

Additional Tables

Tables 1 - 2 report results only for instances for which at least one feasible solution has been found within 480 seconds. Each table row is the average across instances belonging to class $(H, K, N, *)$, under the following column
5 headings.

- T - average computational time in seconds;
- D : average value of the gap between the objective function value z of the determined solution and the optimal solution z_{BK} , i.e.

$$D := \frac{z - z_{BK}}{z_{BK}} \%,$$

For instances not solved to optimality z_{BK} represents the best solution determined with a time limit of 3600 seconds.

- C : average value of the percentage of negative interactions computed as

$$C := \frac{total_{neg}}{total_{neg} + total_{pos}} \%,$$

10 where $total_{neg}$ and $total_{pos}$ are the total number of, respectively, negative interactions and positive interactions triggered by the CPLP solution of the *Soft*-instance.

Results show that for both *Hard* and *Soft* variants of *IV* model, CP-Optimizer took (on average) less than 20 seconds to find the optimal solution for about 420 instances out to 572 and less than 35 seconds to determine at least one
15 feasible solution for all 572 instances. On the other hand the OR-Tools determined a feasible solution within 202 (166) seconds on average for 540 (551) out of 572 instances of the *Soft* (*Hard*) variant of *IP* model. Both solver were able to determine feasible solutions with a gap D lower than 1% on average. Nevertheless, CP-Optimizer determined such high-quality solutions within the
20 first 60 seconds. As far as the percentage C of negative interactions associated to *Soft*-instances, we observe that both models provided solutions that were almost always feasible for the *Hard* variant (i.e. $C = 0.00\%$).

Table 1: Computational results: hard

H	K	N	count	CP Optimizer						OR-Tools									
				TL = 60s		TL = 120s		TL = 240s		TL = 480s		TL = 60s		TL = 120s		TL = 240s		TL = 480s	
				T [s]	D [%]	T [s]	D [%]	T [s]	D [%]	T [s]	D [%]	T [s]	D [%]	T [s]	D [%]	T [s]	D [%]	T [s]	D [%]
2	6	33	25	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	12.1	0.7	16.4	0.4	26.0	0.2	45.2	0.0
		60	25	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	11.6	0.0	21.2	0.2	40.5	0.0	78.9	0.0
		100	25	2.6	0.0	3.2	0.0	3.2	0.0	3.2	0.0	14.0	0.0	19.9	0.3	34.3	0.0	44.2	0.0
		135	25	7.3	0.0	14.5	0.0	28.5	0.0	30.5	0.0	16.9	0.0	33.7	0.0	67.3	0.0	134.6	0.9
		8	100	25	4.9	0.0	9.7	0.0	19.3	0.0	38.5	0.0	15.8	0.0	30.2	0.0	59.0	0.0	116.6
4	6	33	25	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	13.8	0.0	22.2	0.0	41.4	0.0	79.8	0.0
		60	25	10.0	0.0	18.1	0.0	32.5	0.0	61.3	0.0	11.9	0.5	21.5	0.4	40.7	0.2	79.1	0.1
		100	25	14.6	0.1	29.0	0.1	57.8	0.1	111.1	0.1	17.5	0.7	34.3	0.8	60.0	0.4	117.6	0.0
		135	25	10.3	0.0	19.9	0.0	34.4	0.0	63.2	0.0	15.7	0.0	26.8	0.1	50.8	0.0	98.9	0.0
		8	100	25	12.8	0.1	24.8	0.0	47.2	0.0	85.6	0.0	21.3	1.3	35.4	0.0	64.2	0.0	121.8
6	6	33	25	13.6	2.7	25.6	2.7	45.6	2.7	84.0	2.7	26.4	3.6	46.4	4.5	84.8	2.9	161.6	3.8
		60	25	15.2	0.4	28.9	0.4	52.9	0.1	100.9	0.1	24.4	0.7	46.0	0.0	89.2	0.0	167.1	0.0
		100	25	25.8	0.3	47.4	0.2	90.6	0.1	177.0	0.1	28.9	1.5	50.9	1.1	94.1	1.4	180.5	0.8
		135	25	17.6	0.2	34.4	0.0	68.0	0.0	135.2	0.0	20.0	0.1	36.8	0.1	70.4	0.0	137.6	0.2
		8	100	25	19.6	0.0	38.8	0.0	77.2	0.0	154.0	0.0	21.8	0.4	41.0	0.5	79.4	0.5	156.3
8	6	33	25	19.5	0.0	36.3	0.0	69.9	0.0	135.6	0.0	20.4	0.9	37.4	0.7	71.0	0.3	138.2	0.0
		60	25	22.6	0.8	44.2	0.5	84.9	0.5	161.7	0.5	34.8	4.4	64.7	3.6	108.6	2.1	195.0	1.8
		100	25	24.2	0.5	44.3	0.4	82.7	0.0	159.5	0.0	38.2	2.7	71.8	0.0	129.4	2.0	233.3	0.5
		135	25	41.0	1.4	72.7	1.0	132.7	0.9	252.7	0.8	42.0	4.3	72.9	3.5	132.9	2.4	252.9	3.6
		8	60	20	33.5	0.2	63.5	0.2	123.5	0.2	243.5	0.2	51.0	1.4	90.7	0.9	168.7	0.8	324.7
8	8	33	20	31.7	1.3	61.7	0.0	121.7	0.0	241.7	0.0	37.7	2.7	70.7	2.2	136.7	0.8	267.7	0.6
		60	20	31.0	0.7	61.0	0.3	121.0	0.3	241.0	0.3	37.1	2.7	67.1	2.2	127.1	1.6	247.1	1.1
		100	20	42.5	1.7	79.2	0.6	147.8	0.6	275.6	0.5	54.8	3.9	106.0	3.6	199.5	4.9	378.2	0.8
		135	21	41.1	1.2	73.3	0.3	131.5	0.3	245.8	0.3	56.8	5.1	109.7	3.1	205.6	5.9	381.9	3.0
		Average		17.8	0.5	33.3	0.3	62.7	0.2	119.3	0.2	25.9	1.5	47.2	1.1	87.6	1.0	166.0	0.7

