Supplementary File for Paper: Two-stage Robust Optimizer for Multi-product Multi-process Resource Allocation in Steel Production Systems

This supplementary presents a comprehensive experimental comparison, detailing the generation of instances and the performance of our algorithm across a spectrum of instances with different scales, under various uncertainty levels.

Table 5 shows the generated range of instance parameters. The nominal customer demand for each product type is randomly generated based on the total machine capacity of an SCC process. The tightness between them is adjusted by a factor τ. Furthermore, a minimum batch size criterion is established, stipulating that the batch size to initiate processing on any machine must be at least 20% of the machine's capacity. This rule ensures a balance between production efficiency and operational feasibility. The remaining parameters for each instance are stochastically determined within predefined intervals, as detailed in Table 5.

Table 5: Generation of instances

Production process	$S = 3$
Machine capacity	$C_i \in [6000, \ 8000]$
Minimum batch size	$\check{L}_{ir} = 20\% C_i$
Initial inventory quantity	$I_{jp}^0 \in [10, \ 20]$
Maximum inventory capacity	$\hat{I}_j \in [1000, \ 3000]$
Transportation cost	$c_{ijp} \in [1, \ 10]$
Fixed activation cost	$f_{ij} \in [100, \ 200]$
Shortage cost	$\delta_k \in [100, \ 200]$
Inventory cost	$\mu_k \in [1, \ 10]$
Tightness factor	$\tau = 1.0$
Normal customer demand	$\sum_{k=1}^{K} \bar{d}_k = \tau \sum_{i=1}^{|\mathbb{M}^1|} C_i$
Demand disturbance parameter	$\varepsilon = 10\%$
Normal production yield rate	$\bar{r}_p \in [0.95, \ 0.99]$
Maximum production yield rate deviation	$\hat{r}_p \in [0.01, \ 0.05]$

Table 6 provides a summary result comparison for a condition of $K = 20$, $|\mathbb{M}^s| = 3$, and $P = 39$. All of instances in the table can be optimally solved by CG and OA-CG. Therefore, $^\#$Ins is 20 for each demand disturbance parameter in a group. Tables 7-12 show experimental comparison results for small-scale instances with $K = 15$ and $K = 20$, under varying demand disturbance parameters and uncertainty levels, respectively. The instances can be optimally solved by using both CG and OA-CG. OA-CG demonstrates superior performance in terms of total computation time for the majority of instances. These results substantiate the high efficiency of our proposed algorithm in solving the problem at hand.

Table 6: Summary result comparison when $|\mathbb{M}^s| = 3$, $K = 20$, and $P = 39$

Γ_D	Γ_R	ε	CG				OA-CG				$\bar{\mathcal{P}}_T$
			#Ins	Time (s)			#Ins	Time (s)			
				Min^C	Max^C	Avg^C		Min	Max	Avg	
4	10	5%	20	1.00	83.71	16.25	20	0.82	20.56	5.42	**55.44%**
		6%	20	0.92	94.41	15.74	20	1.08	35.25	6.38	**44.34%**
		7%	20	0.63	78.97	12.44	20	0.98	16.30	4.98	**34.64%**
		8%	20	0.67	46.51	10.45	20	0.86	30.27	5.80	**31.32%**
		9%	20	0.66	88.97	13.91	20	0.83	25.43	5.96	**35.75%**
		10%	20	0.61	103.45	12.97	20	0.95	29.14	5.86	**27.85%**
6	15	5%	20	3.23	58.39	17.80	20	1.52	15.65	5.70	**58.01%**
		6%	20	2.89	64.70	16.52	20	1.44	14.72	4.93	**59.43%**
		7%	20	1.50	60.10	16.53	20	1.45	14.83	5.35	**53.92%**
		8%	20	1.42	44.26	12.93	20	1.30	11.94	5.39	**41.77%**
		9%	20	1.83	40.12	11.73	20	1.39	20.91	5.30	**40.19%**
		10%	20	1.73	32.23	9.27	20	1.33	20.47	5.74	**24.50%**
8	20	5%	20	2.01	34.14	9.58	20	1.87	16.10	4.72	**40.45%**
		6%	20	1.30	27.72	8.95	20	1.44	15.36	4.94	**39.02%**
		7%	20	1.09	30.25	8.90	20	1.39	14.12	4.42	**40.59%**
		8%	20	1.28	25.88	7.56	20	1.29	19.98	4.69	**30.23%**
		9%	20	1.14	22.19	7.40	20	1.33	11.86	4.40	**28.77%**
		10%	20	1.02	23.69	7.30	20	1.20	12.72	4.38	**17.58%**

Table 13 gives a comparative analysis of the experimental results for large-scale instances with $|\mathbb{M}^s| = 4$ under different levels of uncertainty. CG yields suboptimal solutions for many instances, whereas OA-CG successfully identifies optimal solutions for most of them. The great improvement in solving efficiency, as evidenced by the reduced computational time, suggests OA-CG's high robustness and suitability for potential real-world industrial applications.

Table 7: Comparison results when $|\mathbb{M}^s| = 3$, $K = 15$, $\Gamma_D = 4$, and $\Gamma_R = 10$

ε	Instance	CG					OA-CG					$\mathcal{P}_T$
		L^C	U^C	G^C	Time (s)		L	U	G	Time (s)		
					RP	Total				RP	Total	
5%	1	496489.74	496489.74	0.00%	20.75	30.89	496489.74	496489.74	0.00%	3.31	9.20	70.22%
	2	549217.66	549217.66	0.00%	24.56	29.56	549217.66	549217.66	0.00%	3.69	13.77	53.43%
	3	588608.44	588608.44	0.00%	36.07	67.82	588608.44	588608.44	0.00%	4.92	35.99	46.94%
	4	560747.32	560747.32	0.00%	253.27	408.36	560747.32	560747.32	0.00%	62.58	258.71	36.65%
	5	842388.85	842388.85	0.00%	28.05	29.98	842388.85	842388.85	0.00%	8.27	11.67	61.06%
	6	546418.02	546418.02	0.00%	4.59	5.09	546418.02	546418.02	0.00%	3.16	3.75	26.33%
	7	566704.22	566704.22	0.00%	11.47	18.08	566704.22	566704.22	0.00%	2.83	9.44	47.80%
	8	960120.11	960120.11	0.00%	6.14	7.83	960120.11	960120.11	0.00%	2.45	4.37	44.15%
	9	501193.63	501193.63	0.00%	12.44	18.61	501193.63	501193.63	0.00%	2.65	11.83	36.42%
	10	501441.35	501441.35	0.00%	24.07	44.05	501441.35	501441.35	0.00%	3.62	28.29	35.77%
	11	779895.83	779895.83	0.00%	15.31	17.38	779895.83	779895.83	0.00%	4.98	11.05	36.43%
	12	710819.10	710819.92	0.00%	6.66	8.16	710819.12	710819.12	0.00%	2.47	4.34	46.76%
	13	615560.72	615560.72	0.00%	5.63	6.50	615560.72	615560.72	0.00%	2.66	3.67	43.48%
	14	557237.81	557237.81	0.00%	9.44	10.74	557237.81	557237.81	0.00%	4.83	6.42	40.21%
	15	1008934.05	1008934.05	0.00%	1.52	1.78	1008934.05	1008934.05	0.00%	2.16	2.42	-35.78%
	16	564437.04	564437.04	0.00%	14.20	22.11	564437.04	564437.04	0.00%	3.86	13.66	38.24%
	17	862551.02	862551.02	0.00%	3.94	5.69	862551.02	862551.02	0.00%	2.58	4.77	16.16%
	18	609537.72	609537.72	0.00%	2.55	2.95	609537.72	609537.72	0.00%	2.12	3.19	-7.89%
	19	634555.16	634555.16	0.00%	9.16	11.28	634555.16	634555.16	0.00%	4.29	6.24	44.70%
	20	715173.08	715173.08	0.00%	11.33	20.36	715173.08	715173.08	0.00%	3.81	20.24	0.60%
6%	1	513855.16	513855.16	0.00%	18.21	22.55	513855.16	513855.16	0.00%	3.53	8.00	64.52%
	2	568858.32	568858.32	0.00%	23.87	28.66	568858.32	568858.32	0.00%	3.73	12.73	55.57%
	3	605117.40	605117.40	0.00%	39.67	68.91	605117.40	605117.40	0.00%	5.30	25.73	62.65%
	4	572152.96	572152.96	0.00%	189.59	241.11	572152.96	572152.96	0.00%	44.13	159.95	33.66%
	5	871551.99	871551.99	0.00%	18.08	20.63	871551.99	871551.99	0.00%	6.95	8.84	57.17%
	6	568299.10	568299.10	0.00%	5.59	6.27	568299.10	568299.10	0.00%	3.02	3.56	43.14%
	7	588101.57	588101.57	0.00%	12.16	19.63	588101.57	588101.57	0.00%	2.89	9.83	49.93%
	8	988357.03	988357.03	0.00%	10.28	14.11	988357.03	988357.03	0.00%	2.89	7.11	49.62%
	9	515133.19	515133.19	0.00%	13.73	21.22	515133.19	515133.19	0.00%	2.45	10.19	52.00%
	10	525384.34	525384.34	0.00%	21.66	43.81	525384.34	525384.34	0.00%	4.52	36.32	17.11%
	11	813413.34	813413.34	0.00%	15.88	18.27	813413.34	813413.34	0.00%	4.55	7.60	58.41%
	12	732595.82	732595.82	0.00%	5.28	6.21	732595.82	732595.82	0.00%	2.55	3.64	41.34%
	13	636642.56	636642.56	0.00%	6.61	7.38	636642.56	636642.56	0.00%	3.42	4.41	40.27%
	14	577337.57	577337.57	0.00%	10.83	12.77	577337.57	577337.57	0.00%	3.32	5.04	60.56%
	15	1052815.65	1052815.65	0.00%	1.48	1.70	1052815.65	1052815.65	0.00%	1.75	1.97	-15.62%
	16	584090.29	584090.29	0.00%	15.36	22.95	584090.29	584090.29	0.00%	5.78	15.86	30.90%
	17	889975.66	889975.66	0.00%	3.86	5.83	889975.66	889975.66	0.00%	3.19	5.78	0.82%
	18	642794.60	642794.60	0.00%	3.22	3.63	642794.60	642794.60	0.00%	2.30	2.81	22.48%
	19	656528.10	656528.10	0.00%	8.77	10.75	656528.10	656528.10	0.00%	4.78	8.37	22.10%
	20	735368.78	735368.78	0.00%	11.67	22.28	735368.78	735368.78	0.00%	4.10	16.57	25.66%
7%	1	531226.37	531226.37	0.00%	19.92	24.95	531226.37	531226.37	0.00%	3.77	13.53	45.76%
	2	588498.98	588498.98	0.00%	26.25	30.61	588498.98	588498.98	0.00%	3.36	11.44	62.63%
	3	621670.75	621670.75	0.00%	50.25	109.77	621628.43	621670.75	0.00%	6.41	56.76	48.29%
	4	585424.03	585424.03	0.00%	177.92	233.89	585424.03	585424.03	0.00%	141.33	219.50	6.15%
	5	900715.14	900715.14	0.00%	16.42	18.45	900715.14	900715.14	0.00%	11.12	14.06	23.79%
	6	590180.18	590180.18	0.00%	4.89	5.47	590180.18	590180.18	0.00%	3.56	4.33	20.91%
	7	609498.92	609498.92	0.00%	10.19	15.73	609498.92	609498.92	0.00%	2.79	9.99	36.50%
	8	1016593.94	1016593.94	0.00%	9.42	13.41	1016593.94	1016593.94	0.00%	2.71	6.46	51.80%
	9	529129.73	529129.73	0.00%	12.03	19.08	529129.73	529129.73	0.00%	2.30	10.28	46.09%
	10	549754.64	549754.64	0.00%	14.64	32.53	549754.64	549754.64	0.00%	3.57	23.03	29.19%
	11	846078.82	846078.82	0.00%	11.92	14.45	846078.82	846078.82	0.00%	5.53	8.36	42.18%
	12	754372.52	754372.52	0.00%	4.69	5.48	754372.52	754372.52	0.00%	2.45	3.20	41.62%
	13	657724.41	657724.41	0.00%	5.37	6.08	657724.41	657724.41	0.00%	2.54	3.24	46.62%

	14	596829.81	596829.81	0.00%	9.23	10.50	596829.81	596829.81	0.00%	3.16	4.39	58.16%
	15	1097255.86	1097255.86	0.00%	0.95	1.20	1097255.86	1097255.86	0.00%	1.39	1.66	-37.77%
	16	603743.55	603743.55	0.00%	12.70	19.49	603743.55	603743.55	0.00%	3.85	12.55	35.58%
	17	917400.30	917400.30	0.00%	3.59	5.27	917400.30	917400.30	0.00%	2.33	4.14	21.39%
	18	676051.47	676051.47	0.00%	2.14	2.52	676051.47	676051.47	0.00%	2.09	2.50	0.72%
	19	678502.16	678502.16	0.00%	7.39	9.26	678502.16	678502.16	0.00%	2.85	5.08	45.14%
	20	761823.06	761823.06	0.00%	9.56	15.50	761823.06	761823.06	0.00%	2.75	9.75	37.07%
8%	1	548694.86	548694.86	0.00%	23.80	31.22	548694.86	548694.86	0.00%	4.31	15.43	50.59%
	2	608139.64	608139.64	0.00%	26.14	31.52	608139.64	608139.64	0.00%	3.81	10.99	65.14%
	3	642230.49	642230.49	0.00%	47.36	85.43	642230.49	642230.49	0.00%	5.77	56.34	34.04%
	4	611662.31	611662.31	0.00%	85.28	163.47	611662.31	611662.31	0.00%	9.57	96.45	41.00%
	5	930777.43	930777.43	0.00%	11.64	12.50	930777.43	930777.43	0.00%	5.54	8.30	33.60%
	6	612151.38	612151.38	0.00%	8.47	9.91	612151.38	612151.38	0.00%	2.49	3.44	65.28%
	7	630896.28	630896.28	0.00%	9.28	14.33	630896.28	630896.28	0.00%	2.64	8.30	42.09%
	8	1045108.49	1045108.49	0.00%	8.77	12.27	1045108.49	1045108.49	0.00%	2.62	6.57	46.46%
	9	543126.26	543126.26	0.00%	12.02	19.12	543126.26	543126.26	0.00%	2.44	10.28	46.25%
	10	576018.41	576018.41	0.00%	14.28	35.29	576018.41	576018.41	0.00%	3.14	20.83	40.97%
	11	880248.54	880248.54	0.00%	9.45	11.80	880248.54	880248.54	0.00%	4.20	6.97	40.90%
	12	776149.21	776149.21	0.00%	3.92	4.63	776149.21	776149.21	0.00%	1.84	2.73	40.97%
	13	678806.25	678806.25	0.00%	5.09	5.69	678806.25	678806.25	0.00%	2.89	3.55	37.63%
	14	615887.94	615887.94	0.00%	7.63	8.83	615887.94	615887.94	0.00%	3.09	4.23	52.09%
	15	1141696.07	1141696.07	0.00%	3.41	4.20	1141696.07	1141696.07	0.00%	1.69	2.69	36.11%
	16	623626.14	623626.14	0.00%	10.02	14.31	623626.14	623626.14	0.00%	3.31	8.28	42.11%
	17	944824.94	944824.94	0.00%	3.33	4.64	944824.94	944824.94	0.00%	2.09	3.81	17.94%
	18	709308.35	709308.35	0.00%	4.59	5.55	709308.35	709308.35	0.00%	2.42	3.58	35.49%
	19	700478.08	700478.08	0.00%	7.19	8.84	700478.08	700478.08	0.00%	2.88	4.69	46.97%
	20	789065.10	789065.10	0.00%	8.86	14.54	789065.10	789065.10	0.00%	2.92	10.34	28.89%
9%	1	566231.93	566231.93	0.00%	21.56	25.89	566231.93	566231.93	0.00%	4.28	10.39	59.88%
	2	627783.27	627783.27	0.00%	18.58	22.47	627783.27	627783.27	0.00%	3.35	11.44	49.08%
	3	662831.93	662831.93	0.00%	32.22	70.00	662831.93	662831.93	0.00%	4.83	55.93	20.10%
	4	638456.10	638456.10	0.00%	73.05	138.03	638456.10	638456.10	0.00%	6.81	77.36	43.96%
	5	960932.70	960932.70	0.00%	10.05	11.05	960932.70	960932.70	0.00%	4.61	6.33	42.70%
	6	634949.24	634949.24	0.00%	11.31	14.28	634949.24	634949.24	0.00%	2.36	3.31	76.80%
	7	652294.41	652294.41	0.00%	6.97	10.33	652294.41	652294.41	0.00%	2.67	6.29	39.08%
	8	1073741.66	1073741.66	0.00%	8.39	11.58	1073741.66	1073741.66	0.00%	2.52	5.89	49.11%
	9	557122.79	557122.79	0.00%	10.97	17.55	557122.79	557122.79	0.00%	2.36	8.59	51.03%
	10	602282.19	602282.19	0.00%	18.01	47.53	602282.19	602282.19	0.00%	3.81	32.25	32.15%
	11	914647.67	914647.67	0.00%	8.73	10.80	914647.67	914647.67	0.00%	3.23	5.69	47.32%
	12	797925.91	797925.91	0.00%	4.28	5.06	797925.91	797925.91	0.00%	1.97	2.72	46.30%
	13	699888.09	699888.09	0.00%	4.77	5.39	699888.09	699888.09	0.00%	2.69	3.31	38.58%
	14	634946.07	634946.07	0.00%	7.92	9.02	634946.07	634946.07	0.00%	3.05	4.19	53.50%
	15	1186370.90	1186370.90	0.00%	2.95	3.73	1186370.90	1186370.90	0.00%	1.36	2.69	27.90%
	16	643976.61	643976.61	0.00%	13.28	21.37	643976.61	643976.61	0.00%	4.05	13.55	36.63%
	17	975892.67	975892.67	0.00%	3.13	4.47	975892.67	975892.67	0.00%	2.19	3.72	16.70%
	18	742565.23	742565.23	0.00%	3.66	4.67	742565.23	742565.23	0.00%	2.29	3.52	24.67%
	19	722454.01	722454.01	0.00%	6.73	8.73	722454.01	722454.01	0.00%	2.94	5.13	41.28%
	20	816307.13	816307.13	0.00%	9.37	14.28	816307.13	816307.13	0.00%	2.65	9.15	35.91%
10%	1	583768.99	583768.99	0.00%	23.36	33.47	583768.99	583768.99	0.00%	5.51	11.71	65.00%
	2	647437.18	647437.18	0.00%	12.50	15.14	647437.18	647437.18	0.00%	3.61	11.99	20.84%
	3	683433.56	683433.56	0.00%	37.14	93.27	683433.56	683433.56	0.00%	5.58	52.08	44.16%
	4	665249.89	665249.89	0.00%	64.91	164.33	665249.89	665249.89	0.00%	6.34	69.87	57.48%
	5	991099.46	991099.46	0.00%	11.44	12.34	991099.46	991099.46	0.00%	4.84	6.55	46.96%
	6	657747.10	657747.10	0.00%	10.36	11.86	657747.10	657747.10	0.00%	3.11	5.30	55.35%
	7	675388.16	675388.16	0.00%	9.53	13.75	675388.16	675388.16	0.00%	2.51	6.18	55.03%
	8	1102374.82	1102374.82	0.00%	10.09	14.11	1102374.82	1102374.82	0.00%	2.71	5.99	57.53%
	9	571119.32	571119.32	0.00%	19.91	29.72	571119.32	571119.32	0.00%	2.50	10.19	65.72%
	10	628747.94	628747.94	0.00%	23.03	62.47	628747.94	628747.94	0.00%	3.80	36.98	40.81%

