

Table 1: Comparison between IMMAS and LP-MMAS-LS on instances having k_{min} .

Instance	LP-MMAS-LS			IMMAS		
	Best	Avg.	Time(s)	Best	Avg.	Time(s)
4.1-min	1,150	1,150.0	1.8	1,150	1,150.0	1.0
4.2-min	1,205	1,205.8	1.5	1,205	1,205.0	0.4
4.3-min	1,213	1,215.4	2.3	1,214	1,215.0	1.0
4.4-min	1,189	1,190.6	1.3	1,185	1185.1	1.0
4.5-min	1,266	1,272.1	1.9	1,266	1,266.3	1.0
4.6-min	1,349	1,349.5	2.1	1,349	1,349.0	1.0
4.7-min	1,115	1,122.7	1.5	1,115	1,1115.3	0.6
4.8-min	1,225	1,226.3	1.3	1,225	1125.4	0.7
4.9-min	1,485	1,485.0	2.5	1,485	11845.0	1.0
4.10-min	1,360	1,360.4	1.5	1,356	1356	1.0
5.1-min	580	584.2	2.0	579	579.0	1.0
5.2-min	677	682.1	3.0	679	679.0	1.0
5.3-min	576	577.4	2.5	574	575.7	1.08
5.4-min	584	587.9	3.0	582	854.3	1.1
5.5-min	550	550.0	2.0	550	550.0	1.0
5.6-min	560	561.1	2.1	560	560.0	1.0
5.7-min	695	695.4	2.1	695	695.0	1.0
5.8-min	664	664.3	2.9	662	664.1	1.1
5.9-min	687	687.7	2.1	687	687.3	1.0
5.10-min	672	681.4	2.6	672	672.4	1.1
6.1-min	283	285.0	1.3	283	283.6	0.1
6.2-min	302	303.1	1.4	302	302.0	0.1
6.3-min	313	315.9	1.0	313	313.0	0.1
6.4-min	292	293.2	1.2	292	292.9	0.1
6.5-min	353	355.2	1.8	353	353.0	0.01
A.1-min	562	567.2	4.9	562	562.0	1.0
A.2-min	564	565.2	4.9	560	560.8	2.4
A.3-min	526	527.3	5.0	524	526.3	2.0
A.4-min	527	527.5	4.8	527	527.0	1.3
A.5-min	558	559.7	5.8	557	558.3	2.3
B.1-min	150	151.5	3.6	149	149.7	1.1
B.2-min	150	150.9	3.9	150	150.6	1.4
B.3-min	165	166.8	4.8	165	165.2	1.1
B.4-min	157	157.9	3.5	157	157.8	1.2
B.5-min	152	154.2	3.1	151	152.2	1.3
C.1-min	516	522.4	8.5	514	515.6	3.7
C.2-min	490	491.4	7.1	483	486.6	3.3
C.3-min	546	546.2	7.1	544	545.1	2.3
C.4-min	485	485.1	6.5	484	484.2	2.9
C.5-min	488	489.5	7.4	488	489.3	4.4
D.1-min	123	124.1	5.0	122	122.4	2.1
D.2-min	127	127.4	4.8	127	127.1	1.9
D.3-min	138	140.4	5.5	138	138.6	2.3
D.4-min	123	124.2	5.4	122	122.8	1.9
D.5-min	131	131.2	5.3	130	130.3	2.1

Table 2: Comparison between IMMAS and LP-MMAS-LS on instances having k_{med} .

Instance	LP-MMAS-LS			IMMAS		
	Best	Avg.	Time(s)	Best	Avg.	Time(s)
4.1-med	8,373	8,373.3	4.8	8,367	8371.1	3.0
4.2-med	6,123	6,132.7	3.5	6,117	6123.5	2.4 1
4.3-med	4,681	4,686.5	2.9	4,681	4681.7	1.6
4.4-med	4,683	4,683.5	3.3	4,679	4684.4	2.6
4.5-med	8,400	8,402.0	3.6	8,400	8400.7	2.1
4.6-med	6,427	6,441.0	3.9	6,427	6436.3	2.7
4.7-med	6,282	6,286.4	2.8	6,282	6284.7	1.4
4.8-med	8,435	8,453.1	4.0	8,427	8439.2	2.9
4.9-med	7,127	7,152.4	3.8	7,107	7111.6	2.3
4.10-med	5,367	5,382.5	3.8	5,358	5366.9	1.8
5.1-med	11,226	11,235.5	8.9	11,213	11218.1	7.9
5.2-med	14,443	14,463.1	8.8	14,431	14447.4	10.2
5.3-med	11,532	11,536.1	9.8	11,501	11519.9	10.4
5.4-med	9,970	9,974.5	7.6	9,956	9966.9	8.1
5.5-med	10,888	10,920.1	8.4	10,888	10897.8	8.5
5.6-med	10,609	10,639.1	7.1	10,601	10607.4	7.1
5.7-med	14,940	14,990.2	12.6	14,930	14966.6	13.4
5.8-med	10,639	10,666.1	7.8	10,634	10649.2	7.7
5.9-med	11,071	11,088.2	8.5	11,051	11071.4	9.5
5.10-med	12,469	12,480.5	10.0	12,452	12464.3	8.9
6.1-med	7,679	7,711.2	6.4	7,672	7692.4	4
6.2-med	6,760	6,779.1	5.8	6,760	6776.2	3.4
6.3-med	8,350	8,364.9	6.3	8,336	8355.4	4.3
6.4-med	8,569	8,579.7	5.4	8,554	8575.7	4.0
6.5-med	9,068	9,072.3	5.8	9,060	9069.2	3.4
A.1-med	21,297	21,331.4	30.4	21,251	21293.4	34.9
A.2-med	21,810	21,823.9	30.5	21,772	21816.2	40.8
A.3-med	20,165	20,205.3	32.6	20,137	20173.8	38.9
A.4-med	22,959	22,976.3	31.6	22,901	22947.7	41.2
A.5-med	18,709	18,730.9	29.6	18,676	18703.0	32.8
B.1-med	29,214	29,245.9	58.4	29,216	29265.4	62.8
B.2-med	28,175	28,177.4	56.0	28,150	28191.2	61.1
B.3-med	27,934	27,928.3	52.1	27,896	27933.9	56.3
B.4-med	25,764	25,741.6	37.4	25,704	25753.9	65.7
B.5-med	28,295	28,336.1	52.3	28,263	28321.6	70.7
C.1-med	32,730	32,750.2	98.4	32,684	32742.0	103.4
C.2-med	32,837	32,844.1	73.3	32,786	32845.7	96.4
C.3-med	34,553	34,558.1	83.0	34,497	34556.3	77.4
C.4-med	31,466	31,468.1	74.9	31,422	31478.4	100.1
C.5-med	30,116	30,144.0	77.9	30,107	30138.9	89.6
D.1-med	39,091	39,071.6	105.3	39,042	39,062.3	112.2
D.2-med	39,090	39,100.1	103.62	39,056	39,085.4	150.2
D.3-med	39,256	39,291.9	114.8	39,228	39,284.5	111.3
D.4-med	38,835	38,851.5	116.3	38,816	38,842.4	122.1
D.5-med	40,401	40,398.9	120.6	40,389	40,401.1	134.6

