



# SMIO–Hexaly Location Routing Challenge Monterrey 2026

Competition Report

Instances, competition dynamics and results

Version 1.0 (final)

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On behalf of the SMIO Board of Directors

August 2026

Diamond Sponsor

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# Contents

## Abstract

The SMIO–Hexaly Location Routing Challenge 2026 invited the Operations Research community to solve 30 instances of the Capacitated Location Routing Problem (CLRP), ranging from 80 to 2500 customers and from 5 to 40 candidate depots, over a 27-day window (20 July–15 August 2026, Monterrey time). Fifteen approved teams competed in two categories (Open, 8 teams; Undergraduate, 7 teams) under a lead-time scoring rule: a team scores the number of days it holds the best known solution (BKS) of each instance, plus a bonus of B = 3 days for each BKS it holds at the close. The competition produced 1,026 verified submissions, 479 BKS events on the general timeline and 219 on the undergraduate timeline; every instance received its first BKS within 92 minutes of the opening, and by the close the participants' BKS improved on the Hexaly Optimizer baseline on 29 of the 30 instances, by 4.23% on average (up to 12.64% on clrp-medium-07). **CIMAT_UP** won the Open category with 714.460 points (20 final BKS, 654.460 days of lead-time), ahead of AgenticOR (91.029) and AILS-CLRP (70.517); **Más óptimo** won the Undergraduate category with 626.494 points and 27 of the 30 undergraduate BKS, ahead of The Badass Optimizers (182.567); the undergraduate BKS themselves beat the Hexaly baseline on 29 of the 30 instances (by 3.63% on average) and finished 0.64% above the general BKS. This report describes the instances, the challenge format, the final results and the dynamics of the competition, and documents the reference library that results from it.


## 1. Introduction

The Capacitated Location Routing Problem (CLRP) integrates two classic decisions that are usually taken separately: where to open depots, and how to route capacitated vehicles from those depots to serve customers. Its benchmark landscape has long been dominated by small and medium instances (the Prins, Tuzun–Burke and Barreto sets, all well under a thousand customers), and by results reported once, in papers, with no shared mechanism to keep the best known solutions current.

The SMIO–Hexaly Location Routing Challenge 2026 was created by the Mexican Society for Operations Research (SMIO), with Hexaly as Diamond Sponsor, to change that on three fronts:

- **A new, larger benchmark.** Thirty synthetic-and-real CLRP instances spanning three scales, including ten instances built on the real road network of the Monterrey Metropolitan Area with asymmetric distances.
- **A live, verified record of best known solutions.** Every submission was verified by an open-source verifier on the platform, and every BKS change was published in real time with its timestamp, cost and holder.
- **A permanent reference library.** At the close of the window every solution that was ever a BKS, together with the compute-time and environment metadata that teams reported, is integrated into a public library alongside the instances and the Hexaly baseline (reglamento §13).

The Challenge is associated with the XIV SMIO Congress (CSMIO 2026, Universidad de Monterrey, 7–9 October 2026), where the winning teams present in a dedicated session. Its rules are set out in the official reglamento (v1.0, 8 June 2026, with the §8.6 amendment of 20 July 2026 creating the undergraduate BKS); the problem, file formats and verifier semantics are in the accompanying technical specification. This report follows the structure of the CVRPLib XL/BKS-Challenge report that inspired the format: the instances first, then the challenge, then the results and what they say.

# 2. The problem and the official instances

## 2.1. The CLRP as posed

An instance gives a set of candidate depots, each with an opening cost, a capacity and a maximum number of vehicles, a set of customers with demands, a homogeneous vehicle capacity, a fixed cost per route, and a distance matrix. A solution decides which depots to open, assigns every customer to exactly one open depot, and designs routes from each open depot so that vehicle capacity, depot capacity and the per-depot vehicle limit are respected. The objective is total cost: depot opening + fixed cost per route + total distance travelled. Small and medium instances use Euclidean distances on synthetic coordinates; large instances use road-network distances from the Monterrey Metropolitan Area, which may be asymmetric. The exact formulation and file formats are in the technical specification; the official verifier (open source, released with the instance generator in June 2026) is the sole arbiter of feasibility and cost (§6.4).

