B. Generation of MRLRP instances from benchmark CLRP ones

As previously recalled, in Prins et al. (2006), the benchmark names follow the pattern n-m-c[b], with n being the number of customers, m the number of depots and c the number of clusters into which customers are grouped; the final 'b' denotes $q = 150$, otherwise $q = 70$. The demands of the n customers are integer and are uniformly distributed in [11,20], while the depot capacities ensure at least 2 depots are opened. As in the original paper, the second-level route costs are obtained starting from Euclidean distances multiplied by 100 and rounded up to the nearest integer. MRLRP features have been added as follows. We will denote as $i = i_{\text{rnd}}(i_a, i_b)$ the function to uniformly pick a random value out of a range of integers.

B.1. UDCs and demands

UDCs and demands are generated from the original benchmark: nevertheless, some processing is needed to adapt the original benchmark graph to the MRLRP features.

B.1.1. Location of points UDC are initially located according to the depot points of the original benchmark instance and given the same capacities and fixed costs. Then, to create the *city context* that is peculiar to the MRLRP, we need the UDCs to be located in such a way as to surround all, or at least the great majority, of the customers, i.e. the demands' locations. To achieve this, we first take the convex hull H_0 of depot and customer points in the original benchmark; then, we eventually exchange some depot and clients locations, in order to have all the depots located on vertices of H_0; finally, we shift the depots along the perimeter of H_0 to maximize the area of the convex polygon described by the depots only.

B.1.2. *D* and *P* and additional demands In most of the instances, the original CLRP customers give rise directly to the MRLRP demands D and P: the former are randomly inserted into the latter in such a way as to have $|D| = |P|$. However, an augmentation of the demands with respect to the initial (CLRP) ones may be necessary. To achieve this, we generate a *second demand* for some of the existing points in the graph – instead of generating new points. The second demand has quantity $q = i_{\text{rnd}}(11, 20)$, i.e. like those in the original benchmark, and may be of the same type (delivery, pick-up) or not. However, new demands are generated in such a way as to preserve $|D| = |P|$. Since the overall demand is greater than that of the original CLRP instance, which we denote by Q_{tot}, we increase the capacity of each UDC by a factor $\frac{\sum_{i \in D \cup P} q_i}{Q_{tot}}$ and finally round it up; then, we do the same for the fixed costs, to preserve the cost/capacity ratio.

B.1.3. Additional UDCs We generate possible additional UDCs (as required for scenario 2 of each collection) in the ring between H_0 and the polygon that is similar to H_0, has the same centroid and an area that is 85% of that of H_0. By doing so, the newly generated points are in the peripheral region of the *city*. The capacity of the new UDCs is generated as $i_{\text{rnd}}(\lceil 0.8 \cdot Q_U^{avg} \rceil, \lfloor Q_U^{avg} \rfloor)$, Q_U^{avg} being the average capacity of the initial UDCs, whereas the fixed cost is obtained by multiplying the capacity by the average cost/capacity ratio of the initial UDCs.

B.1.4. Tightness of the UDC capacities and minimal number of UDCs needed Once the UDCs and demands have been obtained in this way, we need to ensure that $\max\limits_{u,v \in U, u \neq v}(Q_u + Q_v) < \sum_{i \in D \cup P} q_i \leq \frac{1}{f_q} \sum_{u \in U} Q_u$. The left inequality ensures that at least three UDCs will be needed, whereas the right one prevents an instance from being too tight, as $f_q \cdot \sum_{i \in D \cup P} q_i$ is an estimation of the total occupation of the UDC capacity due to the demand allocation on both the first and the second level; as for f_q, its value must be comprised in $[1, 2]$, with $f_q = 1$ and $f_q = 2$ representing the two extreme cases of, respectively, all direct and all indirect shipments; we always choose $f_q = 2$. If necessary, we alternate two steps as long as required for both the above inequalities to be verified: a) we iteratively increment each demand by 1 load unit until the left inequality is verified; b) we iteratively increment by 1 the capacity of each UDC but the greatest one, without exceeding it, until the right inequality is satisfied.