11	**950826.68**	**950826.68**	**0.00%**	13.06	15.94	**950826.68**	**950826.68**	**0.00%**	3.72	6.33	**60.29%**
12	**819702.61**	**819702.61**	**0.00%**	6.50	7.48	**819702.61**	**819702.61**	**0.00%**	2.16	2.91	**61.17%**
13	**720985.56**	**720985.56**	**0.00%**	8.31	9.10	**720985.56**	**720985.56**	**0.00%**	2.78	3.44	**62.21%**
14	**654160.13**	**654160.13**	**0.00%**	12.83	14.41	**654160.13**	**654160.13**	**0.00%**	3.02	4.24	**70.59%**
15	**1233612.50**	**1233612.50**	**0.00%**	3.78	4.77	**1233612.50**	**1233612.50**	**0.00%**	1.39	2.14	**55.13%**
16	**664327.47**	**664327.47**	**0.00%**	18.86	31.31	**664327.47**	**664327.47**	**0.00%**	3.36	10.28	**67.16%**
17	**1007169.85**	**1007169.85**	**0.00%**	4.34	6.17	**1007169.85**	**1007169.85**	**0.00%**	2.02	3.39	**45.05%**
18	**775822.11**	**775822.11**	**0.00%**	5.78	7.23	**775822.11**	**775822.11**	**0.00%**	2.51	3.63	**49.79%**
19	**744429.93**	**744429.93**	**0.00%**	10.05	12.66	**744429.93**	**744429.93**	**0.00%**	2.76	5.77	**54.45%**
20	**843549.16**	**843549.16**	**0.00%**	9.86	15.64	**843549.16**	**843549.16**	**0.00%**	2.54	8.93	**42.91%**

Table 8: Comparison results when $|\mathbb{M}^s| = 3$, $K = 15$, $\Gamma_D = 6$, and $\Gamma_R = 15$

ε	Instance	CG					OA-CG					$\mathcal{P}_T$
		L^C	U^C	G^C	Time (s)		L	U	G	Time (s)		
					RP	Total				RP	Total	
5%	1	569796.21	569796.21	0.00%	18.75	27.03	569749.74	569796.21	0.00%	4.56	12.10	55.23%
	2	640935.42	640935.42	0.00%	15.37	23.00	640935.42	640935.42	0.00%	3.64	11.67	49.25%
	3	680538.28	680538.28	0.00%	100.41	169.67	680538.28	680538.28	0.00%	15.41	67.55	60.19%
	4	640067.75	640067.75	0.00%	95.83	162.06	640067.75	640067.75	0.00%	6.94	45.61	71.86%
	5	983568.94	983568.94	0.00%	31.74	33.77	983568.94	983568.94	0.00%	8.03	10.06	70.20%
	6	632262.78	632262.78	0.00%	11.13	13.86	632262.78	632262.78	0.00%	3.23	5.79	58.21%
	7	631590.58	631590.58	0.00%	16.95	35.61	631590.58	631590.58	0.00%	3.59	28.32	20.47%
	8	977102.64	977102.64	0.00%	6.66	7.72	977021.71	977102.64	0.00%	3.30	5.38	30.29%
	9	544647.95	544647.95	0.00%	15.97	24.89	544647.95	544647.95	0.00%	2.66	13.55	45.58%
	10	577578.78	577578.78	0.00%	17.61	35.94	577578.78	577578.78	0.00%	4.38	30.60	14.85%
	11	901788.00	901788.00	0.00%	16.09	21.81	901788.00	901788.00	0.00%	3.94	9.62	55.88%
	12	769445.65	769445.65	0.00%	7.38	9.16	769445.65	769445.65	0.00%	2.57	5.73	37.44%
	13	682168.98	682168.98	0.00%	13.56	14.75	682168.98	682168.98	0.00%	5.41	8.41	43.02%
	14	620968.66	620968.66	0.00%	14.86	16.99	620968.66	620968.66	0.00%	3.42	5.98	64.80%
	15	1128381.57	1128381.57	0.00%	5.91	6.89	1128381.57	1128381.57	0.00%	2.49	3.61	47.58%
	16	661698.19	661698.19	0.00%	24.27	45.06	661698.19	661698.19	0.00%	4.08	21.13	53.12%
	17	961359.29	961359.29	0.00%	6.61	10.81	961359.29	961359.29	0.00%	2.95	11.39	-5.33%
	18	685161.07	685161.07	0.00%	6.46	7.96	685161.07	685161.07	0.00%	2.99	4.63	41.80%
	19	718632.07	718632.07	0.00%	9.13	11.23	718632.07	718632.07	0.00%	3.19	5.59	50.20%
	20	817913.78	817913.78	0.00%	11.51	25.84	817913.78	817913.78	0.00%	3.30	19.79	23.42%
6%	1	594862.07	594862.07	0.00%	24.78	35.14	594812.45	594862.07	0.00%	4.52	14.47	58.82%
	2	668122.95	668122.95	0.00%	22.70	31.78	668122.95	668122.95	0.00%	3.61	12.25	61.46%
	3	711583.31	711583.31	0.00%	78.13	153.47	711583.31	711583.31	0.00%	12.03	94.86	38.19%
	4	676886.48	676886.48	0.00%	68.96	129.59	676886.48	676886.48	0.00%	8.11	104.23	19.57%
	5	1027003.85	1027084.95	0.00%	28.92	30.32	1027084.95	1027084.95	0.00%	16.16	19.40	36.02%
	6	663347.55	663347.55	0.00%	14.09	17.69	663347.55	663347.55	0.00%	3.57	7.28	58.81%
	7	659426.47	659426.47	0.00%	18.50	36.95	659426.47	659426.47	0.00%	3.70	30.48	17.52%
	8	1007548.18	1007548.18	0.00%	6.81	7.92	1007548.18	1007548.18	0.00%	3.25	4.33	45.36%
	9	562230.30	562230.30	0.00%	34.89	47.14	562230.30	562230.30	0.00%	2.88	11.76	75.06%
	10	609117.53	609117.53	0.00%	18.56	40.21	609117.53	609117.53	0.00%	4.19	37.19	7.50%
	11	945303.25	945303.25	0.00%	15.52	20.78	945303.25	945303.25	0.00%	5.11	11.28	45.71%
	12	798322.15	798322.15	0.00%	7.42	9.13	798322.15	798322.15	0.00%	2.43	4.37	52.17%
	13	710503.38	710503.38	0.00%	10.98	12.11	710503.38	710503.38	0.00%	4.41	5.70	52.90%
	14	645806.07	645806.07	0.00%	15.89	18.56	645806.07	645806.07	0.00%	3.77	6.59	64.48%
	15	1182885.71	1182885.71	0.00%	2.86	3.39	1182858.47	1182885.71	0.00%	1.83	2.81	17.08%
	16	691011.11	691011.11	0.00%	29.88	60.38	691011.11	691011.11	0.00%	4.27	32.41	46.32%
	17	1002209.10	1002209.10	0.00%	6.06	9.64	1002209.10	1002209.10	0.00%	2.70	7.36	23.67%
	18	725910.90	725910.90	0.00%	4.83	6.06	725910.90	725910.90	0.00%	3.01	4.54	25.09%
	19	749249.27	749249.27	0.00%	8.16	10.16	749249.27	749249.27	0.00%	2.97	6.72	33.84%
	20	853657.06	853657.06	0.00%	10.85	22.91	853657.06	853657.06	0.00%	3.09	16.76	26.83%
7%	1	619933.05	619933.05	0.00%	23.31	32.47	619875.16	619933.05	0.00%	4.41	10.55	67.50%
	2	695310.48	695310.48	0.00%	22.63	33.31	695310.48	695310.48	0.00%	3.75	10.73	67.78%
	3	742773.94	742773.94	0.00%	76.53	168.35	742768.37	742773.94	0.00%	9.30	106.41	36.79%
	4	714789.17	714789.17	0.00%	52.08	100.03	714789.17	714789.17	0.00%	6.11	46.11	53.90%
	5	1070532.37	1070634.37	0.00%	24.11	26.28	1070634.37	1070634.37	0.00%	10.50	12.18	53.64%
	6	694432.32	694432.32	0.00%	14.72	19.49	694432.32	694432.32	0.00%	3.62	7.62	60.88%
	7	690024.48	690024.48	0.00%	24.45	62.59	690024.48	690024.48	0.00%	3.75	39.79	36.42%
	8	1038152.80	1038152.80	0.00%	6.83	7.81	1038152.80	1038152.80	0.00%	2.58	3.43	56.04%
	9	579901.84	579901.84	0.00%	26.44	35.23	579901.84	579901.84	0.00%	2.44	10.09	71.36%
	10	640656.28	640656.28	0.00%	23.50	72.50	640656.28	640656.28	0.00%	3.34	41.22	43.15%
	11	988649.24	988649.24	0.00%	15.52	20.12	988649.24	988649.24	0.00%	3.69	7.51	62.67%
	12	827287.49	827287.49	0.00%	5.14	6.05	827287.49	827287.49	0.00%	2.02	2.80	53.70%
	13	739088.86	739088.86	0.00%	7.88	8.81	739088.86	739088.86	0.00%	3.80	4.66	47.11%