Table 2: Computational results: soft

H	K	N	CP Optimizer												OR-Tools																				
			TL = 60s				TL = 120s				TL = 240s				TL = 480s				TL = 60s				TL = 120s				TL = 240s				TL = 480s				
T	D	C	%	T	D	C	%	T	D	C	%	T	D	C	%	T	D	C	%	T	D	C	%	T	D	C	%	T	D	C	%	T	D	C	%
2	6	33	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	9.1	0.2	0.0	0.0	13.9	0.3	0.0	0.0	23.5	0.7	0.0	0.0	42.7	0.0	0.0	0.0	
		60	3.1	0.0	0.0	0.0	3.1	0.0	0.0	0.0	3.1	0.0	0.0	0.0	3.1	0.0	0.0	0.0	17.9	0.0	0.0	0.0	30.4	0.2	0.0	0.0	59.3	0.0	0.0	0.0	116.9	0.0	0.0	0.0	
		100	2.7	0.0	0.0	0.0	3.2	0.0	0.0	0.0	3.2	0.0	0.0	0.0	3.2	0.0	0.0	0.0	19.3	0.0	0.0	0.0	37.7	0.0	0.0	0.0	65.4	0.0	0.0	0.0	93.3	0.0	0.0	0.0	
8	135	100	7.4	0.0	0.0	0.0	14.6	0.0	0.0	0.0	28.5	0.0	0.0	0.0	31.7	0.0	0.0	0.0	19.3	0.0	0.0	0.0	38.5	0.4	0.0	0.0	76.9	0.0	0.0	0.0	150.8	0.0	0.0	0.0	
		135	5.0	0.0	0.0	0.0	9.8	0.0	0.0	0.0	19.4	0.0	0.0	0.0	38.6	0.0	0.0	0.0	17.2	0.0	0.0	0.0	34.0	0.0	0.0	0.0	67.6	0.0	0.0	0.0	134.8	0.0	0.0	0.0	
		135	2.9	0.0	0.0	0.0	4.1	0.0	0.0	0.0	4.1	0.0	0.0	0.0	4.1	0.0	0.0	0.0	17.2	0.0	0.0	0.0	34.0	0.0	0.0	0.0	67.6	0.0	0.0	0.0	134.8	0.0	0.0	0.0	
4	6	33	10.3	0.0	0.0	0.0	18.3	0.0	0.0	0.0	32.7	0.0	0.0	0.0	61.5	0.0	0.0	0.0	20.0	0.8	4.0	0.0	39.2	0.1	0.0	0.0	77.7	0.0	0.0	0.0	154.5	0.0	0.0	0.0	
		60	14.5	0.1	0.0	0.0	28.9	0.1	0.0	0.0	57.7	0.1	0.0	0.0	107.7	0.1	0.0	0.0	22.1	1.5	0.0	0.0	43.7	0.4	0.0	0.0	86.9	0.4	0.0	0.0	173.3	0.3	0.0	0.0	
		100	11.9	0.0	0.0	0.0	21.5	0.0	0.0	0.0	40.7	0.0	0.0	0.0	79.1	0.0	0.0	0.0	22.1	1.7	0.0	0.0	44.3	1.1	0.0	0.0	87.5	1.0	0.0	0.0	169.0	0.0	0.0	0.0	
8	135	100	12.8	0.0	0.0	0.0	24.8	0.0	0.0	0.0	47.0	0.0	0.0	0.0	85.4	0.0	0.0	0.0	22.1	1.7	0.0	0.0	44.3	1.1	0.0	0.0	87.5	1.0	0.0	0.0	169.0	0.0	0.0	0.0	
		135	15.3	0.3	0.0	0.0	29.0	0.3	0.0	0.0	52.9	0.1	0.0	0.0	101.0	0.0	0.0	0.0	31.1	1.6	0.0	0.0	55.5	0.8	0.0	0.0	103.0	0.0	0.0	0.0	189.8	0.0	0.0	0.0	
		135	24.3	0.6	0.0	0.0	45.9	0.4	0.0	0.0	89.1	0.4	0.0	0.0	175.5	0.4	0.0	0.0	31.0	1.2	0.0	0.0	55.0	0.6	0.0	0.0	103.0	0.4	0.0	0.0	199.0	0.7	0.0	0.0	