B.2. Gates and SPLs

Table 13 shows how many gates and SPLs have been generated, according to the values of n and m in the original CLRP benchmark instance. The value between parentheses is the

n	m	$\lvert K \rvert$	$\lvert L \rvert$
20	5	5(10)	5(10)
50	5	5(10)	5(10)
100	5	5(10)	10(15)
100	10	5(10)	10(15)

Table 13 Number of gates and SPL in the generated MRLRP instances.

maximal value, i.e. the one in the corresponding scenario of a collection that considers an augmented number of gates or SPLs. To locate both gates and SPLs, we take the convex hull H_0 and we enlarge it by an extension factor $f > 1$ to obtain the polygon $H(f)$ according to the extension principle shown in figure 5; n_{H_0}, p_{H_0} and A_{H_0} are the number of vertices, the perimeter and the area of H_0, respectively. Then, the SPL positions are randomly generated inside $H(1.1)$ in such a way as to have a distance greater than or equal to $0.3\frac{p_{H_0}}{n_{H_0}}$ from any

UDCs and any other SPLs, while the positions of the gates are randomly generated in the ring between $H(1.2)$ and $H(1.6)$ in such a way as to be uniformly distributed all around H_0.

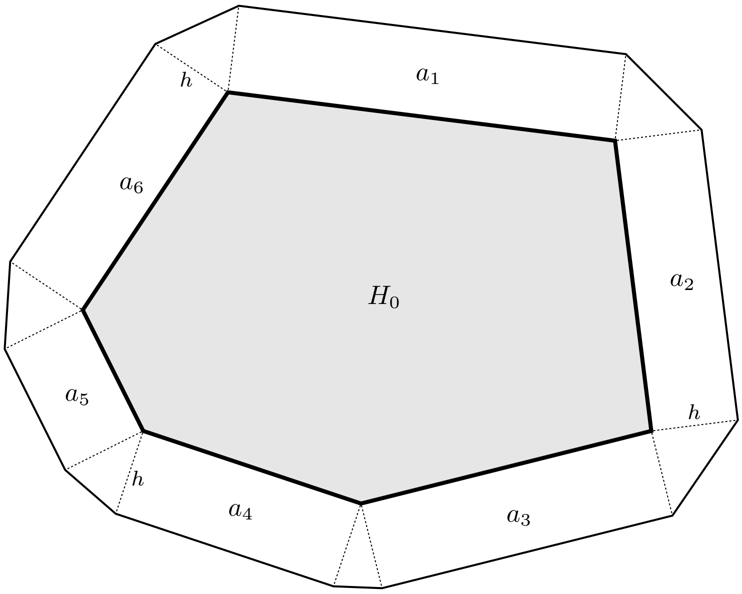

Figure 5 **Polygon $H(f)$ obtained by extension of the convex polygon H_0 according to the extension factor $f > 1$: height h is chosen so to have $\sum_i a_i = h \cdot p_{H_0}$ equal to $(f-1) \cdot A_{H_0}$.**

B.3. Second-level vehicle features

For q the value of the original benchmark instance is taken, whereas for M we choose $M = 50$ when $q = 70$, and $M = 65$ when $q = 150$, except for collection galwc04, in which $q = 70$ and $M = 60$.

B.4. Budget constraint and maximum number of UDCs a gate can address

Regarding the budget constraint, it is always relaxed by fixing $N = |U|$, as it has already been said in 6.1.1. The constant B has always been given the value 2.

B.5. Demands and their assignment to gates

We randomly choose $2|K|$ demands in $D \cup P$ to assure that each gate is assigned at least two demands: the remaining $|D| + |P| - 2|K|$ are randomly assigned. When a second demand needs to be generated for a customer point in the graph, and has the same type as the first one, it is guaranteed not to be associated with the same gate as the first one.

B.6. First-level arc features

The flow transportation costs c_{ku} and c_{uk} are both obtained by multiplying the distance between gate k and UDC u by $c^{\star}_{PU} = 2.5$, whereas for c_{uv}, $u, v \in U$, we multiply the distance between u and v by $c^{\star}_{ring} = 0.5$; both constants $c^{\star}_{PU}$ and $c^{\star}_{ring}$ are costs per length unit and per load unit. Regarding ring construction costs, we suppose that there is a subset $U^\star \subset U$ of UDCs which are more expensive to connect in the ring: UDCs in $U^\star$ are picked randomly, and $|U^\star| = 1$ or $|U^\star| = 2$, depending on whether the base scenario has $|U| = 5$ or $|U| = 10$. Cost g_{uv}, $u, v \in U, u < v$ is obtained by multiplying the distance between u and v by the cost per length unit $g^\star_{uv}$, with $g^\star_{uv} = 50$ if neither of u and v is in $U^\star$, or $g^\star_{uv} = i_{\text{rnd}}(50, 100)$ otherwise. If needed, the ring costruction costs generated in this way are adjusted to guarantee that the triangular inequality is always verified. Finally, capacity q_{uv}, $u, v \in U$, is obtained:

$$q_{uv} = \max\left(Q_u,\ \left(\tfrac{1}{2}\cdot i_{\text{rnd}}(\lceil 0.8\cdot Q_u\rceil, \lfloor 1.1\cdot Q_u\rfloor)\ +\ \tfrac{1}{2}\cdot i_{\text{rnd}}(\lceil 0.8\cdot \sum_{i\in D\cup P} q_i\rceil, \lfloor 1.1\cdot \sum_{i\in D\cup P} q_i\rfloor)\right)\right)$$

Costs c_{uv} and g_{uv} described so far represent the low levels of ring transportation and installation costs, i.e. the ones of instances of type L|L; for the high level of both types of costs, we multiply the corresponding low-level cost by 5.

