



Master-Thesis

# High Quality Hypergraph Partitioning via Max-Flow-Min-Cut Computations

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## Contents

<b>1 Experimental Results</b>	<b>3</b>
1.1 Flow Algorithms and Networks . . . . .	3
1.2 Configuring direct $k$ -way Flow-based Refinement . . . . .	7
1.3 Speed-Up Heuristics . . . . .	10
1.4 Comparison with other Hypergraph Partitioners . . . . .	15

# 1 Experimental Results

## 1.1 Flow Algorithms and Networks

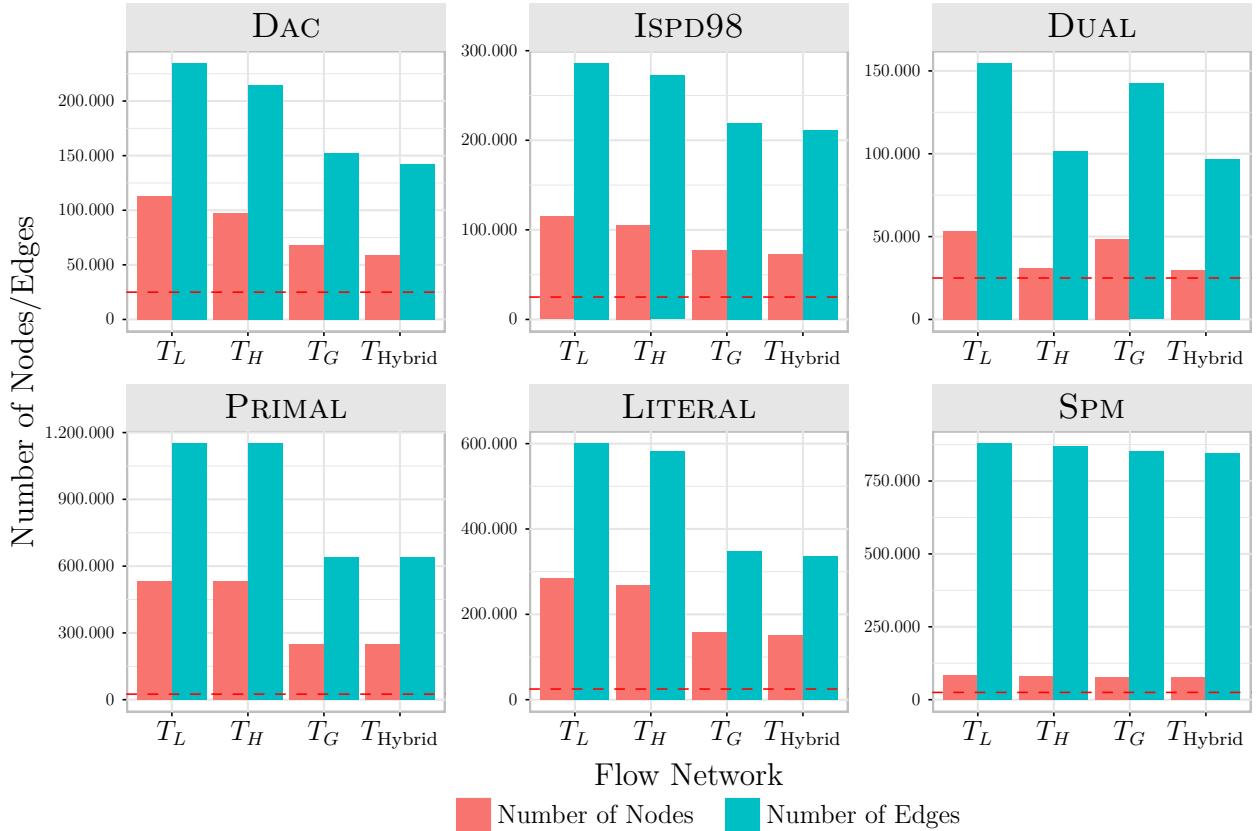


Figure 1: Comparison of the number of nodes and edges induced by flow problems of size  $|V'| = 25000$  on our flow networks for different benchmark types. The red dashed lines indicates 25000 nodes.

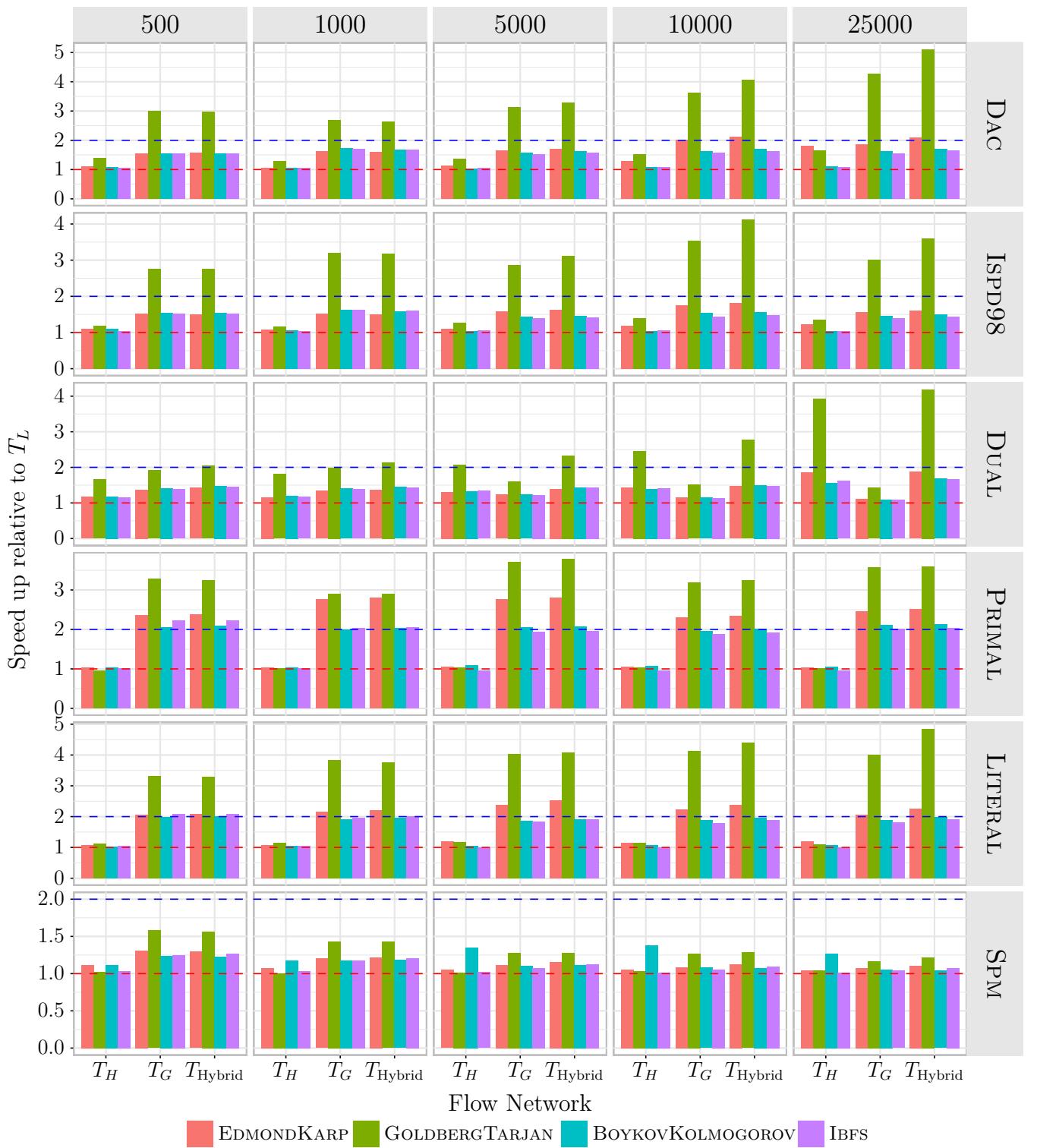


Figure 2: Speed-ups of the flow algorithms on different flow networks relative to execution on  $T_L$  for different problem sizes and types. The red resp. blue dashed line indicate a speed-up of 1 resp. 2.