Table 3: Comparison between IMMAS and LP-MMAS-LS on instances having k_{max} .

Instance	LP-MMAS-LS			IMMAS		
	Best	Avg.	Time(s)	Best	Avg.	Time(s)
4.1-max	18,265	18,296.4	10.0	18,270	18273.6	4.1
4.2-max	12,378	12,393.7	8.1	12,380	12,395.6	5.4
4.3-max	10,397	10,402.7	8.1	10,397	10,402.1	3.0
4.4-max	10,415	10,430.1	5.4	10,408	10,416.0	2.9
4.5-max	18,861	18,870.6	6.4	18,858	18,859.6	4.5
4.6-max	15,426	15,431.3	5.6	15,415	15,425.9	4.0
4.7-max	15,261	15,263.4	6.1	15,248	15,258.5	5.3
4.8-max	18,635	18,629.1	6.5	18,616	18,638.9	4.2
4.9-max	16,586	16,592.9	6.7	16,570	16,577.4	5.8
4.10-max	11,615	11,622.03	4.8	11,617	11,624.5	2.3
5.1-max	35,722	35,768.1	29.6	35,687	35,735.5	25.3
5.2-max	45,449	45,471.5	29.4	45,428	45,440.0	31.8
5.3-max	36,374	36,390.1	30.37	36,353	36,387.3	25.7
5.4-max	28,044	28,077.4	21.5	28,036	28,052.6	12.7
5.5-max	32,808	32,851.9	25.3	32,814	32,827.0	20.2
5.6-max	29,656	29,681.6	24.5	29,630	29,667.0	20.3
5.7-max	41,964	41,998.3	33.1	41,955	41,966.7	23.9
5.8-max	32,358	32,395.8	26.1	32,344	32,372.1	18.9
5.9-max	33,600	33,634.3	23.8	33,607	33,627.6	21.5
5.10-max	38,779	38,798.8	29.8	38,756	38,793.6	26.6
6.1-max	23,559	23,581.9	11.6	23,562	23,573.7	6.8
6.2-max	19,980	20,000.3	11.8	19,971	19,987.9	6.4
6.3-max	28,021	28,051.5	11.4	28,033	28,055.7	6.4
6.4-max	26,477	26,505.6	11.9	26,479	26,507.8	7.9
6.5-max	27,090	27,127.3	11.1	27,098	27,111.9	8.1
A.1-max	68,620	68,666.7	101.5	68,576	68,614.1	83.4
A.2-max	65,940	65,957.9	81.125	65,891	65,936.8	79.7
A.3-max	66,978	6,7021.2	97.3	66,932	66,969.3	91.1
A.4-max	72,436	72,462.9	90.9	72,362	72,417.3	98.8
A.5-max	60,609	60,653.1	88.4	60,543	60,581.6	76.8
B.1-max	105,580	105,622.0	120.87	105,540	105,589.6	131.7
B.2-max	102,988	103,027.0	121.6	102,960	102,966.3	133.4
B.3-max	98,334	98,413.9	115.25	98,314	98,362.4	128.5
B.4-max	93,797	93,856.5	118.12	93,776	93,818.8	138.1
B.5-max	102,878	102,909.9	122.1	102,845	102,903.8	127.4
C.1-max	112,595	112,636.5	216.87	112,555	112,618.5	219.6
C.2-max	114,017	114,105.1	217.12	114,016	114,068.7	270.7
C.3-max	117,505	117,609.12	210.6	117,504	117,558.2	252.2
C.4-max	110,945	111,003.4	228.0	110,905	110,976.5	251.6
C.5-max	104,509	104,595.0	208.8	104,482	104,558.5	271.7
D.1-max	144,891	144,959.0	193.0	144,881	144,952.2	341.2
D.2-max	144,165	144,209.6	190.00	144,108	144,172.2	322.8
D.3-max	140,542	140,630.7	216.75	140,540	140,616.9	370.2
D.4-max	143,470	143,541.1	172.25	143,463	143,527.7	306.8
D.5-max	146,308	146,388.1	181.75	146,296	146,354.0	311.1