B.7. Fleet balance bounds

For each $u \in U$, we estimate the number of vehicles needed as

$$\nu_u = \lceil \sum_{i\in D\cup P} q_i \cdot \frac{Q_u}{\sum_{v\in U} Q_v} \frac{|U|}{N} \frac{1}{q} \rceil + 1$$

to take into account both the budget constraint and the capacity q of second-level vehicles; then, we randomly choose both δ^-_u and δ^+_u as $i_{\text{rnd}}(0, \lfloor \frac{\nu_u}{2} \rfloor)$; if $\lfloor \frac{\nu_u}{2} \rfloor = 0$, we randomly choose $\{\delta^-_u, \delta^+_u\}$ in $\{\{1,0\},\{0,1\},\{1,1\}\}$. For each SPL l, we randomly choose both δ^-_l and δ^+_l as $i_{\text{rnd}}(0, \max_{u\in U} \lfloor \frac{\nu_u}{2} \rfloor)$; if $\max_{u\in U} \lfloor \frac{\nu_u}{2} \rfloor = 0$, we randomly choose also $\{\delta^-_l, \delta^+_l\}$ in $\{\{1,0\},\{0,1\},\{1,1\}\}$.

C. Complete Results

In the following the reader will find the tables with all the results of the conducted experimental sessions.