6	6	33	15.5	0.1	0.0	0.0	34.3	0.0	0.0	0.0	67.9	0.0	0.0	0.0	135.1	0.0	0.0	0.0	27.7	0.5	0.0	0.0	51.7	0.2	0.0	0.0	99.7	0.1	0.0	0.0	195.7	0.2	0.0	0.0	
		60	17.5	0.0	0.0	0.0	38.8	0.0	0.0	0.0	77.2	0.0	0.0	0.0	154.0	0.0	0.0	0.0	26.1	1.0	0.0	0.0	50.1	0.9	0.0	0.0	98.1	0.5	0.0	0.0	194.1	0.6	0.0	0.0	
		100	19.6	0.0	0.0	0.0	44.3	0.0	0.0	0.0	68.1	0.0	0.0	0.0	130.3	0.0	0.0	0.0	26.7	1.9	0.0	0.0	50.7	1.3	0.0	0.0	98.1	0.6	0.0	0.0	194.1	0.6	0.0	0.0	
8	135	100	22.7	0.8	0.0	0.0	44.3	0.7	0.0	0.0	84.3	0.6	0.0	0.0	161.1	0.5	0.0	0.0	39.6	3.5	0.0	0.0	78.0	1.8	0.0	0.0	98.1	0.7	0.0	0.0	194.1	0.6	0.0	0.0	
		135	24.7	0.3	0.0	0.0	44.3	0.3	0.0	0.0	79.9	0.3	0.0	0.0	147.1	0.2	0.0	0.0	42.9	3.0	1.7	0.0	81.1	1.4	4.5	0.0	148.9	2.6	0.0	0.0	273.3	3.4	0.0	0.0	
		135	33.3	0.4	0.0	0.0	71.4	0.8	0.0	0.0	131.4	0.8	0.0	0.0	251.4	0.8	0.0	0.0	46.2	6.2	0.0	0.0	82.2	3.4	0.0	0.0	152.9	2.6	0.0	0.0	287.4	1.6	0.0	0.0	
8	60	33	33.3	0.8	0.0	0.0	63.3	0.4	0.0	0.0	123.3	0.4	0.0	0.0	243.3	0.4	0.0	0.0	54.0	2.5	0.0	0.0	95.5	2.4	0.0	0.0	173.5	0.8	0.0	0.0	329.5	0.8	0.0	0.0	
		100	32.0	1.8	0.0	0.0	62.0	1.2	0.0	0.0	122.0	0.7	0.0	0.0	242.0	0.5	0.0	0.0	43.4	3.4	0.0	0.0	78.5	2.4	0.0	0.0	138.9	2.6	0.0	0.0	258.9	1.9	0.0	0.0	
		135	31.2	0.3	0.0	0.0	61.2	0.3	0.0	0.0	121.2	0.3	0.0	0.0	241.2	0.3	0.0	0.0	41.3	7.8	0.0	0.0	71.4	3.1	0.0	0.0	131.4	2.4	0.0	0.0	251.4	1.6	0.0	0.0	
8	100	33	42.1	0.6	0.0	0.0	80.9	0.9	0.0	0.0	149.3	0.6	0.0	0.0	275.0	0.6	0.0	0.0	57.1	4.6	0.0	0.0	108.8	3.6	0.5	0.0	207.6	2.0	0.0	0.0	390.5	2.3	0.0	0.0	
		135	42.1	0.6	0.0	0.0	80.9	0.9	0.0	0.0	149.3	0.6	0.0	0.0	275.0	0.6	0.0	0.0	57.1	4.6	0.0	0.0	108.8	3.6	0.5	0.0	207.6	2.0	0.0	0.0	390.5	2.3	0.0	0.0	
		135	42.8	2.5	0.1	0.0	76.8	0.6	0.0	0.0	139.7	0.4	0.0	0.0	253.8	0.2	0.0	0.0	57.4	6.9	0.0	0.0	114.5	9.3	0.0	0.0	223.9	6.9	0.0	0.0	412.3	3.0	0.0	0.0	
Average			17.9	0.5	0.2	0.0	33.5	0.4	0.2	0.0	63.2	0.3	0.2	0.0	119.4	0.3	0.2	0.0	30.1	1.9	0.7	0.0	56.4	1.3	0.6	0.0	106.9	1.1	0.4	0.0	202.8	0.8	0.4	0.0	