	14	**670643.47**	**670643.47**	**0.00%**	12.70	14.86	**670643.47**	**670643.47**	**0.00%**	3.45	5.41	**63.62%**
	15	**1238509.64**	**1238509.64**	**0.00%**	2.25	2.75	**1238443.52**	**1238509.64**	**0.00%**	1.26	2.01	**26.94%**
	16	**720434.37**	**720434.37**	**0.00%**	20.94	39.01	**720434.37**	**720434.37**	**0.00%**	3.03	11.75	**69.89%**
	17	**1043762.48**	**1043762.48**	**0.00%**	4.69	8.83	**1043762.48**	**1043762.48**	**0.00%**	1.97	6.09	**30.97%**
	18	**766676.68**	**766676.68**	**0.00%**	3.34	4.20	**766676.68**	**766676.68**	**0.00%**	1.84	2.31	**44.97%**
	19	**779971.38**	**779971.38**	**0.00%**	7.78	9.66	**779971.38**	**779971.38**	**0.00%**	2.65	5.58	**42.17%**
	20	**889538.73**	**889538.73**	**0.00%**	9.36	20.36	**889538.73**	**889538.73**	**0.00%**	4.04	28.22	-38.62%
	1	**646571.06**	**646571.06**	**0.00%**	24.72	35.86	**646571.06**	**646571.06**	**0.00%**	4.64	11.89	**66.85%**
	2	**722498.01**	**722498.01**	**0.00%**	17.84	26.35	**722498.01**	**722498.01**	**0.00%**	3.31	9.78	**62.87%**
	3	**772941.93**	**772941.93**	**0.00%**	63.80	200.29	**772941.93**	**772941.93**	**0.00%**	9.05	83.36	**58.38%**
	4	**752967.21**	**752967.21**	**0.00%**	45.75	100.00	**752967.21**	**752967.21**	**0.00%**	5.81	59.19	**40.81%**
	5	**1114189.46**	**1114250.80**	**0.00%**	20.39	22.66	**1114250.80**	**1114250.80**	**0.00%**	10.75	13.41	**40.83%**
	6	**725517.08**	**725517.08**	**0.00%**	18.01	23.47	**725517.08**	**725517.08**	**0.00%**	3.72	8.38	**64.30%**
	7	**718196.92**	**718196.92**	**0.00%**	17.60	40.82	**718196.92**	**718196.92**	**0.00%**	4.11	24.19	**40.73%**
	8	**1068994.83**	**1068994.83**	**0.00%**	7.17	8.01	**1068994.83**	**1068994.83**	**0.00%**	2.58	3.52	**56.09%**
	9	**597573.37**	**597573.37**	**0.00%**	30.19	41.66	**597573.37**	**597573.37**	**0.00%**	2.84	12.85	**69.15%**
8%	10	**672195.03**	**672195.03**	**0.00%**	21.59	64.56	**672195.03**	**672195.03**	**0.00%**	3.74	37.08	**42.56%**
	11	**1032071.91**	**1032071.91**	**0.00%**	12.59	15.42	**1032071.91**	**1032071.91**	**0.00%**	3.53	6.08	**60.58%**
	12	**856252.82**	**856252.82**	**0.00%**	4.25	5.30	**856252.82**	**856252.82**	**0.00%**	2.04	2.92	**44.95%**
	13	**767976.12**	**767976.12**	**0.00%**	7.95	8.91	**767976.12**	**767976.12**	**0.00%**	3.28	4.08	**54.21%**
	14	**702582.32**	**702582.32**	**0.00%**	10.91	12.62	**702582.32**	**702582.32**	**0.00%**	3.50	5.55	**56.04%**
	15	**1294831.55**	**1294831.55**	**0.00%**	1.88	2.30	**1294831.55**	**1294831.55**	**0.00%**	1.01	1.47	**36.13%**
	16	**748302.27**	**748302.27**	**0.00%**	15.50	28.78	**748302.27**	**748302.27**	**0.00%**	3.11	16.08	**44.12%**
	17	**1085315.86**	**1085315.86**	**0.00%**	3.98	7.16	**1085315.86**	**1085315.86**	**0.00%**	2.39	6.50	**9.19%**
	18	**807511.13**	**807511.13**	**0.00%**	3.20	3.98	**807511.13**	**807511.13**	**0.00%**	2.41	3.62	**9.04%**
	19	**810693.48**	**810693.48**	**0.00%**	3.09	3.69	**810693.48**	**810693.48**	**0.00%**	2.06	3.56	**3.39%**
	20	**925420.40**	**925420.40**	**0.00%**	8.41	17.14	**925420.40**	**925420.40**	**0.00%**	2.85	12.40	**27.67%**
	1	**675275.91**	**675275.91**	**0.00%**	15.27	19.61	**675275.91**	**675275.91**	**0.00%**	3.55	6.25	**68.13%**
	2	**749685.54**	**749685.54**	**0.00%**	11.66	16.45	**749685.54**	**749685.54**	**0.00%**	3.80	8.56	**47.98%**
	3	**802967.97**	**802967.97**	**0.00%**	38.14	111.58	**802967.97**	**802967.97**	**0.00%**	7.97	80.80	**27.59%**
	4	**791145.24**	**791145.24**	**0.00%**	49.62	102.06	**791145.24**	**791145.24**	**0.00%**	5.98	46.46	**54.48%**
	5	**1157937.93**	**1157990.50**	**0.00%**	18.08	20.08	**1157990.50**	**1157990.50**	**0.00%**	5.86	8.47	**57.84%**
	6	**763981.56**	**763981.56**	**0.00%**	10.20	12.38	**763981.56**	**763981.56**	**0.00%**	2.90	4.53	**63.40%**
	7	**747966.81**	**747966.81**	**0.00%**	12.89	23.88	**747966.81**	**747966.81**	**0.00%**	3.95	12.20	**48.91%**
	8	**1099836.85**	**1099836.85**	**0.00%**	5.39	5.86	**1099836.85**	**1099836.85**	**0.00%**	2.55	2.97	**49.30%**
	9	**615244.91**	**615244.91**	**0.00%**	24.92	38.33	**615244.91**	**615244.91**	**0.00%**	2.80	9.73	**74.60%**
9%	10	**705715.08**	**705715.08**	**0.00%**	27.47	84.36	**705715.08**	**705715.08**	**0.00%**	3.94	48.96	**41.97%**
	11	**1075494.57**	**1075494.57**	**0.00%**	11.78	14.13	**1075494.57**	**1075494.57**	**0.00%**	4.46	6.42	**54.53%**
	12	**885578.04**	**885578.04**	**0.00%**	4.48	5.28	**885578.04**	**885578.04**	**0.00%**	2.11	3.69	**30.13%**
	13	**796892.83**	**796892.83**	**0.00%**	9.16	10.08	**796892.83**	**796892.83**	**0.00%**	3.73	4.73	**53.04%**
	14	**737231.88**	**737231.88**	**0.00%**	15.03	18.42	**737205.23**	**737231.88**	**0.00%**	3.92	7.22	**60.83%**
	15	**1351524.21**	**1351524.21**	**0.00%**	1.81	2.72	**1351524.21**	**1351524.21**	**0.00%**	0.97	1.89	**30.40%**
	16	**779567.46**	**779567.46**	**0.00%**	22.70	41.77	**779567.46**	**779567.46**	**0.00%**	6.41	28.96	**30.67%**
	17	**1126869.24**	**1126869.24**	**0.00%**	6.22	9.13	**1126869.24**	**1126869.24**	**0.00%**	2.09	6.56	**28.11%**
	18	**848345.57**	**848345.57**	**0.00%**	4.61	5.47	**848345.57**	**848345.57**	**0.00%**	1.92	2.42	**55.68%**
	19	**842806.52**	**842806.52**	**0.00%**	5.20	6.03	**842806.52**	**842806.52**	**0.00%**	2.88	3.72	**38.32%**
	20	**961151.07**	**961151.07**	**0.00%**	11.59	26.14	**961151.07**	**961151.07**	**0.00%**	2.72	19.84	**24.09%**
	1	**703980.76**	**703980.76**	**0.00%**	17.66	21.51	**703980.76**	**703980.76**	**0.00%**	3.92	7.99	**62.88%**
	2	**776950.21**	**776950.21**	**0.00%**	13.19	16.81	**776950.21**	**776950.21**	**0.00%**	3.29	7.60	**54.82%**
	3	**833493.72**	**833493.72**	**0.00%**	39.68	110.00	**833493.72**	**833493.72**	**0.00%**	7.37	59.30	**46.10%**
	4	**829323.27**	**829323.27**	**0.00%**	44.56	93.33	**829323.27**	**829323.27**	**0.00%**	6.34	58.18	**37.66%**
	5	**1201686.40**	**1201738.89**	**0.00%**	13.33	15.47	**1201738.89**	**1201738.89**	**0.00%**	5.23	7.48	**51.64%**
	6	**808530.46**	**808530.46**	**0.00%**	9.10	11.02	**808530.46**	**808530.46**	**0.00%**	2.23	3.62	**67.16%**
	7	**779246.50**	**779246.50**	**0.00%**	10.08	21.11	**779246.50**	**779246.50**	**0.00%**	3.48	11.56	**45.23%**
	8	**1132996.87**	**1132996.87**	**0.00%**	3.83	4.25	**1132996.87**	**1132996.87**	**0.00%**	4.05	5.13	-20.62%
	9	**632916.45**	**632916.45**	**0.00%**	25.19	36.42	**632916.45**	**632916.45**	**0.00%**	2.75	10.19	**72.03%**
10%	10	**740250.45**	**740250.45**	**0.00%**	16.14	32.50	**740250.45**	**740250.45**	**0.00%**	3.92	22.88	**29.60%**

11	**1118921.31**	**1118921.31**	**0.00%**	11.11	12.94	**1118921.31**	**1118921.31**	**0.00%**	3.55	5.00	**61.36%**
12	**914999.18**	**914999.18**	**0.00%**	3.24	4.00	**914999.18**	**914999.18**	**0.00%**	1.81	2.22	**44.58%**
13	**825875.13**	**825875.13**	**0.00%**	7.88	8.63	**825875.13**	**825875.13**	**0.00%**	3.13	3.72	**56.87%**
14	**772556.56**	**772556.56**	**0.00%**	9.16	11.04	**772556.56**	**772556.56**	**0.00%**	3.04	4.73	**57.13%**
15	**1410771.70**	**1410771.70**	**0.00%**	1.74	2.75	**1410771.70**	**1410771.70**	**0.00%**	1.50	2.61	**5.34%**
16	**811068.14**	**811068.14**	**0.00%**	26.67	65.50	**811068.14**	**811068.14**	**0.00%**	4.63	31.66	**51.66%**
17	**1168422.61**	**1168422.61**	**0.00%**	4.05	5.77	**1168422.61**	**1168422.61**	**0.00%**	1.75	2.88	**50.06%**
18	**889180.02**	**889180.02**	**0.00%**	3.24	3.80	**889180.02**	**889180.02**	**0.00%**	1.90	2.61	**31.35%**
19	**875356.36**	**875356.36**	**0.00%**	6.27	7.88	**875356.36**	**875356.36**	**0.00%**	2.49	3.74	**52.57%**
20	**997032.74**	**997032.74**	**0.00%**	15.11	38.80	**997032.74**	**997032.74**	**0.00%**	3.38	21.27	**45.17%**

Table 9: Comparison results when $|\mathbb{M}^s| = 3$, $K = 15$, $\Gamma_D = 8$, and $\Gamma_R = 20$

ε	Instance	CG			Time (s)		OA-CG			Time (s)		$\mathcal{P}_T$
		L^C	U^C	G^C	RP	Total	L	U	G	RP	Total	
5%	1	632093.35	632093.35	0.00%	22.17	39.39	632093.35	632093.35	0.00%	3.88	16.44	58.27%
	2	703307.42	703307.42	0.00%	10.38	13.48	703307.42	703307.42	0.00%	2.90	4.96	63.18%
	3	766607.07	766607.07	0.00%	47.03	205.16	766607.07	766607.07	0.00%	9.45	202.64	1.23%
	4	730402.91	730402.91	0.00%	18.89	45.51	730402.91	730402.91	0.00%	4.39	31.89	29.92%
	5	1087521.25	1087521.25	0.00%	9.11	10.31	1087521.25	1087521.25	0.00%	5.45	6.69	35.18%
	6	691261.51	691261.51	0.00%	11.51	15.55	691261.51	691261.51	0.00%	3.19	6.70	56.87%
	7	675992.48	675992.48	0.00%	8.25	15.63	675992.48	675992.48	0.00%	2.22	9.59	38.61%
	8	993994.06	993994.06	0.00%	3.11	3.50	993994.06	993994.06	0.00%	2.56	2.99	14.68%
	9	574246.39	574246.39	0.00%	11.69	18.52	574246.39	574246.39	0.00%	2.36	12.75	31.13%
	10	627110.16	627110.16	0.00%	10.84	35.89	627110.16	627110.16	0.00%	1.55	11.83	67.03%
	11	983791.69	983791.69	0.00%	9.52	17.96	983791.69	983791.69	0.00%	3.89	13.67	23.87%
	12	805465.50	805465.50	0.00%	3.14	4.77	805465.50	805465.50	0.00%	1.57	3.49	26.81%
	13	742056.57	742056.57	0.00%	14.13	16.39	742056.57	742056.57	0.00%	4.02	7.85	52.14%
	14	662581.21	662581.21	0.00%	13.08	14.61	662581.21	662581.21	0.00%	3.53	5.30	63.72%
	15	1206078.44	1206078.44	0.00%	0.87	1.39	1206078.44	1206078.44	0.00%	0.86	1.35	3.10%
	16	715396.45	715396.45	0.00%	13.86	30.28	715396.45	715396.45	0.00%	3.35	21.88	27.75%
	17	1024215.41	1024215.41	0.00%	2.20	5.81	1024215.41	1024215.41	0.00%	1.30	5.25	9.74%
	18	733132.48	733132.48	0.00%	1.14	1.59	733132.48	733132.48	0.00%	1.10	1.97	-23.73%
	19	762999.21	762999.21	0.00%	4.59	5.86	762999.21	762999.21	0.00%	2.03	3.33	43.18%
	20	891891.36	891891.36	0.00%	6.48	38.03	891891.36	891891.36	0.00%	2.83	36.22	4.76%
6%	1	664693.04	664706.54	0.00%	20.33	40.16	664706.54	664706.54	0.00%	4.33	23.92	40.44%
	2	737251.31	737277.84	0.00%	10.49	15.47	737277.84	737277.84	0.00%	3.33	12.24	20.91%
	3	803304.28	803304.28	0.00%	48.17	246.05	803304.28	803304.28	0.00%	9.80	174.14	29.22%
	4	777411.22	777411.22	0.00%	16.34	42.16	777411.22	777411.22	0.00%	3.95	20.56	51.24%
	5	1137855.77	1137855.77	0.00%	7.33	8.47	1137855.77	1137855.77	0.00%	3.67	5.25	38.00%
	6	727028.47	727028.47	0.00%	15.16	21.00	727028.47	727028.47	0.00%	3.11	6.61	68.53%
	7	708830.31	708830.31	0.00%	9.47	26.39	708830.31	708830.31	0.00%	2.90	15.61	40.87%
	8	1030626.00	1030626.00	0.00%	2.63	3.05	1030626.00	1030626.00	0.00%	1.89	2.26	25.80%
	9	595618.95	595618.95	0.00%	11.44	18.69	595618.95	595618.95	0.00%	2.51	7.90	57.71%
	10	665308.72	665308.72	0.00%	6.85	18.57	665308.72	665308.72	0.00%	2.26	11.13	40.06%
	11	1034795.77	1034795.77	0.00%	10.28	19.50	1034795.77	1034795.77	0.00%	3.70	9.35	52.08%
	12	838120.98	838120.98	0.00%	4.09	5.63	838120.98	838120.98	0.00%	1.81	3.87	31.16%
	13	777329.04	777329.04	0.00%	9.50	10.88	777288.25	777329.04	0.00%	3.32	4.55	58.16%
	14	695246.75	695246.75	0.00%	13.36	14.80	695246.75	695246.75	0.00%	2.83	3.94	73.37%
	15	1270479.65	1270479.65	0.00%	0.73	1.16	1270479.65	1270479.65	0.00%	0.87	1.30	-12.72%
	16	749089.08	749089.08	0.00%	16.02	35.38	749089.08	749089.08	0.00%	3.99	18.17	48.63%
	17	1072530.73	1072530.73	0.00%	2.53	6.88	1072530.73	1072530.73	0.00%	1.68	5.27	23.40%
	18	779702.39	779702.39	0.00%	2.47	3.80	779702.39	779702.39	0.00%	1.66	2.69	29.16%
	19	799058.07	799058.07	0.00%	5.72	7.05	799058.07	799058.07	0.00%	1.98	3.06	56.56%
	20	933653.08	933653.08	0.00%	7.16	42.66	933653.08	933653.08	0.00%	3.00	27.42	35.73%
7%	1	699880.47	699880.47	0.00%	19.25	33.85	699880.47	699880.47	0.00%	3.88	19.23	43.17%
	2	771510.18	771543.81	0.00%	9.56	14.47	771543.81	771543.81	0.00%	2.54	9.86	31.84%
	3	840035.23	840035.23	0.00%	53.11	261.25	840035.23	840035.23	0.00%	8.24	99.03	62.09%
	4	824835.22	824835.22	0.00%	15.98	48.37	824835.22	824835.22	0.00%	4.41	41.91	13.36%
	5	1189989.05	1190021.68	0.00%	7.50	9.28	1190021.68	1190021.68	0.00%	5.31	8.85	4.69%
	6	762795.43	762795.43	0.00%	10.91	15.39	762795.43	762795.43	0.00%	3.79	8.15	47.03%
	7	741788.50	741788.50	0.00%	8.52	24.25	741788.50	741788.50	0.00%	2.58	21.53	11.22%
	8	1067316.09	1067316.09	0.00%	2.91	3.39	1067316.09	1067316.09	0.00%	2.21	2.64	22.24%
	9	617095.33	617095.33	0.00%	12.13	20.41	617095.33	617095.33	0.00%	2.46	13.55	33.61%
	10	703527.85	703578.82	0.00%	6.39	20.32	703527.85	703527.85	0.00%	1.89	13.96	31.26%
	11	1088555.47	1088555.47	0.00%	8.69	15.95	1088555.47	1088555.47	0.00%	3.96	11.06	30.66%
	12	870776.45	870776.45	0.00%	2.02	2.55	870767.31	870776.45	0.00%	2.31	3.01	-18.31%
	13	812855.07	812855.07	0.00%	8.37	9.95	812855.07	812855.07	0.00%	3.66	5.41	45.64%

