0 (4.89e-2)	1.3715e+1 (2.32e+0) -	**6.1342e+0 (4.82e-1)**
		200	6.0558e+0 (9.59e-16) -	**5.0416e+0 (0.00e+0)**	**4.5941e+0 (5.51e-2) =**	4.6372e+0 (7.13e-2)	1.0972e+1 (1.85e+0) -	**6.5802e+0 (8.35e-1)**
		500	7.0047e+0 (0.00e+0) -	**6.2363e+0 (0.00e+0)**	**4.8974e+0 (1.89e-1) =**	5.0515e+0 (8.17e-2)	8.6738e+0 (6.90e-1) -	**5.6362e+0 (6.06e-1)**
		1000	7.1895e+0 (9.59e-16) -	**5.7497e+0 (9.59e-16)**	**4.8908e+0 (1.54e-1) =**	4.9860e+0 (1.42e-1)	8.4672e+0 (6.53e-1) -	**6.5027e+0 (8.18e-1)**
+/-/=			16/92/0	——	5/42/61	——	0/107/1	——

TABLE A. 5
THE IGD COMPARISON RESULTS OF SIX COMPARED ALGORITHMS ON LSMOP1-LSMOP9 TEST PROBLEMS WITH 2-3 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	LSMOF	DGEA	LMEA	LSMOEAD	MOEADVA	NN-CSO
LSMOP1	2	100	5.2434e-1 (2.78e-2) -	1.0276e+0 (1.33e-1) -	9.3143e-1 (2.02e+0) -	3.23e+00(1.00e+00)-	1.60e+00(2.47e-01)-	**2.0217e-1 (1.04e-2)**
		200	5.8204e-1 (2.43e-2) -	5.1114e-1 (4.78e-1) -	9.4374e+0 (6.25e-1) -	6.43e+00(5.00e-01)-	4.48e+00(3.38e-01)-	**2.8176e-1 (1.72e-2)**
		500	5.7182e-1 (2.55e-2) -	4.0520e-1 (1.45e-1) =	1.0626e+1 (2.48e-1) -	8.94e+00(7.03e-01)-	8.91e+00(2.87e-01)-	**3.2321e-1 (1.40e-2)**
		1000	6.5147e-1 (6.49e-3) -	6.0693e-1 (3.39e-1) -	1.0852e+1 (1.31e-1) -	9.97e+00(2.74e-01)-	1.02e+01(2.38e-01)-	**3.3104e-1 (8.72e-3)**
	3	100	5.4935e-1 (3.68e-2) -	7.0046e-1 (3.28e-1) -	**1.5137e-1 (9.02e-3) +**	2.57e+00(1.14e+00)-	1.71e+00(3.37e-01)-	3.2358e-1 (1.05e-2)
		200	5.8156e-1 (3.11e-2) -	6.2812e-1 (1.35e-1) -	9.5172e+0 (1.58e+0) -	6.14e+00(1.01e+00)-	4.20e+00(6.32e-01)-	**3.4195e-1 (9.75e-3)**
		500	6.2146e-1 (1.48e-2) -	7.5292e-1 (8.13e-2) -	1.0810e+1 (1.89e-1) -	9.29e+00(4.26e-01)-	9.17e+00(3.30e-01)-	**3.5389e-1 (1.61e-2)**
		1000	6.3154e-1 (4.75e-3) -	8.3988e-1 (1.17e-1) -	1.1146e+1 (3.20e-1) -	1.04e+01(4.45e-01)-	1.04e+01(3.16e-01)-	**3.7023e-1 (1.53e-2)**
LSMOP2	2	100	1.2782e-1 (2.11e-3) -	1.1459e-1 (5.88e-2) -	1.6610e-1 (7.07e-2) -	2.49e-01(6.52e-03)-	2.32e-01(2.50e-03)-	**4.2763e-2 (1.64e-3)**
		200	6.9542e-2 (8.63e-4) -	3.2251e-2 (4.32e-3) =	1.5826e-1 (4.28e-4) -	1.54e-01(1.68e-03)-	1.54e-01(3.67e-04)-	**2.8407e-2 (1.27e-3)**
		500	2.5522e-2 (6.09e-4) -	1.4876e-2 (1.53e-3) =	7.2703e-2 (1.23e-4) -	7.42e-02(1.10e-03)-	7.25e-02(6.98e-05)-	**1.3729e-2 (7.39e-4)**
		1000	1.8810e-2 (1.68e-3) -	9.4701e-3 (2.75e-3) =	3.9351e-2 (2.96e-5) -	4.10e-02(1.27e-03)-	3.92e-02(4.36e-05)-	**8.1902e-3 (2.42e-4)**
	3	100	1.9669e-1 (6.12e-3) -	1.3203e-1 (1.27e-2) -	1.5132e-1 (5.27e-2) -	1.98e-01(2.64e-03)-	1.73e-01(1.14e-03)-	**8.4013e-2 (3.28e-3)**
		200	1.2274e-1 (1.76e-3) -	8.5131e-2 (8.53e-3) -	1.1904e-1 (3.69e-3) -	1.18e-01(2.41e-03)-	1.16e-01(2.25e-04)-	**5.7013e-2 (1.60e-3)**
		500	6.5749e-2 (1.30e-3) -	4.9981e-2 (1.01e-3) -	6.2559e-2 (7.46e-4) -	6.48e-02(4.52e-03)-	6.23e-02(7.87e-04)-	**3.8768e-2 (1.43e-3)**
		1000	4.6604e-2 (9.35e-4) -	3.4575e-2 (4.42e-4) -	4.4478e-2 (1.61e-3) -	5.53e-02(3.84e-03)-	4.43e-02(6.69e-04)-	**2.9433e-2 (1.36e-3)**
LSMOP3	2	100	**1.2990e+0 (3.09e-1) =**	1.6189e+1 (1.06e+1) -	1.0879e+1 (6.20e+0) -	8.11e+00(4.03e+00)-	8.68e+01(1.03e+02)-	1.5170e+0 (4.71e-1)
		200	**1.4800e+0 (1.45e-1) +**	6.8561e+0 (9.08e+0) =	2.7296e+2 (5.40e+2) -	1.59e+01(2.02e+00)-	4.46e+02(4.47e+02)-	1.9101e+0 (4.24e-1)
		500	**1.5641e+0 (1.45e-3) +**	1.5688e+0 (3.80e-3) +	5.4285e+2 (5.01e+2) -	2.73e+01(3.75e+00)-	5.82e+02(8.04e+02)-	3.1135e+0 (1.72e+0)
		1000	**1.5737e+0 (3.30e-4) +**	3.0592e+0 (3.93e+0) -	6.4795e+2 (3.41e+2) -	3.67e+01(2.78e+00)-	5.03e+02(3.48e+02)-	2.2104e+0 (1.65e+0)
	3	100	**8.0353e-1 (3.98e-2) +**	3.0014e+0 (3.76e+0) =	3.3598e+0 (3.31e+0) -	5.85e+00(1.61e+00)-	2.27e+01(1.19e+01)-	8.5877e-1 (5.15e-3)
		200	**8.5053e-1 (1.55e-2) +**	1.6402e+0 (2.11e+0) =	9.3608e+1 (1.12e+2) -	1.09e+01(1.08e+00)-	8.71e+01(4.66e+01)-	8.6072e-1 (1.20e-16)
		500	**8.6024e-1 (1.16e-3) +**	2.5496e+0 (2.43e+0) =	2.4494e+2 (1.98e+2) -	1.44e+01(1.49e+00)-	1.12e+02(8.63e+01)-	8.6072e-1 (1.20e-16)
		1000	**8.6068e-1 (3.55e-5) =**	1.6874e+0 (2.19e+0) =	1.5274e+2 (1.36e+2) -	3.43e+01(3.88e+01)-	1.62e+02(7.66e+01)-	8.6072e-1 (1.20e-16)
LSMOP4	2	100	2.4029e-1 (9.78e-3) -	1.6057e-1 (6.98e-2) -	2.0848e-1 (5.84e-2) -	3.21e-01(1.25e-02)-	2.77e-01(9.47e-03)-	**6.7048e-2 (2.28e-2)**
		200	1.8305e-1 (7.91e-3) -	9.7774e-2 (9.81e-3) -	2.5457e-1 (6.96e-3) -	2.38e-01(6.06e-03)-	2.08e-01(1.48e-03)-	**8.3159e-2 (6.00e-3)**
		500	5.4837e-2 (1.90e-3) -	5.1832e-2 (3.84e-3) -	1.3447e-1 (2.29e-4) -	1.32e-01(2.31e-03)-	1.28e-01(5.56e-04)-	**4.4418e-2 (9.30e-4)**
		1000	5.4126e-2 (2.86e-3) -	2.5523e-2 (1.84e-3) -	7.6720e-2 (1.17e-4) -	7.87e-02(9.55e-04)-	7.52e-02(1.58e-04)-	**2.2817e-2 (5.77e-4)**
	3	100	3.4603e-1 (9.23e-3) -	4.1558e-1 (3.48e-2) -	**2.8138e-1 (1.08e-1) +**	5.17e-01(8.23e-03)-	4.52e-01(7.80e-03)-	2.9903e-1 (1.40e-2)
		200	3.0142e-1 (3.60e-3) -	2.5086e-1 (2.29e-2) -	3.8077e-1 (3.74e-3) -	3.65e-01(8.04e-03)-	3.25e-01(3.56e-03)-	**1.9584e-1 (7.70e-3)**
		500	1.9019e-1 (5.11e-3) -	1.3596e-1 (1.53e-2) -	2.0293e-1 (1.47e-3) -	1.99e-01(3.44e-03)-	1.94e-01(9.78e-04)-	**1.0064e-1 (2.13e-3)**
		1000	1.1693e-1 (1.40e-3) -	8.7320e-2 (1.03e-2) -	1.1774e-1 (8.44e-4) -	1.22e-01(3.02e-03)-	1.16e-01(8.38e-04)-	**6.1411e-2 (2.39e-3)**
LSMOP5	2	100	7.4209e-1 (1.20e-16) -	2.6902e+0 (7.46e-1) -	7.1328e-1 (3.14e-1) =	1.07e+01(2.28e+00)-	4.25e+00(4.52e-01)-	**6.9839e-1 (3.87e-2)**
		200	7.4209e-1 (1.20e-16) =	4.3081e+0 (5.08e-1) -	2.0729e+1 (8.98e-1) -	1.80e+01(1.60e+00)-	1.43e+01(6.23e-01)-	**7.4209e-1 (1.20e-16)**
		500	7.4209e-1 (1.20e-16) =	4.8163e+0 (1.62e+0) -	2.2524e+1 (3.18e-1) -	2.07e+01(1.02e+00)-	2.03e+01(4.68e-01)-	**7.4209e-1 (3.92e-7)**
		1000	7.4209e-1 (1.20e-16) =	6.0120e+0 (1.23e+0) -	2.3329e+1 (5.07e-1) -	2.30e+01(5.63e-01)-	2.23e+01(3.26e-01)-	**7.4209e-1 (1.20e-16)**
	3	100	5.2308e-1 (4.86e-2) -	7.4872e-1 (6.52e-1) =	2.9568e+0 (4.32e+0) -	5.74e+00(2.67e+00)-	2.76e+00(2.83e-01)-	**3.8292e-1 (3.63e-2)**
		200	5.5295e-1 (1.79e-2) -	9.6924e-1 (5.99e-1) =	1.5598e+1 (1.94e+0) -	1.12e+01(8.93e-01)-	1.11e+01(1.08e+00)-	**4.7438e-1 (1.44e-2)**
		500	5.5594e-1 (1.29e-2) -	1.3695e+0 (6.89e-1) -	1.8997e+1 (7.26e-1) -	1.50e+01(6.31e-01)-	1.62e+01(5.09e-01)-	**5.1560e-1 (1.36e-2)**
		1000	5.6684e-1 (4.52e-2) -	1.5791e+0 (5.95e-1) -	1.9511e+1 (2.78e-1) -	1.81e+01(7.50e-01)-	1.82e+01(1.08e+00)-	**5.1962e-1 (4.01e-3)**
LSMOP6	2	100	**4.2468e-1 (3.48e-3) +**	7.7717e-1 (1.58e-1) =	1.0696e+0 (1.04e-1) -	1.02e+00(9.25e-02)-	7.75e+01(8.16e+01)-	7.3329e-1 (1.95e-2)
		200	**3.5745e-1 (1.17e-3) +**	7.6302e-1 (4.60e-2) =	5.6211e+2 (8.82e+2) -	7.48e-01(9.16e-02)+	1.69e+02(1.48e+02)-	7.5911e-1 (5.40e-3)
		500	**3.2024e-1 (3.82e-4) +**	7.4190e-1 (4.20e-2) =	6.1881e+2 (3.54e+2) -	5.67e-01(5.61e-02)+	7.61e+02(5.59e+02)-	7.5233e-1 (9.55e-4)
		1000	**3.1227e-1 (1.86e-4) +**	6.8193e-1 (1.64e-1) =	1.2429e+3 (1.48e+3) -	5.66e-01(1.44e-01)=	1.32e+03(9.13e+02)-	7.5010e-1 (1.79e-3)
	3	100	1.0566e+0 (6.74e-3) =	2.6482e+1 (2.88e+1) -	2.3786e+3 (6.25e+3) -	3.20e+03(2.46e+03)-	7.45e+02(3.50e+02)-	**9.8301e-1 (1.86e-1)**
		200	**1.0920e+0 (1.93e-1) +**	1.4590e+1 (2.66e+1) =	2.3290e+4 (1.06e+4) -	1.26e+04(3.91e+03)-	1.34e+04(2.21e+03)-	1.2356e+0 (1.98e-3)
		500	**1.2533e+0 (8.20e-2) +**	7.8582e+1 (1.16e+2) -	2.9819e+4 (4.93e+3) -	1.82e+04(4.24e+03)-	2.61e+04(2.47e+03)-	1.2959e+0 (3.85e-4)
		1000	**1.1505e+0 (2.69e-1) +**	1.0522e+2 (1.34e+2) =	3.5801e+4 (4.01e+3) -	2.22e+04(1.97e+03)-	3.28e+04(5.31e+03)-	1.3168e+0 (1.48e-3)
LSMOP7	2	100	1.4601e+0 (3.82e-4) -	2.0901e+2 (8.97e+1) -	1.7924e+1 (2.63e+0) -	2.51e+04(1.13e+04)-	4.39e+03(7.99e+02)-	**1.4577e+0 (7.35e-4)**
		200	**1.4904e+0 (8.53e-4) +**	2.2437e+3 (5.95e+2) -	6.7514e+4 (4.80e+3) -	4.69e+04(8.56e+03)-	4.03e+04(4.71e+03)-	1.4916e+0 (5.54e-4)
		500	**1.5023e+0 (1.28e-3) +**	5.7882e+3 (9.36e+2) -	7.8612e+4 (3.07e+3) -	6.83e+04(4.42e+03)-	6.43e+04(3.32e+03)-	1.5109e+0 (1.83e-3)
		1000	**1.5144e+0 (8.89e-4) =**	6.0164e+3 (1.52e+3) -	8.3559e+4 (1.62e+3) -	7.98e+04(3.18e+03)-	7.78e+04(2.38e+03)-	1.5156e+0 (2.36e-3)
	3	100	**9.0510e-1 (6.12e-2) =**	1.1212e+0 (1.59e-1) -	3.5550e+0 (6.29e-1) -	1.59e+00(2.24e-01)-	1.04e+02(7.83e+01)-	9.1842e-1 (9.45e-2)
		200	**9.2707e-1 (2.45e-2) +**	1.0764e+0 (1.19e-1) =	3.6173e+2 (3.31e+2) -	1.65e+00(1.02e-01)-	5.46e+02(5.41e+02)-	1.0253e+0 (5.64e-2)
		500	9.2434e-1 (3.65e-2) =	9.4830e-1 (9.07e-2) =	7.2343e+2 (5.35e+2) -	1.11e+00(4.92e-02)-	1.08e+03(1.10e+03)-	**9.2035e-1 (8.90e-2)**
		1000	**8.9570e-1 (4.64e-2) =**	9.1924e-1 (1.00e-1) =	6.6750e+2 (9.02e+2) -	9.49e-01(1.17e-01)=	1.38e+03(9.88e+02)-	9.5474e-1 (2.46e-2)