	Features							Exact(X)				GALW							Hybrid(Y)	
Instance	$\|K\|$	$\|U\|$	$\|L\|$	$\|D\|$	N	q	M	$\%^r$	r	$T/\%$	#ps	$\%^X$	s	r	$a/\%$	t	#ps	$\%^Y$	$\%^X$	$T/\%$
galwc01-0-L|L	5	5	5	15	5	70	50	3.5	9.6	24.8	21503	2.1	0.0	0.4	2.9	3.6	3122	0.0	2.1	3.6
galwc01-0-L|H	5	5	5	15	5	70	50	5.0	9.5	30.8	21503	4.9	0.0	0.4	4.2	4.9	3121	0.6	4.3	4.9
galwc01-0-H|L	5	5	5	15	5	70	50	6.5	9.6	16.3	21503	6.2	0.0	0.4	3.0	3.7	2926	4.6	1.7	2.4
galwc01-0-H|H	5	5	5	15	5	70	50	9.6	9.6	15.4	21503	9.3	0.0	0.4	7.4	8.1	3021	5.8	3.7	2.9
galwc01-1-L|L	5	5	5	20	5	70	50	3.3	14.0	48.7	37839	3.3	0.0	0.7	4.2	5.2	4033	0.1	3.2	4.8
galwc01-1-L|H	5	5	5	20	5	70	50	5.9	14.2	169.9	37839	4.8	0.0	0.7	8.9	9.8	4039	0.5	4.3	9.4
galwc01-1-H|L	5	5	5	20	5	70	50	7.2	14.1	80.7	37839	2.8	0.0	0.7	4.3	5.3	4140	0.0	2.8	5.0
galwc01-1-H|H	5	5	5	20	5	70	50	10.3	14.0	109.7	37839	5.0	0.0	0.7	3.8	4.8	4223	1.3	3.7	6.1
galwc01-2-L|L	5	10	5	15	10	70	50	4.5	24.9	642.5	64737	6.2	1.1	0.4	28.5	29.2	8388	2.4	3.9	37.3
galwc01-2-L|H	5	10	5	15	10	70	50	7.4	25.4	442.0	64737	5.1	1.1	0.4	31.0	31.7	8489	0.5	4.7	39.8
galwc01-2-H|L	5	10	5	15	10	70	50	9.0	25.4	320.5	64737	5.0	1.1	0.4	39.4	40.1	8630	0.3	4.7	33.6
galwc01-2-H|H	5	10	5	15	10	70	50	12.3	25.2	419.1	64737	8.3	1.3	0.4	64.2	65.0	8665	3.8	4.7	30.7
galwc01-3-L|L	10	5	5	15	5	70	50	4.7	9.6	16.8	21503	3.8	0.0	0.4	4.0	4.7	3068	2.5	1.4	2.3
galwc01-3-L|H	10	5	5	15	5	70	50	7.6	9.5	24.9	21503	3.8	0.0	0.4	2.8	3.5	3025	2.4	1.5	3.6
galwc01-3-H|L	10	5	5	15	5	70	50	8.3	9.6	10.2	21503	4.8	0.0	0.4	2.8	3.6	3067	3.7	1.1	1.8
galwc01-3-H|H	10	5	5	15	5	70	50	12.2	9.6	20.3	21503	5.9	0.0	0.4	3.5	4.2	3143	4.7	1.2	2.5
galwc01-4-L|L	5	5	10	15	5	70	50	4.4	13.6	31.0	31503	2.5	0.0	0.4	4.2	5.0	4348	0.0	2.5	2.7
galwc01-4-L|H	5	5	10	15	5	70	50	8.6	13.7	69.8	31503	4.6	0.0	0.4	6.0	6.7	4309	0.9	3.7	3.6
galwc01-4-H|L	5	5	10	15	5	70	50	8.9	13.7	29.3	31503	4.0	0.0	0.4	5.8	6.5	4313	2.2	1.9	2.7
galwc01-4-H|H	5	5	10	15	5	70	50	13.0	14.1	53.4	31503	5.8	0.0	0.4	5.1	5.8	4158	2.4	3.5	3.2
galwc02-0-L|L	5	5	5	15	5	70	50	5.7	3.0	8.0	14066	1.4	0.0	0.3	1.6	2.2	2319	0.0	1.4	1.6
galwc02-0-L|H	5	5	5	15	5	70	50	10.0	3.0	10.3	14066	5.9	0.0	0.3	2.3	3.0	2418	1.3	4.6	2.0
galwc02-0-H|L	5	5	5	15	5	70	50	5.8	3.0	9.5	14066	1.7	0.0	0.3	2.3	2.9	2352	0.0	1.7	1.9
galwc02-0-H|H	5	5	5	15	5	70	50	7.4	3.0	4.0	14066	4.7	0.0	0.3	2.4	3.1	2421	0.2	4.5	1.7
galwc02-1-L|L	5	5	5	20	5	70	50	6.0	9.0	13.3	33616	0.9	0.0	0.6	2.4	3.4	3253	0.1	0.8	1.9
galwc02-1-L|H	5	5	5	20	5	70	50	10.4	9.2	189.8	33616	2.5	0.0	0.7	2.4	3.4	3303	1.2	1.3	3.2
galwc02-1-H|L	5	5	5	20	5	70	50	7.0	9.1	32.8	33616	3.1	0.0	0.7	2.2	3.2	3209	0.0	3.1	2.8
galwc02-1-H|H	5	5	5	20	5	70	50	9.0	9.1	430.5	33616	3.1	0.0	0.6	2.9	3.8	3195	0.5	2.6	3.9
galwc02-2-L|L	5	10	5	15	10	70	50	5.0	7.6	59.7	39438	3.6	1.1	0.3	4.7	5.3	4707	0.1	3.5	7.5