$ V' $	IBFS $t[ms]$	BOYKOV $t[\%]$	GOLDBERG $t[\%]$	TARJAN $t[\%]$	EDMOND $t[\%]$	KARP $t[\%]$
500	0.81	1.79	24.56		<b>-7.36</b>	
1000	<b>1.91</b>	12.92	26.88		13.90	
5000	<b>13.52</b>	38.11	63.68		108.43	
10000	<b>28.40</b>	53.52	92.56		182.79	
25000	<b>64.18</b>	50.19	95.25		157.03	

Table 1: Average running times of our maximum flow algorithms on flow network  $T_{\text{Hybrid}}$ . Note, all values in the table are in percentage relative to the running time of the IBFS algorithm. In each line the fastest variant is marked bold.

Instance	$ V' $	IBFS $t[ms]$	BOYKOV-KOLMOGOROV $t[\%]$	GOLDBERG-TARJAN $t[\%]$	EDMOND-KARP $t[\%]$
ALL	500	0.81	1.79	24.56	<b>-7.36</b>
	1000	<b>1.91</b>	12.92	26.88	13.90
	5000	<b>13.52</b>	38.11	63.68	108.43
	10000	<b>28.40</b>	53.52	92.56	182.79
	25000	<b>64.18</b>	50.19	95.25	157.03
DAC	500	0.29	-10.46	11.79	<b>-34.02</b>
	1000	0.71	-9.51	18.18	<b>-35.86</b>
	5000	5.16	-5.94	12.21	<b>-17.03</b>
	10000	10.23	<b>-1.30</b>	33.46	32.26
	25000	<b>26.05</b>	2.14	112.29	67.77
ISPD98	500	0.42	-11.77	23.10	<b>-13.55</b>
	1000	0.98	-11.76	14.61	<b>-12.01</b>
	5000	7.33	<b>-1.06</b>	65.21	41.04
	10000	<b>15.19</b>	5.27	209.29	164.02
	25000	<b>41.50</b>	15.04	782.45	525.31
DUAL	500	0.24	-12.17	1.24	<b>-42.11</b>
	1000	0.51	-11.40	3.32	<b>-43.34</b>
	5000	3.41	-7.46	7.30	<b>-43.50</b>
	10000	6.65	-2.56	21.99	<b>-37.53</b>
	25000	15.63	3.86	65.81	<b>-17.12</b>
PRIMAL	500	<b>1.45</b>	24.48	58.97	143.23
	1000	<b>3.51</b>	22.79	66.63	200.62
	5000	<b>26.34</b>	23.07	122.09	589.46
	10000	<b>48.87</b>	14.37	110.18	484.42
	25000	<b>102.32</b>	17.38	237.90	852.30
LITERAL	500	<b>0.66</b>	0.55	61.36	38.80
	1000	<b>1.63</b>	8.06	51.86	84.71
	5000	<b>11.55</b>	13.41	94.09	227.94
	10000	<b>25.28</b>	14.81	130.87	375.89
	25000	<b>55.67</b>	7.27	125.34	367.70
SPM	500	1.60	3.50	8.07	<b>-39.46</b>
	1000	3.79	34.29	14.28	<b>-14.95</b>
	5000	<b>26.30</b>	121.86	65.34	105.19
	10000	<b>60.57</b>	196.95	103.28	256.18
	25000	<b>140.35</b>	169.78	14.70	62.44

Table 2: Average running times of our maximum flow algorithms on flow network  $T_{\text{Hybrid}}$ . Note, all values in the table are in percentage relative to the running time of the IBFS algorithm. In each line the fastest variant is marked bold.

## 1.2 Configuring direct $k$ -way Flow-based Refinement

M2 - IBFS with Multilevel Flow Execution Policy								
Config.	(+F,-M,-FM)		(+F,+M,-FM)		(+F,+M,+FM)		CONSTANT128	
$\alpha'$	Avg[%]	$t[s]$	Avg[%]	$t[s]$	Avg[%]	$t[s]$	Avg[%]	$t[s]$
1	-6.43	12.14	-5.91	12.49	0.22	14.44	0.53	55.75
2	-3.46	13.87	-2.40	14.56	0.68	15.75	1.09	87.93
4	-1.99	16.71	-0.42	17.63	1.19	18.06	1.61	144.42
8	-1.04	21.59	0.78	22.80	1.65	22.06	2.16	257.41
16	-0.35	30.61	1.57	32.42	2.07	29.50	2.69	498.29
Ref.	(-F,-M,+FM)		6373.88	13.73				
M2 - IBFS with Exponential Flow Execution Policy								
Config.	(+F,-M,-FM)		(+F,+M,-FM)		(+F,+M,+FM)		CONSTANT128	
$\alpha'$	Avg[%]	$t[s]$	Avg[%]	$t[s]$	Avg[%]	$t[s]$	Avg[%]	$t[s]$
1	-6.09	12.91	-5.60	13.40	0.23	15.16	0.53	55.75
2	-3.19	15.75	-2.07	16.74	0.73	17.51	1.09	87.93
4	-1.82	20.37	-0.19	21.88	1.21	21.53	1.61	144.42
8	-0.85	28.49	0.98	30.67	1.71	28.68	2.16	257.41
16	-0.19	43.32	1.75	46.66	2.21	41.31	2.69	498.29
Ref.	(-F,-M,+FM)		6373.88	13.73				
M2 - BOYKOVKOLMOGOROV without HE 1 removal								
Config.	(+F,-M,-FM)		(+F,+M,-FM)		(+F,+M,+FM)		CONSTANT128	
$\alpha'$	Avg[%]	$t[s]$	Avg[%]	$t[s]$	Avg[%]	$t[s]$	Avg[%]	$t[s]$
1	-6.10	13.51	-5.62	14.22	0.23	15.19	0.53	55.75
2	-3.20	16.89	-2.08	18.23	0.74	17.97	1.09	87.93
4	-1.82	22.23	-0.20	24.29	1.21	22.50	1.61	144.42
8	-0.85	31.49	0.98	34.43	1.71	30.58	2.16	257.41
16	-0.20	48.66	1.75	53.23	2.21	45.04	2.69	498.29
Ref.	(-F,-M,+FM)		6373.88	13.73				

Table 3: Table contains results for different configurations of our flow-based refinement framework for increasing  $\alpha'$ . The quality in column *Avg.* is relative to our baseline configuration (-F,-M,+FM).

Config.	(+F,-M,-FM)		(+F,+M,-FM)		(+F,+M,+FM)	
$\alpha'$	M1 - Avg [%]	M2 - Avg [%]	M1 - Avg [%]	M2 - Avg [%]	M1 - Avg [%]	M2 - Avg [%]
1	-15.48	-6.10	-15.26	-5.62	0.14	0.23
2	-10.50	-3.20	-10.12	-2.08	0.36	0.74
4	-5.98	-1.82	-5.08	-0.20	0.67	1.21
8	-3.22	-0.85	-1.64	0.98	1.25	1.71
16	-1.52	-0.20	0.51	1.75	1.87	2.21
Ref.	(-F,-M,+FM)		6373.88			

Table 4: Comparison on quality of our framework with different source and sink set modeling approaches. M1 represents the approach of Sanders and Schulz and M2 is our new variant.

Config.	$\varepsilon = 1\%$			$\varepsilon = 3\%$		
	$\alpha'$	KaFFPa	Our	Improv. [%]	KaFFPa	Our
1	7789.2	7190.4	8.3	7360.3	6761.9	8.9
2	7571.6	6975.7	8.5	7042.8	6576.9	7.1
4	7378.4	6867.6	7.4	6755.0	6489.7	4.1
8	7139.9	6777.0	5.4	6579.1	6427.9	2.4
16	6936.4	6703.9	3.5	6470.4	6385.8	1.3

Table 5: Comparison on quality of configuration (+F,-M,-FM) with the flow problem modeling approach of *KaFFPa* and *KaHyPar* and  $\varepsilon \in \{0.01, 0.03\}$ .