LSMOP8	2	100	7.4209e-1 (1.20e-16) -	1.5785e+0 (6.76e-1) -	3.4014e-1 (2.13e-2) =	1.41e+01(1.40e+00)-	3.27e+00(5.00e-01)-	**2.9998e-1 (5.28e-2)**
		200	7.4209e-1 (1.20e-16) -	3.2966e+0 (6.47e-1) -	1.7439e+1 (5.36e-1) -	1.68e+01(3.20e-01)-	1.27e+01(3.64e-01)-	**6.5133e-1 (6.66e-2)**
		500	7.4209e-1 (1.20e-16) =	4.5203e+0 (4.47e-1) -	1.9130e+1 (4.74e-1) -	1.85e+01(5.05e-01)-	1.72e+01(4.16e-01)-	**7.4209e-1 (1.20e-16)**
		1000	7.4209e-1 (1.20e-16) =	4.1292e+0 (1.51e+0) -	1.9957e+1 (4.21e-1) -	1.96e+01(3.58e-01)-	1.89e+01(3.99e-01)-	**7.4209e-1 (1.20e-16)**
	3	100	3.7046e-1 (2.24e-2) -	6.5854e-1 (1.67e-1) -	3.4703e-1 (6.89e-2) -	6.77e-01(2.49e-02)-	7.46e-01(5.22e-02)-	**2.2384e-1 (2.52e-2)**
		200	4.0454e-1 (6.88e-2) -	3.5548e-1 (1.68e-1) -	7.0342e-1 (3.39e-2) -	6.82e-01(4.72e-02)-	7.25e-01(6.49e-02)-	**1.6963e-1 (1.16e-2)**
		500	4.0422e-1 (5.94e-2) -	3.4096e-1 (1.66e-1) -	6.5173e-1 (2.50e-2) -	6.44e-01(6.84e-02)-	6.45e-01(4.53e-02)-	**1.5592e-1 (1.80e-2)**
		1000	4.6143e-1 (2.65e-2) -	4.1178e-1 (1.67e-1) -	6.3326e-1 (1.95e-2) -	5.97e-01(1.69e-02)-	6.23e-01(2.37e-02)-	**1.6270e-1 (3.69e-2)**
LSMOP9	2	100	8.1004e-1 (0.00e+0) -	1.9235e+0 (7.44e-1) -	8.9923e+0 (7.60e+0) -	7.31e+00(2.01e+00)-	6.93e+00(1.20e+00)-	**8.1004e-1 (5.64e-16)**
		200	8.1004e-1 (0.00e+0) =	3.3653e+0 (1.45e+0) -	3.9236e+1 (8.92e+0) -	2.13e+01(6.71e+00)-	1.76e+01(2.19e+00)-	**8.0603e-1 (5.30e-3)**
		500	8.0895e-1 (6.01e-4) -	8.9924e+0 (1.10e+0) -	5.4906e+1 (2.24e+0) -	2.68e+01(3.99e+00)-	4.31e+01(2.80e+00)-	**6.6887e-1 (1.24e-1)**
		1000	8.0627e-1 (2.24e-4) -	1.0527e+1 (1.66e+0) -	5.7790e+1 (1.26e+0) -	4.00e+01(3.89e+00)-	5.37e+01(1.02e+00)-	**6.6516e-1 (7.38e-2)**
	3	100	1.5379e+0 (2.40e-16) -	5.1136e+0 (1.12e+0) -	1.2102e+0 (4.61e-2) -	3.42e+01(7.38e+00)-	1.86e+01(2.00e+00)-	**5.9295e-1 (2.15e-3)**
		200	1.4817e+0 (1.49e-1) -	9.5105e+0 (3.61e+0) -	1.0982e+2 (2.49e+1) -	6.21e+01(8.12e+00)-	4.72e+01(2.87e+00)-	**6.7195e-1 (2.09e-1)**
		500	1.3691e+0 (2.10e-1) -	3.0712e+1 (5.40e+0) -	1.2961e+2 (1.89e+0) -	7.95e+01(6.92e+00)-	1.06e+02(6.02e+00)-	**5.8631e-1 (1.58e-2)**
		1000	**1.1446e+0 (1.87e-4) =**	3.7763e+1 (1.26e+1) -	1.4238e+2 (3.48e+0) -	9.72e+01(4.24e+00)-	1.32e+02(2.12e+00)-	2.5451e+0 (1.34e+0)
+/-/=			16/42/14	1/51/20	2/68/2	2/68/2	0/72/0	

TABLE A. 6
THE IGD COMPARISON RESULTS OF SIX COMPARED ALGORITHMS ON UF1-UF10 TEST PROBLEMS WITH 2-3 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	LSMOF	DGEA	LMEA	LSMOEAD	MOEADVA	NN-CSO
UF1	2	100	1.4349e-1 (2.13e-2) +	7.1944e-1 (1.67e-1) -	**4.1409e-2 (1.43e-3) +**	1.31e+00(1.31e-01)-	3.94e-01(2.00e-02)-	2.4318e-1 (1.16e-2)
		200	**2.0901e-1 (4.27e-2) +**	1.1972e+0 (9.62e-2) -	1.8699e+0 (6.12e-2) -	1.57e+00(1.04e-01)-	1.15e+00(4.23e-02)-	5.0663e-1 (6.26e-1)
		500	3.0578e-1 (5.88e-2) =	9.6395e-1 (5.93e-1) -	2.0674e+0 (3.36e-2) -	1.87e+00(6.01e-02)-	1.77e+00(4.86e-02)-	**2.8877e-1 (4.73e-3)**
		1000	3.2827e-1 (2.12e-2) -	5.3782e-1 (4.32e-1) -	2.1304e+0 (2.13e-2) -	2.08e+00(4.44e-02)-	2.01e+00(5.53e-02)-	**2.9360e-1 (5.83e-3)**
UF2	2	100	1.9456e-1 (6.95e-2) -	1.8207e-1 (1.96e-2) -	**1.7251e-2 (3.17e-4) +**	4.84e-01(6.64e-02)-	1.96e-01(1.02e-02)-	8.3317e-2 (4.18e-3)
		200	2.4282e-1 (4.76e-2) -	2.2943e-1 (2.35e-2) -	8.5254e-1 (2.45e-2) -	7.15e-01(3.62e-02)-	5.46e-01(9.97e-03)-	**1.1017e-1 (4.73e-2)**
		500	3.2271e-1 (2.78e-2) -	2.8149e-1 (2.81e-2) -	8.9856e-1 (7.61e-3) -	7.98e-01(3.47e-02)-	8.04e-01(1.08e-02)-	**9.2597e-2 (3.54e-3)**
		1000	3.8262e-1 (4.01e-2) -	3.0738e-1 (1.25e-2) -	9.3439e-1 (1.18e-2) -	9.09e-01(1.22e-02)-	8.89e-01(1.13e-02)-	**9.6263e-2 (4.00e-3)**
UF3	2	100	2.3127e-1 (8.73e-3) -	2.8003e-1 (4.83e-2) -	**1.4085e-1 (2.57e-3) +**	7.41e-01(6.46e-02)-	3.64e-01(1.19e-02)-	1.8399e-1 (7.77e-3)
		200	2.1555e-1 (4.79e-3) -	3.6099e-1 (1.66e-2) -	1.0422e+0 (2.22e-2) -	8.69e-01(2.99e-02)-	6.96e-01(1.64e-02)-	**1.5620e-1 (3.36e-3)**
		500	2.0555e-1 (3.28e-3) -	3.8754e-1 (1.12e-1) -	1.0891e+0 (1.67e-2) -	9.22e-01(1.93e-02)-	9.60e-01(8.22e-03)-	**1.3442e-1 (1.11e-3)**
		1000	2.0280e-1 (1.63e-3) -	3.7934e-1 (1.61e-1) -	1.1058e+0 (1.03e-2) -	1.04e+00(7.73e-03)-	1.05e+00(1.10e-02)-	**1.2473e-1 (7.05e-4)**
UF4	2	100	9.8790e-2 (2.67e-2) -	1.2687e-1 (4.67e-3) -	**4.2089e-2 (1.62e-4) +**	1.87e-01(2.40e-03)-	9.73e-02(9.85e-04)-	5.8690e-2 (1.95e-4)
		200	1.1356e-1 (2.62e-2) -	1.2584e-1 (1.22e-2) -	2.1385e-1 (8.14e-4) -	2.07e-01(1.87e-03)-	1.68e-01(1.02e-03)-	**5.9575e-2 (5.51e-4)**
		500	1.3919e-1 (1.18e-2) -	1.2766e-1 (1.26e-2) -	2.1987e-1 (6.29e-4) -	2.16e-01(1.26e-03)-	2.03e-01(6.11e-04)-	**6.1020e-2 (1.79e-3)**
		1000	1.3437e-1 (2.70e-2) -	1.3508e-1 (7.68e-4) -	2.2269e-1 (1.21e-3) -	2.22e-01(1.68e-03)-	2.16e-01(4.86e-04)-	**6.0001e-2 (5.24e-4)**
UF5	2	100	9.6521e-1 (9.79e-2) =	2.5211e+0 (4.43e-1) -	**8.4887e-1 (5.47e-2) +**	4.94e+00(2.83e-01)-	2.39e+00(8.37e-02)-	1.1267e+0 (1.73e-1)
		200	**1.5900e+0 (5.07e-1) +**	4.0524e+0 (4.69e-1) -	6.4982e+0 (1.20e-1) -	5.72e+00(1.54e-01)-	4.83e+00(6.79e-02)-	2.3209e+0 (3.11e-1)
		500	**2.1960e+0 (2.17e-1) +**	4.9939e+0 (4.28e-1) -	6.9829e+0 (1.03e-1) -	6.47e+00(1.30e-01)-	6.35e+00(7.92e-02)-	3.0021e+0 (6.99e-2)
		1000	**2.9378e+0 (2.78e-1) =**	5.7137e+0 (1.24e-1) -	7.1961e+0 (5.16e-2) -	6.98e+00(3.35e-02)-	6.89e+00(9.13e-02)-	3.0914e+0 (6.43e-2)
UF6	2	100	**4.1538e-1 (1.37e-1) =**	2.2169e+0 (2.20e-1) -	2.4367e-1 (4.03e-3) +	5.03e+00(5.84e-01)-	1.61e+00(1.71e-01)-	5.1688e-1 (9.19e-2)
		200	**5.0481e-1 (1.96e-1) =**	4.0059e+0 (3.64e-1) -	7.8753e+0 (2.32e-1) -	6.71e+00(2.56e-01)-	4.76e+00(1.31e-01)-	7.1853e-1 (2.07e-1)
		500	**6.6943e-1 (1.07e-1) +**	5.2685e+0 (2.68e-1) -	8.2628e+0 (2.05e-1) -	7.41e+00(3.53e-01)-	7.34e+00(1.22e-01)-	1.1645e+0 (6.83e-2)
		1000	**1.0601e+0 (1.49e-1) =**	5.9626e+0 (1.76e-1) -	8.5635e+0 (1.51e-1) -	8.45e+00(2.19e-01)-	8.21e+00(1.12e-01)-	1.1917e+0 (4.72e-2)
UF7	2	100	**1.7185e-1 (1.33e-1) =**	7.8848e-1 (1.73e-1) -	8.5529e-2 (2.49e-2) +	1.13e+00(1.08e-01)-	4.81e-01(2.08e-02)-	3.5681e-1 (3.58e-1)
		200	**2.0807e-1 (1.39e-1) =**	1.1637e+0 (1.14e-1) -	1.9279e+0 (5.58e-2) -	1.63e+00(1.11e-01)-	1.23e+00(3.06e-02)-	2.6931e-1 (1.08e-2)
		500	**2.6120e-1 (1.12e-1) =**	1.2694e+0 (4.09e-1) -	2.0973e+0 (2.16e-2) -	1.94e+00(7.82e-02)-	1.86e+00(3.51e-02)-	3.0180e-1 (6.16e-3)
		1000	3.3575e-1 (1.23e-1) =	4.8469e-1 (1.89e-1) -	2.1994e+0 (1.59e-2) -	2.14e+00(2.53e-02)-	2.07e+00(1.21e-02)-	**3.0113e-1 (1.01e-2)**
UF8	3	100	4.7656e-1 (2.16e-2) -	6.7429e-1 (1.14e-1) -	**1.7226e-1 (9.98e-3) +**	2.18e+00(3.15e-01)-	9.89e-01(2.56e-02)-	3.4881e-1 (1.46e-2)
		200	5.2538e-1 (1.04e-2) -	8.6434e-1 (1.06e-1) -	3.9916e+0 (1.13e-1) -	2.86e+00(2.14e-01)-	2.56e+00(9.12e-02)-	**4.1731e-1 (3.11e-2)**
		500	5.6558e-1 (2.27e-2) -	1.0051e+0 (1.95e-1) -	4.2399e+0 (6.80e-2) -	3.41e+00(1.78e-01)-	3.69e+00(1.11e-01)-	**4.8100e-1 (1.45e-2)**
		1000	6.0969e-1 (2.39e-2) -	1.1445e+0 (1.60e-1) -	4.3248e+0 (4.30e-2) -	3.78e+00(5.65e-02)-	4.03e+00(8.57e-02)-	**4.9542e-1 (2.93e-2)**
UF9	3	100	4.9519e-1 (5.29e-3) +	7.4916e-1 (5.04e-2) -	**1.9022e-1 (1.55e-2) +**	2.06e+00(4.90e-01)-	1.07e+00(4.79e-02)-	5.0989e-1 (4.59e-3)
		200	**5.2126e-1 (8.09e-3) +**	1.0372e+0 (8.93e-2) -	4.1095e+0 (7.27e-2) -	3.22e+00(2.44e-01)-	2.72e+00(7.62e-02)-	5.6101e-1 (7.41e-3)
		500	**5.6199e-1 (1.01e-2) +**	1.2599e+0 (8.19e-2) -	4.3692e+0 (5.69e-2) -	3.53e+00(8.93e-02)-	3.88e+00(7.08e-02)-	6.1365e-1 (1.26e-2)
		1000	**5.8510e-1 (1.35e-2) +**	1.3848e+0 (1.41e-1) -	4.4708e+0 (5.28e-2) -	3.97e+00(5.35e-02)-	4.28e+00(7.65e-02)-	6.6051e-1 (1.66e-2)
UF10	3	100	**1.2671e+0 (3.66e-1) +**	4.1683e+0 (5.02e-1) -	1.2158e+0 (6.49e-2) +	1.23e+01(8.71e-01)-	6.27e+00(3.64e-01)-	1.8287e+0 (1.87e-1)
		200	**1.0936e+0 (1.27e-1) +**	6.1673e+0 (3.71e-1) -	1.9659e+1 (5.73e-1) -	1.57e+01(1.23e+00)-	1.36e+01(4.01e-01)-	2.4275e+0 (1.72e-1)
		500	**1.9335e+0 (3.55e-1) +**	7.4275e+0 (1.35e+0) -	2.0398e+1 (2.63e-1) -	1.74e+01(3.25e-01)-	1.82e+01(2.62e-01)-	3.1637e+0 (3.38e-1)
		1000	**2.7519e+0 (3.56e-1) +**	8.8886e+0 (1.32e+0) -	2.0772e+1 (1.97e-1) -	1.89e+01(3.04e-01)-	1.98e+01(3.45e-01)-	3.7282e+0 (2.54e-1)
+/-/=			13/17/10	0/40/0	10/30/0	0/40/0	0/40/0	

TABLE A. 7
THE IGD COMPARISON RESULTS OF SIX COMPARED ALGORITHMS ON DTLZ1-DTLZ7 TEST PROBLEMS WITH 5-10 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	LSMOF	DGEA	LMEA	LSMOEAD	MOEADVA	NN-CSO
DTLZ1	5	100	1.1497e+2 (3.04e+2) +	2.5896e+2 (4.77e+1) =	**2.5706e+1 (1.25e+0) =**	1.29e+03(1.23e+02)-	5.86e+02(4.02e+01)-	1.6925e+2 (1.38e+2)