galwc02-2-L|H	5	10	5	15	10	70	50	8.7	7.7	78.7	39438	4.0	1.7	0.3	4.2	4.8	4667	2.5	1.5	11.0
galwc02-2-H|L	5	10	5	15	10	70	50	10.9	7.6	61.5	39438	0.2	1.1	0.3	5.5	6.1	4676	0.0	0.2	5.7
galwc02-2-H|H	5	10	5	15	10	70	50	14.6	7.6	80.8	39438	6.4	2.1	0.3	4.3	4.9	5012	2.8	3.8	17.7
galwc02-3-L|L	10	5	5	15	5	70	50	3.2	3.1	2.8	14066	0.3	0.0	0.3	2.1	2.7	2324	0.1	0.2	1.4
galwc02-3-L|H	10	5	5	15	5	70	50	9.6	3.1	8.7	14066	2.3	0.0	0.3	1.9	2.6	2347	2.1	0.2	1.7
galwc02-3-H|L	10	5	5	15	5	70	50	3.2	3.0	4.2	14066	1.8	0.0	0.3	2.3	3.0	2440	0.2	1.6	1.6
galwc02-3-H|H	10	5	5	15	5	70	50	7.7	3.0	4.8	14066	2.7	0.0	0.3	2.5	3.1	2322	1.1	1.6	1.9
galwc02-4-L|L	5	5	10	15	5	70	50	6.3	5.2	8.0	23190	0.2	0.0	0.3	2.4	3.1	3478	0.0	0.2	2.0
galwc02-4-L|H	5	5	10	15	5	70	50	12.3	5.2	18.0	23190	3.2	0.0	0.3	2.2	2.8	3419	1.0	2.3	2.1
galwc02-4-H|L	5	5	10	15	5	70	50	6.1	5.2	6.4	23190	1.6	0.0	0.3	3.6	4.3	3547	0.0	1.6	2.5
galwc02-4-H|H	5	5	10	15	5	70	50	7.9	5.2	12.6	23190	4.6	0.0	0.3	2.5	3.2	3375	0.4	4.2	2.6
galwc03-0-L|L	5	5	5	15	5	150	65	18.6	6.6	10.8	18761	2.1	0.0	0.5	1.9	2.7	2082	0.0	2.1	2.2
galwc03-0-L|H	5	5	5	15	5	150	65	16.6	6.6	23.6	18761	6.3	0.0	0.5	4.9	5.7	2099	1.5	4.8	2.5
galwc03-0-H|L	5	5	5	15	5	150	65	26.5	6.6	20.2	18761	6.6	0.0	0.5	1.9	2.7	2012	1.2	5.4	1.8
galwc03-0-H|H	5	5	5	15	5	150	65	25.3	6.6	23.5	18761	6.9	0.0	0.5	5.0	5.8	2129	2.4	4.6	2.2
galwc03-1-L|L	5	5	5	20	5	150	65	16.0	51.3	113.8	68987	3.7	0.0	1.2	2.5	4.0	3513	1.5	2.2	3.8
galwc03-1-L|H	5	5	5	20	5	150	65	18.3	51.8	149.9	68987	7.4	0.0	1.1	9.2	10.6	3488	3.4	4.1	4.1
galwc03-1-H|L	5	5	5	20	5	150	65	23.9	51.8	131.6	68987	2.8	0.0	1.2	2.8	4.3	3476	0.0	2.8	3.7
galwc03-1-H|H	5	5	5	20	5	150	65	25.6	51.2	230.1	68987	7.0	0.0	1.1	4.2	5.6	3399	4.2	3.0	3.5
galwc03-2-L|L	5	10	5	15	10	150	65	19.2	24.1	181.9	79140	0.6	2.0	0.6	26.2	27.1	8449	0.0	0.6	13.7
galwc03-2-L|H	5	10	5	15	10	150	65	18.7	24.2	117.6	79140	0.8	1.1	0.6	25.7	26.6	8550	0.1	0.7	11.4
galwc03-2-H|L	5	10	5	15	10	150	65	20.9	24.2	151.1	79140	0.6	1.1	0.6	33.6	34.5	7849	0.0	0.6	11.5
galwc03-2-H|H	5	10	5	15	10	150	65	23.2	24.3	130.8	79140	5.6	1.7	0.6	39.6	40.5	8348	5.0	0.6	13.2
galwc03-3-L|L	10	5	5	15	5	150	65	18.6	6.7	11.3	18761	2.7	0.0	0.5	1.7	2.5	2085	0.0	2.7	1.8
galwc03-3-L|H	10	5	5	15	5	150	65	13.3	6.7	16.3	18761	4.3	0.0	0.5	1.9	2.7	2127	1.9	2.4	2.5
galwc03-3-H|L	10	5	5	15	5	150	65	24.1	6.6	14.2	18761	6.0	0.0	0.5	4.1	5.0	2183	3.9	2.3	1.9
galwc03-3-H|H	10	5	5	15	5	150	65	22.6	6.7	16.0	18761	4.5	0.0	0.5	3.7	4.5	2084	1.9	2.7	2.5
galwc03-4-L|L	5	5	10	15	5	150	65	18.1	11.0	22.7	31590	1.9	0.0	0.5	2.4	3.2	3319	0.0	1.9	2.7
galwc03-4-L|H	5	5	10	15	5	150	65	16.3	11.0	20.0	31590	3.9	0.0	0.5	6.2	7.0	3223	0.9	3.0	3.1
galwc03-4-H|L	5	5	10	15	5	150	65	26.7	11.0	29.4	31590	4.0	0.0	0.5	6.4	7.2	3287	1.4	2.7	2.3
galwc03-4-H|H	5	5	10	15	5	150	65	28.1	11.2	32.7	31590	3.6	0.0	0.5	9.5	10.3	3237	2.5	1.1	3.1