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	14	736652.39	736652.39	0.00%	5.66	6.11	736652.39	736652.39	0.00%	2.91	3.41	44.21%
	15	1334952.40	1334952.40	0.00%	0.70	1.22	1334952.40	1334952.40	0.00%	0.74	1.25	-2.54%
	16	784547.63	784547.63	0.00%	15.88	39.94	784547.63	784547.63	0.00%	4.41	32.13	19.55%
	17	1121191.44	1121191.44	0.00%	2.05	3.78	1121191.44	1121191.44	0.00%	1.24	3.19	15.60%
	18	828234.81	828234.81	0.00%	2.14	2.91	828234.81	828234.81	0.00%	1.27	2.23	23.15%
	19	835116.94	835116.94	0.00%	6.05	8.20	835116.94	835116.94	0.00%	3.08	3.87	52.78%
	20	975414.81	975414.81	0.00%	5.86	30.69	975414.81	975414.81	0.00%	2.29	30.95	-0.85%
	1	735156.39	735156.39	0.00%	21.91	41.38	735156.39	735156.39	0.00%	5.43	29.31	29.17%
	2	805844.56	805888.82	0.00%	8.55	12.98	805888.82	805888.82	0.00%	2.11	9.54	26.48%
	3	878610.82	878610.82	0.00%	49.64	299.41	878610.82	878610.82	0.00%	7.22	170.75	42.97%
	4	872889.43	872889.43	0.00%	15.19	57.67	872889.43	872889.43	0.00%	4.28	51.93	9.95%
	5	1243068.06	1243168.06	0.00%	7.88	9.60	1243168.06	1243168.06	0.00%	4.63	7.90	17.68%
	6	804764.55	804764.55	0.00%	12.89	18.69	804764.55	804764.55	0.00%	3.64	7.72	58.67%
	7	775907.48	775907.48	0.00%	10.75	27.47	775907.48	775907.48	0.00%	4.09	23.43	14.70%
	8	1104222.12	1104222.12	0.00%	2.63	2.97	1104222.12	1104222.12	0.00%	2.33	2.81	5.39%
	9	638571.72	638571.72	0.00%	11.46	20.41	638571.72	638571.72	0.00%	2.89	16.91	17.13%
	10	745273.11	745273.11	0.00%	5.76	14.47	745273.11	745273.11	0.00%	1.75	13.37	7.56%
8%	11	1144330.91	1144330.91	0.00%	5.72	10.33	1144330.91	1144330.91	0.00%	3.85	9.66	6.48%
	12	903944.69	903944.69	0.00%	1.44	2.00	903944.69	903944.69	0.00%	1.61	2.31	-15.62%
	13	848421.88	848421.88	0.00%	7.53	8.89	848421.88	848421.88	0.00%	3.70	5.63	36.72%
	14	777624.00	777624.00	0.00%	7.77	8.58	777624.00	777624.00	0.00%	10.92	12.55	-46.30%
	15	1399499.53	1399499.53	0.00%	1.77	2.95	1399499.53	1399499.53	0.00%	0.99	2.47	16.42%
	16	823963.72	823963.72	0.00%	14.75	42.99	823963.72	823963.72	0.00%	4.34	41.87	2.59%
	17	1169852.15	1169852.15	0.00%	1.45	3.00	1169852.15	1169852.15	0.00%	1.11	2.94	2.17%
	18	876771.66	876771.66	0.00%	1.12	1.56	876771.66	876771.66	0.00%	0.94	1.59	-1.92%
	19	871970.87	871970.87	0.00%	3.81	4.52	871970.87	871970.87	0.00%	2.36	3.22	28.66%
	20	1019301.78	1019301.78	0.00%	4.20	35.39	1019301.78	1019301.78	0.00%	3.09	32.71	7.57%
	1	769863.04	769863.04	0.00%	18.28	42.75	769863.04	769863.04	0.00%	4.59	22.31	47.82%
	2	840178.94	840233.83	0.00%	9.30	13.34	840233.83	840233.83	0.00%	2.39	6.52	51.14%
	3	917530.89	917530.89	0.00%	37.85	157.03	917530.89	917530.89	0.00%	7.89	107.88	31.30%
	4	921131.81	921131.81	0.00%	15.95	65.94	921131.81	921131.81	0.00%	3.75	38.17	42.11%
	5	1296342.50	1296342.50	0.00%	13.96	18.45	1296342.50	1296342.50	0.00%	3.91	7.16	61.22%
	6	854249.58	854249.58	0.00%	12.19	18.09	854249.58	854249.58	0.00%	2.97	6.36	64.86%
	7	810381.64	810381.64	0.00%	14.06	41.36	810381.64	810381.64	0.00%	4.45	25.81	37.60%
	8	1141128.15	1141128.15	0.00%	3.22	3.61	1141128.15	1141128.15	0.00%	1.96	2.34	35.22%
	9	660048.10	660048.10	0.00%	11.67	19.08	660048.10	660048.10	0.00%	3.52	17.23	9.70%
9%	10	793424.60	793424.60	0.00%	7.41	25.17	793424.60	793424.60	0.00%	3.77	38.91	-54.54%
	11	1200106.35	1200106.35	0.00%	8.59	15.03	1200106.35	1200106.35	0.00%	3.47	8.56	43.03%
	12	937122.07	937122.07	0.00%	1.56	2.05	937122.07	937122.07	0.00%	1.33	1.81	11.49%
	13	883988.70	883988.70	0.00%	8.27	9.74	883988.70	883988.70	0.00%	3.16	4.51	53.70%
	14	818501.96	818501.96	0.00%	9.59	11.15	818501.96	818501.96	0.00%	4.94	6.18	44.59%
	15	1459621.85	1459621.85	0.00%	1.56	2.74	1459558.75	1459621.85	0.00%	1.25	2.33	14.88%
	16	859882.30	859882.30	0.00%	15.75	59.42	859882.30	859882.30	0.00%	4.16	40.23	32.29%
	17	1218512.86	1218512.86	0.00%	1.50	2.73	1218512.86	1218512.86	0.00%	1.44	2.67	2.23%
	18	925331.04	925331.04	0.00%	1.17	1.60	925331.04	925331.04	0.00%	0.92	1.30	18.62%
	19	909759.10	909759.10	0.00%	4.98	7.22	909683.27	909759.10	0.00%	2.57	3.79	47.53%
	20	1063401.89	1063401.89	0.00%	4.83	40.22	1063401.89	1063401.89	0.00%	3.27	43.24	-7.49%
	1	807256.35	807256.35	0.00%	16.81	38.22	807256.35	807256.35	0.00%	4.38	17.86	53.26%
	2	874578.84	874578.84	0.00%	10.22	14.94	874578.84	874578.84	0.00%	2.27	5.53	62.99%
	3	956722.40	956730.99	0.00%	34.69	195.61	956730.99	956730.99	0.00%	7.70	100.59	48.58%
	4	969378.66	969378.66	0.00%	12.59	62.97	969378.66	969378.66	0.00%	3.79	40.49	35.69%
	5	1349536.40	1349536.40	0.00%	10.50	14.95	1349536.40	1349536.40	0.00%	3.80	7.35	50.86%
	6	904138.73	904138.73	0.00%	7.58	10.48	904138.73	904138.73	0.00%	2.56	3.97	62.18%
	7	843822.85	843822.85	0.00%	11.25	32.11	843814.06	843822.85	0.00%	2.85	15.74	50.98%
	8	1178034.17	1178034.17	0.00%	2.53	2.94	1178034.17	1178034.17	0.00%	1.85	2.19	25.33%
	9	681524.49	681524.49	0.00%	13.92	23.11	681524.49	681524.49	0.00%	3.17	14.66	36.57%
10%	10	836571.96	836571.96	0.00%	10.19	51.30	836571.96	836571.96	0.00%	2.65	21.86	57.40%

11	**1256749.75**	**1256749.75**	**0.00%**	9.16	17.75	**1256749.75**	**1256749.75**	**0.00%**	3.59	11.03	**37.86%**
12	**970299.44**	**970299.44**	**0.00%**	1.63	2.05	**970299.44**	**970299.44**	**0.00%**	1.15	1.51	**26.09%**
13	**919555.51**	**919555.51**	**0.00%**	7.47	8.91	**919555.51**	**919555.51**	**0.00%**	3.08	4.37	**50.90%**
14	**859454.79**	**859454.79**	**0.00%**	6.47	7.83	**859454.79**	**859454.79**	**0.00%**	3.64	5.01	**36.09%**
15	**1515207.78**	**1515207.78**	**0.00%**	1.58	3.44	**1515061.26**	**1515207.78**	**0.00%**	1.32	2.96	**13.94%**
16	**894929.13**	**894929.13**	**0.00%**	7.92	21.42	**894929.13**	**894929.13**	**0.00%**	3.00	15.22	**28.93%**
17	**1268329.71**	**1268329.71**	**0.00%**	1.38	3.88	**1268329.71**	**1268329.71**	**0.00%**	1.45	3.59	**7.28%**
18	**973890.41**	**973890.41**	**0.00%**	1.42	1.89	**973890.41**	**973890.41**	**0.00%**	0.95	1.37	**27.53%**
19	**948167.11**	**948187.49**	**0.00%**	4.72	5.88	**948187.49**	**948187.49**	**0.00%**	2.15	4.43	**24.54%**
20	**1107444.42**	**1107502.01**	**0.00%**	4.40	37.77	**1107502.01**	**1107502.01**	**0.00%**	3.17	46.54	-23.25%

Table 10: Comparison results when $|\mathbb{M}^s| = 3$, $K = 20$, $\Gamma_D = 4$, and $\Gamma_R = 10$

ε	Instance	CG					OA-CG					$\mathcal{P}_T$
		L^C	U^C	G^C	RP	Total	L	U	G	RP	Total	
5%	1	721274.47	721274.47	0.00%	14.95	17.64	721274.47	721274.47	0.00%	3.42	5.52	68.72%
	2	777358.67	777358.67	0.00%	14.58	17.50	777358.67	777358.67	0.00%	2.91	4.93	71.86%
	3	660255.03	660255.03	0.00%	38.75	41.39	660255.03	660255.03	0.00%	6.55	9.31	77.50%
	4	717360.88	717360.88	0.00%	10.95	15.83	717360.88	717360.88	0.00%	4.99	15.14	4.32%
	5	1044880.25	1044880.25	0.00%	0.77	1.00	1044880.25	1044880.25	0.00%	0.64	0.82	17.60%
	6	750712.28	750712.28	0.00%	5.28	5.74	750712.28	750712.28	0.00%	2.58	2.93	49.01%
	7	690410.87	690410.87	0.00%	5.59	8.03	690410.87	690410.87	0.00%	1.77	3.29	59.10%
	8	1188675.26	1188675.26	0.00%	2.69	2.84	1188675.26	1188675.26	0.00%	2.22	2.34	17.65%
	9	1066771.30	1066771.30	0.00%	16.23	27.37	1066771.30	1066771.30	0.00%	3.66	10.52	61.57%
	10	526429.28	526429.28	0.00%	7.19	7.98	526426.28	526429.28	0.00%	2.85	3.31	58.49%
	11	784067.97	784067.97	0.00%	81.89	83.71	784067.97	784067.97	0.00%	18.65	20.56	75.44%
	12	607588.62	607588.62	0.00%	11.02	14.17	607575.43	607588.62	0.00%	2.58	4.56	67.83%
	13	640452.44	640452.44	0.00%	28.85	30.16	640452.44	640452.44	0.00%	2.30	3.10	89.72%
	14	748577.11	748577.11	0.00%	7.31	8.30	748577.11	748577.11	0.00%	2.30	2.99	63.98%
	15	771370.64	771370.64	0.00%	6.74	8.92	771370.64	771370.64	0.00%	2.11	3.63	59.35%
	16	989095.35	989095.35	0.00%	4.97	7.33	989095.35	989095.35	0.00%	1.30	2.83	61.42%
	17	653028.31	653028.31	0.00%	6.94	7.95	653028.31	653028.31	0.00%	2.35	3.07	61.45%
	18	1321736.50	1321736.50	0.00%	6.99	8.96	1321736.50	1321736.50	0.00%	1.97	3.44	61.61%
	19	1019891.47	1019891.47	0.00%	3.86	6.78	1019891.47	1019891.47	0.00%	1.95	4.15	38.77%
	20	689273.46	689280.86	0.00%	2.80	3.34	689273.46	689273.46	0.00%	1.35	1.89	43.42%
6%	1	741296.40	741296.40	0.00%	17.39	20.23	741296.40	741296.40	0.00%	3.55	5.73	71.67%
	2	802776.72	802776.72	0.00%	15.88	19.89	802776.72	802776.72	0.00%	3.44	6.36	68.02%
	3	686570.21	686570.21	0.00%	48.80	51.70	686570.21	686570.21	0.00%	7.31	11.64	77.48%
	4	740005.36	740005.36	0.00%	10.50	15.35	740005.36	740005.36	0.00%	5.14	14.13	7.92%
	5	1076894.70	1076894.70	0.00%	0.70	0.92	1076894.70	1076894.70	0.00%	0.87	1.08	-16.59%
	6	784314.38	784314.38	0.00%	4.35	4.75	784314.38	784314.38	0.00%	2.31	2.62	44.79%
	7	721570.68	721570.68	0.00%	4.59	6.03	721570.68	721570.68	0.00%	1.69	3.39	43.71%
	8	1220614.33	1220614.33	0.00%	3.52	3.69	1220614.33	1220614.33	0.00%	2.38	2.50	32.14%
	9	1107380.11	1107413.91	0.00%	11.16	15.70	1107413.91	1107413.91	0.00%	3.50	8.66	44.86%
	10	550086.85	550086.85	0.00%	11.92	14.17	550086.85	550086.85	0.00%	2.66	3.28	76.84%
	11	804452.72	804452.72	0.00%	92.97	94.41	804452.72	804452.72	0.00%	33.31	35.25	62.66%
	12	624702.15	624702.15	0.00%	9.53	12.01	624702.15	624702.15	0.00%	2.55	6.13	49.01%
	13	656505.34	656505.34	0.00%	15.52	16.48	656505.34	656505.34	0.00%	2.64	3.59	78.22%
	14	772995.84	772995.84	0.00%	5.00	5.81	772995.84	772995.84	0.00%	2.27	3.08	47.08%
	15	799310.12	799310.12	0.00%	5.89	8.58	799310.12	799310.12	0.00%	1.88	3.50	59.19%
	16	1023843.91	1023843.91	0.00%	3.67	5.26	1023843.91	1023843.91	0.00%	1.10	2.72	48.29%
	17	681679.66	681679.66	0.00%	5.58	6.35	681679.66	681679.66	0.00%	2.38	4.19	33.90%
	18	1356660.49	1356660.49	0.00%	5.25	6.77	1356660.49	1356660.49	0.00%	2.27	4.06	39.93%
	19	1053407.75	1053407.75	0.00%	2.81	5.05	1053407.75	1053407.75	0.00%	1.80	4.10	18.79%
	20	709716.97	709716.97	0.00%	1.38	1.59	709716.97	709716.97	0.00%	1.39	1.61	-1.07%
7%	1	761391.76	761391.76	0.00%	14.81	17.25	761391.76	761391.76	0.00%	4.81	7.00	59.43%
	2	828194.77	828194.77	0.00%	13.27	17.14	828194.77	828194.77	0.00%	3.28	6.92	59.65%
	3	712885.39	712885.39	0.00%	31.34	34.48	712885.39	712885.39	0.00%	7.52	10.27	70.23%
	4	762649.83	762649.83	0.00%	7.17	10.75	762649.83	762649.83	0.00%	4.16	9.89	7.99%
	5	1108909.15	1108909.15	0.00%	0.44	0.63	1108909.15	1108909.15	0.00%	0.78	0.98	-56.39%
	6	817916.49	817916.49	0.00%	3.56	3.86	817916.49	817916.49	0.00%	2.04	2.36	38.92%
	7	749718.58	749718.58	0.00%	3.06	4.05	749718.58	749718.58	0.00%	1.48	2.42	40.19%
	8	1252553.40	1252553.40	0.00%	2.47	2.59	1252553.40	1252553.40	0.00%	2.50	2.77	-6.71%
	9	1148056.52	1148056.52	0.00%	7.00	10.63	1148056.52	1148056.52	0.00%	2.05	5.65	46.87%
	10	575711.56	575711.56	0.00%	7.75	9.47	575711.56	575711.56	0.00%	2.41	3.36	64.51%
	11	824837.47	824837.47	0.00%	77.28	78.97	824837.47	824837.47	0.00%	14.33	16.30	79.36%
	12	642328.91	642328.91	0.00%	6.69	8.99	642328.91	642328.91	0.00%	2.57	5.73	36.26%
	13	672558.25	672558.25	0.00%	13.20	14.12	672558.25	672558.25	0.00%	2.36	3.26	76.91%