		200	**1.3726e+2 (3.63e+2) +**	6.2035e+2 (2.47e+2) -	4.6919e+3 (1.78e+2) -	3.71e+03(6.11e+01)-	3.08e+03(1.75e+02)-	2.6128e+2 (2.57e+2)
		500	**7.0610e-2 (1.68e-3) +**	9.9795e+2 (3.68e+2) -	1.1943e+4 (3.13e+2) -	1.11e+04(3.23e+02)-	1.09e+04(2.61e+02)-	1.2046e+2 (2.56e+2)
		1000	6.7920e+3 (3.58e+3) -	3.3512e+3 (9.18e+2) -	2.4636e+4 (4.20e+2) -	2.40e+04(3.51e+02)-	2.33e+04(3.29e+02)-	**2.2002e+2 (2.22e+2)**
	8	100	7.6648e+2 (2.53e+2) -	2.7663e+2 (3.61e+1) =	**2.1388e+1 (1.66e+0) +**	1.07e+03(1.20e+02)-	5.88e+02(3.53e+01)-	2.4699e+2 (6.08e+1)
		200	1.2699e+3 (4.24e+2) -	5.3954e+2 (2.06e+2) =	4.3433e+3 (2.03e+2) -	3.08e+03(2.05e+02)-	3.01e+03(1.49e+02)-	**4.6851e+2 (1.64e+2)**
		500	4.7818e+3 (1.92e+3) -	1.8236e+3 (3.20e+2) -	1.0927e+4 (5.73e+2) -	9.19e+03(4.00e+02)-	9.74e+03(3.56e+02)-	**4.2218e+2 (6.81e+2)**
		1000	8.7278e+3 (5.06e+3) -	3.2942e+3 (1.03e+3) -	2.1955e+4 (1.22e+3) -	2.00e+04(5.40e+02)-	2.13e+04(8.95e+02)-	**6.8877e+2 (8.48e+2)**
	10	100	7.9116e+2 (2.01e+2) -	2.9306e+2 (8.04e+1) =	**1.9581e+1 (1.29e+0) +**	1.23e+03(1.89e+02)-	6.00e+02(2.79e+01)-	1.9673e+2 (1.55e+2)
		200	1.8619e+3 (4.19e+2) -	6.2382e+2 (2.07e+2) =	4.0241e+3 (1.97e+2) -	3.50e+03(1.15e+02)-	3.02e+03(2.42e+02)-	**5.3201e+2 (1.79e+2)**
		500	4.0741e+3 (1.12e+3) -	1.7280e+3 (2.46e+2) -	1.0735e+4 (7.04e+2) -	9.81e+03(4.77e+02)-	9.99e+03(2.63e+02)-	**2.7571e+2 (2.80e+2)**
		1000	1.0145e+4 (3.67e+3) -	3.4907e+3 (9.03e+2) -	2.1843e+4 (1.18e+3) -	1.91e+04(8.19e+02)-	2.06e+04(8.66e+02)-	**3.2814e+2 (5.18e+2)**
DTLZ2	5	100	2.5195e+0 (5.24e-1) -	7.5579e-1 (6.46e-2) -	**1.5239e-1 (2.62e-3) +**	3.40e+00(2.53e-01)-	1.36e+00(6.10e-02)-	4.9801e-1 (4.04e-2)
		200	8.4418e+0 (1.40e+0) -	1.3947e+0 (1.76e-1) -	1.3755e+1 (3.68e-1) -	1.13e+01(7.43e-01)-	7.77e+00(3.11e-01)-	**5.6523e-1 (6.63e-2)**
		500	3.4105e+1 (2.11e+0) -	2.9162e+0 (1.30e-1) -	3.6973e+1 (4.10e-1) -	3.28e+01(1.25e+00)-	3.18e+01(4.62e-01)-	**6.9030e-1 (6.45e-2)**
		1000	5.8958e+1 (1.37e+0) -	5.4007e+0 (5.61e-1) -	7.6754e+1 (6.81e-1) -	7.47e+01(1.03e+00)-	7.23e+01(4.52e-01)-	**8.2565e-1 (3.53e-2)**
	8	100	1.5534e+1 (1.73e+0) -	1.0453e+0 (8.57e-2) -	**3.3266e-1 (6.29e-3) +**	5.15e+00(2.42e-01)-	1.70e+00(3.43e-02)-	8.8452e-1 (3.41e-2)
		200	2.8831e+1 (5.08e+0) -	1.4586e+0 (1.35e-1) -	1.3718e+1 (3.71e-1) -	1.32e+01(4.94e-01)-	8.68e+00(9.29e-02)-	**1.0250e+0 (2.93e-2)**
		500	4.3349e+1 (7.83e+0) -	3.0779e+0 (3.62e-1) -	3.6929e+1 (4.70e-1) -	3.49e+01(5.79e-01)-	3.22e+01(3.00e-01)-	**9.8507e-1 (4.22e-2)**
		1000	7.8487e+1 (9.76e+0) -	5.8028e+0 (6.06e-1) -	7.6851e+1 (7.09e-1) -	7.55e+01(1.57e+00)-	7.23e+01(9.43e-01)-	**9.8649e-1 (2.51e-2)**
	10	100	1.0879e+1 (3.04e+0) -	1.1251e+0 (1.02e-1) -	**4.1071e-1 (7.33e-3) +**	5.30e+00(3.15e-01)-	1.88e+00(7.37e-02)-	9.9078e-1 (2.74e-2)
		200	2.7987e+1 (6.08e+0) -	1.5628e+0 (1.20e-1) -	1.3964e+1 (2.71e-1) -	1.29e+01(3.34e-01)-	9.04e+00(2.31e-01)-	**1.0680e+0 (5.82e-2)**
		500	7.7268e+1 (1.60e+1) -	3.1548e+0 (3.94e-1) -	3.6814e+1 (4.76e-1) -	3.51e+01(8.82e-01)-	3.27e+01(4.95e-01)-	**1.0921e+0 (9.10e-2)**
		1000	8.0609e+1 (1.57e+1) -	5.2500e+0 (7.49e-1) -	7.6309e+1 (7.61e-1) -	7.48e+01(2.23e+00)-	7.32e+01(8.43e-01)-	**1.0579e+0 (3.91e-2)**
DTLZ3	5	100	1.8340e+2 (3.48e+2) =	7.3817e+2 (3.49e+2) =	**1.1859e+2 (5.83e+0) +**	5.18e+03(3.32e+02)-	2.14e+03(6.62e+01)-	7.6616e+2 (4.86e+2)
		200	**1.5020e+2 (2.25e+2) =**	1.8645e+3 (8.82e+2) -	1.8035e+4 (4.30e+2) -	1.57e+04(4.74e+02)-	1.20e+04(3.07e+02)-	7.4980e+2 (1.01e+3)
		500	1.9466e+3 (1.29e+3) -	5.4544e+3 (1.73e+3) -	4.8987e+4 (5.30e+2) -	4.52e+04(6.85e+02)-	4.36e+04(8.96e+02)-	**3.8409e+2 (6.12e+2)**
		1000	2.8187e+3 (3.41e+3) =	4.8999e+3 (3.21e+3) -	1.0173e+5 (6.12e+2) -	9.98e+04(1.01e+03)-	9.66e+04(1.43e+03)-	**1.3701e+3 (1.40e+3)**
	8	100	2.2487e+3 (8.34e+1) -	9.5022e+2 (2.77e+2) =	**1.1129e+2 (2.33e+0) +**	6.55e+03(2.34e+02)-	2.23e+03(1.04e+02)-	1.0390e+3 (2.46e+2)
		200	4.5414e+3 (5.51e+2) -	2.3074e+3 (5.84e+2) =	1.7966e+4 (5.95e+2) -	1.71e+04(5.25e+02)-	1.22e+04(3.79e+02)-	**1.6571e+3 (8.85e+2)**
		500	2.2166e+4 (4.29e+3) -	3.9971e+3 (1.35e+3) -	4.8903e+4 (2.33e+2) -	4.70e+04(7.14e+02)-	4.41e+04(2.63e+02)-	**4.8984e+2 (4.86e+2)**
		1000	3.3338e+4 (1.18e+4) -	6.9528e+3 (2.72e+3) -	1.0096e+5 (4.51e+2) -	9.91e+04(1.61e+03)-	9.69e+04(3.98e+02)-	**4.2066e+2 (4.91e+2)**
	10	100	2.2578e+3 (3.76e+1) -	8.6595e+2 (3.67e+2) +	**1.0981e+2 (6.42e+0) +**	7.26e+03(5.02e+02)-	2.27e+03(7.73e+01)-	1.1943e+3 (1.02e+2)
		200	4.6720e+3 (9.61e+1) -	**1.7969e+3 (5.34e+2) =**	1.7782e+4 (5.03e+2) -	1.75e+04(6.37e+02)-	1.29e+04(2.79e+02)-	1.8951e+3 (1.32e+3)
		500	1.9228e+4 (5.55e+3) -	3.6291e+3 (2.35e+3) =	4.8659e+4 (6.02e+2) -	4.72e+04(7.25e+02)-	4.43e+04(8.55e+02)-	**1.0827e+3 (1.58e+3)**
		1000	3.5243e+4 (8.84e+3) -	9.2376e+3 (2.46e+3) -	1.0119e+5 (7.53e+2) -	1.00e+05(9.48e+02)-	9.71e+04(6.77e+02)-	**2.2712e+3 (1.98e+3)**
DTLZ4	5	100	4.9134e+0 (4.57e+0) -	1.2706e+0 (2.23e-1) -	**3.6263e-1 (6.39e-2) +**	3.84e+00(6.15e-01)-	1.74e+00(6.32e-02)-	9.0123e-1 (2.29e-1)
		200	1.8012e+1 (9.31e+0) -	3.0288e+0 (6.44e-1) -	1.4137e+1 (2.62e-1) -	1.14e+01(6.52e-01)-	8.26e+00(1.60e-01)-	**1.1041e+0 (7.73e-3)**
		500	3.7679e+1 (1.14e+1) -	6.4330e+0 (1.02e+0) -	3.7057e+1 (5.04e-1) -	3.29e+01(1.50e+00)-	3.17e+01(3.02e-01)-	**1.1081e+0 (7.96e-7)**
		1000	7.8601e+1 (1.89e+1) -	1.1546e+1 (1.50e+0) -	7.6785e+1 (6.78e-1) -	7.25e+01(2.60e+00)-	7.17e+01(9.77e-01)-	**1.2318e+0 (3.14e-2)**
	8	100	1.5614e+1 (4.17e+0) -	1.7410e+0 (1.38e-1) -	**4.1005e-1 (3.00e-2) +**	3.80e+00(4.16e-01)-	1.95e+00(6.19e-02)-	1.1920e+0 (1.04e-2)
		200	2.4207e+1 (9.43e+0) -	2.4999e+0 (2.32e-1) -	1.4198e+1 (2.24e-1) -	1.17e+01(8.22e-01)-	8.69e+00(2.65e-01)-	**1.2133e+0 (2.39e-3)**
		500	4.9721e+1 (1.82e+1) -	5.3502e+0 (7.39e-1) -	3.7395e+1 (2.14e-1) -	2.98e+01(2.81e+00)-	3.25e+01(3.75e-01)-	**1.3757e+0 (7.06e-2)**
		1000	1.0893e+2 (3.19e+1) -	1.1142e+1 (1.34e+0) -	7.6936e+1 (6.45e-1) -	7.27e+01(2.41e+00)-	7.22e+01(1.01e+00)-	**1.3439e+0 (3.91e-2)**
	10	100	1.1826e+1 (3.63e+0) -	1.6901e+0 (1.19e-1) -	**4.4223e-1 (2.56e-2) +**	4.81e+00(3.17e-01)-	2.04e+00(9.21e-02)-	1.2250e+0 (1.20e-2)
		200	3.5112e+1 (1.00e+1) -	2.5033e+0 (2.76e-1) -	1.3884e+1 (2.61e-1) -	1.20e+01(3.26e-01)-	9.19e+00(4.56e-01)-	**1.3963e+0 (1.14e-1)**
		500	5.5392e+1 (1.32e+1) -	4.7595e+0 (5.90e-1) -	3.6967e+1 (7.91e-1) -	3.17e+01(2.06e+00)-	3.28e+01(1.08e+00)-	**1.3750e+0 (8.46e-2)**
		1000	1.2165e+2 (3.24e+1) -	8.6497e+0 (1.31e+0) -	7.6268e+1 (1.26e+0) -	7.06e+01(1.76e+00)-	7.29e+01(8.85e-01)-	**1.3390e+0 (6.47e-2)**
DTLZ5	5	100	3.6219e+0 (4.06e+0) -	6.4306e-1 (1.76e-1) -	**2.2639e-3 (2.73e-4) +**	3.31e+00(2.16e-01)-	1.52e+00(6.84e-02)-	3.1277e-1 (1.93e-2)
		200	1.6472e+1 (8.87e-1) -	1.3186e+0 (1.12e-1) -	1.3699e+1 (3.23e-1) -	1.06e+01(3.84e-01)-	8.02e+00(3.02e-01)-	**3.5304e-1 (2.71e-2)**
		500	4.3189e+1 (7.79e+0) -	3.0608e+0 (7.14e-1) -	3.6622e+1 (9.68e-1) -	3.16e+01(7.65e-01)-	3.16e+01(5.73e-01)-	**3.7765e-1 (2.68e-2)**
		1000	4.8752e+1 (1.86e+1) -	5.6973e+0 (8.12e-1) -	7.6366e+1 (7.25e-1) -	7.52e+01(7.70e-01)-	7.20e+01(6.17e-01)-	**4.8973e-1 (3.81e-2)**
	8	100	7.0726e+0 (4.26e+0) -	7.5440e-1 (4.71e-2) -	**2.1206e-3 (2.29e-4) +**	4.98e+00(2.14e-01)-	2.60e+00(2.75e-01)-	3.1610e-1 (2.27e-2)
		200	1.8188e+1 (6.86e+0) -	1.4012e+0 (1.99e-1) -	1.3461e+1 (2.30e-1) -	1.24e+01(4.81e-01)-	8.60e+00(3.32e-01)-	**3.7485e-1 (1.02e-2)**
		500	4.2608e+1 (8.24e+0) -	3.4005e+0 (8.95e-1) -	3.6734e+1 (4.83e-1) -	3.40e+01(7.53e-01)-	3.17e+01(5.93e-01)-	**3.9319e-1 (2.00e-2)**
		1000	8.2719e+1 (7.14e+0) -	5.5787e+0 (7.57e-1) -	7.6290e+1 (1.35e+0) -	7.37e+01(1.53e+00)-	7.20e+01(7.44e-01)-	**4.4120e-1 (5.98e-2)**
	10	100	8.1365e+0 (3.74e+0) -	7.5612e-1 (1.23e-1) -	**2.2727e-3 (1.01e-4) +**	4.95e+00(3.91e-01)-	3.58e+00(2.81e-01)-	3.3800e-1 (4.47e-2)
		200	2.4451e+1 (4.58e+0) -	1.3333e+0 (1.94e-1) -	1.3440e+1 (2.08e-1) -	1.28e+01(2.39e-01)-	9.53e+00(3.17e-01)-	**4.5488e-1 (3.23e-2)**
		500	4.9461e+1 (9.08e+0) -	2.9058e+0 (5.62e-1) -	3.6599e+1 (4.98e-1) -	3.55e+01(1.09e+00)-	3.26e+01(4.58e-01)-	**5.1257e-1 (7.28e-2)**
		1000	9.8967e+1 (1.27e+1) -	5.6669e+0 (7.90e-1) -	7.5841e+1 (9.52e-1) -	7.47e+01(1.47e+00)-	7.24e+01(5.85e-01)-	**5.0542e-1 (5.40e-2)**
DTLZ6	5	100	1.4736e+0 (2.40e-16) -	3.5759e+1 (3.62e+0) -	1.4926e+1 (1.46e+0) -	6.36e+01(2.03e+00)-	6.22e+01(9.56e-01)-	**1.1439e+0 (1.24e-1)**
		200	**1.4736e+0 (2.40e-16) =**	8.1987e+1 (2.41e+0) -	1.7419e+2 (5.39e-1) -	1.63e+02(1.41e+00)-	1.66e+02(5.18e-01)-	7.4977e+0 (1.30e+1)