M2 - IBFS with Exponential Flow Execution Policy			
Config.	(+F,-M,-FM)	(+F,+M,-FM)	(+F,+M,+FM)
$\alpha'$	Avg[%]	Avg[%]	Avg[%]
1	-6.06	-5.52	0.24
2	-3.15	-2.06	0.73
4	-1.89	-0.19	1.20
8	-0.87	0.96	1.68
16	-0.29	1.66	2.16
Ref.	(-F,-M,+FM)	6377.15	
M2 - BOYKOV-KOLMOGOROV			
Config.	(+F,-M,-FM)	(+F,+M,-FM)	(+F,+M,+FM)
$\alpha'$	Avg[%]	Avg[%]	Avg[%]
1	-6.08	-5.57	0.23
2	-3.22	-2.10	0.72
4	-1.90	-0.26	1.18
8	-0.91	0.92	1.67
16	-0.29	1.65	2.15
Ref.	(-F,-M,+FM)	6376.03	
M1 - GOLDBERG-TARJAN			
Config.	(+F,-M,-FM)	(+F,+M,-FM)	(+F,+M,+FM)
$\alpha'$	Avg[%]	Avg[%]	Avg[%]
1	-15.45	-15.19	0.17
2	-10.51	-10.08	0.38
4	-5.97	-5.10	0.68
8	-3.22	-1.66	1.26
16	-1.67	0.46	1.84
Ref.	(-F,-M,+FM)	6376.03	

Table 6: Table contains results of the effectiveness test for different configurations of our flow-based refinement framework for increasing  $\alpha'$ . The quality in column *Avg.* is relative to our baseline configuration (-F,-M,+FM).

### 1.3 Speed-Up Heuristics

Variant	M2 - IBFS			
	Avg [%]	Min [%]	$t_{\text{flow}}[s]$	$t[s]$
KaHyPar-CA	7077.20	6820.17	-	29.26
KaHyPar-MF	-2.47	-2.12	43.04	72.30
KaHyPar-MF <sub>(R1)</sub>	-2.41	-2.06	33.89	63.15
KaHyPar-MF <sub>(R1,R2)</sub>	-2.40	-2.05	28.52	57.78
KaHyPar-MF <sub>(R1,R2,R3)</sub>	-2.41	-2.06	21.23	50.49
Variant	M2 - BOYKOV-KOLMOGOROV			
	Avg [%]	Min [%]	$t_{\text{flow}}[s]$	$t[s]$
KaHyPar-CA	7077.20	6820.17	-	29.26
KaHyPar-MF	-2.48	-2.13	51.76	81.02
KaHyPar-MF <sub>(R1)</sub>	-2.41	-2.05	41.21	70.47
KaHyPar-MF <sub>(R1,R2)</sub>	-2.40	-2.04	35.56	64.82
KaHyPar-MF <sub>(R1,R2,R3)</sub>	-2.41	-2.05	26.64	55.90
Variant	M1 - GOLDBERG-TARJAN			
	Avg [%]	Min [%]	$t_{\text{flow}}[s]$	$t[s]$
KaHyPar-CA	7077.20	6820.17	-	29.26
KaHyPar-MF	-2.13	-1.80	52.28	81.54
KaHyPar-MF <sub>(R1)</sub>	-2.05	-1.74	41.48	70.74
KaHyPar-MF <sub>(R1,R2)</sub>	-2.05	-1.73	35.27	64.54
KaHyPar-MF <sub>(R1,R2,R3)</sub>	-2.04	-1.75	27.62	56.88

Table 7: Results of our flow-based refinement framework with different speedup heuristics.

Partitioner	M2 - IBFS						
	Running Time $t[s]$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-CA	29.26	343.40	21.57	36.44	56.49	58.75	11.31
KaHyPar-MF	72.30	595.69	66.87	96.09	150.17	126.87	27.66
KaHyPar-MF <sub>(R1)</sub>	63.15	515.61	53.57	81.27	124.68	114.27	25.19
KaHyPar-MF <sub>(R1,R2)</sub>	57.78	495.94	45.96	75.53	112.35	101.28	23.58
KaHyPar-MF <sub>(R1,R2,R3)</sub>	50.49	451.99	38.41	65.01	97.32	89.84	20.78
Partitioner	M2 - BOYKOV KOLMOGOROV						
	Running Time $t[s]$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-CA	29.26	343.40	21.57	36.44	56.49	58.75	11.31
KaHyPar-MF	81.02	610.48	69.84	107.72	164.68	127.09	33.81
KaHyPar-MF <sub>(R1)</sub>	70.47	526.26	55.56	91.10	136.17	113.87	30.62
KaHyPar-MF <sub>(R1,R2)</sub>	64.82	503.04	47.31	84.65	123.63	101.41	28.95
KaHyPar-MF <sub>(R1,R2,R3)</sub>	55.90	452.27	39.03	71.64	105.20	89.07	25.24
Partitioner	M1 - GOLDBERG TARJAN						
	Running Time $t[s]$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-CA	29.26	343.40	21.57	36.44	56.49	58.75	11.31
KaHyPar-MF	81.54	699.18	75.97	114.67	185.56	143.93	28.74
KaHyPar-MF <sub>(R1)</sub>	70.74	600.87	59.69	94.90	150.56	128.67	26.47
KaHyPar-MF <sub>(R1,R2)</sub>	64.54	573.41	50.28	88.11	134.84	113.59	24.80
KaHyPar-MF <sub>(R1,R2,R3)</sub>	56.88	526.86	43.32	74.76	116.79	101.76	22.31

Table 8: Comparing the average running time of KaHyPar-MF with KaHyPar-CA.