	14	797588.09	797588.09	0.00%	4.80	5.44	797588.09	797588.09	0.00%	2.20	2.86	47.44%
	15	828117.69	828117.69	0.00%	6.39	9.86	828117.69	828117.69	0.00%	2.22	4.53	54.02%
	16	1057723.40	1057723.40	0.00%	2.20	3.73	1057723.40	1057723.40	0.00%	1.38	2.92	21.69%
	17	710331.01	710331.01	0.00%	4.78	5.53	710331.01	710331.01	0.00%	2.53	3.17	42.72%
	18	1391584.48	1391584.48	0.00%	5.00	6.59	1391584.48	1391584.48	0.00%	2.23	3.62	45.03%
	19	1085771.50	1085771.50	0.00%	1.89	3.37	1085771.50	1085771.50	0.00%	1.67	3.94	-16.66%
	20	731167.98	731167.98	0.00%	1.11	1.35	731167.98	731167.98	0.00%	1.36	1.60	-18.66%
	1	781490.26	781490.26	0.00%	16.88	19.39	781490.26	781490.26	0.00%	5.16	7.25	62.60%
	2	853612.81	853612.81	0.00%	12.56	16.25	853612.81	853612.81	0.00%	3.67	7.24	55.48%
	3	739200.57	739200.57	0.00%	28.19	31.30	739200.57	739200.57	0.00%	5.59	8.45	72.99%
	4	785294.30	785294.30	0.00%	7.47	10.67	785294.30	785294.30	0.00%	4.56	11.14	-4.36%
	5	1140923.60	1140923.60	0.00%	0.45	0.67	1140923.60	1140923.60	0.00%	0.66	0.86	-28.27%
	6	851844.16	851844.16	0.00%	3.05	3.34	851844.16	851844.16	0.00%	2.20	2.48	25.81%
	7	781111.47	781111.47	0.00%	2.61	3.69	781111.47	781111.47	0.00%	1.59	2.62	28.86%
	8	1285100.44	1285100.44	0.00%	2.44	2.59	1285100.44	1285100.44	0.00%	2.53	2.69	-3.70%
	9	1188707.85	1188707.85	0.00%	6.67	10.23	1188707.85	1188707.85	0.00%	1.92	5.34	47.79%
	10	601336.28	601336.28	0.00%	7.84	9.56	601336.28	601336.28	0.00%	2.14	3.20	66.51%
8%	11	845246.35	845246.35	0.00%	44.59	46.51	845246.35	845246.35	0.00%	28.97	30.27	34.93%
	12	660159.66	660159.66	0.00%	7.70	9.95	660159.58	660169.96	0.00%	2.42	5.94	40.38%
	13	688611.15	688611.15	0.00%	9.33	10.33	688611.15	688611.15	0.00%	2.67	3.70	64.17%
	14	823307.66	823307.66	0.00%	4.56	5.30	823307.66	823307.66	0.00%	2.11	2.90	45.19%
	15	856368.30	856368.30	0.00%	4.33	6.62	856368.30	856368.30	0.00%	1.92	5.53	16.47%
	16	1089368.81	1089368.81	0.00%	2.25	4.05	1089368.81	1089368.81	0.00%	1.22	3.06	24.35%
	17	738982.35	738982.35	0.00%	4.74	5.41	738982.35	738982.35	0.00%	2.26	3.62	33.10%
	18	1426508.47	1426508.47	0.00%	5.28	6.89	1426508.47	1426508.47	0.00%	2.19	3.95	42.63%
	19	1115058.65	1115058.65	0.00%	2.31	4.84	1115058.65	1115058.65	0.00%	1.57	4.23	12.74%
	20	752618.98	752618.98	0.00%	1.13	1.36	752618.98	752618.98	0.00%	1.26	1.51	-11.32%
	1	801588.77	801588.77	0.00%	29.23	32.08	801588.77	801588.77	0.00%	10.76	12.73	60.31%
	2	880681.63	880681.63	0.00%	7.27	8.55	880681.63	880681.63	0.00%	3.52	9.80	-14.62%
	3	765515.75	765515.75	0.00%	29.72	33.11	765515.75	765515.75	0.00%	7.37	9.43	71.51%
	4	807938.77	807938.77	0.00%	8.83	12.78	807938.77	807938.77	0.00%	4.09	10.70	16.27%
	5	1172938.05	1172938.05	0.00%	0.50	0.66	1172938.05	1172938.05	0.00%	0.66	0.83	-26.41%
	6	886505.61	886505.61	0.00%	3.84	4.20	886505.61	886505.61	0.00%	2.17	2.50	40.56%
	7	812504.36	812504.36	0.00%	3.23	4.48	812504.36	812504.36	0.00%	1.48	3.17	29.24%
	8	1319412.48	1319412.48	0.00%	2.24	2.36	1319412.48	1319412.48	0.00%	2.14	2.30	2.63%
	9	1229373.97	1229373.97	0.00%	10.89	15.10	1229373.97	1229373.97	0.00%	1.81	5.57	63.08%
9%	10	627808.43	627808.43	0.00%	11.06	13.11	627808.43	627808.43	0.00%	2.63	5.55	57.67%
	11	865660.42	865660.42	0.00%	86.81	88.97	865660.42	865660.42	0.00%	24.05	25.43	71.41%
	12	677990.41	677990.41	0.00%	10.92	14.27	677990.41	677990.41	0.00%	2.47	5.61	60.65%
	13	704664.06	704664.06	0.00%	12.35	13.33	704664.06	704664.06	0.00%	2.77	3.66	72.57%
	14	849252.06	849252.06	0.00%	5.25	6.08	849252.06	849252.06	0.00%	2.16	3.00	50.63%
	15	879133.87	879134.59	0.00%	4.87	6.39	879134.59	879134.59	0.00%	2.03	4.55	28.82%
	16	1121014.22	1121014.22	0.00%	2.30	3.98	1121014.22	1121014.22	0.00%	1.05	2.75	31.01%
	17	767636.36	767636.36	0.00%	5.39	6.13	767636.36	767636.36	0.00%	2.07	2.96	51.76%
	18	1461432.46	1461432.46	0.00%	5.88	7.66	1461432.46	1461432.46	0.00%	2.26	4.10	46.42%
	19	1144345.80	1144345.80	0.00%	1.95	3.53	1144345.80	1144345.80	0.00%	1.25	2.85	19.41%
	20	774069.99	774069.99	0.00%	1.20	1.49	774069.99	774069.99	0.00%	1.49	1.75	-17.98%
	1	821687.27	821687.27	0.00%	15.69	17.90	821687.27	821687.27	0.00%	4.34	6.60	63.11%
	2	908468.27	908468.27	0.00%	9.45	11.20	908468.27	908468.27	0.00%	3.33	6.94	38.06%
	3	791830.93	791830.93	0.00%	23.50	26.58	791830.93	791830.93	0.00%	8.50	11.58	56.44%
	4	830586.72	830586.72	0.00%	7.28	10.50	830586.72	830586.72	0.00%	2.87	7.51	28.45%
	5	1204952.50	1204952.50	0.00%	0.42	0.61	1204952.50	1204952.50	0.00%	0.73	0.95	-56.32%
	6	921167.06	921167.06	0.00%	3.33	3.69	921167.06	921167.06	0.00%	2.00	2.37	35.61%
	7	843897.25	843897.25	0.00%	2.81	3.97	843897.25	843897.25	0.00%	1.41	3.03	23.56%
	8	1353727.56	1353727.56	0.00%	1.67	1.84	1353724.53	1353727.56	0.00%	2.19	2.36	-27.96%
	9	1270047.24	1270047.24	0.00%	7.72	12.38	1270047.24	1270047.24	0.00%	1.85	6.46	47.82%
10%	10	657468.47	657468.47	0.00%	8.37	10.11	657468.47	657468.47	0.00%	2.86	5.70	43.56%

11	**886150.82**	**886150.82**	**0.00%**	102.10	103.45	**886150.82**	**886150.82**	**0.00%**	27.84	29.14	**71.83%**
12	**695821.15**	**695821.15**	**0.00%**	9.99	13.89	**695821.15**	**695821.15**	**0.00%**	3.83	8.60	**38.13%**
13	**720716.96**	**720716.96**	**0.00%**	11.90	13.50	**720716.96**	**720716.96**	**0.00%**	3.10	4.60	**65.95%**
14	**875196.46**	**875196.46**	**0.00%**	4.88	5.59	**875196.46**	**875196.46**	**0.00%**	2.17	2.95	**47.20%**
15	**899369.84**	**899427.65**	**0.00%**	5.30	8.72	**899369.84**	**899369.84**	**0.00%**	2.03	5.67	**34.94%**
16	**1152723.02**	**1152723.02**	**0.00%**	1.28	2.13	**1152723.02**	**1152723.02**	**0.00%**	0.81	1.75	**17.65%**
17	**796674.62**	**796674.62**	**0.00%**	3.12	3.48	**796674.62**	**796674.62**	**0.00%**	2.05	2.52	**27.79%**
18	**1496356.45**	**1496356.45**	**0.00%**	4.16	5.70	**1496356.45**	**1496356.45**	**0.00%**	2.27	3.85	**32.55%**
19	**1173632.96**	**1173632.96**	**0.00%**	1.70	2.91	**1173632.96**	**1173632.96**	**0.00%**	1.54	2.83	**2.48%**
20	**795521.00**	**795521.00**	**0.00%**	1.06	1.31	**795521.00**	**795521.00**	**0.00%**	1.50	1.75	-33.74%

Table 11: Comparison results when $|\mathbb{M}^s| = 3$, $K = 20$, $\Gamma_D = 6$, and $\Gamma_R = 15$

ε	Instance	CG					OA-CG					$\mathcal{P}_T$
		L^C	U^C	G^C	Time (s)		L	U	G	Time (s)		
					RP	Total				RP	Total	
5%	1	828271.98	828271.98	0.00%	19.36	21.58	828271.98	828271.98	0.00%	4.03	6.34	70.62%
	2	905310.00	905356.87	0.00%	8.49	10.02	905356.87	905356.87	0.00%	3.18	6.43	35.86%
	3	755504.35	755504.35	0.00%	42.85	47.24	755451.09	755504.35	0.00%	10.82	15.65	66.86%
	4	804142.21	804142.21	0.00%	35.08	53.36	804142.21	804142.21	0.00%	6.14	13.45	74.80%
	5	1084732.32	1084732.32	0.00%	3.61	3.80	1084732.32	1084732.32	0.00%	1.36	1.52	60.06%
	6	897614.36	897614.36	0.00%	6.78	7.70	897614.36	897614.36	0.00%	2.55	3.69	52.14%
	7	768832.54	768832.54	0.00%	4.06	6.33	768821.90	768832.54	0.00%	1.88	3.49	44.85%
	8	1256227.05	1256227.05	0.00%	3.92	4.09	1256227.05	1256227.05	0.00%	2.66	2.81	31.27%
	9	1169648.39	1169648.39	0.00%	9.81	14.38	1169648.39	1169648.39	0.00%	2.15	5.34	62.85%
	10	624512.09	624512.09	0.00%	14.19	18.05	624512.09	624512.09	0.00%	3.56	6.28	65.19%
	11	897153.78	897153.78	0.00%	27.98	29.64	897153.78	897153.78	0.00%	10.11	11.28	61.94%
	12	667484.63	667484.63	0.00%	11.50	14.91	667484.63	667484.63	0.00%	2.32	5.70	61.76%
	13	713458.10	713458.10	0.00%	57.27	58.39	713458.10	713458.10	0.00%	3.06	3.84	93.42%
	14	839974.11	839974.11	0.00%	6.44	7.55	839974.11	839974.11	0.00%	2.50	3.81	49.47%
	15	841962.05	841962.05	0.00%	9.78	14.40	841962.05	841962.05	0.00%	2.31	4.43	69.22%
	16	1072967.89	1072967.89	0.00%	1.78	3.23	1072967.89	1072967.89	0.00%	1.11	2.16	33.24%
	17	759207.83	759207.83	0.00%	10.48	12.24	759207.83	759207.83	0.00%	2.76	4.80	60.81%
	18	1365198.50	1365198.50	0.00%	10.61	13.44	1365198.50	1365198.50	0.00%	2.54	5.18	61.47%
	19	1099896.47	1099896.47	0.00%	4.83	9.91	1099836.80	1099896.47	0.00%	1.52	5.41	45.44%
	20	754275.45	754275.45	0.00%	4.87	5.70	754275.45	754275.45	0.00%	1.70	2.34	58.93%
6%	1	858600.66	858600.66	0.00%	14.19	15.91	858600.66	858600.66	0.00%	3.71	5.18	67.46%
	2	943491.47	943491.47	0.00%	13.80	16.22	943491.47	943491.47	0.00%	3.30	6.18	61.92%
	3	789950.65	789950.65	0.00%	52.17	56.78	789950.65	789950.65	0.00%	11.44	14.72	74.07%
	4	836122.03	836140.73	0.00%	17.56	22.03	836140.73	836140.73	0.00%	5.65	10.06	54.35%
	5	1122990.11	1122990.11	0.00%	2.69	2.89	1122990.11	1122990.11	0.00%	1.27	1.44	50.16%
	6	940786.17	940786.17	0.00%	6.42	7.30	940770.13	940786.17	0.00%	2.19	2.78	61.85%
	7	807239.76	807239.76	0.00%	3.17	4.64	807239.76	807239.76	0.00%	1.34	2.30	50.54%
	8	1297038.93	1297038.93	0.00%	3.62	3.80	1297038.93	1297038.93	0.00%	2.59	2.73	28.01%
	9	1217281.30	1217281.30	0.00%	10.13	15.67	1217281.30	1217281.30	0.00%	2.00	5.69	63.70%
	10	662036.23	662050.45	0.00%	10.58	13.06	662050.45	662050.45	0.00%	2.50	5.00	61.73%
	11	926559.66	926559.66	0.00%	19.60	21.23	926559.66	926559.66	0.00%	3.64	4.70	77.85%
	12	690502.39	690502.39	0.00%	14.83	19.84	690502.39	690502.39	0.00%	2.64	5.44	72.60%
	13	736150.88	736150.88	0.00%	63.59	64.70	736150.88	736150.88	0.00%	2.98	3.60	94.43%
	14	871404.98	871404.98	0.00%	6.94	8.01	871404.98	871404.98	0.00%	1.99	2.68	66.62%
	15	882227.00	882227.00	0.00%	8.86	13.39	882227.00	882227.00	0.00%	2.13	5.44	59.34%
	16	1113010.55	1113010.55	0.00%	1.50	3.08	1113010.55	1113010.55	0.00%	1.13	2.19	28.95%
	17	794734.65	794734.65	0.00%	10.60	12.64	794734.65	794734.65	0.00%	2.95	4.17	67.00%
	18	1405423.57	1405423.57	0.00%	11.50	14.80	1405423.57	1405423.57	0.00%	2.58	4.94	66.64%
	19	1137330.30	1137330.30	0.00%	4.19	9.46	1137330.30	1137330.30	0.00%	1.91	7.22	23.65%
	20	782707.46	782707.46	0.00%	4.39	5.05	782707.46	782707.46	0.00%	1.59	2.14	57.67%
7%	1	890353.60	890353.60	0.00%	19.99	22.05	890353.60	890353.60	0.00%	3.93	5.53	74.90%
	2	982203.98	982203.98	0.00%	7.59	8.89	982203.98	982203.98	0.00%	3.13	6.29	29.31%
	3	824396.95	824396.95	0.00%	54.70	60.10	824396.95	824396.95	0.00%	6.25	9.80	83.69%
	4	868788.44	868788.44	0.00%	21.53	30.14	868788.44	868788.44	0.00%	5.73	12.10	59.85%
	5	1161423.47	1161423.47	0.00%	2.36	2.59	1161423.47	1161423.47	0.00%	1.18	1.57	39.32%
	6	984072.40	984072.40	0.00%	5.92	6.87	984072.40	984072.40	0.00%	2.28	2.92	57.56%
	7	845657.62	845657.62	0.00%	3.33	4.82	845657.62	845657.62	0.00%	1.09	2.17	54.91%
	8	1337940.27	1337940.27	0.00%	3.77	3.95	1337940.27	1337940.27	0.00%	2.80	2.94	25.68%
	9	1264914.20	1264914.20	0.00%	9.67	14.72	1264914.20	1264914.20	0.00%	1.83	5.61	61.90%
	10	690320.29	690320.29	0.00%	12.26	16.22	690320.29	690320.29	0.00%	2.99	5.97	63.20%
	11	955979.81	955979.81	0.00%	21.61	23.38	955979.81	955979.81	0.00%	4.56	5.89	74.80%
	12	713520.16	713520.16	0.00%	16.16	20.53	713520.16	713520.16	0.00%	2.39	5.23	74.52%
	13	758843.66	758843.66	0.00%	50.35	51.25	758843.66	758843.66	0.00%	2.52	3.33	93.50%