		500	**1.4736e+0 (2.40e-16) +**	1.9447e+2 (5.82e+1) =	4.4469e+2 (6.98e-1) -	4.35e+02(1.30e+00)-	4.38e+02(1.40e+00)-	1.2555e+2 (6.86e+1)
		1000	**3.7603e+2 (4.81e+1) =**	4.4896e+2 (4.74e+1) =	8.9684e+2 (8.10e-1) -	8.96e+02(2.32e+00)-	8.93e+02(8.69e-01)-	4.4290e+2 (5.97e+1)
	8	100	2.1272e+0 (0.00e+0) -	3.3755e+1 (4.40e+0) -	1.4692e+1 (1.10e+0) -	7.76e+01(8.83e-01)-	6.03e+01(7.93e-01)-	**1.4865e+0 (1.14e-1)**
		200	**2.1272e+0 (0.00e+0) =**	6.3658e+1 (2.19e+1) -	1.7102e+2 (2.85e-1) -	1.70e+02(1.27e+00)-	1.65e+02(4.12e-01)-	5.5756e+0 (9.93e+0)
		500	3.2506e+2 (4.02e+1) -	2.0427e+2 (4.41e+1) =	4.4098e+2 (1.11e+0) -	4.41e+02(1.55e+00)-	4.37e+02(1.01e+00)-	**1.8481e+2 (8.36e+1)**
		1000	7.0539e+2 (4.32e+1) -	**4.2547e+2 (1.08e+2) =**	8.9404e+2 (1.31e+0) -	8.95e+02(1.37e+00)-	8.91e+02(7.62e-01)-	4.6411e+2 (2.03e+1)
	10	100	2.5196e+0 (4.80e-16) -	3.1060e+1 (9.14e+0) -	1.4724e+1 (1.30e+0) -	7.83e+01(1.44e+00)-	5.94e+01(1.31e+00)-	**1.8316e+0 (1.90e-1)**
		200	**2.5196e+0 (4.80e-16) =**	6.5655e+1 (2.30e+1) -	1.6929e+2 (5.42e-1) -	1.70e+02(9.47e-01)-	1.63e+02(8.71e-01)-	3.4666e+0 (2.95e+0)
		500	3.3167e+2 (6.82e+1) -	2.0063e+2 (4.95e+1) =	4.4033e+2 (6.54e-1) -	4.40e+02(9.75e-01)-	4.36e+02(7.84e-01)-	**1.9093e+2 (8.34e+1)**
		1000	5.9334e+2 (1.00e+2) -	**4.1390e+2 (8.39e+1) =**	8.9164e+2 (8.28e-1) -	8.92e+02(2.31e+00)-	8.90e+02(6.03e-01)-	4.7408e+2 (1.61e+1)
DTLZ7	5	100	1.3658e+0 (2.87e-1) -	1.8749e+0 (1.21e+0) -	**2.3730e-1 (3.82e-3) +**	8.69e+00(1.02e+00)-	4.71e+00(7.49e-01)-	5.2470e-1 (4.62e-3)
		200	1.5643e+0 (2.11e-1) -	3.8662e+0 (3.93e+0) -	1.8254e+1 (5.64e-1) -	1.29e+01(9.34e-01)-	1.19e+01(6.18e-01)-	**5.2269e-1 (9.85e-3)**
		500	2.5696e+0 (7.36e-1) -	5.6080e+0 (5.60e+0) -	1.8809e+1 (4.07e-1) -	1.32e+01(4.59e-01)-	1.62e+01(4.10e-01)-	**5.3577e-1 (5.48e-2)**
		1000	**7.4045e-1 (3.83e-1) =**	5.8051e+0 (5.94e+0) -	1.9379e+1 (3.64e-1) -	1.65e+01(2.41e-01)-	1.78e+01(1.55e-01)-	1.0133e+0 (1.57e-1)
	8	100	7.2877e-1 (2.09e-2) +	3.4521e+0 (2.03e+0) -	**6.3318e-1 (7.23e-3) +**	1.85e+01(3.06e+00)-	1.00e+01(8.05e-01)-	1.6240e+0 (2.70e-2)
		200	3.9158e+0 (1.91e+0) -	7.5607e+0 (4.26e+0) -	3.0851e+1 (7.47e-1) -	2.43e+01(1.28e+00)-	2.19e+01(3.67e-01)-	**1.7672e+0 (4.05e-1)**
		500	3.6563e+0 (1.22e+0) -	6.7727e+0 (5.50e+0) -	3.1385e+1 (6.88e-1) -	2.37e+01(6.83e-01)-	2.84e+01(1.07e+00)-	**1.9336e+0 (3.03e-1)**
		1000	4.3311e+0 (7.06e-1) =	4.4140e+0 (2.89e+0) =	3.1812e+1 (7.22e-1) -	2.75e+01(7.45e-01)-	3.05e+01(4.30e-01)-	**3.3249e+0 (7.49e-1)**
	10	100	1.0466e+0 (5.41e-2) +	2.8808e+0 (1.78e+0) =	**8.8268e-1 (1.63e-2) +**	2.70e+01(3.58e+00)-	1.37e+01(1.17e+00)-	2.5731e+0 (7.75e-1)
		200	6.5043e+0 (6.69e-2) -	5.5423e+0 (5.07e+0) -	3.9233e+1 (5.90e-1) -	3.27e+01(9.63e-01)-	2.86e+01(9.05e-01)-	**1.9409e+0 (2.96e-1)**
		500	6.5031e+0 (8.92e-2) -	9.1824e+0 (3.42e+0) -	3.9643e+1 (1.06e+0) -	3.12e+01(1.76e+00)-	3.68e+01(8.30e-01)-	**2.6103e+0 (7.30e-1)**
		1000	6.3154e+0 (3.51e-1) -	5.8587e+0 (3.34e+0) =	3.9957e+1 (4.43e-1) -	3.35e+01(6.20e-01)-	3.82e+01(8.22e-01)-	**3.1208e+0 (1.39e+0)**
+/-/=			6/69/9	1/64/19	17/66/1	0/84/0	0/84/0	

TABLE A. 8
THE IGD COMPARISON RESULTS OF SIX COMPARED ALGORITHMS ON WFG1-WFG9 TEST PROBLEMS WITH 5-10 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	LSMOF	DGEA	LMEA	LSMOEAD	MOEADVA	NN-CSO
WFG1	5	100	1.9291e+0 (3.10e-2) +	1.9930e+0 (1.21e-2) =	2.2781e+0 (3.42e-2) -	**1.82e+00(2.83e-02)+**	2.67e+00(2.52e-02)-	2.0110e+0 (2.93e-2)
		200	1.9688e+0 (3.09e-2) =	1.9953e+0 (1.53e-2) =	2.6638e+0 (2.30e-2) -	**1.94e+00(3.60e-02)+**	2.69e+00(6.56e-02)-	2.0071e+0 (1.28e-2)
		500	1.9842e+0 (3.08e-2) =	2.0023e+0 (2.99e-2) =	2.6664e+0 (2.57e-2) -	**1.95e+00(6.07e-03)+**	2.69e+00(4.09e-02)-	2.0096e+0 (2.30e-2)
		1000	2.0519e+0 (2.27e-2) +	2.0284e+0 (5.26e-2) +	2.6844e+0 (1.68e-2) -	**2.02e+00(6.67e-02)+**	2.70e+00(3.85e-02)-	2.1607e+0 (3.70e-2)
	8	100	**2.5595e+0 (3.53e-2) +**	2.6353e+0 (5.35e-2) =	2.6111e+0 (4.51e-2) =	2.62e+00(5.33e-02)=	3.13e+00(3.50e-02)-	2.6508e+0 (2.50e-2)
		200	**2.6018e+0 (3.22e-2) +**	2.6403e+0 (3.35e-2) =	3.1475e+0 (3.49e-2) -	2.68e+00(2.74e-02)-	3.14e+00(3.38e-02)-	2.6401e+0 (2.00e-2)
		500	**2.5989e+0 (2.93e-2) +**	2.6423e+0 (3.95e-2) =	3.1545e+0 (2.81e-2) -	2.64e+00(3.41e-02)=	3.15e+00(3.77e-02)-	2.6538e+0 (3.33e-2)
		1000	2.6643e+0 (1.24e-2) +	**2.6420e+0 (2.91e-2) +**	3.1406e+0 (3.59e-2) -	2.68e+00(1.71e-02)+	3.17e+00(2.63e-02)-	2.8140e+0 (5.60e-2)
	10	100	2.9181e+0 (5.67e-2) +	3.0555e+0 (3.45e-2) =	**2.8314e+0 (3.83e-2) +**	3.12e+00(2.01e-02)-	3.43e+00(3.26e-02)-	3.0278e+0 (2.83e-2)
		200	**2.9684e+0 (2.75e-2) +**	3.0696e+0 (4.88e-2) =	3.4513e+0 (2.00e-2) -	3.14e+00(2.44e-02)-	3.43e+00(1.59e-02)-	3.0462e+0 (2.01e-2)
		500	**2.9584e+0 (2.16e-2) +**	3.0810e+0 (2.58e-2) =	3.4359e+0 (3.16e-2) -	3.03e+00(2.49e-02)=	3.44e+00(2.51e-02)-	3.0566e+0 (2.62e-2)
		1000	**3.0400e+0 (1.98e-2) +**	3.0471e+0 (2.39e-2) +	3.4415e+0 (1.13e-2) -	3.11e+00(3.17e-02)+	3.45e+00(4.40e-02)-	3.1995e+0 (4.98e-2)
WFG2	5	100	7.2004e-1 (4.27e-2) -	7.0386e-1 (4.56e-2) -	**4.9042e-1 (6.91e-2) =**	9.30e-01(2.96e-02)-	1.50e+00(1.42e-02)-	5.0634e-1 (1.48e-2)
		200	7.1690e-1 (4.43e-2) -	6.7882e-1 (3.22e-2) -	1.5203e+0 (1.36e-1) -	1.00e+00(5.28e-02)-	1.65e+00(9.31e-03)-	**5.5282e-1 (1.92e-2)**
		500	7.0608e-1 (5.14e-2) -	7.2178e-1 (3.79e-2) -	1.5083e+0 (1.50e-1) -	1.02e+00(2.64e-02)-	1.77e+00(1.10e-02)-	**5.7927e-1 (1.76e-2)**
		1000	**7.2294e-1 (5.84e-2) =**	7.3557e-1 (3.10e-2) =	1.6005e+0 (2.26e-1) -	1.09e+00(1.15e-02)-	1.81e+00(9.25e-03)-	7.2980e-1 (2.70e-2)
	8	100	1.3389e+0 (4.44e-2) -	1.3577e+0 (6.06e-2) -	**8.7857e-1 (7.82e-2) +**	1.85e+00(8.10e-02)-	2.58e+00(5.09e-01)-	1.1968e+0 (2.06e-2)
		200	1.3827e+0 (4.78e-2) -	1.3888e+0 (5.73e-2) -	2.8956e+0 (3.27e-1) -	1.80e+00(2.56e-02)-	2.68e+00(3.24e-01)-	**1.2357e+0 (2.93e-2)**
		500	1.3538e+0 (9.63e-2) =	1.4160e+0 (6.18e-2) -	2.8752e+0 (3.24e-1) -	1.60e+00(3.71e-02)-	2.94e+00(3.21e-01)-	**1.2865e+0 (3.89e-2)**
		1000	1.7758e+0 (1.12e-1) -	1.4767e+0 (7.64e-2) -	3.1004e+0 (5.11e-1) -	1.73e+00(6.98e-02)-	2.95e+00(5.54e-01)-	**1.3762e+0 (4.31e-2)**
	10	100	1.5688e+0 (5.03e-2) -	1.6010e+0 (6.39e-2) -	**1.0946e+0 (5.54e-2) +**	2.23e+00(9.18e-02)-	3.87e+00(8.53e-01)-	1.4342e+0 (4.64e-2)
		200	1.5787e+0 (8.50e-2) =	1.6287e+0 (9.47e-2) -	3.9159e+0 (7.13e-1) -	2.21e+00(3.72e-02)-	3.62e+00(8.27e-01)-	**1.4897e+0 (6.34e-2)**
		500	1.6132e+0 (8.40e-2) =	1.7349e+0 (7.99e-2) -	3.9291e+0 (8.27e-1) -	1.89e+00(5.11e-02)-	3.73e+00(1.06e+00)-	**1.5601e+0 (8.69e-2)**
		1000	2.3242e+0 (6.64e-2) -	1.7967e+0 (9.25e-2) =	3.8247e+0 (5.61e-1) -	1.97e+00(3.58e-02)-	3.77e+00(5.78e-01)-	**1.7821e+0 (1.27e-1)**
WFG3	5	100	4.9955e-1 (6.78e-2) +	1.0588e+0 (9.54e-2) -	**4.5176e-2 (1.83e-2) +**	1.12e+00(5.27e-02)-	8.01e-01(3.18e-02)-	5.9375e-1 (3.14e-2)
		200	**4.5540e-1 (4.26e-2) +**	1.1358e+0 (8.27e-2) -	1.1396e+0 (1.42e-2) -	1.29e+00(2.90e-02)-	9.70e-01(1.25e-02)-	6.3256e-1 (4.62e-2)
		500	**4.5469e-1 (6.40e-2) +**	1.1323e+0 (1.09e-1) -	1.1448e+0 (1.62e-2) -	1.34e+00(1.79e-02)-	1.10e+00(1.95e-02)-	6.8104e-1 (9.27e-2)
		1000	**4.7415e-1 (3.30e-2) +**	1.1435e+0 (1.24e-1) -	1.1586e+0 (1.06e-2) -	1.37e+00(1.97e-02)-	1.15e+00(1.95e-02)-	9.2953e-1 (3.72e-2)
	8	100	7.4297e-1 (1.06e-1) +	2.7119e+0 (3.61e-1) -	**1.1668e-1 (3.46e-2) +**	4.05e+00(2.64e-01)-	1.24e+00(3.47e-02)+	2.2319e+0 (5.89e-2)
		200	**7.0496e-1 (8.21e-2) +**	2.5675e+0 (2.33e-1) -	1.5756e+0 (2.33e-2) +	3.46e+00(1.39e+00)-	1.45e+00(2.56e-02)+	2.1652e+0 (1.93e-1)
		500	**7.1337e-1 (1.37e-1) +**	2.7859e+0 (1.94e-1) -	1.6133e+0 (1.64e-2) +	2.68e+00(2.20e-01)-	1.56e+00(2.51e-02)+	2.0726e+0 (1.50e-1)
		1000	**7.0464e-1 (2.63e-2) +**	2.7294e+0 (2.15e-1) -	1.6110e+0 (1.13e-2) +	3.27e+00(9.74e-01)=	1.60e+00(2.06e-02)+	2.5123e+0 (6.40e-2)
	10	100	8.9822e-1 (1.56e-1) +	3.5447e+0 (1.11e-1) -	**1.5583e-1 (4.10e-2) +**	5.42e+00(5.50e-01)-	1.53e+00(3.85e-02)+	3.0854e+0 (1.81e-1)
		200	**9.9375e-1 (1.39e-1) +**	3.6409e+0 (6.59e-2) -	1.8282e+0 (2.86e-2) +	3.55e+00(6.02e-01)=	1.73e+00(1.52e-02)+	3.0089e+0 (3.13e-1)
		500	**8.2383e-1 (1.81e-1) +**	3.7490e+0 (3.62e-1) -	1.8529e+0 (1.57e-2) +	3.27e+00(1.67e-01)-	1.81e+00(2.30e-02)+	2.8836e+0 (2.04e-1)
		1000	**8.2345e-1 (4.38e-2) +**	3.6395e+0 (1.35e-1) -	1.8591e+0 (3.12e-2) +	3.20e+00(3.56e-01)=	1.84e+00(2.86e-02)+	3.0806e+0 (1.78e-1)
WFG4	5	100	1.1544e+0 (3.40e-2) -	1.0864e+0 (1.54e-2) -	**1.0447e+0 (3.36e-2) =**	1.57e+00(2.43e-01)-	2.04e+00(5.21e-03)-	1.0561e+0 (5.97e-3)
		200	1.1503e+0 (3.15e-2) -	1.0925e+0 (2.87e-2) -	2.3214e+0 (1.55e-1) -	1.36e+00(2.37e-01)-	2.14e+00(3.58e-03)-	**1.0542e+0 (6.35e-3)**