## 2.2. How the instances were designed

The 30 instances were produced by the open-source generator (`smio-clrp`, generator version 0.1.0) from a committed design matrix, `configs/official-2026.yaml`, which is the source of truth for what the official instances are. Each entry fixes the size of the world (`n` customers, `m` candidate depots), the geometry (how customers and depots are placed), the demand distribution, the fleet (`Q`, the common vehicle capacity, and `g`, the fixed cost per dispatched route), the spread of depot opening costs `f_i`, and, most importantly, two **capacity-tightness targets**:

- $\rho_{\mathrm{d}} = \Sigma \mathrm{q} \,/\, \Sigma \mathrm{W_i}$, the ratio of total demand to total depot capacity, and
- $\rho_{\mathrm{v}} = \Sigma \mathrm{q} \,/\, (\mathrm{Q} \cdot \Sigma \mathrm{V_i})$, the ratio of total demand to total fleet capacity.

The design guarantees, per scale, at least two **loose** instances (both $\rho \leq 0.5$: nothing binds and the problem is a pure cost trade-off between opening depots and routing), at least two **tight** ones (both $\rho \geq 0.85$: nearly every depot and vehicle is needed and the problem is bin-packing under geography), one **asymmetric** instance where only depot capacity binds and one where only the fleet binds (they isolate which side of the location–routing interaction a method handles well), one **pathological** instance, and the remainder **moderate** ($\rho \approx 0.65$–$0.80$). The pathological instances are constructed (clustered customers, depots on the periphery of the box, a very wide opening-cost range, bimodal demand and a low `g`) so that the obvious "assign each customer to its nearest depot, then pack routes" strategy is provably more than 5% worse than the optimum; for the small one this gap was verified with a MIP, which is why it is deliberately tiny (80 customers). Depot capacities and vehicle limits are sized per depot from the projected nearest-depot load ("load-balanced" capacities) on almost every entry, so that tight targets are feasible under uneven geography.

Three structural axes vary across the synthetic (small and medium) instances: customer placement (**uniform**; **clustered**, 3–8 Gaussian clusters; **mixed**, half clustered and half uniform), candidate-depot placement (**random**; **grid** with a small jitter; **co-located** with the cluster centres; **peripheral**, all depots near the sides of the box) and demand (**uniform** integers, or **bimodal**: 70% light customers and 30% heavy ones, the mix that defeats simple bin-packing). The medium set is a direct uplift of the small design matrix at 2–3× the customers.

The **large** instances are different in kind. Customers are sampled from OpenStreetMap residential and commercial land-use polygons of the Zona Metropolitana de Monterrey (14 municipios, from the Monterrey core to Santiago, Cadereyta, Salinas Victoria and Zuazua), weighted by area, so density

follows the real city; candidate depots are sampled from industrial polygons (which concentrate along the Apodaca–Escobedo corridor); and the distance matrix is the real road-network driving distance between every pair of nodes, computed with a self-hosted OSRM router on the Geofabrik OSM snapshot of 2026-04-01. Those matrices are mildly asymmetric (one-way streets, ramps) and occasionally violate the triangle inequality, which is exactly the signal the design wanted; the file for the largest instances carries a 2 540 × 2 540 matrix. Instance files record the seed, generator version and OSM snapshot, so every instance is reproducible bit for bit.

The instances were published on the platform under neutral ids, `clrp-<scale>-<nn>`, numbered alphabetically by design name within each scale, so that participants could not read the capacity regime off the name. Table 1 gives the design of each instance and Table 2 its realized parameters; Appendix C shows a map of every instance.