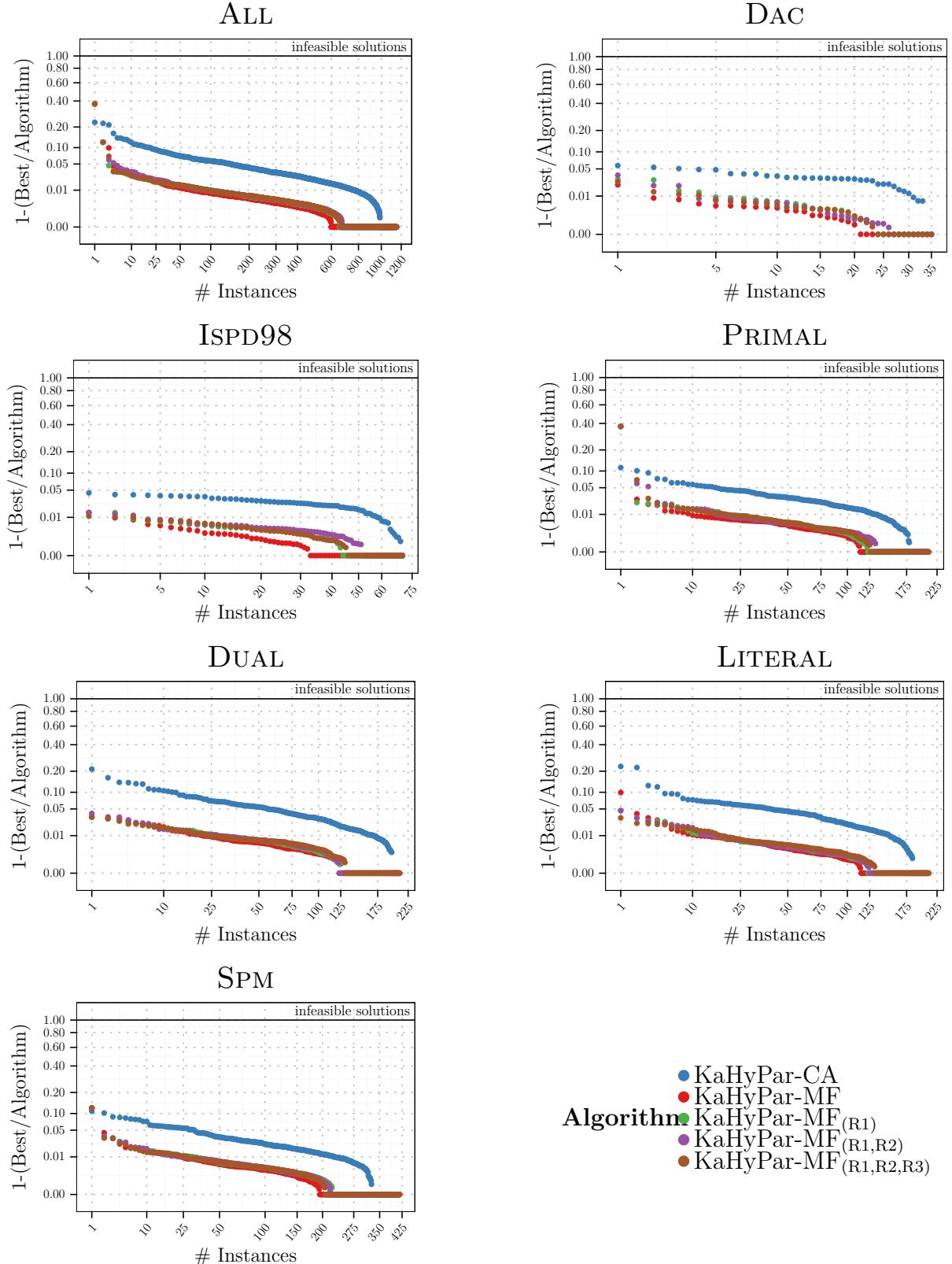


Figure 3: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA. M2 - IBFS

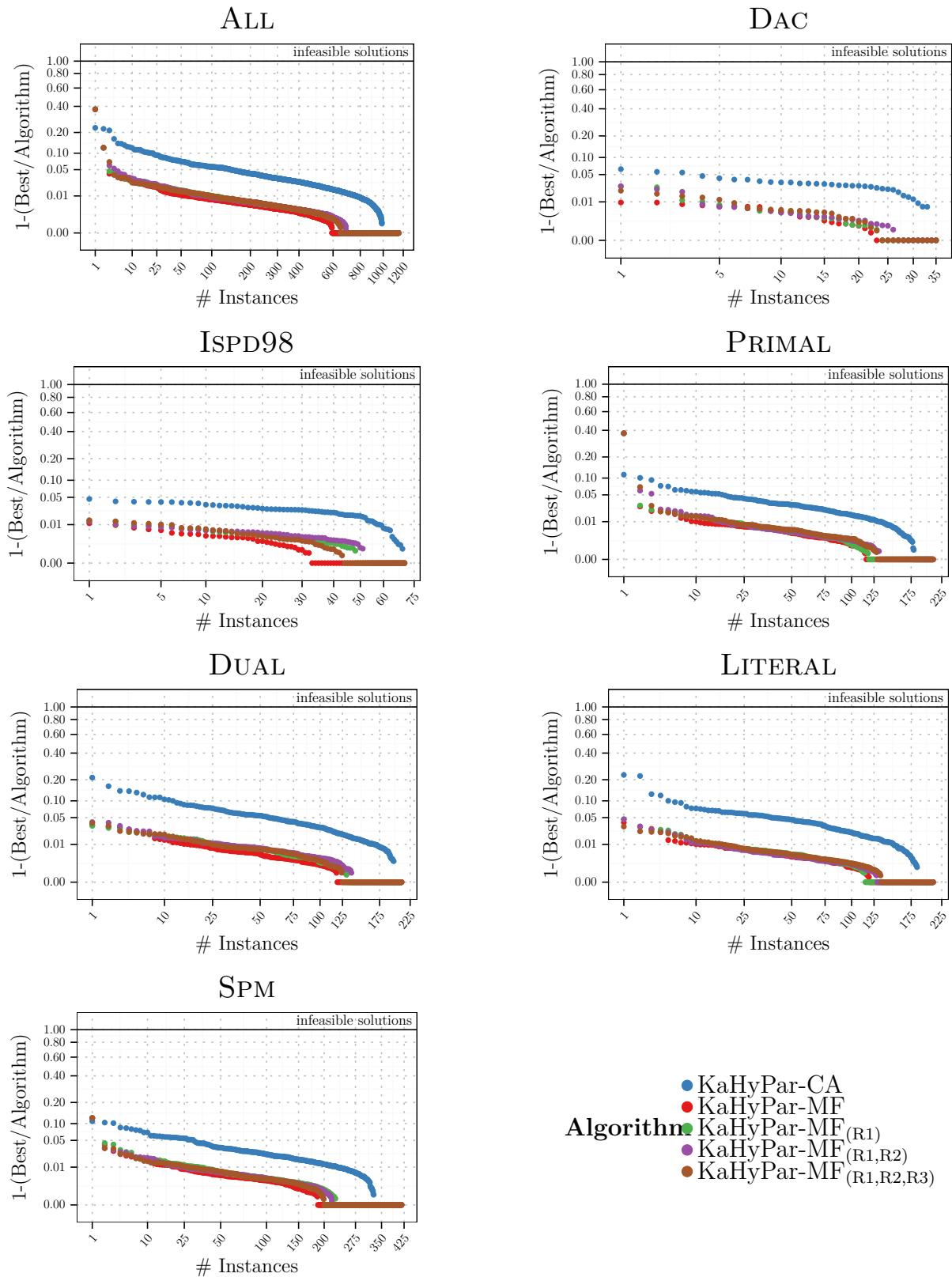


Figure 4: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA. M2 - BOYKOV-KOLMOGOROV

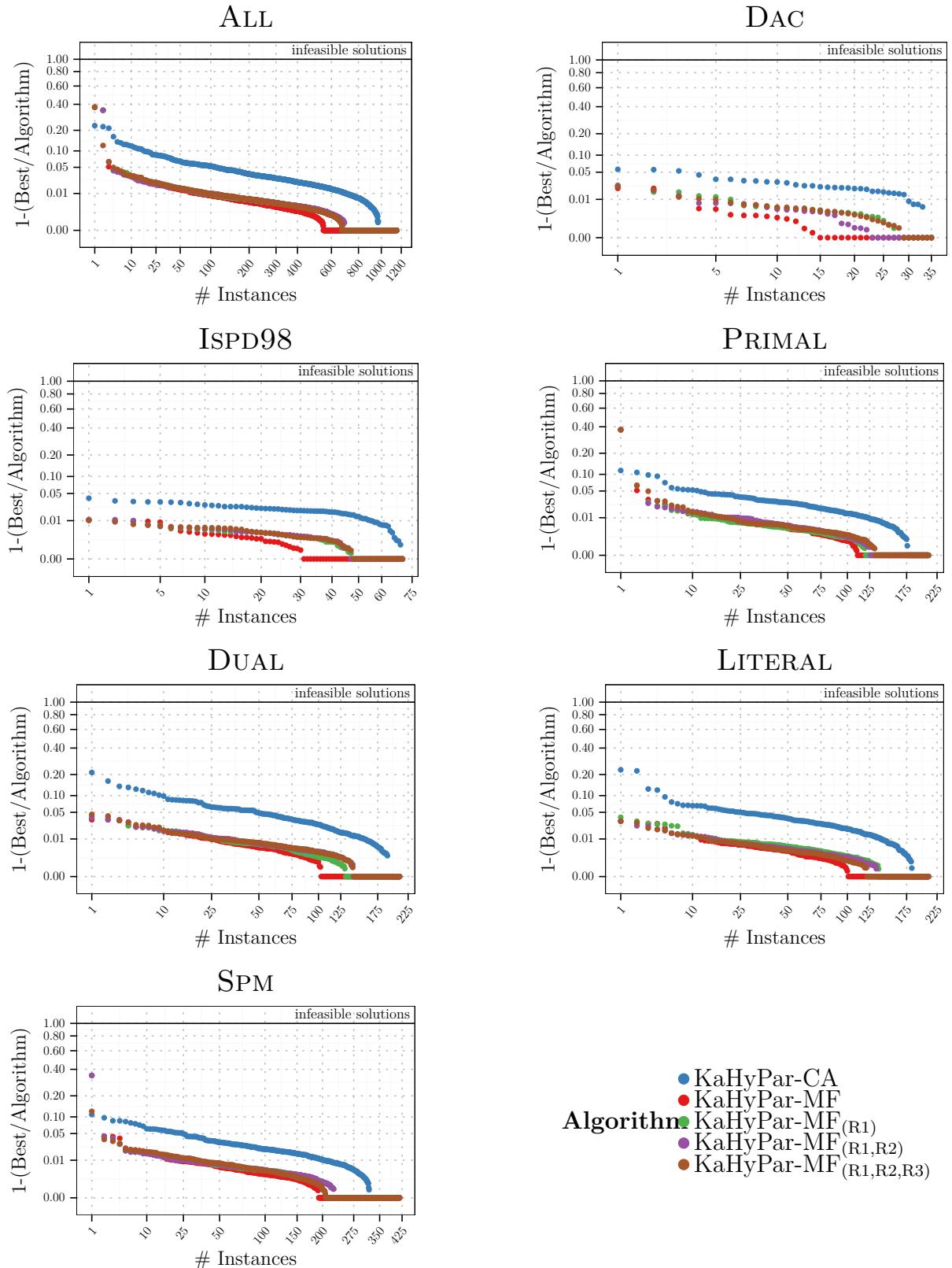


Figure 5: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA. M1 - GOLDBERG-TARJAN