Table 14 Result of the three methods on all the instances of collections galwc01, galwc02 and galwc03.

	Features							GALW						Hybrid(Y)
Instance	$\|K\|$	$\|U\|$	$\|L\|$	$\|D\|$	N	q	M	s	r	a/%	t	#ps	%Y	T/%
galwc04-0-L|L	5	5	5	25	5	70	60	0.0	1.7	2.0	4.0	3180	3.0	3.9
galwc04-0-L|H	5	5	5	25	5	70	60	0.0	1.6	2.4	4.3	3107	8.7	5.5
galwc04-0-H|L	5	5	5	25	5	70	60	0.0	1.7	3.7	5.7	3135	0.1	4.0
galwc04-0-H|H	5	5	5	25	5	70	60	0.0	1.6	3.5	5.5	3092	2.5	5.5
galwc04-1-L|L	5	5	5	40	5	70	60	0.0	4.0	5.7	10.0	7376	2.0	8.3
galwc04-1-L|H	5	5	5	40	5	70	60	0.0	4.0	9.2	13.6	7395	6.4	12.5
galwc04-1-H|L	5	5	5	40	5	70	60	0.0	4.0	12.3	16.7	7558	3.4	13.1
galwc04-1-H|H	5	5	5	40	5	70	60	0.0	4.4	11.7	16.4	7580	1.1	15.4
galwc04-2-L|L	5	10	5	25	10	70	60	1.1	1.4	11.0	12.7	9428	1.4	33.2
galwc04-2-L|H	5	10	5	25	10	70	60	1.2	1.4	15.3	17.0	9679	4.6	29.0
galwc04-2-H|L	5	10	5	25	10	70	60	1.1	1.4	17.0	18.7	9389	0.2	33.7
galwc04-2-H|H	5	10	5	25	10	70	60	1.3	1.4	26.6	28.3	9359	4.7	24.3
galwc04-3-L|L	10	5	5	25	5	70	60	0.0	1.7	2.4	4.4	3155	1.1	4.1
galwc04-3-L|H	10	5	5	25	5	70	60	0.0	1.6	3.3	5.3	3134	8.6	5.7
galwc04-3-H|L	10	5	5	25	5	70	60	0.0	1.6	4.3	6.3	3111	0.0	4.2
galwc04-3-H|H	10	5	5	25	5	70	60	0.0	1.6	5.7	7.7	3165	1.6	5.7
galwc04-4-L|L	5	5	10	25	5	70	60	0.0	1.5	2.8	4.7	4448	0.6	4.2
galwc04-4-L|H	5	5	10	25	5	70	60	0.0	1.4	3.2	4.9	4260	8.0	6.1
galwc04-4-H|L	5	5	10	25	5	70	60	0.0	1.4	4.2	5.9	4401	0.0	3.7
galwc04-4-H|H	5	5	10	25	5	70	60	0.0	1.4	4.1	5.8	4472	1.1	5.0
galwc05-0-L|L	5	5	5	25	5	150	65	0.0	2.6	6.0	8.9	4791	0.7	7.4
galwc05-0-L|H	5	5	5	25	5	150	65	0.0	2.7	7.3	10.3	4880	0.1	7.1
galwc05-0-H|L	5	5	5	25	5	150	65	0.0	2.6	8.1	11.0	4813	0.2	7.8
galwc05-0-H|H	5	5	5	25	5	150	65	0.0	2.6	8.0	10.9	4839	0.1	9.6
galwc05-1-L|L	5	5	5	40	5	150	65	0.0	7.7	18.2	26.2	10902	0.3	23.1
galwc05-1-L|H	5	5	5	40	5	150	65	0.0	7.8	14.7	22.8	10769	0.7	27.3
galwc05-1-H|L	5	5	5	40	5	150	65	0.0	7.6	16.9	24.8	10658	0.2	18.8
galwc05-1-H|H	5	5	5	40	5	150	65	0.0	8.2	23.8	32.2	10861	1.5	31.7
galwc05-2-L|L	5	10	5	25	10	150	65	1.2	2.6	22.7	25.7	13286	3.0	31.1
galwc05-2-L|H	5	10	5	25	10	150	65	1.1	2.6	15.1	18.1	13426	2.1	21.6
galwc05-2-H|L	5	10	5	25	10	150	65	2.0	2.6	23.6	26.5	13463	3.8	64.0
galwc05-2-H|H	5	10	5	25	10	150	65	1.1	2.7	29.0	32.0	13753	4.1	37.8
galwc05-3-L|L	10	5	5	25	5	150	65	0.0	2.6	5.8	8.7	4752	0.0	8.9
galwc05-3-L|H	10	5	5	25	5	150	65	0.0	2.7	6.6	9.6	4886	1.8	10.6
galwc05-3-H|L	10	5	5	25	5	150	65	0.0	2.6	7.5	10.4	5037	0.0	9.0
galwc05-3-H|H	10	5	5	25	5	150	65	0.0	2.6	8.0	10.9	4861	2.1	12.4
galwc05-4-L|L	5	5	10	25	5	150	65	0.0	2.6	7.7	10.6	6936	0.0	9.0
galwc05-4-L|H	5	5	10	25	5	150	65	0.0	2.6	16.0	18.9	7048	3.1	11.5
galwc05-4-H|L	5	5	10	25	5	150	65	0.0	2.6	19.9	22.9	7175	0.4	9.9
galwc05-4-H|H	5	5	10	25	5	150	65	0.0	2.6	13.6	16.6	7354	4.1	9.7