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	14	905354.12	905354.12	0.00%	6.58	7.61	905354.12	905354.12	0.00%	2.44	3.88	49.07%
	15	919788.26	919788.26	0.00%	11.85	21.13	919788.26	919788.26	0.00%	3.72	14.83	29.81%
	16	1153055.98	1153055.98	0.00%	0.72	1.50	1153055.98	1153055.98	0.00%	0.82	1.45	3.47%
	17	830261.47	830261.47	0.00%	7.55	8.89	830261.47	830261.47	0.00%	2.87	4.31	51.52%
	18	1445308.23	1445308.23	0.00%	7.70	10.25	1445308.23	1445308.23	0.00%	2.55	5.29	48.44%
	19	1174764.14	1174764.14	0.00%	4.25	10.92	1174760.64	1174764.14	0.00%	1.28	5.61	48.64%
	20	811139.47	811139.47	0.00%	4.19	4.89	811139.47	811139.47	0.00%	1.65	2.24	54.23%
8%	1	922260.81	922260.81	0.00%	10.88	12.42	922260.81	922260.81	0.00%	3.63	5.22	57.95%
	2	1020922.38	1020922.38	0.00%	6.25	7.19	1020922.38	1020922.38	0.00%	3.58	6.99	2.81%
	3	859114.23	859114.23	0.00%	36.55	44.26	859114.23	859114.23	0.00%	6.53	11.94	73.03%
	4	901436.14	901436.14	0.00%	20.12	33.76	901436.14	901436.14	0.00%	5.44	9.66	71.40%
	5	1199856.83	1199856.83	0.00%	2.22	2.41	1199856.83	1199856.83	0.00%	1.11	1.30	46.16%
	6	1027465.31	1027465.31	0.00%	3.66	4.03	1027465.31	1027465.31	0.00%	2.11	2.45	39.22%
	7	884075.47	884075.47	0.00%	2.11	3.55	884075.47	884075.47	0.00%	1.08	2.19	38.45%
	8	1378841.60	1378841.60	0.00%	3.47	3.63	1378841.60	1378841.60	0.00%	2.53	2.66	26.80%
	9	1312547.11	1312547.11	0.00%	6.42	9.97	1312547.11	1312547.11	0.00%	1.59	3.87	61.15%
	10	715094.90	715094.90	0.00%	10.09	12.89	715094.90	715094.90	0.00%	2.53	5.04	60.88%
	11	985399.96	985399.96	0.00%	26.23	27.66	985399.96	985399.96	0.00%	6.73	8.05	70.90%
	12	735862.45	735862.45	0.00%	10.75	14.13	735862.45	735862.45	0.00%	4.14	8.20	41.93%
	13	781616.92	781616.92	0.00%	33.88	34.74	781616.92	781616.92	0.00%	2.77	4.17	87.99%
	14	940574.54	940574.54	0.00%	4.64	5.47	940574.54	940574.54	0.00%	2.23	3.49	36.12%
	15	947928.26	947928.26	0.00%	6.59	10.06	947928.26	947928.26	0.00%	3.04	9.62	4.41%
	16	1193549.95	1193549.95	0.00%	0.80	1.42	1193549.95	1193549.95	0.00%	0.86	1.54	-8.44%
	17	865788.29	865788.29	0.00%	7.61	9.13	865788.29	865788.29	0.00%	2.94	4.45	51.22%
	18	1488899.82	1488899.82	0.00%	7.11	9.67	1488899.82	1488899.82	0.00%	2.52	6.33	34.57%
	19	1212197.97	1212197.97	0.00%	4.14	7.09	1212197.97	1212197.97	0.00%	1.46	8.27	-16.62%
	20	839571.48	839571.48	0.00%	4.47	5.16	839571.48	839571.48	0.00%	1.75	2.30	55.50%
9%	1	954168.02	954168.02	0.00%	14.05	15.89	954168.02	954168.02	0.00%	3.64	5.26	66.87%
	2	1059640.78	1059640.78	0.00%	7.45	8.53	1059640.78	1059640.78	0.00%	2.95	3.98	53.32%
	3	893859.49	893859.49	0.00%	31.58	40.12	893859.49	893859.49	0.00%	6.27	11.30	71.84%
	4	934083.84	934083.84	0.00%	22.64	33.95	934083.84	934083.84	0.00%	6.02	20.91	38.41%
	5	1238290.18	1238290.18	0.00%	2.30	2.49	1238290.18	1238290.18	0.00%	1.19	1.39	44.05%
	6	1071816.05	1071816.05	0.00%	3.67	4.02	1071816.05	1071816.05	0.00%	2.00	2.33	41.99%
	7	922554.25	922554.25	0.00%	1.69	2.72	922493.33	922554.25	0.00%	0.97	2.05	24.66%
	8	1419746.68	1419746.68	0.00%	2.42	2.55	1419746.68	1419746.68	0.00%	2.73	2.89	-13.47%
	9	1360180.01	1360180.01	0.00%	5.38	8.11	1360180.01	1360180.01	0.00%	1.58	4.25	47.54%
	10	739869.50	739869.50	0.00%	6.83	8.53	739869.50	739869.50	0.00%	2.67	4.33	49.27%
	11	1015607.91	1015607.91	0.00%	14.38	15.64	1015607.91	1015607.91	0.00%	4.94	6.12	60.86%
	12	757944.96	757944.96	0.00%	9.59	11.97	757944.96	757944.96	0.00%	3.92	8.12	32.11%
	13	804431.51	804431.51	0.00%	36.80	37.66	804431.51	804431.51	0.00%	2.79	4.20	88.85%
	14	976064.45	976064.45	0.00%	5.00	5.78	976064.45	976064.45	0.00%	2.21	3.49	39.62%
	15	976068.27	976068.27	0.00%	6.05	8.81	976068.27	976068.27	0.00%	1.85	4.94	43.94%
	16	1234451.74	1234451.74	0.00%	0.77	1.83	1234451.74	1234451.74	0.00%	0.89	1.96	-7.00%
	17	901391.84	901391.84	0.00%	6.39	7.27	901391.84	901391.84	0.00%	2.47	3.37	53.61%
	18	1533087.10	1533087.10	0.00%	6.03	8.28	1533087.10	1533087.10	0.00%	2.91	6.97	15.82%
	19	1249631.80	1249631.80	0.00%	3.30	5.87	1249631.80	1249631.80	0.00%	1.24	5.55	5.57%
	20	869288.89	869288.89	0.00%	4.02	4.63	869288.89	869288.89	0.00%	1.99	2.50	45.88%
10%	1	986075.23	986075.23	0.00%	12.00	13.52	986075.23	986075.23	0.00%	3.26	4.86	64.07%
	2	1098368.11	1098368.11	0.00%	6.09	7.03	1098368.11	1098368.11	0.00%	2.99	3.94	44.00%
	3	928604.75	928604.75	0.00%	23.52	32.23	928604.75	928604.75	0.00%	5.55	13.02	59.62%
	4	966713.03	966731.54	0.00%	14.38	22.63	966731.54	966731.54	0.00%	6.11	20.47	9.52%
	5	1276723.54	1276723.54	0.00%	1.58	1.80	1276723.54	1276723.54	0.00%	1.13	1.33	26.00%
	6	1116395.39	1116395.39	0.00%	3.11	3.42	1116395.39	1116395.39	0.00%	2.06	2.36	31.01%
	7	961122.49	961122.49	0.00%	1.31	2.42	961122.49	961122.49	0.00%	1.07	2.83	-16.89%
	8	1460670.33	1460670.33	0.00%	2.47	2.63	1460670.33	1460670.33	0.00%	2.67	2.80	-6.55%
	9	1407812.92	1407812.92	0.00%	5.19	7.31	1407812.92	1407812.92	0.00%	2.29	7.76	-6.17%
	10	762778.66	762778.66	0.00%	6.05	7.66	762756.79	762778.66	0.00%	2.74	4.46	41.80%

11	**1046981.75**	**1046981.75**	**0.00%**	12.92	14.16	**1046981.75**	**1046981.75**	**0.00%**	4.28	5.57	**60.68%**
12	**783172.26**	**783172.26**	**0.00%**	6.92	9.14	**783172.26**	**783172.26**	**0.00%**	4.22	8.86	**3.02%**
13	**827360.59**	**827360.59**	**0.00%**	20.70	22.03	**827360.59**	**827360.59**	**0.00%**	2.78	5.16	**76.60%**
14	**1011579.30**	**1011579.30**	**0.00%**	5.97	7.23	**1011579.30**	**1011579.30**	**0.00%**	2.37	3.70	**48.82%**
15	**1004208.28**	**1004208.28**	**0.00%**	4.83	8.21	**1004208.28**	**1004208.28**	**0.00%**	1.92	5.14	**37.34%**
16	**1275747.10**	**1275747.10**	**0.00%**	0.70	1.73	**1275747.10**	**1275747.10**	**0.00%**	0.85	1.93	-11.14%
17	**937565.32**	**937565.32**	**0.00%**	3.35	3.81	**937565.32**	**937565.32**	**0.00%**	2.56	4.38	-14.74%
18	**1578906.78**	**1578906.78**	**0.00%**	5.84	8.16	**1578906.78**	**1578906.78**	**0.00%**	4.06	7.87	**3.45%**
19	**1287065.64**	**1287065.64**	**0.00%**	3.19	5.53	**1287065.64**	**1287065.64**	**0.00%**	1.08	5.51	**0.33%**
20	**903069.24**	**903069.24**	**0.00%**	4.16	4.70	**903069.24**	**903069.24**	**0.00%**	1.90	2.86	**39.23%**

Table 12: Comparison results when $|\mathbb{M}^s| = 3$, $K = 20$, $\Gamma_D = 8$, and $\Gamma_R = 20$

ε	Instance	CG					OA-CG					$\mathcal{P}_T$
		L^C	U^C	G^C	Time (s)		L	U	G	Time (s)		
					RP	Total				RP	Total	
5%	1	918170.76	918170.76	0.00%	6.31	7.25	918170.76	918170.76	0.00%	3.31	4.17	42.48%
	2	1001517.29	1001517.29	0.00%	3.81	5.37	1001517.29	1001517.29	0.00%	2.11	3.59	33.11%
	3	834593.06	834593.06	0.00%	29.22	34.14	834593.06	834593.06	0.00%	13.66	16.10	52.85%
	4	878113.72	878113.72	0.00%	13.33	22.79	878113.72	878113.72	0.00%	4.14	11.55	49.34%
	5	1107092.99	1107092.99	0.00%	2.14	2.53	1107092.99	1107092.99	0.00%	1.72	1.87	25.96%
	6	988638.46	988638.46	0.00%	2.50	3.25	988638.46	988638.46	0.00%	1.45	2.09	35.63%
	7	814054.85	814054.85	0.00%	0.92	2.01	814054.85	814054.85	0.00%	1.00	2.00	0.65%
	8	1309291.80	1309291.80	0.00%	4.75	4.92	1309291.80	1309291.80	0.00%	3.61	3.75	23.85%
	9	1224233.60	1224233.60	0.00%	2.97	4.66	1224233.60	1224233.60	0.00%	1.28	3.31	28.95%
	10	694099.72	694099.72	0.00%	5.64	7.80	694099.72	694099.72	0.00%	2.00	3.63	53.51%
	11	985283.45	985283.45	0.00%	10.38	11.16	985283.45	985283.45	0.00%	3.55	4.66	58.25%
	12	711473.20	711473.20	0.00%	10.81	14.58	711473.20	711473.20	0.00%	2.86	7.33	49.73%
	13	767561.17	767561.17	0.00%	26.63	28.05	767561.17	767561.17	0.00%	3.20	4.89	82.56%
	14	903624.52	903624.52	0.00%	3.08	3.50	903624.52	903624.52	0.00%	1.72	2.17	38.00%
	15	900626.81	900626.81	0.00%	5.45	12.56	900626.81	900626.81	0.00%	2.83	8.20	34.72%
	16	1106317.80	1106317.80	0.00%	1.03	3.42	1106317.80	1106317.80	0.00%	1.25	3.18	6.95%
	17	842196.94	842196.94	0.00%	6.77	7.92	842196.94	842196.94	0.00%	2.50	3.25	58.97%
	18	1388622.34	1388622.34	0.00%	4.70	6.39	1388622.34	1388622.34	0.00%	2.47	3.88	39.33%
	19	1135168.76	1135168.76	0.00%	2.11	4.10	1135149.96	1135168.76	0.00%	1.27	2.73	33.24%
	20	795710.67	795710.67	0.00%	4.56	5.24	795710.67	795710.67	0.00%	1.59	2.05	60.92%
6%	1	956916.11	956916.11	0.00%	5.31	5.87	956916.11	956916.11	0.00%	3.04	3.58	39.02%
	2	1049312.55	1049312.55	0.00%	3.55	5.50	1049312.55	1049312.55	0.00%	1.58	3.37	38.70%
	3	875530.17	875530.17	0.00%	24.74	27.72	875530.17	875530.17	0.00%	12.96	15.36	44.58%
	4	917799.86	917799.86	0.00%	14.87	26.14	917799.86	917799.86	0.00%	3.69	15.25	41.65%
	5	1148986.29	1148986.29	0.00%	2.78	3.16	1148986.29	1148986.29	0.00%	1.61	1.77	44.01%
	6	1039430.17	1039430.17	0.00%	2.00	2.92	1039430.17	1039430.17	0.00%	1.30	1.98	32.08%
	7	856632.89	856632.89	0.00%	1.31	2.91	856632.89	856632.89	0.00%	0.98	2.08	28.50%
	8	1355292.46	1355292.46	0.00%	5.23	5.41	1355292.46	1355292.46	0.00%	3.41	3.55	34.41%
	9	1278137.56	1278137.56	0.00%	2.73	4.81	1278137.56	1278137.56	0.00%	1.17	3.51	27.06%
	10	725242.88	725242.88	0.00%	5.22	6.66	725242.88	725242.88	0.00%	1.86	3.03	54.49%
	11	1021129.69	1021129.69	0.00%	9.56	10.53	1021129.69	1021129.69	0.00%	3.36	4.64	55.92%
	12	736411.53	736411.53	0.00%	11.98	16.28	736411.53	736411.53	0.00%	4.34	10.09	38.00%
	13	796010.93	796010.93	0.00%	16.84	18.56	796010.93	796010.93	0.00%	2.99	5.14	72.29%
	14	943823.64	943823.64	0.00%	2.45	3.00	943823.64	943823.64	0.00%	2.25	2.74	8.77%
	15	932780.13	932781.12	0.00%	4.73	12.22	932781.12	932781.12	0.00%	2.27	8.44	30.92%
	16	1149885.46	1149885.46	0.00%	0.56	1.30	1149885.46	1149885.46	0.00%	0.81	1.44	-10.72%
	17	883509.43	883509.43	0.00%	6.56	7.75	883509.43	883509.43	0.00%	2.64	3.65	52.88%
	18	1437089.18	1437089.18	0.00%	6.42	9.19	1437089.18	1437089.18	0.00%	2.42	4.61	49.85%
	19	1177926.69	1177926.69	0.00%	2.56	4.28	1177907.88	1177926.69	0.00%	1.13	2.71	36.81%
	20	829025.22	829025.22	0.00%	4.25	4.81	829025.22	829025.22	0.00%	1.30	1.87	61.22%
7%	1	996427.22	996427.22	0.00%	7.48	8.23	996427.22	996427.22	0.00%	3.06	3.60	56.34%
	2	1097203.72	1097203.72	0.00%	6.97	12.17	1097203.72	1097203.72	0.00%	1.72	4.09	66.36%
	3	916467.29	916467.29	0.00%	26.44	30.25	916467.29	916467.29	0.00%	10.39	14.12	53.31%
	4	957486.01	957486.01	0.00%	15.34	29.09	957486.01	957486.01	0.00%	3.99	13.52	53.54%
	5	1190879.59	1190879.59	0.00%	3.02	3.47	1190879.59	1190879.59	0.00%	1.69	1.83	47.25%
	6	1091033.04	1091033.04	0.00%	1.88	2.34	1091033.04	1091033.04	0.00%	1.06	1.39	40.83%
	7	899210.93	899210.93	0.00%	1.70	3.30	899210.93	899210.93	0.00%	1.08	2.24	32.10%
	8	1401922.09	1401922.09	0.00%	3.64	3.78	1401922.09	1401922.09	0.00%	2.76	3.02	20.26%
	9	1332041.52	1332041.52	0.00%	2.72	4.64	1332041.52	1332041.52	0.00%	1.27	3.45	25.57%
	10	755636.96	755636.96	0.00%	5.72	7.65	755636.96	755636.96	0.00%	2.19	3.72	51.37%
	11	1060801.58	1060801.58	0.00%	7.94	8.91	1060801.58	1060801.58	0.00%	2.71	3.89	56.38%
	12	760887.96	760887.96	0.00%	9.58	12.00	760887.96	760887.96	0.00%	4.22	6.89	42.59%
	13	824714.30	824714.30	0.00%	14.42	15.81	824714.30	824714.30	0.00%	3.17	4.30	72.82%