## 1.4 Comparison with other Hypergraph Partitioners

Partitioner	M2 - IBFS Running Time $t[s]$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-MF	55.67	504.27	20.83	61.78	119.51	97.21	27.40
KaHyPar-CA	31.05	368.97	12.35	32.91	64.65	68.27	13.91
hMetis-R	79.23	446.36	29.03	66.25	142.12	200.36	41.79
hMetis-K	57.86	240.92	23.18	44.23	94.89	125.55	35.95
PaToH-Q	5.89	28.34	1.89	6.90	9.24	10.57	3.42
PaToH-D	1.22	6.45	0.35	1.12	1.58	2.87	0.77
Partitioner	M2 - BOYKOV KOLMOGOROV Running Time $t[s]$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-MF	63.33	505.75	21.10	71.81	140.53	98.06	32.64
KaHyPar-CA	30.85	368.97	12.35	32.91	64.65	68.27	13.63
hMetis-R	78.47	446.36	29.03	66.25	142.12	200.36	40.64
hMetis-K	57.36	240.92	23.18	44.23	94.89	125.55	35.08
PaToH-Q	5.84	28.34	1.89	6.90	9.24	10.57	3.35
PaToH-D	1.21	6.45	0.35	1.12	1.58	2.87	0.75
Partitioner	M1 - GOLDBERG TARJAN Running Time $t[s]$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-MF	62.24	637.58	22.29	71.63	140.84	106.24	29.61
KaHyPar-CA	31.05	368.97	12.35	32.91	64.65	68.27	13.91
hMetis-R	79.23	446.36	29.03	66.25	142.12	200.36	41.79
hMetis-K	57.86	240.92	23.18	44.23	94.89	125.55	35.95
PaToH-Q	5.89	28.34	1.89	6.90	9.24	10.57	3.42
PaToH-D	1.22	6.45	0.35	1.12	1.58	2.87	0.77

Table 9: Comparing the average running time of KaHyPar-MF with KaHyPar-CA and other hypergraph partitioners.

Partitioner	M2 - IBFS						
	Average $\lambda - 1$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-MF	7782.51	17 476.91	5643.99	15 863.75	15 770.06	3038.55	6143.73
KaHyPar-CA	2.51	3.13	2.21	2.08	2.74	3.51	2.11
hMetis-R	15.75	3.66	1.63	2.07	2.79	43.42	19.65
hMetis-K	15.25	8.48	1.39	4.05	9.28	28.64	19.52
PaToH-Q	9.49	13.59	7.93	12.14	13.35	8.79	6.75
PaToH-D	16.75	23.78	15.09	18.27	21.54	18.30	12.90
Partitioner	M2 - BOYKOV KOLMOGOROV						
	Average $\lambda - 1$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-MF	7727.97	17 480.70	5644.61	15 863.61	15 769.49	3038.31	6027.03
KaHyPar-CA	2.49	3.11	2.20	2.08	2.74	3.51	2.08
hMetis-R	15.79	3.64	1.62	2.07	2.80	43.44	19.77
hMetis-K	15.25	8.46	1.38	4.05	9.29	28.65	19.54
PaToH-Q	9.51	13.57	7.92	12.14	13.35	8.80	6.79
PaToH-D	16.77	23.75	15.08	18.27	21.54	18.31	12.92
Partitioner	M1 - GOLDBERG TARJAN						
	Average $\lambda - 1$						
	ALL	DAC	ISPD98	PRIMAL	LITERAL	DUAL	SPM
KaHyPar-MF	7819.11	17 590.10	5671.37	15 923.74	15 844.61	3061.94	6165.74
KaHyPar-CA	2.03	2.47	1.72	1.69	2.25	2.71	1.75
hMetis-R	15.21	2.99	1.14	1.69	2.31	42.33	19.22
hMetis-K	14.71	7.78	0.90	3.66	8.77	27.66	19.09
PaToH-Q	8.98	12.86	7.41	11.72	12.81	7.96	6.37
PaToH-D	16.21	22.98	14.54	17.83	20.97	17.40	12.50

Table 10: Comparison of average ( $\lambda - 1$ ) metric of KaHyPar-MF with KaHyPar-CA and other partitioners on different benchmark types. The results are in percentage relative to KaHyPar-MF.

Partitioner	M2 - IBFS						
	Running Time $t[s]$						
	$k = 2$	$k = 4$	$k = 8$	$k = 16$	$k = 32$	$k = 64$	$k = 128$
KaHyPar-MF	19.75	32.89	47.52	60.38	78.50	100.34	119.15
KaHyPar-CA	12.68	17.16	23.88	31.01	41.69	57.35	76.61
hMetis-R	27.87	51.59	74.74	91.09	109.13	128.66	149.34
hMetis-K	25.47	32.27	42.50	53.41	74.00	109.12	152.92
PaToH-Q	1.93	3.61	5.44	7.01	8.40	10.06	11.44
PaToH-D	0.43	0.77	1.12	1.42	1.71	2.02	2.29

Partitioner	M2 - BOYKOV-KOLMOGOROV						
	Running Time $t[s]$						
	$k = 2$	$k = 4$	$k = 8$	$k = 16$	$k = 32$	$k = 64$	$k = 128$
KaHyPar-MF	23.56	39.84	56.44	68.69	86.73	108.35	125.74
KaHyPar-CA	12.68	17.02	23.70	30.78	41.38	56.95	76.05
hMetis-R	27.87	51.03	73.94	90.09	107.94	127.26	147.72
hMetis-K	25.47	31.92	42.06	52.87	73.30	108.15	151.63
PaToH-Q	1.93	3.58	5.39	6.95	8.32	9.97	11.34
PaToH-D	0.43	0.76	1.11	1.40	1.69	2.00	2.27

Partitioner	M1 - GOLDBERG-TARJAN						
	Running Time $t[s]$						
	$k = 2$	$k = 4$	$k = 8$	$k = 16$	$k = 32$	$k = 64$	$k = 128$
KaHyPar-MF	22.13	38.51	55.04	67.83	85.75	108.97	128.04
KaHyPar-CA	12.68	17.16	23.88	31.01	41.69	57.35	76.61
hMetis-R	27.87	51.59	74.74	91.09	109.13	128.66	149.34
hMetis-K	25.47	32.27	42.50	53.41	74.00	109.12	152.92
PaToH-Q	1.93	3.61	5.44	7.01	8.40	10.06	11.44
PaToH-D	0.43	0.77	1.12	1.42	1.71	2.02	2.29

Table 11: Comparing the average running time of KaHyPar-MF with KaHyPar-CA and other partitioners for different values of  $k$ .

Partitioner	M2 - IBFS						
	Average $\lambda - 1$						
	$k = 2$	$k = 4$	$k = 8$	$k = 16$	$k = 32$	$k = 64$	$k = 128$
KaHyPar-MF	1057.93	3130.20	6032.58	9362.55	14 693.96	21 893.59	31 706.57
KaHyPar-CA	2.32	2.64	2.88	2.75	2.54	2.29	2.09
hMetis-R	27.19	18.93	16.92	15.78	12.81	10.66	8.47
hMetis-K	27.59	17.85	15.76	15.60	11.76	10.26	8.49
PaToH-Q	11.74	9.12	9.11	10.00	9.33	9.02	8.08
PaToH-D	15.29	16.60	19.15	19.89	16.10	15.75	14.50

Partitioner	M2 - BOYKOV-KOLMOGOROV						
	Average $\lambda - 1$						
	$k = 2$	$k = 4$	$k = 8$	$k = 16$	$k = 32$	$k = 64$	$k = 128$
KaHyPar-MF	1057.94	3105.80	5988.27	9292.89	14 582.34	21 735.78	31 477.02
KaHyPar-CA	2.32	2.62	2.86	2.73	2.55	2.28	2.08
hMetis-R	27.19	18.98	16.97	15.81	12.86	10.70	8.49
hMetis-K	27.59	17.84	15.75	15.58	11.78	10.25	8.48
PaToH-Q	11.74	9.14	9.14	10.01	9.38	9.05	8.10
PaToH-D	15.29	16.60	19.17	19.91	16.15	15.78	14.52

Partitioner	M1 - GOLDBERG-TARJAN						
	Average $\lambda - 1$						
	$k = 2$	$k = 4$	$k = 8$	$k = 16$	$k = 32$	$k = 64$	$k = 128$
KaHyPar-MF	1064.06	3147.96	6062.80	9406.00	14 756.03	21 978.89	31 820.94
KaHyPar-CA	1.73	2.06	2.36	2.28	2.11	1.90	1.73
hMetis-R	26.46	18.26	16.34	15.25	12.33	10.23	8.08
hMetis-K	26.86	17.19	15.18	15.06	11.29	9.83	8.10
PaToH-Q	11.10	8.50	8.57	9.49	8.87	8.60	7.70
PaToH-D	14.62	15.94	18.55	19.34	15.62	15.31	14.09

Table 12: Comparison of average ( $\lambda - 1$ ) metric of KaHyPar-MF with KaHyPar-CA and other partitioners for different values of  $k$ . The results are in percentage relative to KaHyPar-MF.