		500	1.1411e+0 (2.93e-2) +	**1.0889e+0 (1.88e-2) +**	2.2466e+0 (1.05e-1) -	1.11e+00(4.26e-03)+	2.22e+00(2.14e-03)-	1.1859e+0 (3.20e-1)
		1000	1.3826e+0 (1.12e-1) -	**1.1110e+0 (2.40e-2) =**	2.2897e+0 (2.18e-1) -	1.13e+00(7.03e-03)=	2.24e+00(2.81e-03)-	1.1353e+0 (1.69e-2)
	8	100	3.1955e+0 (5.35e-2) =	3.2748e+0 (3.92e-2) -	3.3879e+0 (1.02e-1) -	6.51e+00(1.66e-01)-	6.37e+00(4.49e-01)-	**3.1920e+0 (3.04e-2)**
		200	**3.1488e+0 (4.97e-2) +**	3.2702e+0 (5.94e-2) =	6.3943e+0 (2.02e-1) -	5.89e+00(4.43e-01)-	6.56e+00(5.12e-01)-	3.2079e+0 (2.39e-2)
		500	**3.1083e+0 (4.07e-2) +**	3.2783e+0 (4.61e-2) -	6.3456e+0 (3.61e-1) -	3.17e+00(9.27e-02)=	6.53e+00(2.53e-01)-	3.1822e+0 (1.84e-2)
		1000	3.4265e+0 (2.60e-2) -	3.2670e+0 (4.19e-2) =	6.4654e+0 (2.51e-1) -	**3.25e+00(1.07e-01)=**	6.52e+00(2.56e-01)-	3.2678e+0 (4.27e-2)
	10	100	**4.4760e+0 (5.21e-2) +**	4.8601e+0 (2.78e-1) =	5.0176e+0 (1.72e-1) -	9.12e+00(5.17e-01)-	9.22e+00(4.77e-01)-	4.7190e+0 (1.23e-1)
		200	**4.5049e+0 (4.17e-2) +**	4.9364e+0 (2.43e-1) -	9.1449e+0 (3.66e-1) -	8.86e+00(1.75e-02)-	9.32e+00(3.75e-01)-	4.6203e+0 (9.04e-2)
		500	**4.4680e+0 (1.73e-2) +**	4.7044e+0 (1.28e-1) =	9.4019e+0 (4.45e-1) -	4.87e+00(3.34e-01)=	9.82e+00(3.50e-01)-	4.6596e+0 (9.84e-2)
		1000	4.7276e+0 (5.49e-2) -	4.9576e+0 (2.02e-1) -	9.4977e+0 (4.05e-1) -	4.97e+00(5.20e-01)-	9.57e+00(3.62e-01)-	**4.5209e+0 (3.49e-2)**
WFG5	5	100	1.0803e+0 (2.84e-2) -	1.0234e+0 (8.93e-3) =	**8.9900e-1 (2.52e-2) +**	1.74e+00(5.85e-02)-	1.38e+00(1.83e-03)-	1.0132e+0 (1.34e-3)
		200	1.0869e+0 (2.77e-2) -	1.0207e+0 (6.49e-3) =	1.7718e+0 (3.64e-2) -	1.55e+00(1.23e-01)-	1.60e+00(1.78e-03)-	**1.0150e+0 (3.04e-3)**
		500	1.0894e+0 (1.49e-2) -	1.0245e+0 (8.28e-3) -	1.6836e+0 (4.74e-2) -	1.23e+00(9.06e-03)-	1.73e+00(2.89e-03)-	**1.0134e+0 (3.75e-3)**
		1000	1.4280e+0 (2.54e-2) -	**1.0320e+0 (1.11e-2) +**	1.7096e+0 (4.29e-2) -	1.29e+00(5.67e-03)-	1.77e+00(1.83e-03)-	1.1103e+0 (1.31e-2)
	8	100	3.2055e+0 (4.78e-2) -	3.2119e+0 (6.86e-2) -	**2.8456e+0 (6.54e-2) +**	6.33e+00(1.35e-01)-	4.41e+00(1.76e-01)-	3.0526e+0 (4.36e-2)
		200	3.1942e+0 (5.94e-2) -	3.2138e+0 (7.91e-2) -	4.8150e+0 (2.01e-1) -	5.20e+00(5.13e-01)-	4.68e+00(7.43e-02)-	**3.0415e+0 (4.23e-2)**
		500	3.1744e+0 (8.06e-2) -	3.2694e+0 (6.00e-2) -	4.8878e+0 (1.78e-1) -	3.51e+00(8.32e-02)-	4.85e+00(1.04e-01)-	**3.0802e+0 (7.22e-2)**
		1000	3.5853e+0 (7.07e-2) -	**3.2548e+0 (7.29e-2) +**	4.7315e+0 (1.19e-1) -	3.63e+00(1.54e-01)-	4.93e+00(1.53e-01)-	3.4457e+0 (2.78e-2)
	10	100	4.5114e+0 (7.47e-2) -	4.4297e+0 (4.75e-2) =	**4.2530e+0 (8.58e-2) +**	8.77e+00(2.05e-01)-	6.85e+00(4.37e-01)-	4.3701e+0 (5.38e-2)
		200	4.5559e+0 (5.55e-2) -	4.4751e+0 (7.71e-2) =	7.3586e+0 (2.17e-1) -	8.77e+00(2.41e-01)-	6.77e+00(2.33e-01)-	**4.4166e+0 (6.79e-2)**
		500	4.5190e+0 (3.63e-2) =	4.5288e+0 (5.31e-2) =	7.1815e+0 (2.38e-1) -	5.04e+00(1.25e-01)-	7.09e+00(3.49e-01)-	**4.5010e+0 (3.98e-2)**
		1000	4.7529e+0 (6.23e-2) +	**4.4961e+0 (6.20e-2) +**	7.2211e+0 (3.72e-1) -	5.60e+00(4.22e-01)-	7.29e+00(3.77e-01)-	4.9927e+0 (7.12e-2)
WFG6	5	100	1.3081e+0 (6.68e-2) -	1.0469e+0 (3.10e-3) +	**1.0444e+0 (4.33e-1) +**	1.79e+00(9.21e-02)-	1.54e+00(8.20e-03)-	1.0606e+0 (8.55e-3)
		200	1.3855e+0 (1.39e-1) -	**1.0489e+0 (3.15e-3) +**	1.9770e+0 (1.00e-1) -	1.69e+00(1.24e-01)-	1.76e+00(3.89e-03)-	1.0734e+0 (2.12e-2)
		500	1.3940e+0 (1.21e-1) -	**1.0665e+0 (1.36e-2) =**	1.9568e+0 (7.85e-2) -	1.35e+00(9.75e-03)-	1.92e+00(2.29e-03)-	1.0849e+0 (2.12e-2)
		1000	1.5316e+0 (3.88e-2) -	**1.0937e+0 (5.92e-2) +**	1.9484e+0 (5.08e-2) -	1.45e+00(5.28e-03)-	1.97e+00(2.85e-03)-	1.3864e+0 (3.03e-2)
	8	100	3.3584e+0 (4.07e-2) -	3.2711e+0 (9.66e-2) -	3.1754e+0 (8.25e-1) -	6.19e+00(2.62e-01)-	4.86e+00(1.91e-01)-	**3.1393e+0 (8.91e-2)**
		200	3.4323e+0 (9.24e-2) -	3.2673e+0 (8.02e-2) -	5.1725e+0 (1.00e-1) -	5.85e+00(2.19e-01)-	5.14e+00(2.33e-01)-	**3.1595e+0 (8.56e-2)**
		500	3.3613e+0 (9.05e-2) -	3.2802e+0 (1.10e-1) =	5.0684e+0 (1.71e-1) -	3.65e+00(1.33e-01)-	5.23e+00(1.53e-01)-	**3.1892e+0 (5.75e-2)**
		1000	3.5150e+0 (3.98e-2) =	**3.3133e+0 (1.52e-1) =**	5.0740e+0 (1.94e-1) -	3.99e+00(3.52e-01)-	5.25e+00(3.03e-01)-	3.4520e+0 (6.52e-2)
	10	100	4.7129e+0 (3.21e-2) =	5.3170e+0 (2.82e-1) -	**4.6036e+0 (1.10e+0) +**	8.84e+00(4.15e-01)-	7.25e+00(3.48e-01)-	4.6680e+0 (1.04e-1)
		200	4.6830e+0 (5.77e-2) -	5.1439e+0 (2.76e-1) -	7.6980e+0 (2.40e-1) -	8.51e+00(1.26e-01)-	7.57e+00(1.88e-01)-	**4.5751e+0 (7.01e-2)**
		500	**4.6160e+0 (8.03e-2) =**	5.2729e+0 (2.91e-1) -	7.4397e+0 (3.57e-1) -	5.25e+00(1.81e-01)-	7.46e+00(2.34e-01)-	4.6990e+0 (1.56e-1)
		1000	**4.7522e+0 (5.74e-2) =**	5.1477e+0 (3.02e-1) =	7.5965e+0 (2.19e-1) -	5.83e+00(6.29e-01)-	7.66e+00(4.22e-01)-	4.9120e+0 (2.16e-1)
WFG7	5	100	1.3319e+0 (3.66e-2) -	1.1701e+0 (2.18e-2) -	**9.9774e-1 (2.42e-2) +**	1.72e+00(9.61e-02)-	1.92e+00(7.95e-02)-	1.1053e+0 (6.00e-3)
		200	1.3825e+0 (3.58e-2) -	1.1956e+0 (2.68e-2) -	**1.0462e+0 (1.19e-1) =**	1.52e+00(1.10e-01)-	1.96e+00(1.17e-01)-	1.1238e+0 (7.95e-3)
		500	1.3570e+0 (6.58e-2) -	1.2154e+0 (3.28e-2) -	1.7977e+0 (5.26e-2) -	1.23e+00(1.23e-02)-	1.88e+00(1.23e-01)-	**1.1375e+0 (6.22e-3)**
		1000	1.4342e+0 (3.96e-2) -	**1.2010e+0 (1.63e-2) +**	1.8060e+0 (4.72e-2) -	1.27e+00(8.13e-03)=	1.89e+00(6.97e-02)-	1.2482e+0 (2.09e-2)
	8	100	3.4150e+0 (6.79e-2) -	3.3449e+0 (6.10e-2) -	**2.7696e+0 (2.96e-2) +**	6.36e+00(1.14e-01)-	5.21e+00(2.50e-01)-	3.1192e+0 (2.66e-2)
		200	3.4214e+0 (4.81e-2) -	3.3702e+0 (1.21e-1) -	**3.0032e+0 (2.26e-1) +**	5.15e+00(5.10e-01)-	5.36e+00(2.12e-01)-	3.1565e+0 (2.86e-2)
		500	3.3915e+0 (5.57e-2) -	3.3855e+0 (9.57e-2) -	5.1216e+0 (3.23e-1) -	3.32e+00(1.21e-01)-	5.47e+00(4.65e-01)-	**3.1208e+0 (1.84e-2)**
		1000	3.6628e+0 (4.27e-2) -	3.3500e+0 (7.47e-2) =	5.1437e+0 (2.09e-1) -	3.41e+00(1.59e-01)=	5.24e+00(3.45e-01)-	**3.3300e+0 (4.05e-2)**
	10	100	4.6902e+0 (5.64e-2) -	4.6593e+0 (8.82e-2) -	**4.0682e+0 (2.71e-2) +**	8.90e+00(1.03e-01)-	7.79e+00(2.25e-01)-	4.4828e+0 (4.43e-2)
		200	4.7015e+0 (3.89e-2) -	4.6155e+0 (7.84e-2) -	**4.4273e+0 (8.26e-1) +**	8.75e+00(6.02e-02)-	7.72e+00(3.08e-01)-	4.4663e+0 (5.14e-2)
		500	4.8597e+0 (5.45e-2) -	4.6306e+0 (7.47e-2) -	7.6659e+0 (3.60e-1) -	5.22e+00(3.25e-01)-	7.79e+00(4.61e-01)-	**4.4638e+0 (1.18e-1)**
		1000	4.9074e+0 (2.59e-2) -	**4.6271e+0 (5.81e-2) =**	7.5940e+0 (3.29e-1) -	5.16e+00(2.59e-01)-	7.59e+00(3.90e-01)-	4.6457e+0 (1.11e-1)
WFG8	5	100	1.3416e+0 (1.31e-1) -	1.2868e+0 (2.95e-2) -	**9.3434e-1 (3.51e-2) +**	1.63e+00(1.06e-01)-	1.47e+00(2.37e-02)-	1.1426e+0 (4.87e-3)
		200	1.4029e+0 (9.56e-2) -	1.3144e+0 (4.28e-2) -	**9.3390e-1 (2.24e-2) +**	1.48e+00(1.54e-01)-	1.59e+00(4.49e-03)-	1.1737e+0 (1.07e-2)
		500	1.3775e+0 (9.21e-2) -	1.3209e+0 (3.74e-2) -	1.8146e+0 (7.09e-2) -	1.19e+00(4.28e-03)-	1.70e+00(1.34e-03)-	**1.1718e+0 (1.33e-2)**
		1000	1.4756e+0 (4.70e-2) -	1.3264e+0 (2.49e-2) =	1.7838e+0 (6.38e-2) -	**1.26e+00(7.23e-03)+**	1.75e+00(4.10e-03)-	1.3015e+0 (1.09e-2)
	8	100	3.5321e+0 (8.31e-2) -	3.5241e+0 (5.74e-2) -	**3.0249e+0 (7.55e-2) +**	5.74e+00(3.16e-01)-	4.84e+00(1.96e-01)-	3.2508e+0 (6.18e-2)
		200	3.5376e+0 (4.58e-2) -	3.5387e+0 (5.61e-2) -	**2.9303e+0 (5.42e-2) +**	4.97e+00(3.61e-01)-	4.90e+00(2.49e-01)-	3.2326e+0 (2.47e-2)
		500	3.4980e+0 (4.55e-2) -	3.4983e+0 (6.15e-2) -	4.9783e+0 (2.20e-1) -	3.34e+00(1.47e-01)-	4.93e+00(1.76e-01)-	**3.1741e+0 (4.80e-3)**
		1000	3.7044e+0 (6.76e-2) -	3.6276e+0 (6.76e-2) -	5.0685e+0 (1.42e-1) -	3.77e+00(4.03e-01)-	4.99e+00(2.27e-01)-	**3.4078e+0 (3.16e-2)**
	10	100	4.7673e+0 (7.71e-2) -	4.8883e+0 (9.77e-2) -	4.6523e+0 (3.45e-1) =	8.48e+00(1.30e-01)-	7.06e+00(3.27e-01)-	**4.6268e+0 (9.97e-2)**
		200	4.7844e+0 (4.77e-2) -	4.8874e+0 (1.06e-1) -	**4.4099e+0 (9.09e-2) +**	8.31e+00(1.20e-01)-	6.98e+00(2.50e-01)-	4.5396e+0 (8.20e-2)
		500	4.9328e+0 (7.63e-2) -	4.9298e+0 (1.04e-1) -	7.1791e+0 (2.23e-1) -	5.22e+00(1.12e-01)-	7.32e+00(3.00e-01)-	**4.7277e+0 (5.74e-2)**
		1000	4.9314e+0 (4.50e-2) -	4.9420e+0 (1.31e-1) -	7.3746e+0 (2.93e-1) -	5.85e+00(5.53e-01)-	7.43e+00(4.49e-01)-	**4.7367e+0 (1.34e-1)**
WFG9	5	100	1.5651e+0 (1.14e-1) -	1.0642e+0 (1.45e-2) -	1.1252e+0 (3.31e-2) -	1.87e+00(1.42e-01)-	2.19e+00(3.47e-02)-	**1.0434e+0 (9.91e-3)**
		200	1.6543e+0 (1.13e-1) -	1.0816e+0 (1.42e-2) -	1.3763e+0 (9.56e-2) -	1.86e+00(1.05e-01)-	2.28e+00(1.15e-01)-	**1.0619e+0 (9.93e-3)**
		500	1.5836e+0 (5.70e-2) -	1.0763e+0 (1.77e-2) =	2.0897e+0 (7.93e-2) -	1.51e+00(1.38e-01)-	2.21e+00(8.79e-02)-	**1.0759e+0 (1.61e-2)**