	14	984022.76	984022.76	0.00%	2.80	3.28	984022.76	984022.76	0.00%	1.89	2.32	**29.39%**
	15	965395.40	965395.40	0.00%	2.91	6.75	965395.40	965395.40	0.00%	1.86	5.42	**19.69%**
	16	1193595.52	1193595.52	0.00%	0.45	1.09	1193595.52	1193595.52	0.00%	0.89	1.50	-37.29%
	17	925266.62	925266.62	0.00%	8.34	9.89	925266.62	925266.62	0.00%	2.41	4.53	**54.16%**
	18	1490581.51	1490581.51	0.00%	5.78	8.45	1490581.51	1490581.51	0.00%	2.28	4.25	**49.75%**
	19	1220684.61	1220684.61	0.00%	2.02	3.55	1220665.80	1220684.61	0.00%	1.20	2.74	**22.86%**
	20	862933.34	862933.34	0.00%	2.84	3.40	862933.34	862933.34	0.00%	1.08	1.55	**54.61%**
	1	1035938.33	1035938.33	0.00%	6.80	7.50	1035938.33	1035938.33	0.00%	3.34	4.75	**36.67%**
	2	1145146.20	1145146.20	0.00%	5.99	9.75	1145146.20	1145146.20	0.00%	2.17	4.88	**49.98%**
	3	957407.92	957407.92	0.00%	22.71	25.88	957407.92	957407.92	0.00%	9.88	12.80	**50.54%**
	4	997172.15	997172.15	0.00%	10.48	19.86	997172.15	997172.15	0.00%	4.10	19.98	-0.60%
	5	1232772.89	1232772.89	0.00%	2.38	2.75	1232772.89	1232772.89	0.00%	1.78	1.94	**29.56%**
	6	1143590.28	1143590.28	0.00%	1.13	1.55	1143590.28	1143590.28	0.00%	0.91	1.29	**16.88%**
	7	941788.97	941788.97	0.00%	1.05	2.24	941788.97	941788.97	0.00%	1.10	2.10	**6.22%**
	8	1448612.97	1448612.97	0.00%	3.19	3.35	1448612.97	1448612.97	0.00%	3.10	3.38	-0.99%
	9	1385945.48	1385945.48	0.00%	2.30	3.89	1385945.48	1385945.48	0.00%	1.27	3.55	**8.79%**
8%	10	787382.99	787382.99	0.00%	4.80	6.53	787382.99	787382.99	0.00%	2.17	3.69	**43.51%**
	11	1100475.59	1100475.59	0.00%	6.59	7.47	1100475.59	1100475.59	0.00%	2.50	3.57	**52.28%**
	12	786890.16	786890.16	0.00%	7.59	9.31	786890.16	786890.16	0.00%	4.30	7.27	**21.93%**
	13	854147.54	854147.54	0.00%	12.88	14.42	854147.54	854147.54	0.00%	3.40	4.39	**69.57%**
	14	1027046.04	1027046.04	0.00%	2.44	2.95	1027046.04	1027046.04	0.00%	1.92	2.32	**21.57%**
	15	1004554.19	1004554.19	0.00%	3.02	9.14	1004554.19	1004554.19	0.00%	1.48	3.67	**59.82%**
	16	1238025.96	1238025.96	0.00%	0.51	1.28	1238025.96	1238025.96	0.00%	0.97	1.52	-18.36%
	17	968475.42	968475.42	0.00%	6.45	7.59	968475.42	968475.42	0.00%	2.54	4.70	**38.14%**
	18	1545838.50	1545838.50	0.00%	6.27	9.25	1545769.49	1545838.50	0.00%	2.04	4.28	**53.72%**
	19	1263442.54	1263442.54	0.00%	0.89	1.81	1263423.73	1263442.54	0.00%	0.88	1.63	**10.21%**
	20	900341.83	900341.83	0.00%	3.56	4.59	900341.83	900341.83	0.00%	1.27	2.06	**55.16%**
	1	1075449.43	1075449.43	0.00%	6.06	6.67	1075449.43	1075449.43	0.00%	2.80	3.69	**44.76%**
	2	1193089.64	1193089.64	0.00%	6.00	10.42	1193089.64	1193089.64	0.00%	2.03	4.86	**53.37%**
	3	998362.17	998362.17	0.00%	15.73	19.00	998362.17	998362.17	0.00%	7.87	11.86	**37.58%**
	4	1036858.30	1036858.30	0.00%	11.86	22.19	1036858.30	1036858.30	0.00%	3.62	11.45	**48.38%**
	5	1282010.10	1282010.10	0.00%	2.13	2.31	1282010.10	1282010.10	0.00%	2.75	3.09	-33.74%
	6	1196392.58	1196392.58	0.00%	1.39	1.83	1196392.58	1196392.58	0.00%	0.97	1.33	**27.34%**
	7	984367.00	984367.00	0.00%	1.55	3.63	984367.00	984367.00	0.00%	1.28	3.08	**15.09%**
	8	1495744.01	1495744.01	0.00%	2.56	2.74	1495744.01	1495744.01	0.00%	2.47	2.63	**4.06%**
	9	1439849.45	1439849.45	0.00%	1.97	3.64	1439849.45	1439849.45	0.00%	1.16	2.71	**25.65%**
9%	10	819252.55	819252.55	0.00%	4.11	6.11	819252.55	819252.55	0.00%	2.05	3.42	**44.03%**
	11	1140150.98	1140150.98	0.00%	6.69	7.57	1140150.98	1140150.98	0.00%	2.26	3.53	**53.38%**
	12	814568.19	814568.19	0.00%	8.75	10.34	814568.19	814568.19	0.00%	4.33	7.49	**27.61%**
	13	883858.92	883858.92	0.00%	13.98	15.50	883858.92	883858.92	0.00%	3.13	4.39	**71.65%**
	14	1070674.05	1070674.05	0.00%	2.61	3.09	1070674.05	1070674.05	0.00%	1.79	2.18	**29.67%**
	15	1046219.72	1046219.72	0.00%	2.05	4.61	1046219.72	1046219.72	0.00%	1.31	3.46	**25.02%**
	16	1282709.38	1282709.38	0.00%	0.50	1.14	1282709.38	1282709.38	0.00%	0.88	1.42	-24.63%
	17	1011985.04	1011985.04	0.00%	5.94	6.92	1011985.04	1011985.04	0.00%	2.50	3.37	**51.29%**
	18	1605219.95	1605219.95	0.00%	5.63	8.86	1605219.95	1605219.95	0.00%	1.89	5.23	**40.98%**
	19	1306228.35	1306228.35	0.00%	1.06	1.92	1306181.65	1306228.35	0.00%	1.02	1.77	**8.01%**
	20	940807.73	940807.73	0.00%	4.84	9.48	940807.73	940807.73	0.00%	2.42	7.03	**25.83%**
	1	1115071.29	1115071.29	0.00%	8.19	8.87	1115071.29	1115071.29	0.00%	3.16	4.14	**53.35%**
	2	1241044.71	1241044.71	0.00%	4.95	8.76	1241044.71	1241044.71	0.00%	1.87	4.82	**44.96%**
	3	1039317.25	1039317.25	0.00%	14.23	17.34	1039317.25	1039317.25	0.00%	7.57	9.95	**42.65%**
	4	1076544.44	1076544.44	0.00%	12.51	23.69	1076544.44	1076544.44	0.00%	3.72	12.72	**46.29%**
	5	1334938.27	1334938.27	0.00%	0.81	1.02	1334938.27	1335070.27	0.00%	1.72	2.11	-107.68%
	6	1249204.59	1249204.59	0.00%	1.16	1.53	1249204.59	1249204.59	0.00%	0.87	1.20	**21.62%**
	7	1027179.50	1027179.50	0.00%	1.55	3.70	1027179.50	1027179.50	0.00%	1.18	2.78	**24.98%**
	8	1543069.51	1543069.51	0.00%	3.25	3.42	1543069.51	1543069.51	0.00%	2.56	2.74	**20.05%**
	9	1493753.41	1493753.41	0.00%	2.06	3.73	1493753.41	1493753.41	0.00%	1.27	3.53	**5.33%**
10%	10	851391.60	851391.60	0.00%	2.84	3.84	851391.60	851391.60	0.00%	1.64	2.55	**33.63%**

11	1179887.56	1179887.56	0.00%	6.06	6.86	1179887.56	1179887.56	0.00%	2.50	3.46	49.61%
12	845141.53	845141.53	0.00%	7.23	8.84	845141.53	845141.53	0.00%	2.97	5.14	41.84%
13	913577.83	913577.83	0.00%	13.05	15.36	913577.83	913577.83	0.00%	3.19	4.82	68.63%
14	1114827.55	1114827.55	0.00%	2.09	2.45	1114827.55	1114827.55	0.00%	1.64	1.99	19.00%
15	1091033.78	1091137.78	0.00%	1.83	4.75	1091137.78	1091137.78	0.00%	1.28	3.58	24.68%
16	1328917.55	1329010.60	0.00%	0.47	1.11	1329010.29	1329010.60	0.00%	1.25	2.24	-101.62%
17	1055710.84	1055710.84	0.00%	5.45	6.47	1055710.84	1055710.84	0.00%	2.12	2.95	54.44%
18	1662748.10	1662748.10	0.00%	8.89	15.80	1662748.10	1662748.10	0.00%	2.81	9.23	41.55%
19	1349171.59	1349171.59	0.00%	1.27	2.08	1349171.59	1349171.59	0.00%	1.08	3.44	-65.32%
20	974691.01	974691.01	0.00%	3.70	6.41	974691.01	974691.01	0.00%	1.90	4.26	33.56%