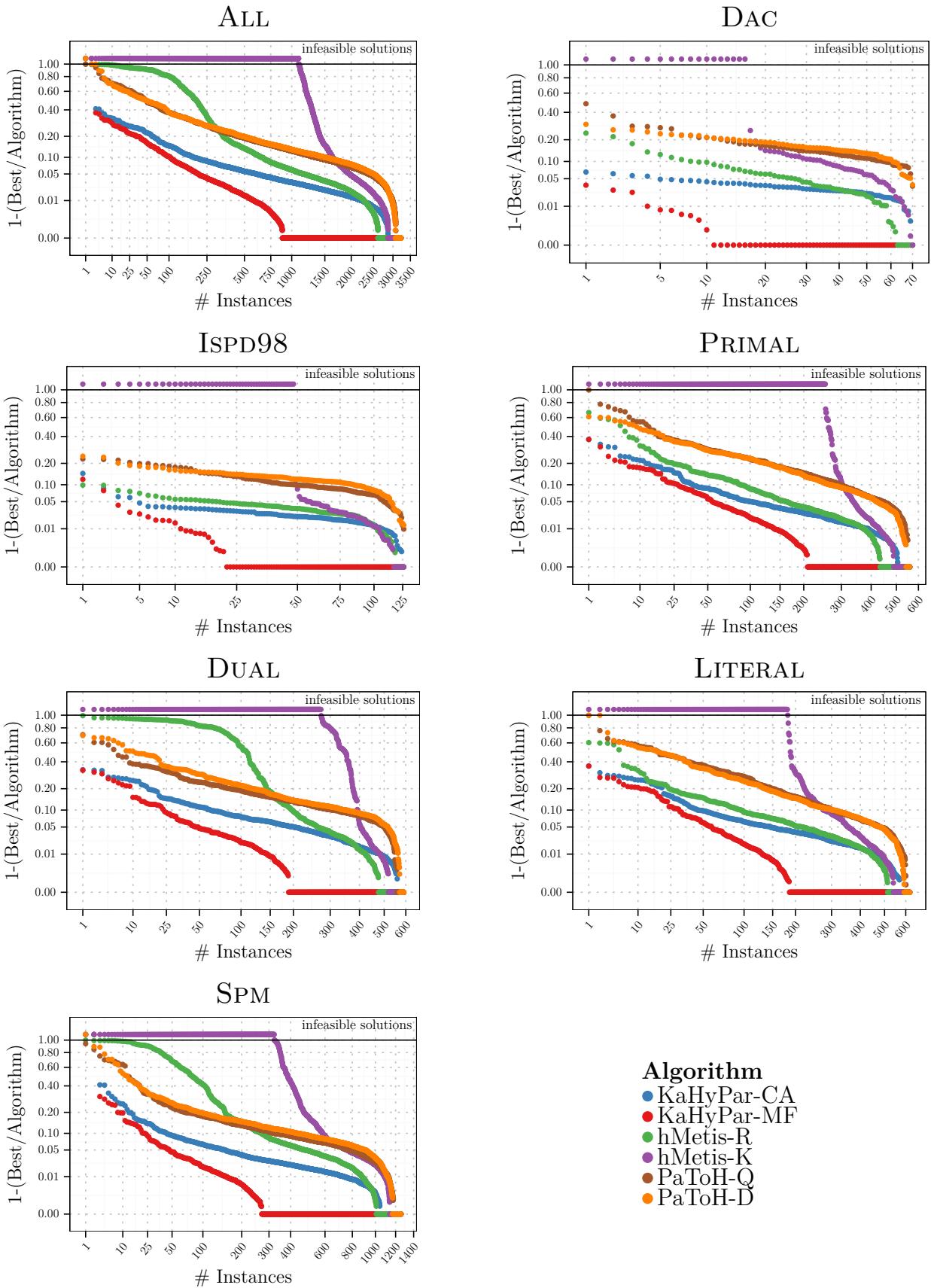


Figure 6: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA and other partitioners. M2 - IBFS

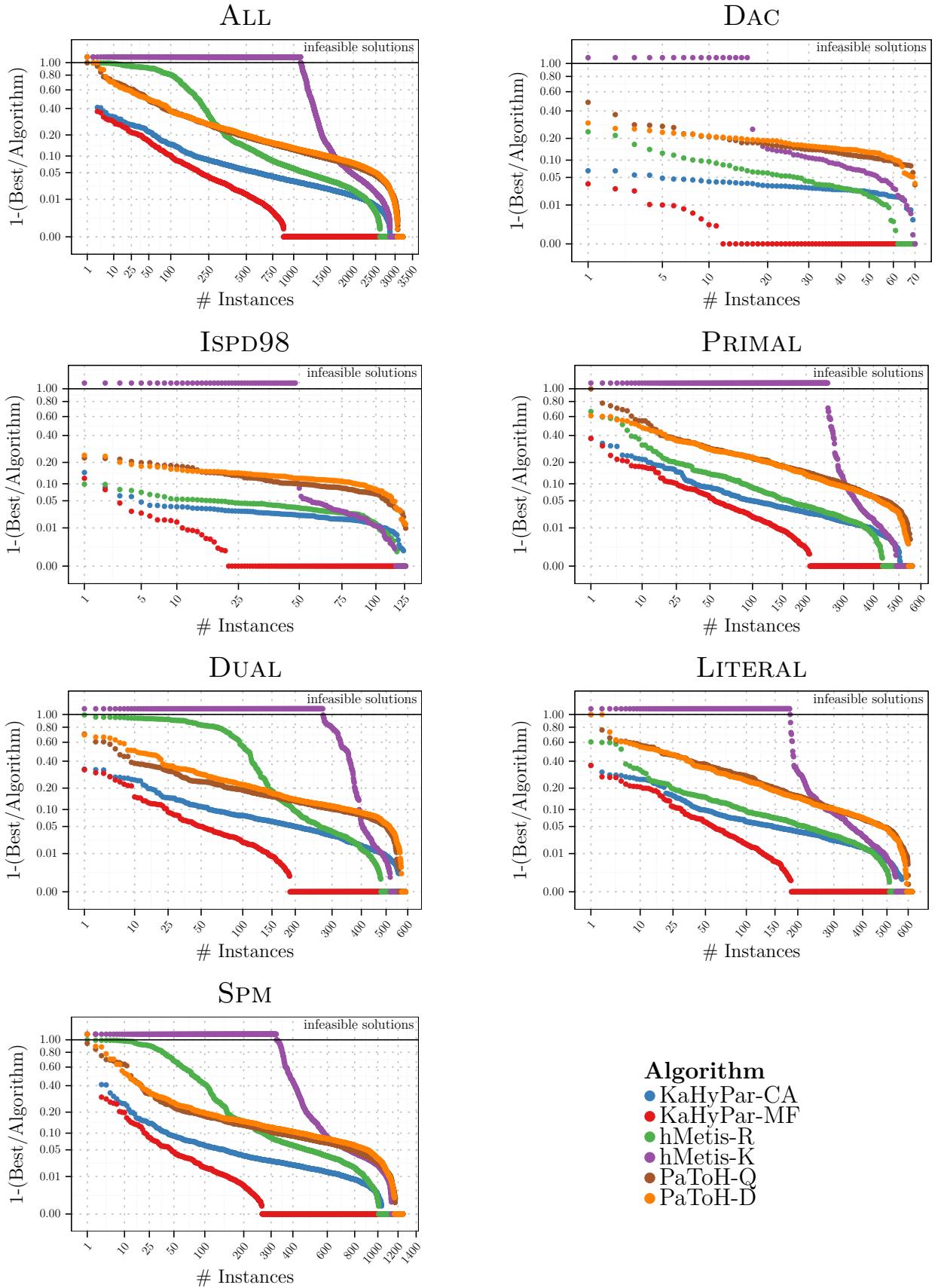


Figure 7: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA and other partitioners. M2 - BOYKOVKOLMOGOROV