**Table 1:** Design of the 30 official instances. $\rho$ targets from the design matrix; the realized values are in Table 2. "Clusters" is the number of Gaussian clusters for clustered/mixed placement.

| Instance | Design name | Regime | Customers | Depots | Demand | Clusters | $\rho_d$ / $\rho_v$ target |
|---|---|---|---|---|---|---|---|
| clrp-small-01 | small_asym_depot_binding | Asym. depot | uniform | grid | uniform | — | 0.90 / 0.40 |
| clrp-small-02 | small_asym_vehicle_binding | Asym. fleet | uniform | grid | uniform | — | 0.40 / 0.98 |
| clrp-small-03 | small_loose_a | Loose | uniform | random | uniform | — | 0.40 / 0.40 |
| clrp-small-04 | small_loose_b | Loose | clustered | grid | bimodal | 5 | 0.45 / 0.45 |
| clrp-small-05 | small_moderate_a | Moderate | uniform | grid | uniform | — | 0.66 / 0.73 |
| clrp-small-06 | small_moderate_b | Moderate | mixed | grid | uniform | 6 | 0.70 / 0.78 |
| clrp-small-07 | small_moderate_c | Moderate | clustered | co-located | uniform | 6 | 0.72 / 0.80 |
| clrp-small-08 | small_pathological | Pathological | clustered | peripheral | bimodal | 3 | 0.45 / 0.50 |
| clrp-small-09 | small_tight_a | Tight | uniform | grid | uniform | — | 0.87 / 0.97 |
| clrp-small-10 | small_tight_b | Tight | clustered | co-located | uniform | 7 | 0.90 / 0.98 |
| clrp-medium-01 | medium_asym_depot_binding | Asym. depot | uniform | grid | uniform | — | 0.90 / 0.45 |
| clrp-medium-02 | medium_asym_vehicle_binding | Asym. fleet | uniform | grid | uniform | — | 0.45 / 0.98 |
| clrp-medium-03 | medium_loose_a | Loose | uniform | random | uniform | — | 0.40 / 0.40 |
| clrp-medium-04 | medium_loose_b | Loose | clustered | grid | bimodal | 6 | 0.45 / 0.45 |
| clrp-medium-05 | medium_moderate_a | Moderate | uniform | grid | uniform | — | 0.66 / 0.73 |
| clrp-medium-06 | medium_moderate_b | Moderate | mixed | grid | uniform | 7 | 0.70 / 0.78 |
| clrp-medium-07 | medium_moderate_c | Moderate | clustered | co-located | uniform | 8 | 0.72 / 0.80 |
| clrp-medium-08 | medium_pathological | Pathological | clustered | peripheral | bimodal | 4 | 0.45 / 0.50 |
| clrp-medium-09 | medium_tight_a | Tight | uniform | grid | uniform | — | 0.87 / 0.97 |
| clrp-medium-10 | medium_tight_b | Tight | clustered | co-located | uniform | 8 | 0.90 / 0.98 |
| clrp-large-01 | large_asym_depot_binding | Asym. depot | ZMM res./comm. | ZMM ind. | uniform | — | 0.90 / 0.45 |
| clrp-large-02 | large_asym_vehicle_binding | Asym. fleet | ZMM res./comm. | ZMM ind. | uniform | — | 0.45 / 0.90 |
| clrp-large-03 | large_loose_a | Loose | ZMM res./comm. | ZMM ind. | uniform | — | 0.40 / 0.40 |
| clrp-large-04 | large_loose_b | Loose | ZMM res./comm. | ZMM ind. | bimodal | — | 0.45 / 0.45 |
| clrp-large-05 | large_moderate_a | Moderate | ZMM res./comm. | ZMM ind. | uniform | — | 0.66 / 0.73 |
| clrp-large-06 | large_moderate_b | Moderate | ZMM res./comm. | ZMM ind. | bimodal | — | 0.70 / 0.78 |
| clrp-large-07 | large_moderate_c | Moderate | ZMM res./comm. | ZMM ind. | uniform | — | 0.72 / 0.80 |
| clrp-large-08 | large_pathological | Pathological | ZMM res./comm. | ZMM ind. | bimodal | — | 0.50 / 0.55 |
| clrp-large-09 | large_tight_a | Tight | ZMM res./comm. | ZMM ind. | uniform | — | 0.85 / 0.85 |
| clrp-large-10 | large_tight_b | Tight | ZMM res./comm. | ZMM ind. | bimodal | — | 0.88 / 0.88 |