Table 15 **Result of GALW and the hybrid method on all the instances of collections galwc04 and galwc05.**

	Features							GALW						Hybrid(Y)
Instance	$\|K\|$	$\|U\|$	$\|L\|$	$\|D\|$	N	q	M	s	r	a/%	t	#ps	%Y	T/%
galwc06-0-L|L	5	5	10	50	5	70	50	0.0	9.2	11.2	20.7	6350	0.5	20.1
galwc06-0-L|H	5	5	10	50	5	70	50	0.0	9.4	6.3	16.1	6424	1.3	19.6
galwc06-0-H|L	5	5	10	50	5	70	50	0.0	9.7	8.9	19.0	6386	6.1	15.2
galwc06-0-H|H	5	5	10	50	5	70	50	0.0	9.5	8.1	18.0	6373	1.8	20.8
galwc06-1-L|L	5	5	10	80	5	70	50	0.0	28.1	31.1	59.7	16593	0.7	271.0
galwc06-1-L|H	5	5	10	80	5	70	50	0.0	26.6	29.6	56.8	16697	1.8	89.3
galwc06-1-H|L	5	5	10	80	5	70	50	0.0	27.1	28.9	56.6	16500	5.2	249.7
galwc06-1-H|H	5	5	10	80	5	70	50	0.0	27.1	76.2	103.8	16611	1.2	109.1
galwc06-2-L|L	5	10	10	50	10	70	50	1.6	7.3	56.5	64.2	15019	0.0	69.8
galwc06-2-L|H	5	10	10	50	10	70	50	1.1	7.0	43.0	50.4	14599	0.5	159.7
galwc06-2-H|L	5	10	10	50	10	70	50	1.9	7.1	104.6	112.1	14973	1.9	168.4
galwc06-2-H|H	5	10	10	50	10	70	50	1.1	7.2	54.4	62.0	14959	1.4	137.4
galwc06-3-L|L	10	5	10	50	5	70	50	0.0	9.6	11.6	21.6	6412	0.1	16.9
galwc06-3-L|H	10	5	10	50	5	70	50	0.0	9.8	11.3	21.5	6386	1.0	20.1
galwc06-3-H|L	10	5	10	50	5	70	50	0.0	10.2	11.4	22.0	6355	5.7	19.5
galwc06-3-H|H	10	5	10	50	5	70	50	0.0	9.2	6.7	16.4	6296	0.8	17.3
galwc06-4-L|L	5	5	15	50	5	70	50	0.0	9.0	13.2	22.7	9334	0.5	21.0
galwc06-4-L|H	5	5	15	50	5	70	50	0.0	9.3	13.7	23.4	9225	1.8	36.8
galwc06-4-H|L	5	5	15	50	5	70	50	0.0	8.8	14.1	23.4	9261	3.7	22.1
galwc06-4-H|H	5	5	15	50	5	70	50	0.0	9.0	22.3	31.7	9416	0.7	31.6
galwc07-0-L|L	5	5	10	50	5	70	50	0.0	7.7	17.1	25.2	10814	0.0	18.0
galwc07-0-L|H	5	5	10	50	5	70	50	0.0	7.8	16.0	24.1	10647	3.2	23.3
galwc07-0-H|L	5	5	10	50	5	70	50	0.0	7.7	26.5	34.6	10820	0.5	42.2
galwc07-0-H|H	5	5	10	50	5	70	50	0.0	7.9	15.2	23.5	11015	0.9	39.0
galwc07-1-L|L	5	5	10	80	5	70	50	0.0	24.0	106.7	131.2	28020	0.6	768.3
galwc07-1-L|H	5	5	10	80	5	70	50	0.0	23.9	262.9	287.2	27891	2.3	170.9
galwc07-1-H|L	5	5	10	80	5	70	50	0.0	25.9	71.7	98.1	28246	1.3	771.6
galwc07-1-H|H	5	5	10	80	5	70	50	0.0	25.4	64.3	90.3	28832	3.0	400.2
galwc07-2-L|L	5	10	10	50	10	70	50	1.4	6.8	242.9	250.1	26212	0.2	281.1
galwc07-2-L|H	5	10	10	50	10	70	50	1.1	7.0	261.3	268.7	25931	3.4	161.5
galwc07-2-H|L	5	10	10	50	10	70	50	1.5	6.6	463.3	470.2	26003	0.4	294.0