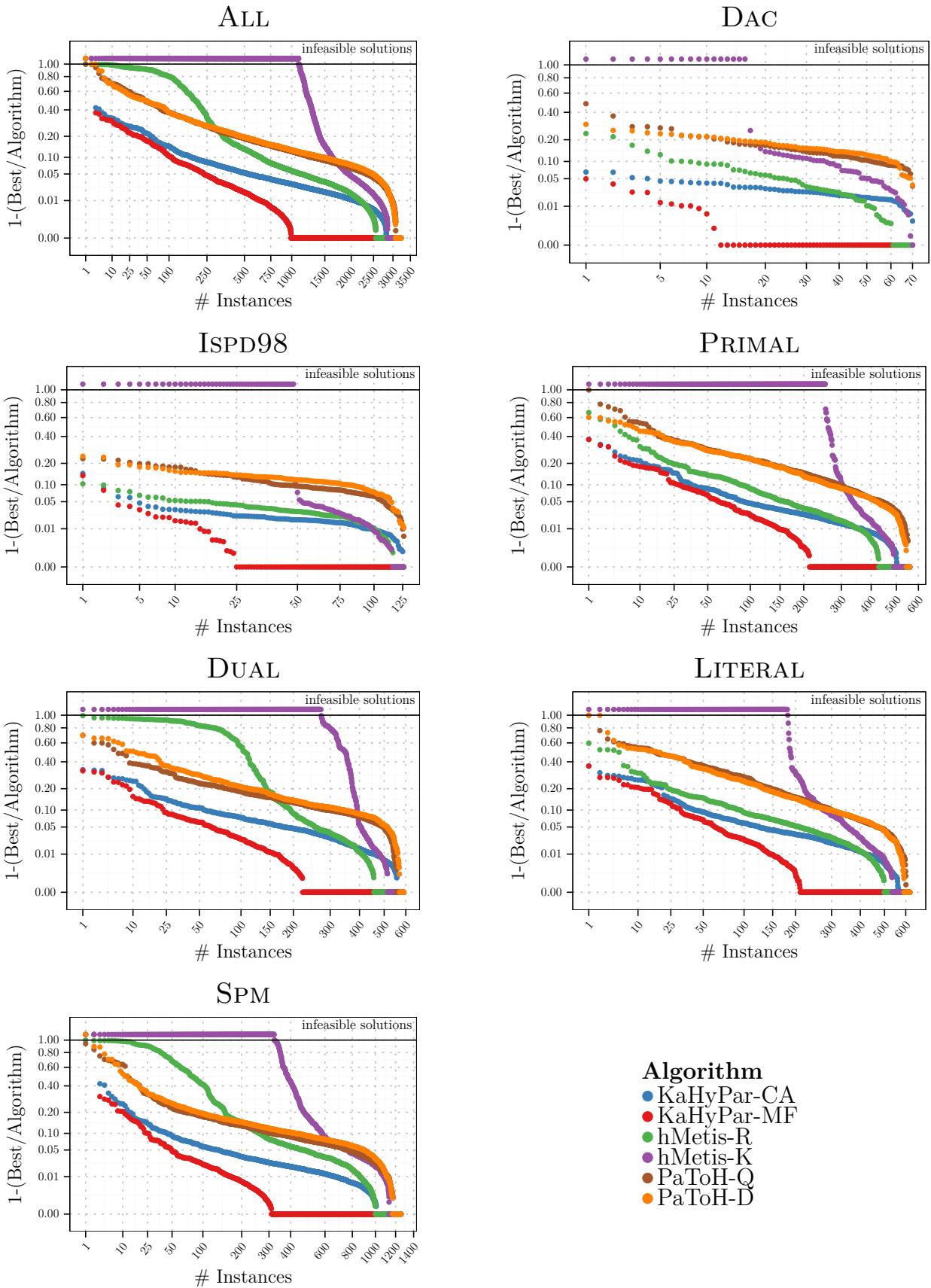


Figure 8: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA and other partitioners. M1 - GOLDBERG-TARJAN

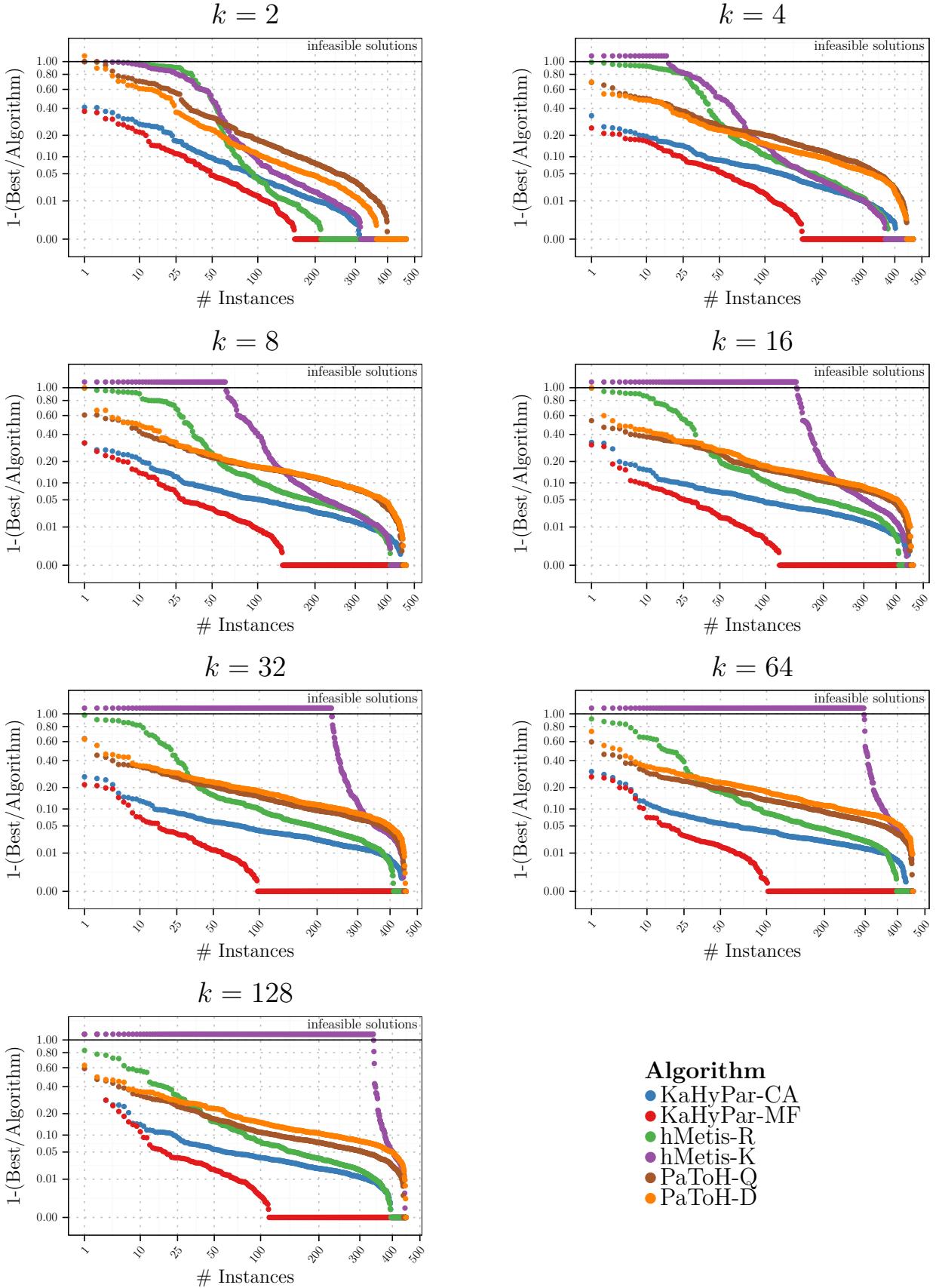


Figure 9: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA and other partitioners for different values of  $k$ . M2 - IBFS