		1000	1.4285e+0 (2.62e-2) -	**1.0950e+0 (2.53e-2) +**	2.1192e+0 (5.97e-2) -	1.53e+00(5.66e-02)-	2.13e+00(8.97e-02)-	1.1851e+0 (1.98e-2)
	8	100	3.8603e+0 (1.32e-1) -	3.2312e+0 (9.56e-2) -	**2.9300e+0 (2.37e-2) +**	6.15e+00(2.40e-01)-	6.42e+00(6.23e-01)-	3.0253e+0 (2.74e-2)
		200	3.8345e+0 (1.58e-1) -	3.1980e+0 (5.08e-2) -	3.2271e+0 (2.54e-1) -	6.05e+00(1.85e-01)-	5.42e+00(1.67e-01)-	**3.0798e+0 (3.05e-2)**
		500	3.8467e+0 (5.48e-2) -	3.2045e+0 (3.81e-2) -	5.3753e+0 (1.69e-1) -	4.08e+00(6.09e-01)-	5.48e+00(2.06e-01)-	**3.0605e+0 (3.92e-2)**
		1000	3.6433e+0 (7.76e-2) -	**3.2825e+0 (9.76e-2) +**	5.3122e+0 (1.49e-1) -	4.09e+00(5.24e-01)-	5.24e+00(1.67e-01)-	3.4628e+0 (6.34e-2)
	10	100	5.1494e+0 (8.12e-2) -	4.5019e+0 (1.05e-1) +	**4.1263e+0 (3.09e-2) +**	8.32e+00(6.42e-01)-	7.54e+00(2.43e-01)-	4.6532e+0 (4.89e-2)
		200	5.0573e+0 (1.38e-1) -	4.5220e+0 (5.92e-2) +	**4.2430e+0 (2.52e-2) +**	8.57e+00(1.35e-01)-	7.85e+00(4.98e-01)-	4.6372e+0 (7.13e-2)
		500	4.9280e+0 (9.57e-2) +	**4.5500e+0 (9.32e-2) +**	7.7311e+0 (2.11e-1) -	7.11e+00(1.47e+00)-	7.73e+00(1.84e-01)-	5.0515e+0 (8.17e-2)
		1000	4.9003e+0 (8.31e-2) =	**4.5806e+0 (7.10e-2) +**	7.6145e+0 (2.60e-1) -	5.56e+00(4.71e-01)-	7.82e+00(3.98e-01)-	4.9860e+0 (1.42e-1)
+/-/=			30/65/13	17/62/29	30/73/5	8/88/12	8/100/0	

TABLE A. 9
THE IGD COMPARISON RESULTS OF THREE MBEAS ON LSMOP1-LSMOP9 TEST PROBLEMS WITH 2-3 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	MOEA/PSL	AMOEA/D	NN-CSO
LSMOP1	2	100	2.9582e-1 (1.11e-2) -	2.9094e-01(2.00e-02)-	**2.0217e-1 (1.04e-2)**
		200	2.9363e-1 (7.84e-3) =	3.2456e-01(2.21e-02)-	**2.8176e-1 (1.72e-2)**
		500	4.5701e-1 (1.93e-1) =	3.3695e-01(4.87e-03)-	**3.2321e-1 (1.40e-2)**
		1000	1.1970e+0 (6.10e-1) -	3.4331e-01(6.56e-03)-	**3.3104e-1 (8.72e-3)**
	3	100	**2.7519e-1 (9.53e-2) +**	3.5425e-01(3.50e-02)=	3.2358e-1 (1.05e-2)
		200	5.3214e-1 (2.71e-1) -	4.3490e-01(1.78e-02)-	**3.4195e-1 (9.75e-3)**
		500	1.2140e+0 (8.21e-1) -	4.7801e-01(6.52e-02)-	**3.5389e-1 (1.61e-2)**
		1000	1.0723e+0 (5.60e-1) -	4.7109e-01(1.06e-02)-	**3.7023e-1 (1.53e-2)**
LSMOP2	2	100	1.2479e-1 (2.02e-3) -	4.3184e-02(3.04e-03)=	**4.2763e-2 (1.64e-3)**
		200	7.1067e-2 (1.22e-3) -	**2.4810e-02(2.64e-03)+**	2.8407e-2 (1.27e-3)
		500	3.3297e-2 (8.06e-3) -	**1.2075e-02(4.67e-04)+**	1.3729e-2 (7.39e-4)
		1000	1.7062e-2 (4.30e-3) -	**6.7946e-03(4.23e-04)+**	8.1902e-3 (2.42e-4)
	3	100	2.0131e-1 (4.71e-3) -	**7.0854e-02(2.85e-03)+**	8.4013e-2 (3.28e-3)
		200	1.2051e-1 (2.96e-3) -	**5.5983e-02(2.22e-03)=**	5.7013e-2 (1.60e-3)
		500	6.0650e-2 (9.43e-4) -	**3.5935e-02(1.69e-03)+**	3.8768e-2 (1.43e-3)
		1000	4.2521e-2 (1.05e-3) -	**2.8446e-02(5.89e-04)=**	2.9433e-2 (1.36e-3)
LSMOP3	2	100	**6.6670e-1 (1.14e-2) +**	1.4572e+00(1.15e-03)=	1.5170e+0 (4.71e-1)
		200	3.0502e+0 (4.78e+0) =	**1.5232e+00(2.38e-03)+**	1.9101e+0 (4.24e-1)
		500	8.8387e+0 (9.17e+0) =	**1.5658e+00(2.80e-04)+**	3.1135e+0 (1.72e+0)
		1000	5.7176e+1 (1.09e+2) -	**1.5793e+00(9.34e-06)+**	2.2104e+0 (1.65e+0)
	3	100	9.8643e-1 (3.67e-1) =	8.6067e-01(1.30e-04)-	**8.5877e-1 (5.15e-3)**
		200	**8.6072e-1 (1.20e-16) =**	8.6072e-01(1.20e-16)-	8.6072e-1 (1.20e-16)
		500	2.6913e+0 (3.72e+0) =	8.6072e-01(1.20e-16)-	**8.6072e-1 (1.20e-16)**
		1000	4.5815e+0 (4.19e+0) =	8.6072e-01(1.20e-16)-	**8.6072e-1 (1.20e-16)**
LSMOP4	2	100	2.2679e-1 (1.26e-2) -	1.3002e-01(8.85e-03)-	**6.7048e-2 (2.28e-2)**
		200	1.4341e-1 (5.40e-3) -	9.2449e-02(6.05e-03)-	**8.3159e-2 (6.00e-3)**
		500	7.4994e-2 (1.99e-3) -	5.3733e-02(2.03e-03)-	**4.4418e-2 (9.30e-4)**
		1000	4.8117e-2 (7.53e-4) -	3.1687e-02(1.92e-03)-	**2.2817e-2 (5.77e-4)**
	3	100	3.2875e-1 (8.66e-3) -	3.1354e-01(1.60e-02)=	**2.9903e-1 (1.40e-2)**
		200	3.0549e-1 (6.38e-3) -	2.1212e-01(4.36e-03)-	**1.9584e-1 (7.70e-3)**
		500	1.7168e-1 (4.66e-3) -	1.1486e-01(2.30e-03)-	**1.0064e-1 (2.13e-3)**
		1000	9.3075e-2 (1.10e-3) -	6.9296e-02(1.05e-03)-	**6.1411e-2 (2.39e-3)**
LSMOP5	2	100	**3.3601e-1 (1.64e-2) +**	7.4191e-01(4.68e-04)-	6.9839e-1 (3.87e-2)
		200	3.5097e-1 (7.03e-2) +	**7.4209e-01(0.00e+00)+**	7.4209e-1 (1.20e-16)
		500	9.6382e-1 (3.81e-1) =	**7.4209e-01(0.00e+00)+**	7.4209e-1 (3.92e-7)
		1000	1.8068e+0 (1.65e+0) =	**7.4209e-01(0.00e+00)+**	7.4209e-1 (1.20e-16)
	3	100	**3.5687e-1 (8.80e-2) =**	5.4189e-01(5.19e-05)-	3.8292e-1 (3.63e-2)
		200	**4.1873e-1 (1.28e-1) =**	5.4192e-01(5.36e-05)-	4.7438e-1 (1.44e-2)
		500	7.8801e-1 (4.63e-1) =	5.4195e-01(1.27e-05)-	**5.1560e-1 (1.36e-2)**
		1000	1.4174e+0 (1.05e+0) -	5.4191e-01(4.35e-05)-	**5.1962e-1 (4.01e-3)**
LSMOP6	2	100	7.4848e-1 (8.80e-2) =	**7.1384e-01(4.87e-02)=**	7.3329e-1 (1.95e-2)
		200	7.1130e-1 (1.38e-1) =	**6.9806e-01(1.01e-02)+**	7.5911e-1 (5.40e-3)
		500	7.5438e-1 (3.38e-1) -	**6.8505e-01(6.71e-03)+**	7.5233e-1 (9.55e-4)
		1000	5.9762e-1 (1.43e-1) =	**6.7784e-01(2.29e-03)+**	7.5010e-1 (1.79e-3)
	3	100	1.1254e+0 (3.80e-3) -	**9.2584e-01(1.48e-03)=**	9.8301e-1 (1.86e-1)
		200	1.2344e+0 (5.76e-4) =	**1.1354e+00(7.67e-06)+**	1.2356e+0 (1.98e-3)
		500	4.3442e+1 (1.12e+2) =	**1.2555e+00(5.37e-05)+**	1.2959e+0 (3.85e-4)
		1000	1.0696e+2 (1.97e+2) =	1.3360e+00(1.08e-01)-	**1.3168e+0 (1.48e-3)**
LSMOP7	2	100	1.4585e+0 (6.06e-3) -	3.3151e+01(8.38e+01)-	**1.4577e+0 (7.35e-4)**
		200	6.4950e+0 (7.99e+0) -	6.1417e+01(1.59e+02)-	**1.4916e+0 (5.54e-4)**
		500	2.0008e+2 (2.93e+2) -	8.4822e+01(2.20e+02)-	**1.5109e+0 (1.83e-3)**
		1000	2.0901e+3 (1.45e+3) -	1.5137e+00(1.45e-05)+	**1.5156e+0 (2.36e-3)**
	3	100	1.0631e+0 (1.68e-1) =	1.2577e+00(9.48e-03)-	**9.1842e-1 (9.45e-2)**
		200	1.1152e+0 (1.13e-1) =	1.1316e+00(1.52e-02)-	**1.0253e+0 (5.64e-2)**
		500	1.0161e+0 (1.21e-1) =	9.6223e-01(9.07e-03)=	**9.2035e-1 (8.90e-2)**
		1000	1.0779e+0 (2.86e-1) =	8.9385e-01(6.00e-03)+	**9.5474e-1 (2.46e-2)**
LSMOP8	2	100	3.4141e-1 (2.44e-3) -	7.0176e-01(4.81e-02)-	**2.9998e-1 (5.28e-2)**
		200	**3.3716e-1 (2.97e-3) +**	7.4209e-01(0.00e+00)-	6.5133e-1 (6.66e-2)
		500	**6.2642e-1 (7.36e-2) +**	7.4209e-01(0.00e+00)+	7.4209e-1 (1.20e-16)
		1000	1.7660e+0 (9.30e-1) -	**7.4136e-01(1.93e-03)+**	7.4209e-1 (1.20e-16)
	3	100	3.5624e-1 (2.91e-2) -	**1.6280e-01(8.90e-02)+**	2.2384e-1 (2.52e-2)
		200	3.2780e-1 (4.76e-2) -	2.0737e-01(6.58e-02)=	**1.6963e-1 (1.16e-2)**
		500	2.8134e-1 (8.18e-2) -	1.9925e-01(5.17e-02)=	**1.5592e-1 (1.80e-2)**
		1000	3.8197e-1 (1.11e-1) -	2.1174e-01(2.40e-02)-	**1.6270e-1 (3.69e-2)**
LSMOP9	2	100	8.1004e-1 (0.00e+0) -	8.3300e-01(0.00e+00)-	**8.1004e-1 (5.64e-16)**
		200	8.1336e-1 (1.18e-1) =	8.1584e-01(1.20e-16)-	**8.0603e-1 (5.30e-3)**
		500	8.9836e-1 (2.34e-1) -	8.1098e-01(1.20e-16)-	**6.6887e-1 (1.24e-1)**
		1000	8.1004e-1 (0.00e+0) -	8.1030e-01(0.00e+00)-	**6.6516e-1 (7.38e-2)**
	3	100	1.5300e+0 (2.09e-2) -	1.1869e+00(5.24e-01)-	**5.9295e-1 (2.15e-3)**
		200	1.5379e+0 (2.53e-10) -	1.4193e+00(3.60e-01)-	**6.7195e-1 (2.09e-1)**
		500	1.4566e+0 (4.94e-2) -	1.4971e+00(8.14e-02)-	**5.8631e-1 (1.58e-2)**
		1000	3.3903e+0 (5.28e+0) =	**1.5350e+00(9.63e-03)=**	2.5451e+0 (1.34e+0)
+/-/=			6/41/25	21/39/12	

TABLE A. 10
THE IGD COMPARISON RESULTS OF THREE MBEAS ON UF1-UF10 TEST PROBLEMS WITH 2-3 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	MOEA/PSL	AMOEA/D	NN-CSO
UF1	2	100	**1.2709e-1 (1.40e-2) +**	3.1438e-01(3.77e-02)-	2.4318e-1 (1.16e-2)
		200	3.5689e-1 (1.60e-1) =	**3.4578e-01(4.15e-02)+**	5.0663e-1 (6.26e-1)
		500	8.0389e-1 (2.00e-1) -	3.8061e-01(2.34e-02)-	**2.8877e-1 (4.73e-3)**
		1000	1.1247e+0 (7.92e-2) -	3.7534e-01(2.54e-02)-	**2.9360e-1 (5.83e-3)**
UF2	2	100	1.1203e-1 (5.53e-3) -	1.6544e-01(2.63e-02)-	**8.3317e-2 (4.18e-3)**
		200	1.2227e-1 (4.97e-3) -	1.8545e-01(1.36e-02)-	**1.1017e-1 (4.73e-2)**
		500	1.3049e-1 (2.35e-3) -	1.9848e-01(1.16e-02)-	**9.2597e-2 (3.54e-3)**
		1000	1.3068e-1 (8.96e-4) -	1.8905e-01(2.34e-02)-	**9.6263e-2 (4.00e-3)**
UF3	2	100	3.8867e-1 (2.29e-1) -	2.8318e-01(1.21e-02)-	**1.8399e-1 (7.77e-3)**
		200	3.1091e-1 (2.34e-1) -	2.4829e-01(9.52e-03)-	**1.5620e-1 (3.36e-3)**
		500	3.2411e-1 (9.66e-2) -	2.3143e-01(8.62e-03)-	**1.3442e-1 (1.11e-3)**
		1000	3.5107e-1 (6.89e-2) -	2.2904e-01(2.46e-02)-	**1.2473e-1 (7.05e-4)**
UF4	2	100	9.6710e-2 (4.39e-3) -	8.6899e-02(2.92e-03)-	**5.8690e-2 (1.95e-4)**
		200	1.3724e-1 (1.08e-2) -	9.1129e-02(1.33e-03)-	**5.9575e-2 (5.51e-4)**
		500	1.8416e-1 (5.67e-3) -	9.4354e-02(1.19e-03)-	**6.1020e-2 (1.79e-3)**
		1000	1.8519e-1 (1.41e-2) -	9.5332e-02(8.21e-04)-	**6.0001e-2 (5.24e-4)**
UF5	2	100	**7.7277e-1 (3.08e-1) =**	2.8931e+00(1.17e-01)-	1.1267e+0 (1.73e-1)