**Table 2:** Realized parameters and the Hexaly baseline. n customers, m candidate depots, Q vehicle capacity, g fixed cost per route, $\Sigma$q total demand, $\rho_d$ and $\rho_v$ as realized in the file, the range of depot opening costs $f_i$, and the Hexaly Optimizer baseline cost (§2.3).

| Instance | n | m | Q | g | $\Sigma$q | $\rho_d$ | $\rho_v$ | $f_i$ range | Hexaly baseline |
|---|---|---|---|---|---|---|---|---|---|
| clrp-small-01 | 300 | 12 | 50 | 20 | 3,203 | 0.90 | 0.38 | 406–1,440 | 38,698.68 |

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| Instance | n | m | Q | g | Σq | $\rho_d$ | $\rho_v$ | $f_i$ range | Hexaly baseline |
|---|---|---|---|---|---|---|---|---|---|
| clrp-small-02 | 350 | 14 | 50 | 25 | 3,660 | 0.40 | 0.88 | 450–1,466 | 44,998.42 |
| clrp-small-03 | 200 | 10 | 50 | 10 | 2,262 | 0.40 | 0.40 | 342–864 | 27,642.26 |
| clrp-small-04 | 250 | 12 | 50 | 15 | 3,163 | 0.45 | 0.42 | 383–1,130 | 24,497.32 |
| clrp-small-05 | 300 | 14 | 50 | 20 | 2,994 | 0.66 | 0.66 | 404–1,478 | 36,438.17 |
| clrp-small-06 | 400 | 16 | 60 | 25 | 4,250 | 0.70 | 0.72 | 558–1,778 | 42,745.18 |
| clrp-small-07 | 450 | 18 | 60 | 30 | 4,531 | 0.72 | 0.74 | 733–1,739 | 39,041.37 |
| clrp-small-08 | 80 | 5 | 40 | 5 | 484 | 0.45 | 0.48 | 529–2,950 | 8,779.87 |
| clrp-small-09 | 350 | 14 | 50 | 25 | 3,827 | 0.87 | 0.88 | 536–1,377 | 44,138.11 |
| clrp-small-10 | 400 | 16 | 60 | 30 | 4,050 | 0.90 | 0.85 | 608–1,792 | 36,285.87 |
| clrp-medium-01 | 800 | 24 | 70 | 25 | 8,372 | 0.90 | 0.43 | 724–1,587 | 67,640.63 |
| clrp-medium-02 | 900 | 28 | 70 | 30 | 9,419 | 0.45 | 0.88 | 606–1,735 | 71,927.64 |
| clrp-medium-03 | 600 | 20 | 60 | 15 | 6,400 | 0.40 | 0.39 | 440–1,446 | 56,688.20 |
| clrp-medium-04 | 700 | 22 | 70 | 20 | 8,411 | 0.45 | 0.42 | 511–1,729 | 51,637.36 |
| clrp-medium-05 | 800 | 25 | 70 | 25 | 8,276 | 0.66 | 0.68 | 653–1,954 | 66,081.62 |
| clrp-medium-06 | 900 | 28 | 80 | 30 | 11,373 | 0.70 | 0.72 | 718–2,169 | 77,120.11 |
| clrp-medium-07 | 1000 | 30 | 80 | 35 | 12,971 | 0.72 | 0.75 | 823–2,496 | 74,463.85 |
| clrp-medium-08 | 200 | 8 | 50 | 8 | 1,272 | 0.45 | 0.46 | 395–3,407 | 24,827.59 |
| clrp-medium-09 | 800 | 25 | 70 | 25 | 8,148 | 0.87 | 0.89 | 631–1,676 | 67,194.25 |
| clrp-medium-10 | 1000 | 30 | 80 | 30 | 10,320 | 0.90 | 0.85 | 727–1,902 | 69,788.29 |
| clrp-large-01 | 2200 | 35 | 120 | 35 | 34,272 | 0.90 | 0.44 | 1,265–3,470 | 7,665,843.73 |
| clrp-large-02 | 2500 | 38 | 120 | 40 | 39,111 | 0.45 | 0.85 | 1,212–3,475 | 8,746,357.50 |
| clrp-large-03 | 1500 | 30 | 100 | 25 | 22,959 | 0.40 | 0.39 | 871–2,973 | 6,870,343.86 |
| clrp-large-04 | 1700 | 32 | 100 | 30 | 25,860 | 0.45 | 0.44 | 1,117–3,499 | 7,514,113.03 |
| clrp-large-05 | 2000 | 35 | 120 | 35 | 31,277 | 0.66 | 0.69 | 1,364–3,970 | 6,864,579.45 |
| clrp-large-06 | 2200 | 38 | 120 | 40 | 28,629 | 0.70 | 0.73 | 1,505–4,458 | 6,587,578.08 |
| clrp-large-07 | 2500 | 40 | 130 | 45 | 44,966 | 0.72 | 0.76 | 1,863–4,876 | 8,682,788.17 |
| clrp-large-08 | 2500 | 40 | 130 | 8 | 34,965 | 0.50 | 0.53 | 598–7,965 | 7,210,039.73 |
| clrp-large-09 | 2000 | 35 | 120 | 35 | 30,918 | 0.85 | 0.80 | 1,274–3,478 | 6,782,735.75 |
| clrp-large-10 | 2500 | 40 | 130 | 40 | 30,914 | 0.88 | 0.81 | 1,515–3,994 | 6,915,926.00 |