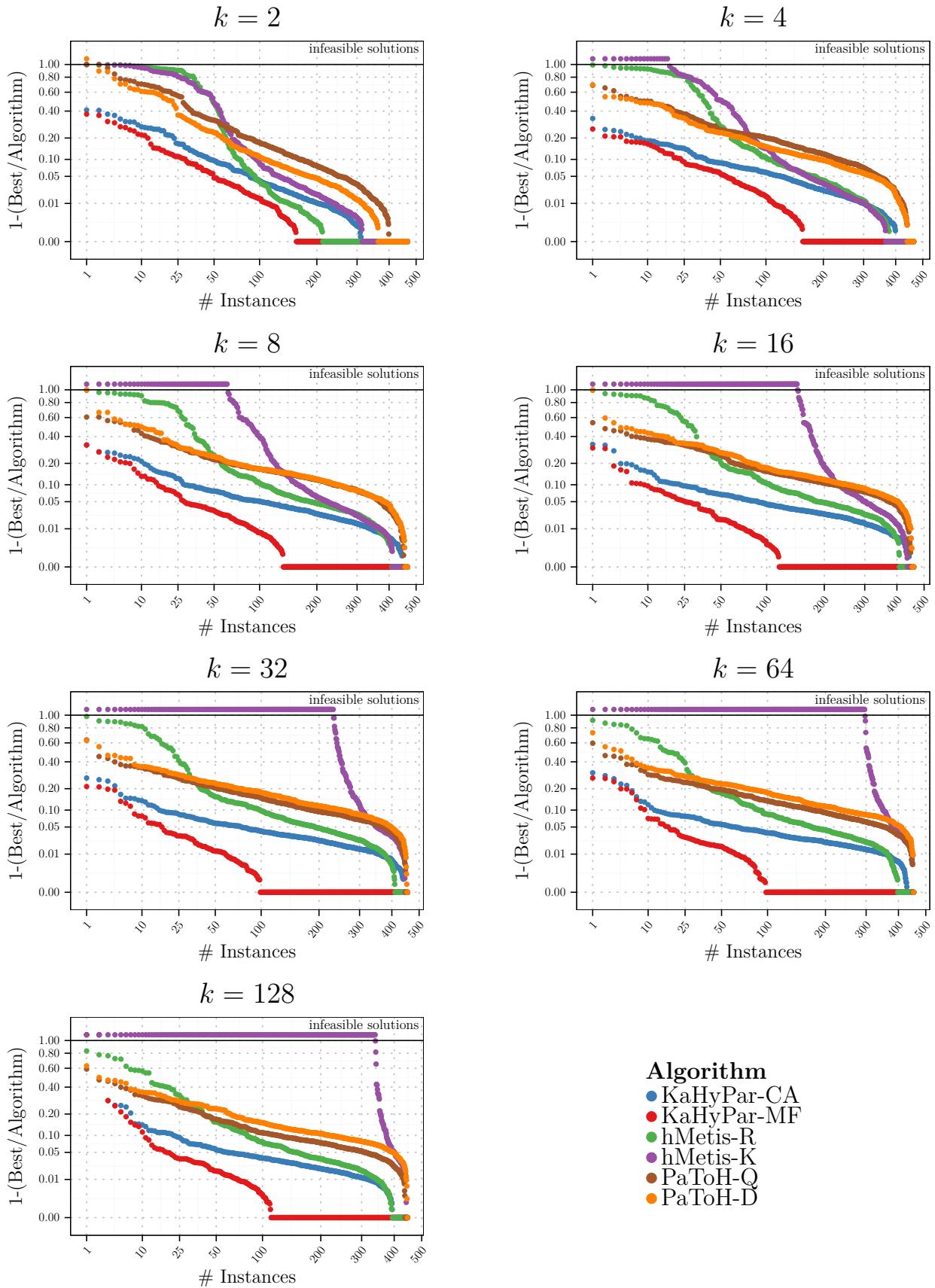


Figure 10: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA and other partitioners for different values of  $k$ . M2 - BOYKOVKOLMOGOROV

# 1 EXPERIMENTAL RESULTS

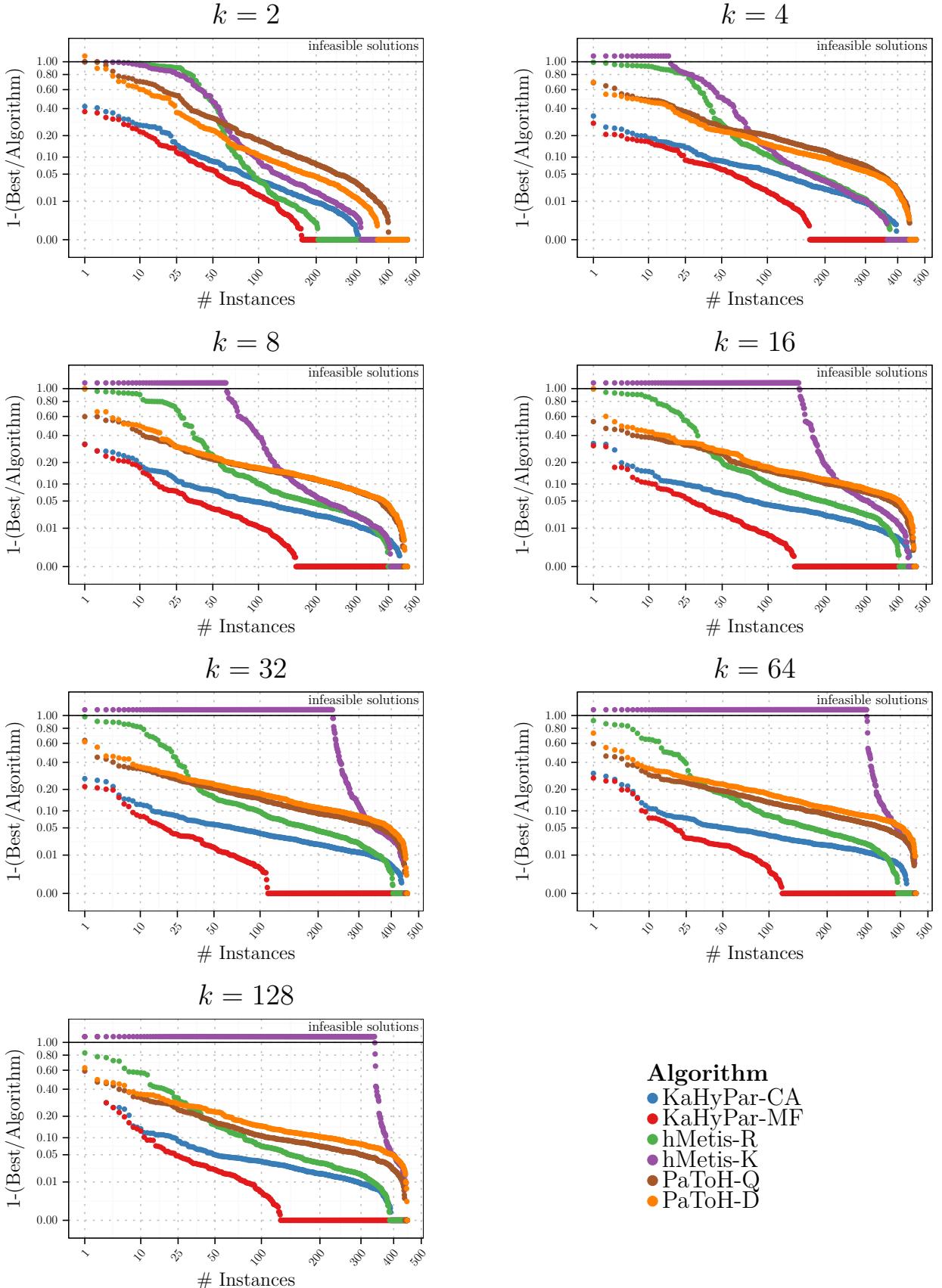


Figure 11: Min-Cut performance plots comparing KaHyPar-MF with KaHyPar-CA and other partitioners for different values of  $k$ . M1 - GOLDBERG-TARJAN