		200	**1.8020e+0 (4.34e-1) +**	3.1123e+00(1.50e-01)-	2.3209e+0 (3.11e-1)
		500	**2.9519e+0 (3.78e-1) =**	3.2946e+00(1.07e-01)-	3.0021e+0 (6.99e-2)
		1000	3.8439e+0 (4.62e-1) -	3.3477e+00(2.96e-02)-	**3.0914e+0 (6.43e-2)**
UF6	2	100	**3.2826e-1 (8.01e-2) +**	1.2935e+00(1.63e-01)-	5.1688e-1 (9.19e-2)
		200	1.0656e+0 (4.29e-1) =	1.4244e+00(1.63e-01)-	**7.1853e-1 (2.07e-1)**
		500	2.6600e+0 (4.09e-1) -	1.4822e+00(2.48e-01)-	**1.1645e+0 (6.83e-2)**
		1000	3.8872e+0 (5.10e-1) -	1.4090e+00(9.69e-02)-	**1.1917e+0 (4.72e-2)**
UF7	2	100	**9.0371e-2 (3.56e-2) +**	4.7047e-01(2.65e-02)-	3.5681e-1 (3.58e-1)
		200	**2.5102e-1 (7.42e-2) =**	5.0605e-01(1.27e-02)-	2.6931e-1 (1.08e-2)
		500	6.4630e-1 (9.15e-2) -	5.1601e-01(5.89e-03)-	**3.0180e-1 (6.16e-3)**
		1000	9.2322e-1 (6.37e-2) -	5.2132e-01(9.43e-03)-	**3.0113e-1 (1.01e-2)**
UF8	3	100	**2.5888e-1 (5.53e-3) +**	5.8996e-01(3.41e-02)-	3.4881e-1 (1.46e-2)
		200	**2.4945e-1 (3.11e-3) +**	6.0723e-01(3.00e-02)-	4.1731e-1 (3.11e-2)
		500	**2.7351e-1 (1.86e-2) +**	6.3433e-01(3.60e-02)-	4.8100e-1 (1.45e-2)
		1000	**4.7051e-1 (1.74e-2) =**	6.3763e-01(2.97e-02)-	4.9542e-1 (2.93e-2)
UF9	3	100	7.1581e-1 (1.63e-1) -	6.5109e-01(4.31e-02)-	**5.0989e-1 (4.59e-3)**
		200	6.7679e-1 (9.77e-2) -	6.7016e-01(4.35e-02)-	**5.6101e-1 (7.41e-3)**
		500	8.0453e-1 (1.06e-1) -	6.7160e-01(1.00e-02)-	**6.1365e-1 (1.26e-2)**
		1000	8.7062e-1 (4.99e-2) -	7.5041e-01(3.46e-02)-	**6.6051e-1 (1.66e-2)**
UF10	3	100	**3.1995e-1 (1.46e-2) +**	3.3368e+00(5.73e-01)-	1.8287e+0 (1.87e-1)
		200	**2.9300e-1 (8.79e-3) +**	3.8627e+00(4.33e-01)-	2.4275e+0 (1.72e-1)
		500	**2.7886e-1 (9.92e-3) +**	3.7178e+00(6.11e-02)-	3.1637e+0 (3.38e-1)
		1000	**2.4254e-1 (4.71e-3) +**	3.8734e+00(2.20e-01)=	3.7282e+0 (2.54e-1)
+/-/=			11/23/6	1/38/1	

TABLE A. 11
THE IGD COMPARISON RESULTS OF THREE MBEAS ON DTLZ1-DTLZ7 TEST PROBLEMS WITH 5-10 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	MOEA/PSL	AMOEA/D	NN-CSO
DTLZ1	5	100	7.2856e+2 (1.16e+2) -	4.4253e+02(3.66e+01)-	**1.6925e+2 (1.38e+2)**
		200	1.5155e+3 (1.78e+2) -	9.7879e+02(5.22e+01)-	**2.6128e+2 (2.57e+2)**
		500	3.9613e+3 (5.35e+2) -	2.5888e+03(2.86e+02)-	**1.2046e+2 (2.56e+2)**
		1000	7.0760e+3 (4.45e+2) -	5.2562e+03(5.95e+02)-	**2.2002e+2 (2.22e+2)**
	8	100	1.0651e+3 (2.01e+2) -	3.7153e+02(4.77e+01)-	**2.4699e+2 (6.08e+1)**
		200	2.3936e+3 (8.38e+0) -	8.3303e+02(7.78e+01)-	**4.6851e+2 (1.64e+2)**
		500	4.3716e+3 (1.30e+3) -	2.1452e+03(2.38e+02)-	**4.2218e+2 (6.81e+2)**
		1000	8.8377e+3 (3.34e+3) -	4.6588e+03(4.68e+02)-	**6.8877e+2 (8.48e+2)**
	10	100	1.1141e+3 (8.11e+0) -	5.5770e+02(6.26e+01)-	**1.9673e+2 (1.55e+2)**
		200	2.0345e+3 (4.19e+2) -	1.2635e+03(1.42e+02)-	**5.3201e+2 (1.79e+2)**
		500	4.7056e+3 (1.03e+3) -	3.2867e+03(2.64e+02)-	**2.7571e+2 (2.80e+2)**
		1000	8.7259e+3 (2.22e+3) -	6.8853e+03(4.82e+02)-	**3.2814e+2 (5.18e+2)**
DTLZ2	5	100	1.7650e+0 (3.56e-1) -	7.0225e-01(3.43e-02)-	**4.9801e-1 (4.04e-2)**
		200	9.8608e+0 (1.25e+0) -	1.0013e+00(1.57e-01)-	**5.6523e-1 (6.63e-2)**
		500	1.2971e+1 (1.09e+0) -	1.6527e+00(3.63e-01)-	**6.9030e-1 (6.45e-2)**
		1000	4.5996e+0 (5.02e-1) -	3.3971e+00(5.99e-01)-	**8.2565e-1 (3.53e-2)**
	8	100	1.3662e+1 (9.75e-1) -	1.0194e+00(4.18e-02)-	**8.8452e-1 (3.41e-2)**
		200	2.7553e+1 (3.46e+0) -	1.4215e+00(1.56e-01)-	**1.0250e+0 (2.93e-2)**
		500	5.9495e+1 (1.48e+1) -	2.1628e+00(7.79e-01)-	**9.8507e-1 (4.22e-2)**
		1000	9.6193e+1 (3.39e+1) -	3.9883e+00(1.50e+00)-	**9.8649e-1 (2.51e-2)**
	10	100	1.4908e+1 (6.50e-1) -	1.1938e+00(1.20e-01)-	**9.9078e-1 (2.74e-2)**
		200	2.9448e+1 (2.48e+0) -	1.7872e+00(3.97e-01)-	**1.0680e+0 (5.82e-2)**
		500	6.5537e+1 (1.17e+1) -	3.4608e+00(4.91e-01)-	**1.0921e+0 (9.10e-2)**
		1000	1.4289e+2 (6.90e+0) -	6.8488e+00(1.45e+00)-	**1.0579e+0 (3.91e-2)**
DTLZ3	5	100	2.3237e+3 (1.51e+1) -	1.7029e+03(1.27e+02)-	**7.6616e+2 (4.86e+2)**
		200	4.8417e+3 (1.62e+1) -	3.5750e+03(2.67e+02)-	**7.4980e+2 (1.01e+3)**
		500	1.2352e+4 (1.25e+1) -	9.2075e+03(7.85e+02)-	**3.8409e+2 (6.12e+2)**
		1000	2.4802e+4 (2.25e+1) -	2.0143e+04(1.73e+03)-	**1.3701e+3 (1.40e+3)**
	8	100	2.2822e+3 (1.41e+1) -	1.6884e+03(6.59e+01)-	**1.0390e+3 (2.46e+2)**
		200	4.7776e+3 (1.61e+1) -	3.7491e+03(1.17e+02)-	**1.6571e+3 (8.85e+2)**
		500	1.2294e+4 (2.06e+1) -	9.9074e+03(5.30e+02)-	**4.8984e+2 (4.86e+2)**
		1000	2.4976e+4 (2.70e+2) -	1.9655e+04(1.54e+03)-	**4.2066e+2 (4.91e+2)**
	10	100	2.2446e+3 (1.10e+1) -	2.0504e+03(1.25e+02)-	**1.1943e+3 (1.02e+2)**
		200	4.7401e+3 (1.12e+1) -	4.9530e+03(1.43e+02)-	**1.8951e+3 (1.32e+3)**
		500	1.2425e+4 (4.28e+2) -	1.3176e+04(3.14e+02)-	**1.0827e+3 (1.58e+3)**
		1000	2.4763e+4 (1.75e+1) -	2.7440e+04(1.08e+03)-	**2.2712e+3 (1.98e+3)**
DTLZ4	5	100	1.5329e+0 (5.92e-1) =	1.1696e+00(3.13e-02)-	**9.0123e-1 (2.29e-1)**
		200	7.3735e+0 (1.41e+0) -	1.3135e+00(1.15e-01)-	**1.1041e+0 (7.73e-3)**
		500	1.2205e+1 (2.01e+0) -	1.4930e+00(2.03e-01)-	**1.1081e+0 (7.96e-7)**
		1000	1.0211e+1 (2.09e+0) -	2.7637e+00(6.27e-01)-	**1.2318e+0 (3.14e-2)**
	8	100	1.0653e+1 (1.41e+0) -	1.3483e+00(9.12e-02)-	**1.1920e+0 (1.04e-2)**
		200	2.2867e+1 (2.61e+0) -	1.5047e+00(2.35e-01)-	**1.2133e+0 (2.39e-3)**
		500	2.5836e+1 (6.51e+0) -	2.0397e+00(6.61e-01)-	**1.3757e+0 (7.06e-2)**
		1000	6.6311e+1 (3.84e+1) -	3.6938e+00(1.55e+00)-	**1.3439e+0 (3.91e-2)**
	10	100	1.3200e+1 (1.31e+0) -	1.5892e+00(2.10e-01)-	**1.2250e+0 (1.20e-2)**
		200	2.7421e+1 (3.52e+0) -	1.9333e+00(3.91e-01)-	**1.3963e+0 (1.14e-1)**
		500	3.9763e+1 (1.47e+1) -	4.0322e+00(2.02e+00)-	**1.3750e+0 (8.46e-2)**
		1000	7.4709e+1 (3.69e+1) -	6.7995e+00(3.01e+00)-	**1.3390e+0 (6.47e-2)**
DTLZ5	5	100	4.9192e+0 (3.56e-1) -	4.5117e-01(1.58e-01)=	**3.1277e-1 (1.93e-2)**
		200	1.1055e+1 (1.27e+0) -	7.3997e-01(2.25e-01)-	**3.5304e-1 (2.71e-2)**
		500	2.5985e+1 (3.57e+0) -	1.7117e+00(3.55e-01)-	**3.7765e-1 (2.68e-2)**
		1000	3.4502e+1 (5.82e+0) -	3.2755e+00(7.47e-01)-	**4.8973e-1 (3.81e-2)**
	8	100	1.2341e+1 (2.08e+0) -	6.8692e-01(2.30e-01)-	**3.1610e-1 (2.27e-2)**
		200	2.8370e+1 (2.44e+0) -	1.1053e+00(3.51e-01)-	**3.7485e-1 (1.02e-2)**
		500	6.1112e+1 (1.73e+1) -	2.6759e+00(5.45e-01)-	**3.9319e-1 (2.00e-2)**
		1000	1.2943e+2 (2.29e+1) -	3.8000e+00(9.69e-01)-	**4.4120e-1 (5.98e-2)**
	10	100	1.2204e+1 (1.80e+0) -	1.0511e+00(2.70e-01)-	**3.3800e-1 (4.47e-2)**
		200	2.8411e+1 (3.25e+0) -	1.5554e+00(3.71e-01)-	**4.5488e-1 (3.23e-2)**
		500	7.1164e+1 (8.47e+0) -	3.5867e+00(1.01e+00)-	**5.1257e-1 (7.28e-2)**
		1000	1.3384e+2 (2.48e+1) -	5.1221e+00(2.34e+00)-	**5.0542e-1 (5.40e-2)**
DTLZ6	5	100	1.2681e+0 (8.73e-1) =	**5.3456e-02(4.66e-03)+**	1.1439e+0 (1.24e-1)
		200	1.5408e+0 (9.32e-1) =	**5.2170e-02(3.19e-03)+**	7.4977e+0 (1.30e+1)
		500	1.2014e+1 (1.49e+1) +	**5.3763e-02(1.73e-03)+**	1.2555e+2 (6.86e+1)
		1000	3.3020e+0 (2.26e+0) +	**1.4052e-01(2.33e-01)+**	4.4290e+2 (5.97e+1)
	8	100	2.6796e+1 (8.72e+0) -	**9.4780e-02(4.60e-03)+**	1.4865e+0 (1.14e-1)
		200	5.9047e+1 (1.81e+1) -	**9.4046e-02(5.23e-03)+**	5.5756e+0 (9.93e+0)
		500	1.4237e+2 (5.48e+1) =	**9.4737e-02(3.73e-03)+**	1.8481e+2 (8.36e+1)
		1000	3.1340e+2 (1.63e+2) +	**8.6028e-02(7.19e-03)+**	4.6411e+2 (2.03e+1)
	10	100	3.2701e+1 (7.34e+0) -	**8.4353e-01(3.75e-01)+**	1.8316e+0 (1.90e-1)
		200	7.8389e+1 (6.98e+0) -	**1.4679e+00(7.65e-01)+**	3.4666e+0 (2.95e+0)
		500	1.8170e+2 (4.52e+1) =	**6.4159e+00(4.90e+00)+**	1.9093e+2 (8.34e+1)
		1000	4.2400e+2 (1.38e+1) +	**1.3364e+01(1.01e+01)+**	4.7408e+2 (1.61e+1)
DTLZ7	5	100	**3.0846e-1 (1.02e-2) +**	6.6965e-01(4.94e-01)-	5.2470e-1 (4.62e-3)
		200	**3.1596e-1 (7.79e-3) +**	4.8310e-01(1.97e-02)+	5.2269e-1 (9.85e-3)
		500	**3.1750e-1 (1.15e-2) +**	5.4412e-01(1.55e-01)=	5.3577e-1 (5.48e-2)
		1000	**2.8680e-1 (6.01e-3) +**	8.6825e-01(4.54e-01)=	1.0133e+0 (1.57e-1)
	8	100	**8.2068e-1 (1.45e-2) +**	1.4371e+00(5.72e-01)+	1.6240e+0 (2.70e-2)
		200	**8.2253e-1 (4.03e-3) +**	1.7506e+00(9.77e-01)=	1.7672e+0 (4.05e-1)
		500	**8.0712e-1 (3.63e-2) +**	1.8283e+00(1.35e+00)+	1.9336e+0 (3.03e-1)
		1000	**9.0229e-1 (7.11e-2) +**	1.9210e+00(1.20e+00)=	3.3249e+0 (7.49e-1)
	10	100	**1.1458e+0 (2.49e-2) +**	3.5572e+00(7.61e-01)-	2.5731e+0 (7.75e-1)
		200	**1.1578e+0 (1.50e-2) +**	3.5443e+00(1.26e+00)-	1.9409e+0 (2.96e-1)
		500	**1.8062e+0 (1.74e+0) +**	3.2224e+00(9.83e-01)=	2.6103e+0 (7.30e-1)
		1000	**1.1753e+0 (5.73e-2) +**	2.7656e+00(9.35e-01)=	3.1208e+0 (1.39e+0)
+/-/=			16/63/5	15/62/7	

TABLE A. 12
THE IGD COMPARISON RESULTS OF THREE MBEAS ON WFG1-WFG9 TEST PROBLEMS WITH 5-10 OBJECTIVES AND 100-1000 DECISION VARIABLES.