**Table 3:** Scale summary.

| Scale | Instances | Customers | Mean | Depots | Mean | Distances |
|---|---|---|---|---|---|---|
| Small | 10 | 80–450 | 308 | 5–18 | 13.1 | Euclidean, synthetic |
| Medium | 10 | 200–1000 | 770 | 8–30 | 24.0 | Euclidean, synthetic |
| Large | 10 | 1500–2500 | 2160 | 30–40 | 36.3 | Road network (Monterrey), asymmetric |

The instances were not published before the window opened. In June 2026 SMIO released the open-source instance generator so that teams could develop and tune on statistically similar instances, plus a set of practice instances on the platform. The official files were published at the opening instant, 20 Jul 2026 06:00 UTC (20 Jul 00:00 Monterrey), together with the Hexaly baseline costs.

## 2.3. The Hexaly baseline

Before the window opened, Hexaly ran Hexaly Optimizer on the 30 instances to produce one reference solution each. The baseline was published with the instances, stayed frozen for the whole window, did not participate in the leaderboard or compete for prizes, and serves as the comparative reference in this report (§6.3). The baseline *cost* was public; the baseline solution files were not distributed during the window. Section 5.5 compares the participants' final BKS with it.

### 2.4. Verification

Every submission was verified server-side by `smio_clrp_verify`, the same open-source verifier teams could run locally. The verifier recomputes the cost from the solution file (the reported cost is informative only), checks depot and vehicle capacities, per-depot vehicle limits and customer coverage, and applies an absolute tolerance of $10^{-4}$ when comparing against the incumbent BKS (§7.5: on an exact tie the incumbent holds). Verification is sub-second on the largest instances; the official timestamp of a submission is the instant the file was received, never the instant verification finished (§7.3).

## 3. The Challenge

### 3.1. Window, platform and rules of play

- **Competition window:** 20 Jul 2026 06:00 UTC (20 Jul 00:00 Monterrey) to 16 Aug 2026 05:59 UTC (15 Aug 23:59 Monterrey), i.e. 27 days.
- **Submissions:** only through the official platform (app.smiochallenge.com), one file per instance per submission, at most one submission per instance per team per minute and 200 submissions per team per UTC day (infeasible submissions do not count toward the limits).
- **Publication during the window (§7.7, v1.2):** for every instance, the current BKS (holder, cost, age) and the complete chronology of lead changes were public in real time. Solution files and the §7.8 metadata (compute time, environment) were withheld until the close.
- **Teams:** up to three people (plus one guide in the Undergraduate track), one person per team, roster fixed at the close of registration; membership of SMIO or of a sister ALIO society was required (§3). Every team submitted a Method Description at registration (§9).
- **Tools:** any solver, library, hardware or AI assistant was allowed (§10); Hexaly offered free academic licences of Hexaly Optimizer to all academic participants.