Table 13: Comparison results when $|\mathbb{M}^s| = 4$

Γ_D	Γ_R	Instance	CG L^C	U^C	G^C	RP	Total	OA-CG L	U	G	RP	Total	$\mathcal{P}_T$	$\mathcal{P}_G$	$\mathcal{P}_F$
4	10	1	**595310.61**	**595310.61**	**0.00%**	2260.77	2356.74	**595310.61**	**595310.61**	**0.00%**	270.53	315.47	**86.61%**	-	**0.00%**
		2	**746287.18**	**746287.18**	**0.00%**	1315.90	1435.75	**746287.18**	**746287.18**	**0.00%**	98.64	191.53	**86.66%**	-	**0.00%**
		3	**621274.01**	**621274.01**	**0.00%**	1814.16	2075.95	**621274.01**	**621274.01**	**0.00%**	129.40	524.37	**74.74%**	-	**0.00%**
		4	**826032.85**	**826032.85**	**0.00%**	547.30	696.49	**826032.85**	**826032.85**	**0.00%**	337.26	506.20	**27.32%**	-	**0.00%**
		5	**720894.59**	**720923.32**	**0.00%**	160.89	184.17	**720923.32**	**720923.32**	**0.00%**	74.84	114.74	**37.70%**	-	**0.00%**
		6	**1081879.72**	**1081879.72**	**0.00%**	437.64	487.03	**1081879.72**	**1081879.72**	**0.00%**	79.75	126.02	**74.13%**	-	**0.00%**
		7	**696092.17**	**696092.17**	**0.00%**	2294.31	2333.31	**696092.17**	**696092.17**	**0.00%**	907.58	926.72	**60.28%**	-	**0.00%**
		8	**689664.55**	**689664.55**	**0.00%**	1112.39	1170.58	**689664.55**	**689664.55**	**0.00%**	104.64	179.21	**84.69%**	-	**0.00%**
		9	**857046.18**	**857090.61**	**0.00%**	245.72	356.46	**857046.18**	**857090.61**	**0.00%**	24.05	132.24	**62.90%**	-	**0.00%**
		10	**866085.65**	**866085.65**	**0.00%**	152.53	187.20	**866085.65**	**866085.65**	**0.00%**	31.38	63.97	**65.83%**	-	**0.00%**
		11	**588378.35**	**588378.35**	**0.00%**	985.52	1310.25	588358.17	**588378.35**	**0.00%**	78.20	273.38	**79.14%**	-	**0.00%**
		12	**800504.08**	**800504.08**	**0.00%**	1508.72	1529.89	**800504.08**	**800504.08**	**0.00%**	642.98	742.23	**51.48%**	-	**0.00%**
		13	**844454.43**	**844454.43**	**0.00%**	419.06	534.73	**844454.43**	**844454.43**	**0.00%**	94.04	387.19	**27.59%**	-	**0.00%**
		14	**715190.98**	**715190.98**	**0.00%**	480.67	639.03	**715190.98**	**715190.98**	**0.00%**	66.18	329.46	**48.44%**	-	**0.00%**
		15	**772098.18**	**772098.18**	**0.00%**	262.36	416.20	**772098.18**	**772098.18**	**0.00%**	56.80	279.49	**32.85%**	-	**0.00%**
		16	**667069.80**	**667069.80**	**0.00%**	526.13	1114.81	**667069.80**	**667069.80**	**0.00%**	52.76	766.84	**31.21%**	-	**0.00%**
		17	**769166.54**	**769166.54**	**0.00%**	1081.95	1157.77	**769166.54**	**769166.54**	**0.00%**	60.91	138.42	**88.04%**	-	**0.00%**
		18	**764927.80**	**764927.80**	**0.00%**	62.22	78.03	**764927.80**	**764927.80**	**0.00%**	14.62	29.53	**62.16%**	-	**0.00%**
		19	**582048.05**	**582048.05**	**0.00%**	2431.33	5040.56	**582048.05**	**582048.05**	**0.00%**	264.06	1342.00	**73.38%**	-	**0.00%**
		20	**1102896.15**	**1102896.15**	**0.00%**	48.20	69.16	**1102896.15**	**1102896.15**	**0.00%**	12.60	35.05	**49.31%**	-	**0.00%**
4	15	1	615489.64	654901.29	6.02%	7173.62	7200.00	**643090.99**	**643090.99**	**0.00%**	536.85	753.58	**89.53%**	**100.00%**	**1.80%**
		2	**802309.15**	**802309.15**	**0.00%**	6185.14	6659.51	**802309.15**	**802309.15**	**0.00%**	129.25	448.94	**93.26%**	-	**0.00%**
		3	647569.72	671721.61	3.60%	7175.42	7200.00	**671721.61**	**671721.61**	**0.00%**	2289.07	2803.85	**61.06%**	**100.00%**	**0.00%**
		4	**906766.86**	**906766.86**	**0.00%**	2207.14	2943.12	**906766.86**	**906766.86**	**0.00%**	339.40	633.89	**78.46%**	-	**0.00%**
		5	**775549.07**	**775549.07**	**0.00%**	632.75	773.06	**775549.07**	**775549.07**	**0.00%**	197.97	496.11	**35.83%**	-	**0.00%**
		6	**1157498.17**	**1157498.17**	**0.00%**	699.05	724.58	**1157498.17**	**1157498.17**	**0.00%**	152.14	177.33	**75.53%**	-	**0.00%**
		7	**743236.60**	**743236.60**	**0.00%**	4182.17	4242.55	**743236.60**	**743236.60**	**0.00%**	254.44	287.59	**93.22%**	-	**0.00%**
		8	**744603.72**	**744603.72**	**0.00%**	2330.36	2474.78	**744603.72**	**744603.72**	**0.00%**	202.67	330.37	**86.65%**	-	**0.00%**
		9	**945166.54**	**945166.54**	**0.00%**	162.72	208.78	**945166.54**	**945166.54**	**0.00%**	24.12	128.52	**38.44%**	-	**0.00%**
		10	**940529.22**	**940529.22**	**0.00%**	122.70	148.81	**940529.22**	**940529.22**	**0.00%**	20.92	56.23	**62.21%**	-	**0.00%**
		11	**617112.52**	**617112.52**	**0.00%**	2925.25	3226.34	617060.98	**617112.52**	**0.00%**	181.42	486.65	**84.92%**	-	**0.00%**
		12	**868167.22**	**868167.22**	**0.00%**	3199.11	3270.87	**868167.22**	**868167.22**	**0.00%**	471.34	525.61	**83.93%**	-	**0.00%**
		13	**913894.46**	**913917.92**	**0.00%**	886.41	1339.77	**913917.92**	**913917.92**	**0.00%**	60.08	338.22	**74.76%**	-	**0.00%**
		14	**769213.84**	**769260.12**	**0.00%**	1598.59	1759.19	**769260.12**	**769260.12**	**0.00%**	146.70	244.91	**86.08%**	-	**0.00%**
		15	**823814.61**	**823814.61**	**0.00%**	1632.36	1935.83	**823814.61**	**823814.61**	**0.00%**	109.08	317.32	**83.61%**	-	**0.00%**
		16	**719750.56**	**719750.56**	**0.00%**	1355.11	2812.95	**719750.56**	**719750.56**	**0.00%**	98.28	1253.65	**55.43%**	-	**0.00%**
		17	**820156.57**	**820195.62**	**0.00%**	3941.72	4134.87	**820195.62**	**820195.62**	**0.00%**	160.37	481.62	**88.35%**	-	**0.00%**
		18	**818156.35**	**818156.35**	**0.00%**	39.19	46.01	**818156.35**	**818156.35**	**0.00%**	21.80	25.02	**45.63%**	-	**0.00%**
		19	**631975.74**	**632007.29**	**0.00%**	3517.61	5090.34	**632007.29**	**632007.29**	**0.00%**	252.54	1513.60	**70.27%**	-	**0.00%**
		20	**1172363.11**	**1172363.11**	**0.00%**	177.74	244.91	**1172363.11**	**1172363.11**	**0.00%**	22.50	87.41	**64.31%**	-	**0.00%**
6	15	1	684354.69	717891.62	4.67%	7184.22	7200.00	**704961.57**	**704961.57**	**0.00%**	3811.95	4214.18	**41.47%**	**100.00%**	**1.80%**
		2	870576.75	880137.97	1.09%	6991.00	7200.00	**877359.76**	**877359.76**	**0.00%**	993.75	1441.00	**79.99%**	**100.00%**	**0.32%**
		3	688161.74	744280.11	7.54%	7194.38	7200.00	**725351.10**	**725351.10**	**0.00%**	3807.23	4371.25	**39.29%**	**100.00%**	**2.54%**
		4	**1014365.62**	**1014365.62**	**0.00%**	5090.92	5884.98	**1014365.62**	**1014365.62**	**0.00%**	499.08	1480.86	**74.84%**	-	**0.00%**
		5	**865000.26**	**865000.26**	**0.00%**	810.41	907.39	**865000.26**	**865000.26**	**0.00%**	419.24	623.99	**31.23%**	-	**0.00%**
		6	**1302455.56**	**1302455.56**	**0.00%**	729.28	775.01	**1302455.56**	**1302455.56**	**0.00%**	83.37	107.16	**86.17%**	-	**0.00%**
		7	760095.38	859143.37	11.53%	7199.24	7200.00	**815633.88**	**815654.90**	**0.00%**	547.13	590.24	**91.80%**	**100.00%**	**5.06%**
		8	830346.16	830607.16	0.03%	7170.39	7200.00	**830607.16**	**830607.16**	**0.00%**	621.61	683.27	**90.51%**	**100.00%**	**0.00%**
		9	**1041192.55**	**1041192.55**	**0.00%**	294.11	390.48	**1041192.55**	**1041192.55**	**0.00%**	44.36	122.47	**68.64%**	-	**0.00%**
		10	**1009760.17**	**1009760.17**	**0.00%**	866.95	903.53	**1009760.17**	**1009760.17**	**0.00%**	79.24	210.82	**76.67%**	-	**0.00%**
		11	664913.70	665163.60	0.04%	6381.44	7200.00	**664913.70**	**664913.70**	**0.00%**	302.50	1148.66	**84.05%**	**100.00%**	**0.04%**
		12	933431.43	984155.88	5.15%	7176.08	7200.00	**955821.86**	**955821.86**	**0.00%**	1776.66	1922.96	**73.29%**	**100.00%**	**2.88%**
		13	**1008513.87**	**1008513.87**	**0.00%**	884.36	1085.88	**1008513.87**	**1008513.87**	**0.00%**	98.27	350.99	**67.68%**	-	**0.00%**
		14	**843383.73**	**843383.73**	**0.00%**	4575.75	4850.03	**843383.73**	**843383.73**	**0.00%**	294.07	402.33	**91.70%**	-	**0.00%**
		15	875643.72	884079.96	0.95%	6801.69	7200.00	**884079.96**	**884079.96**	**0.00%**	1088.92	1977.62	**72.53%**	**100.00%**	**0.00%**
		16	**790442.31**	**790442.31**	**0.00%**	2602.63	6117.03	**790442.31**	**790442.31**	**0.00%**	176.48	3558.31	**41.83%**	-	**0.00%**
		17	897655.90	905970.59	0.92%	7106.97	7200.00	**905970.59**	**905970.59**	**0.00%**	405.92	699.56	**90.28%**	**100.00%**	**0.00%**
		18	**904010.15**	**904010.15**	**0.00%**	87.02	97.31	**904010.15**	**904010.15**	**0.00%**	21.75	33.19	**65.89%**	-	**0.00%**
		19	696339.05	700756.48	0.63%	5547.38	7200.00	**700756.48**	**700756.48**	**0.00%**	432.92	3482.50	**51.63%**	**100.00%**	**0.00%**
		20	**1251470.12**	**1251470.12**	**0.00%**	911.05	1007.83	**1251470.12**	**1251470.12**	**0.00%**	225.25	322.19	**68.03%**	-	**0.00%**
8	10	1	705406.17	712028.13	0.93%	7183.16	7200.00	**712028.13**	**712028.13**	**0.00%**	1498.18	1536.77	**78.66%**	**100.00%**	**0.00%**
		2	**893809.71**	**893809.71**	**0.00%**	3042.31	3141.63	**893809.71**	**893809.71**	**0.00%**	112.27	176.63	**94.38%**	-	**0.00%**
		3	695476.45	749524.29	7.21%	7197.80	7200.00	**727913.21**	**727913.21**	**0.00%**	3365.19	3642.79	**49.41%**	**100.00%**	**2.88%**
		4	**1028605.32**	**1028605.32**	**0.00%**	805.42	979.52	**1028605.32**	**1028605.32**	**0.00%**	223.44	372.03	**62.02%**	-	**0.00%**
		5	**879065.78**	**879065.78**	**0.00%**	235.13	275.98	**879065.78**	**879065.78**	**0.00%**	142.57	204.06	**26.06%**	-	**0.00%**
		6	**1333015.79**	**1333015.79**	**0.00%**	165.38	217.25	**1333015.79**	**1333015.79**	**0.00%**	28.48	85.31	**60.73%**	-	**0.00%**
		7	**826726.85**	**826726.85**	**0.00%**	2905.17	2920.35	**826726.85**	**826726.85**	**0.00%**	1603.28	1618.23	**44.59%**	-	**0.00%**
		8	**834755.50**	**834755.50**	**0.00%**	3747.16	3778.81	**834755.50**	**834755.50**	**0.00%**	852.53	886.93	**76.53%**	-	**0.00%**
		9	**1027236.15**	**1027236.15**	**0.00%**	239.67	317.28	**1027236.15**	**1027236.15**	**0.00%**	17.75	91.72	**71.09%**	-	**0.00%**
		10	**994789.84**	**994789.84**	**0.00%**	1345.53	1391.31	**994789.84**	**994789.84**	**0.00%**	152.66	199.14	**85.69%**	-	**0.00%**
		11	**676521.87**	**676521.87**	**0.00%**	5157.75	5794.72	**676521.87**	**676521.87**	**0.00%**	295.29	555.28	**90.42%**	-	**0.00%**

G1	G2	#													
		12	964498.20	964564.93	0.00%	5130.12	5261.81	964564.93	964564.93	0.00%	641.55	779.69	85.18%	-	0.00%
		13	1013888.74	1013978.46	0.00%	300.36	515.89	1013978.46	1013978.46	0.00%	90.28	168.17	67.40%	-	0.00%
		14	859640.18	859640.18	0.00%	702.75	787.81	859640.18	859640.18	0.00%	123.42	215.03	72.71%	-	0.00%
		15	884174.77	884174.77	0.00%	3534.84	3746.51	884174.77	884174.77	0.00%	122.34	376.42	89.95%	-	0.00%
		16	790705.03	790705.03	0.00%	1004.81	1658.23	790669.86	790705.03	0.00%	115.42	553.49	66.62%	-	0.00%
		17	930020.14	930048.54	0.00%	2486.02	2606.71	930020.14	930020.14	0.00%	256.74	467.55	82.06%	-	0.00%
		18	911592.17	911592.17	0.00%	75.36	80.61	911592.17	911592.17	0.00%	39.14	47.83	40.66%	-	0.00%
		19	715179.68	718299.82	0.43%	5204.22	7200.00	715373.68	715373.68	0.00%	86.18	1967.07	72.68%	100.00%	0.41%
		20	1247167.07	1247167.07	0.00%	344.33	358.17	1247167.07	1247167.07	0.00%	62.12	76.36	78.68%	-	0.00%
10	10	1	755309.73	765070.26	1.28%	7192.81	7200.00	763133.08	763133.08	0.00%	2949.95	3038.64	57.80%	100.00%	0.25%
		2	954108.87	954108.87	0.00%	2795.94	2930.94	954108.87	954108.87	0.00%	160.28	322.58	88.99%	-	0.00%
		3	739167.15	798121.82	7.39%	7198.08	7200.00	775041.98	775041.98	0.00%	2184.71	2328.42	67.66%	100.00%	2.89%
		4	1097436.27	1097436.27	0.00%	1206.03	1382.44	1097436.27	1097436.27	0.00%	220.22	518.67	62.48%	-	0.00%
		5	933582.21	933582.21	0.00%	662.63	709.58	933582.21	933582.21	0.00%	168.73	271.63	61.72%	-	0.00%
		6	1416378.80	1416378.80	0.00%	286.47	327.81	1416378.80	1416378.80	0.00%	27.18	85.78	73.83%	-	0.00%
		7	881796.55	881796.55	0.00%	2543.69	2553.64	881796.55	881796.55	0.00%	2060.48	2072.61	18.84%	-	0.00%
		8	905199.84	905199.84	0.00%	2695.72	2720.69	905199.84	905199.84	0.00%	666.65	710.77	73.88%	-	0.00%
		9	1093605.55	1093605.55	0.00%	177.19	229.31	1093605.55	1093605.55	0.00%	24.74	192.92	15.87%	-	0.00%
		10	1049161.82	1049161.82	0.00%	1259.95	1331.80	1049161.82	1049161.82	0.00%	175.99	356.17	73.26%	-	0.00%
		11	715000.43	715000.43	0.00%	3576.92	3730.70	715000.43	715000.43	0.00%	458.19	579.91	84.46%	-	0.00%
		12	1034564.55	1034564.55	0.00%	4825.83	4954.75	1034564.55	1034564.55	0.00%	563.82	639.96	87.08%	-	0.00%
		13	1080852.81	1080852.81	0.00%	131.39	196.28	1080852.81	1080852.81	0.00%	34.17	135.22	31.11%	-	0.00%
		14	912917.34	912917.34	0.00%	1293.41	1347.08	912917.34	912917.34	0.00%	237.03	311.83	76.85%	-	0.00%
		15	927512.84	927512.84	0.00%	2260.62	2379.05	927512.84	927512.84	0.00%	192.20	556.23	76.62%	-	0.00%
		16	840587.16	840587.16	0.00%	432.13	808.73	840587.16	840587.16	0.00%	67.94	743.20	8.10%	-	0.00%
		17	1001976.45	1001976.45	0.00%	2149.03	2205.46	1001976.45	1001976.45	0.00%	1179.41	1236.33	43.94%	-	0.00%
		18	958713.68	958713.68	0.00%	82.67	87.92	958713.68	958713.68	0.00%	20.83	33.38	62.04%	-	0.00%
		19	773778.70	773778.70	0.00%	2743.03	4246.25	773778.70	773778.70	0.00%	95.84	1887.31	55.55%	-	0.00%
		20	1315441.76	1315441.76	0.00%	323.09	354.94	1315441.76	1315441.76	0.00%	57.11	78.56	77.87%	-	0.00%
20	10	1	959738.58	959848.58	0.01%	7182.33	7200.00	959848.58	959848.58	0.00%	349.69	387.11	94.62%	100.00%	0.00%
		2	1155235.60	1155235.60	0.00%	1966.39	2423.99	1155235.60	1155235.60	0.00%	42.92	317.22	86.91%	-	0.00%
		3	934790.99	948175.70	1.41%	7185.12	7200.00	948175.70	948175.70	0.00%	1982.25	2061.38	71.37%	100.00%	0.00%
		4	1316736.71	1316736.71	0.00%	739.36	1015.14	1316736.71	1316736.71	0.00%	130.87	349.74	65.55%	-	0.00%
		5	1124693.36	1124693.36	0.00%	640.83	701.67	1124693.36	1124693.36	0.00%	91.83	154.75	77.95%	-	0.00%
		6	1650632.47	1650632.47	0.00%	140.56	206.23	1650632.47	1650632.47	0.00%	18.73	68.04	67.01%	-	0.00%
		7	1063359.59	1063428.53	0.00%	825.48	842.30	1063411.39	1063428.53	0.00%	111.98	130.16	84.55%	-	0.00%
		8	1117882.82	1117882.82	0.00%	346.84	389.91	1117882.82	1117882.82	0.00%	44.11	74.79	80.82%	-	0.00%
		9	1320581.14	1320581.14	0.00%	297.44	384.01	1320581.14	1320581.14	0.00%	76.06	274.53	28.51%	-	0.00%
		10	1270287.25	1270287.25	0.00%	233.89	270.61	1270287.25	1270287.25	0.00%	118.73	152.85	43.52%	-	0.00%
		11	875051.12	875127.31	0.00%	460.25	565.08	875127.31	875127.31	0.00%	60.87	191.23	66.16%	-	0.00%
		12	1265990.97	1265990.97	0.00%	1313.63	1357.92	1265990.97	1265990.97	0.00%	88.91	111.10	91.82%	-	0.00%
		13	1233454.07	1233454.07	0.00%	145.89	194.55	1233454.07	1233454.07	0.00%	66.32	131.36	32.48%	-	0.00%
		14	1127236.57	1127236.57	0.00%	1771.72	1875.16	1127236.57	1127236.57	0.00%	55.22	163.38	91.29%	-	0.00%
		15	1089614.03	1089614.03	0.00%	1834.50	2041.95	1089614.03	1089614.03	0.00%	17.94	132.36	93.52%	-	0.00%
		16	987660.57	987670.90	0.00%	803.37	1619.72	987660.60	987660.60	0.00%	57.60	529.43	67.31%	-	0.00%
		17	1266466.68	1266466.68	0.00%	940.13	1015.58	1266466.68	1266466.68	0.00%	63.73	111.53	89.02%	-	0.00%
		18	1103887.28	1103887.28	0.00%	303.72	377.39	1103887.28	1103887.28	0.00%	47.41	131.78	65.08%	-	0.00%
		19	969563.12	969563.12	0.00%	857.35	2330.97	969563.12	969563.12	0.00%	50.50	1210.18	48.08%	-	0.00%
		20	1549807.58	1549807.58	0.00%	116.63	162.72	1549807.58	1549807.58	0.00%	9.58	45.86	71.82%	-	0.00%