Problem	M	D	MOEA/PSL	AMOEA/D	NN-CSO
WFG1	5	100	2.1122e+0 (3.38e-2) -	2.1318e+00(2.36e-02)-	**2.0110e+0 (2.93e-2)**
		200	2.0830e+0 (4.76e-2) -	2.1339e+00(3.06e-02)-	**2.0071e+0 (1.28e-2)**
		500	2.1208e+0 (3.18e-2) -	2.1447e+00(2.60e-02)-	**2.0096e+0 (2.30e-2)**
		1000	**1.9982e+0 (3.01e-2) +**	2.1200e+00(2.75e-02)+	2.1607e+0 (3.70e-2)
	8	100	2.7112e+0 (2.38e-2) -	2.8745e+00(5.06e-02)-	**2.6508e+0 (2.50e-2)**
		200	2.7211e+0 (3.64e-2) -	2.8563e+00(6.43e-02)-	**2.6401e+0 (2.00e-2)**
		500	2.8153e+0 (6.01e-2) -	2.8508e+00(2.55e-02)-	**2.6538e+0 (3.33e-2)**
		1000	2.8165e+0 (2.72e-2) =	2.8484e+00(4.04e-02)=	**2.8140e+0 (5.60e-2)**
	10	100	3.0821e+0 (5.26e-2) =	3.4354e+00(1.36e-01)-	**3.0278e+0 (2.83e-2)**
		200	3.0674e+0 (3.18e-2) =	3.4922e+00(6.61e-02)-	**3.0462e+0 (2.01e-2)**
		500	3.2152e+0 (5.08e-2) -	3.4473e+00(1.22e-01)-	**3.0566e+0 (2.62e-2)**
		1000	**3.1960e+0 (5.75e-2) =**	3.4637e+00(1.06e-01)-	3.1995e+0 (4.98e-2)
WFG2	5	100	7.8136e-1 (5.04e-2) -	1.8722e+00(8.23e-01)-	**5.0634e-1 (1.48e-2)**
		200	8.8675e-1 (7.01e-2) -	2.2128e+00(7.60e-01)-	**5.5282e-1 (1.92e-2)**
		500	9.7600e-1 (7.38e-2) -	2.1876e+00(6.74e-01)-	**5.7927e-1 (1.76e-2)**
		1000	9.5845e-1 (5.53e-2) -	2.2469e+00(9.61e-01)-	**7.2980e-1 (2.70e-2)**
	8	101	1.5378e+0 (6.40e-2) -	4.3127e+00(1.05e+00)-	**1.1968e+0 (2.06e-2)**
		201	1.5346e+0 (6.39e-2) -	5.2802e+00(1.41e+00)-	**1.2357e+0 (2.93e-2)**
		501	1.4939e+0 (5.47e-2) -	5.4225e+00(1.52e+00)-	**1.2865e+0 (3.89e-2)**
		1001	1.4369e+0 (5.65e-2) =	5.0449e+00(1.07e+00)-	**1.3762e+0 (4.31e-2)**
	10	101	1.8060e+0 (9.99e-2) -	6.5905e+00(1.99e+00)-	**1.4342e+0 (4.64e-2)**
		201	1.8197e+0 (9.21e-2) -	6.7680e+00(2.00e+00)-	**1.4897e+0 (6.34e-2)**
		501	1.8437e+0 (1.52e-1) -	6.8893e+00(1.75e+00)-	**1.5601e+0 (8.69e-2)**
		1001	1.9247e+0 (1.50e-1) =	6.8256e+00(1.99e+00)-	**1.7821e+0 (1.27e-1)**
WFG3	5	100	1.0615e+0 (8.44e-2) -	9.8838e-01(1.25e-01)-	**5.9375e-1 (3.14e-2)**
		200	1.1097e+0 (4.68e-2) -	9.5496e-01(1.53e-01)-	**6.3256e-1 (4.62e-2)**
		500	1.1070e+0 (8.24e-2) -	9.8040e-01(9.85e-02)-	**6.8104e-1 (9.27e-2)**
		1000	9.7353e-1 (8.32e-2) =	1.0419e+00(1.15e-01)-	**9.2953e-1 (3.72e-2)**
	8	101	**2.0577e+0 (8.00e-2) +**	3.5018e+00(4.12e-01)-	2.2319e+0 (5.89e-2)
		201	**2.0274e+0 (1.21e-1) =**	3.4152e+00(3.36e-01)-	2.1652e+0 (1.93e-1)
		501	**1.5024e+0 (1.15e-1) +**	3.6173e+00(2.24e-01)-	2.0726e+0 (1.50e-1)
		1001	**1.5075e+0 (1.68e-1) +**	3.2482e+00(4.10e-01)-	2.5123e+0 (6.40e-2)
	10	101	2.6346e+0 (1.26e-1) +	**2.0492e+00(2.66e-01)+**	3.0854e+0 (1.81e-1)
		201	2.5373e+0 (1.28e-1) +	**2.0302e+00(1.16e-01)+**	3.0089e+0 (3.13e-1)
		501	**1.8946e+0 (1.99e-1) +**	2.0902e+00(1.25e-01)+	2.8836e+0 (2.04e-1)
		1001	**1.4461e+0 (8.69e-2) +**	2.0090e+00(1.55e-01)+	3.0806e+0 (1.78e-1)
WFG4	5	100	1.2040e+0 (3.03e-2) -	**1.0367e+00(6.04e-03)+**	1.0561e+0 (5.97e-3)
		200	1.1459e+0 (1.32e-2) -	**1.0458e+00(1.59e-02)=**	1.0542e+0 (6.35e-3)
		500	1.0759e+0 (1.34e-2) =	**1.0455e+00(1.42e-02)+**	1.1859e+0 (3.20e-1)
		1000	1.0521e+0 (1.66e-2) +	**1.0387e+00(1.14e-02)+**	1.1353e+0 (1.69e-2)
	8	100	3.3154e+0 (3.84e-2) -	3.6061e+00(1.37e-01)-	**3.1920e+0 (3.04e-2)**
		200	3.3462e+0 (4.62e-2) -	3.5379e+00(8.20e-02)-	**3.2079e+0 (2.39e-2)**
		500	3.2293e+0 (3.08e-2) -	3.6328e+00(1.60e-01)-	**3.1822e+0 (1.84e-2)**
		1000	**3.2436e+0 (6.05e-2) =**	3.6028e+00(9.70e-02)-	3.2678e+0 (4.27e-2)
	10	100	4.5792e+0 (3.93e-2) +	**4.4687e+00(5.82e-02)+**	4.7190e+0 (1.23e-1)
		200	4.5845e+0 (4.52e-2) =	**4.4689e+00(5.22e-02)+**	4.6203e+0 (9.04e-2)
		500	4.6422e+0 (3.09e-2) =	**4.4920e+00(5.26e-02)+**	4.6596e+0 (9.84e-2)
		1000	4.6462e+0 (5.32e-2) -	**4.4566e+00(5.99e-02)+**	4.5209e+0 (3.49e-2)
WFG5	5	100	**9.9644e-1 (1.46e-2) +**	1.0107e+00(2.47e-02)=	1.0132e+0 (1.34e-3)
		200	**9.7488e-1 (1.30e-2) +**	1.0164e+00(2.41e-02)=	1.0150e+0 (3.04e-3)
		500	**9.7150e-1 (1.35e-2) +**	1.0246e+00(2.05e-02)=	1.0134e+0 (3.75e-3)
		1000	**9.5339e-1 (1.02e-2) +**	1.0278e+00(3.54e-02)+	1.1103e+0 (1.31e-2)
	8	100	3.1965e+0 (3.12e-2) -	3.7686e+00(7.88e-02)-	**3.0526e+0 (4.36e-2)**
		200	3.1782e+0 (3.18e-2) -	3.7841e+00(7.27e-02)-	**3.0415e+0 (4.23e-2)**
		500	3.1840e+0 (4.64e-2) -	3.8085e+00(5.56e-02)-	**3.0802e+0 (7.22e-2)**
		1000	**3.1810e+0 (9.85e-2) +**	3.7796e+00(5.70e-02)-	3.4457e+0 (2.78e-2)
	10	100	4.4908e+0 (5.15e-2) -	5.1854e+00(7.85e-02)-	**4.3701e+0 (5.38e-2)**
		200	4.4226e+0 (3.33e-2) =	5.1470e+00(1.04e-01)-	**4.4166e+0 (6.79e-2)**
		500	4.5300e+0 (2.87e-2) =	5.1936e+00(1.37e-01)-	**4.5010e+0 (3.98e-2)**
		1000	**4.6164e+0 (5.35e-2) +**	5.2520e+00(1.33e-01)-	4.9927e+0 (7.12e-2)
WFG6	5	100	1.0615e+0 (1.84e-2) =	**1.0300e+00(8.23e-03)+**	1.0606e+0 (8.55e-3)
		200	**1.0263e+0 (1.24e-2) +**	1.0316e+00(8.83e-03)+	1.0734e+0 (2.12e-2)
		500	**1.0013e+0 (2.48e-2) +**	1.0262e+00(9.29e-03)+	1.0849e+0 (2.12e-2)
		1000	**9.7241e-1 (1.07e-2) +**	1.0314e+00(1.04e-02)+	1.3864e+0 (3.03e-2)
	8	100	3.3281e+0 (5.88e-2) -	3.4873e+00(3.08e-01)-	**3.1393e+0 (8.91e-2)**
		200	3.3033e+0 (3.70e-2) -	3.4588e+00(5.74e-01)=	**3.1595e+0 (8.56e-2)**
		500	3.4173e+0 (7.24e-2) -	3.2709e+00(1.79e-01)=	**3.1892e+0 (5.75e-2)**
		1000	3.3268e+0 (7.66e-2) +	**3.2212e+00(1.26e-01)+**	3.4520e+0 (6.52e-2)
	10	100	**4.6295e+0 (4.10e-2) =**	5.6169e+00(4.84e-01)-	4.6680e+0 (1.04e-1)
		200	4.6365e+0 (2.42e-2) =	5.8026e+00(5.15e-01)-	**4.5751e+0 (7.01e-2)**
		500	4.8264e+0 (2.12e-1) =	5.6689e+00(4.01e-01)-	**4.6990e+0 (1.56e-1)**
		1000	**4.7804e+0 (1.09e-1) =**	5.4252e+00(4.37e-01)=	4.9120e+0 (2.16e-1)
WFG7	5	100	1.2924e+0 (2.24e-2) -	1.2390e+00(1.48e-02)-	**1.1053e+0 (6.00e-3)**
		200	1.2925e+0 (3.45e-2) -	1.2653e+00(2.37e-02)-	**1.1238e+0 (7.95e-3)**
		500	1.2213e+0 (2.69e-2) -	1.2571e+00(1.52e-02)-	**1.1375e+0 (6.22e-3)**
		1000	**1.2276e+0 (4.05e-2) =**	1.2680e+00(2.54e-02)=	1.2482e+0 (2.09e-2)
	8	100	3.5875e+0 (5.30e-2) -	4.1885e+00(5.92e-02)-	**3.1192e+0 (2.66e-2)**
		200	3.5478e+0 (3.38e-2) -	4.2056e+00(9.32e-02)-	**3.1565e+0 (2.86e-2)**
		500	3.6222e+0 (5.63e-2) -	4.1289e+00(6.25e-02)-	**3.1208e+0 (1.84e-2)**
		1000	3.6886e+0 (8.71e-2) -	4.1694e+00(9.97e-02)-	**3.3300e+0 (4.05e-2)**
	10	100	4.8447e+0 (3.79e-2) -	5.6428e+00(4.55e-01)-	**4.4828e+0 (4.43e-2)**
		200	4.8418e+0 (4.70e-2) -	5.5887e+00(3.02e-01)-	**4.4663e+0 (5.14e-2)**
		500	4.9394e+0 (8.56e-2) -	5.6143e+00(2.87e-01)-	**4.4638e+0 (1.18e-1)**
		1000	4.9761e+0 (6.85e-2) -	5.3640e+00(2.97e-01)-	**4.6457e+0 (1.11e-1)**
WFG8	5	100	1.3066e+0 (1.77e-2) -	1.1830e+00(2.86e-02)-	**1.1426e+0 (4.87e-3)**
		200	1.3276e+0 (4.31e-2) -	1.1815e+00(1.07e-02)=	**1.1737e+0 (1.07e-2)**
		500	1.2276e+0 (1.52e-2) -	1.1847e+00(2.19e-02)=	**1.1718e+0 (1.33e-2)**
		1000	**1.0816e+0 (2.95e-2) +**	1.1917e+00(1.30e-02)+	1.3015e+0 (1.09e-2)
	8	100	3.4809e+0 (6.12e-2) -	4.4365e+00(2.43e-01)-	**3.2508e+0 (6.18e-2)**
		200	3.4557e+0 (4.05e-2) -	4.6687e+00(6.27e-01)-	**3.2326e+0 (2.47e-2)**
		500	3.4097e+0 (5.26e-2) -	4.1164e+00(1.69e-01)-	**3.1741e+0 (4.80e-3)**
		1000	3.4986e+0 (5.56e-2) -	4.6518e+00(2.38e-01)-	**3.4078e+0 (3.16e-2)**
	10	100	4.7536e+0 (5.37e-2) -	5.9049e+00(4.21e-01)-	**4.6268e+0 (9.97e-2)**
		200	4.7148e+0 (4.64e-2) -	5.8954e+00(6.43e-01)-	**4.5396e+0 (8.20e-2)**
		500	4.9660e+0 (1.59e-1) -	5.9735e+00(4.18e-01)-	**4.7277e+0 (5.74e-2)**
		1000	4.9745e+0 (1.72e-1) -	6.0053e+00(5.22e-01)-	**4.7367e+0 (1.34e-1)**
WFG9	5	100	1.2006e+0 (3.82e-2) -	1.0469e+00(1.26e-02)=	**1.0434e+0 (9.91e-3)**
		200	1.2699e+0 (1.44e-1) -	**1.0529e+00(1.97e-02)=**	1.0619e+0 (9.93e-3)
		500	1.3413e+0 (7.13e-2) -	**1.0362e+00(1.21e-02)+**	1.0759e+0 (1.61e-2)
		1000	1.1384e+0 (8.46e-2) =	**1.0334e+00(1.03e-02)+**	1.1851e+0 (1.98e-2)
	8	100	3.7612e+0 (5.03e-2) -	3.9191e+00(6.01e-02)-	**3.0253e+0 (2.74e-2)**
		200	3.8530e+0 (5.88e-2) -	3.8805e+00(1.29e-01)-	**3.0798e+0 (3.05e-2)**
		500	3.7867e+0 (9.01e-2) -	3.8128e+00(1.29e-01)-	**3.0605e+0 (3.92e-2)**
		1000	3.6885e+0 (1.44e-1) -	3.7313e+00(1.08e-01)-	**3.4628e+0 (6.34e-2)**
	10	100	5.1466e+0 (9.37e-2) -	5.2748e+00(9.74e-02)-	**4.6532e+0 (4.89e-2)**
		200	5.2758e+0 (1.07e-1) -	5.2504e+00(1.60e-01)-	**4.6372e+0 (7.13e-2)**
		500	**5.0246e+0 (1.26e-1) =**	5.2600e+00(6.79e-02)-	5.0515e+0 (8.17e-2)
		1000	**4.9593e+0 (1.03e-1) =**	5.2676e+00(1.39e-01)-	4.9860e+0 (1.42e-1)
+/-/=			21/64/13	21/74/13	