### 3.2. Scoring: lead time plus a final-BKS bonus

For each instance $\ell$ and team t, $\Delta_{\ell,\mathrm{t}}$ is the accumulated time, in decimal days with second precision, during which t held the BKS of $\ell$ (the clock starts at the official timestamp of the submission that establishes the BKS and stops when another team displaces it or the window closes). $\mathrm{b}_{\ell,\mathrm{t}} = 1$ if t holds the final BKS of $\ell$ at the close. The total score is

$$S_t \;=\; \sum_{\ell} \Delta_{\ell,t} \;+\; B \cdot \sum_{\ell} b_{\ell,t}, \qquad B = 3 \text{ days for 2026.}$$

Ties are broken by more final BKS, then more lead-time, then the earliest first feasible submission (§8.4). No lead-time accrues on an instance before some team establishes its first BKS.

### 3.3. Two categories, two BKS timelines

Teams competed in the **Open** or the **Undergraduate** track. The general BKS of an instance is the best feasible solution submitted by *any* team. By the amendment of 20 July 2026 (§8.6), the Undergraduate track is scored on its own **undergraduate BKS**: the best feasible solution among undergraduate teams only, with the same lead-time rule, the same B and the same tie-breaking.

Undergraduate teams can (and did, once) hold the general BKS, but that does not contribute to their category score; open teams are unaffected by the undergraduate timeline. The two chronologies are separate event logs on the platform, and this report treats them separately (Sections 5.1–5.4).

### 3.4. Prizes

The winning team of each category receives travel support for one member to CSMIO 2026 (capped at 500 USD), a presentation slot in the Challenge session, Amazon gift cards (600 USD Open, 400 USD Undergraduate), Hexaly merchandise, and the inclusion of its BKS solutions in the reference library. Every participating team's BKS solutions enter the library regardless of ranking (§11).

## 4. Participation

Fifteen teams were approved: 8 in the Open track and 7 in the Undergraduate track, 40 people in all (Table 4). No team was disqualified. Between them the teams made 1,026 submissions (907 feasible, 110 infeasible, 9 rejected for format errors); Table 5 lists the teams with their activity on their own scoring timeline.

The platform also recorded the registrations that did not complete: 8 draft teams (7 Open, 1 Undergraduate) with 11 people between them, none of which uploaded a Method Description (one of them a duplicate draft by a member of an approved team), and 12 further people who created a profile but never joined or created a team; 64 profiles in all, of which 40 belong to approved teams and 1 to the internal test team. The institutions declared by the approved teams span seven countries (Mexico, Colombia, Brazil, Chile, Sweden, China and India), plus one private company; the incomplete registrations added institutions in Italy, France and Hong Kong, and four companies.

**Table 4:** Approved teams: size and affiliations. Affiliations as self-declared by the members at registration (institution names normalized).

| Track | Team | Members | Affiliations |
|---|---|---|---|
| Open | CIMAT_UP | 3 | Centro de Investigación en Matemáticas (CIMAT), Guanajuato Unit; Universidad Panamericana, Campus Guadalajara |
| Open | AgenticOR | 3 | Independiente; Tecnológico de Monterrey, Campus Monterrey; Universidad de la Sabana |
| Open | AILS-CLRP | 2 | Instituto Tecnológico de Aeronáutica (ITA); Universidade Federal de São Paulo (UNIFESP) |
| Open | OPERE LAB | 2 | Private company |
| Open | DALR | 1 | KTH Royal Institute of Technology |
| Open | Kitchen sink solver | 1 | Universidad de los Andes, Colombia |
| Open | LONGZHIGUO | 1 | Northwest A&F University |
| Open | OptiRoute | 2 | Indian Institute of Technology Delhi |
| Undergraduate | Más óptimo | 4 (incl. 1 guide) | Tecnológico de Monterrey, Campus Monterrey |
| Undergraduate | The Badass Optimizers | 3 (incl. 1 guide) | Universidad Autónoma de Nuevo León |