galwc07-2-H|H	5	10	10	50	10	70	50	1.5	6.7	837.9	845.0	25450	2.7	583.1
galwc07-3-L|L	10	5	10	50	5	70	50	0.0	8.2	31.0	39.7	10912	0.2	55.7
galwc07-3-L|H	10	5	10	50	5	70	50	0.0	7.9	17.1	25.5	11028	1.5	36.2
galwc07-3-H|L	10	5	10	50	5	70	50	0.0	7.7	19.1	27.2	10952	0.0	26.1
galwc07-3-H|H	10	5	10	50	5	70	50	0.0	7.8	15.8	24.0	10813	1.2	32.9
galwc07-4-L|L	5	5	15	50	5	70	50	0.0	7.8	19.5	27.7	13963	0.1	23.8
galwc07-4-L|H	5	5	15	50	5	70	50	0.0	7.6	34.6	42.6	13762	2.5	48.1
galwc07-4-H|L	5	5	15	50	5	70	50	0.0	7.6	20.0	28.0	13641	0.0	34.0
galwc07-4-H|H	5	5	15	50	5	70	50	0.0	7.9	56.7	65.0	14032	1.2	30.4
galwc08-0-L|L	5	10	10	50	10	70	50	1.4	7.9	466.4	474.8	14835	2.0	2681.4
galwc08-0-L|H	5	10	10	50	10	70	50	1.8	8.0	514.2	522.7	14663	3.1	(0.6%)
galwc08-0-H|L	5	10	10	50	10	70	50	1.1	8.1	414.7	423.1	14671	2.6	3211.2
galwc08-0-H|H	5	10	10	50	10	70	50	1.1	8.0	548.9	557.3	14532	2.6	1628.3
galwc08-1-L|L	5	10	10	80	10	70	50	1.1	21.6	476.7	499.0	36996	$-\infty$	($+\infty$)
galwc08-1-L|H	5	10	10	80	10	70	50	1.1	22.3	(3.5%)	3636.1	36457	-8.0	(15.8%)
galwc08-1-H|L	5	10	10	80	10	70	50	1.4	21.7	(3.8%)	3635.5	36861	-4.3	(11.4%)
galwc08-1-H|H	5	10	10	80	10	70	50	1.6	22.7	(6.0%)	3651.0	37080	-8.3	(15.3%)
galwc08-2-L|L	5	15	10	50	15	70	50	69.7	8.1	612.8	621.3	27451	-18.6	(28.9%)
galwc08-2-L|H	5	15	10	50	15	70	50	70.2	8.3	1563.2	1571.9	27986	$-\infty$	($+\infty$)
galwc08-2-H|L	5	15	10	50	15	70	50	68.7	8.2	2482.2	2490.9	27455	$-\infty$	($+\infty$)
galwc08-2-H|H	5	15	10	50	15	70	50	68.4	8.3	3335.4	3344.2	27629	$-\infty$	($+\infty$)
galwc08-3-L|L	10	10	10	50	10	70	50	1.1	8.3	834.0	842.8	14691	-0.1	(2.0%)
galwc08-3-L|H	10	10	10	50	10	70	50	1.1	8.0	236.5	245.0	14532	22.9	(3.6%)
galwc08-3-H|L	10	10	10	50	10	70	50	1.3	8.0	679.2	687.6	14513	2.7	(2.9%)
galwc08-3-H|H	10	10	10	50	10	70	50	1.1	8.0	474.8	483.4	14495	22.0	(6.7%)
galwc08-4-L|L	5	10	15	50	10	70	50	1.2	7.6	391.6	399.7	19571	5.8	879.2
galwc08-4-L|H	5	10	15	50	10	70	50	1.1	8.0	1240.5	1248.9	19519	0.9	(6.0%)
galwc08-4-H|L	5	10	15	50	10	70	50	1.1	7.5	381.2	389.2	20048	5.8	1705.0
galwc08-4-H|H	5	10	15	50	10	70	50	1.1	7.5	310.6	318.5	19612	4.1	(0.4%)

Table 16 **Result of GALW and the hybrid method on all the instances of collections galwc06, galwc07 and galwc08.**