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| Track | Team | Members | Affiliations |
|---|---|---|---|
| Undergraduate | SEIN3 | 3 (incl. 1 guide) | Pontificia Universidad Javeriana Cali |
| Undergraduate | The Gap Hunters USACH | 4 (incl. 1 guide) | Universidad de Santiago de Chile |
| Undergraduate | Pequeños chicos casi optimizadores | 3 (incl. 1 guide) | Universidad Autónoma de Nuevo León |
| Undergraduate | LCZ | 4 (incl. 1 guide) | Universidad de Santiago de Chile |
| Undergraduate | Lobos UAD | 4 (incl. 1 guide) | Universidad Autónoma de Durango |

**Table 5:** Approved teams and BKS activity. "BKS events" counts every time the team established a BKS on its category's timeline (a new BKS on a free instance, a takeover from another team, or an improvement of its own BKS). "Instances led" is the number of distinct instances on which it held a BKS at some point. "Submissions" counts every submission with completed verification; "Feasible" those the verifier accepted.

| Track | Team | Submissions | Feasible | BKS events | Instances led | First BKS (Mty) | Last BKS (Mty) |
|---|---|---|---|---|---|---|---|
| Open | CIMAT_UP | 351 | 304 | 288 | 30 | 20 Jul 00:08 | 15 Aug 23:57 |
| Open | AgenticOR | 180 | 170 | 88 | 18 | 20 Jul 00:38 | 15 Aug 23:09 |
| Open | AILS-CLRP | 39 | 38 | 36 | 20 | 20 Jul 02:24 | 15 Aug 17:17 |
| Open | OPERE LAB | 46 | 46 | 45 | 4 | 29 Jul 20:14 | 04 Aug 15:55 |
| Open | DALR | 22 | 21 | 19 | 10 | 20 Jul 00:30 | 20 Jul 12:15 |
| Open | Kitchen sink solver | 12 | 12 | 2 | 2 | 20 Jul 11:41 | 20 Jul 11:43 |
| Open | LONGZHIGUO | 0 | 0 | 0 | 0 | — | — |
| Open | OptiRoute | 0 | 0 | 0 | 0 | — | — |
| Undergraduate | Más óptimo | 134 | 98 | 80 | 29 | 20 Jul 00:21 | 06 Aug 08:13 |
| Undergraduate | The Badass Optimizers | 74 | 71 | 67 | 30 | 20 Jul 06:58 | 30 Jul 08:33 |
| Undergraduate | SEIN3 | 34 | 30 | 27 | 21 | 22 Jul 14:10 | 31 Jul 22:21 |
| Undergraduate | The Gap Hunters USACH | 39 | 39 | 33 | 21 | 20 Jul 11:02 | 29 Jul 14:54 |
| Undergraduate | Pequeños chicos casi optimizadores | 69 | 67 | 10 | 9 | 20 Jul 21:29 | 21 Jul 12:42 |
| Undergraduate | LCZ | 4 | 4 | 2 | 1 | 24 Jul 23:47 | 25 Jul 00:31 |
| Undergraduate | Lobos UAD | 22 | 7 | 0 | 0 | — | — |

6 of the 8 open teams and 6 of the 7 undergraduate teams established at least one BKS on their timeline. LONGZHIGUO and OptiRoute never submitted a solution; Lobos UAD made 22 submissions (7 feasible) without ever holding a BKS. The methods each team used are described in the Method Descriptions submitted at registration, which the Board has reviewed (§9.6) and which are not part of the public record.

# 5. Results

## 5.1. Open track

**Table 6:** Final ranking, Open track. Score = lead-time + B × final BKS, B = 3. "Takeovers" are BKS events that displaced another team; "self-improvements" are events where the team improved its own BKS; "first on instance" counts the instances where the team set the very first BKS.

| Team | Score (days) | Lead-time (days) | Final BKS | BKS events | Takeovers | Self-impr. | First on inst. | Instances led |
|---|---|---|---|---|---|---|---|---|
| **CIMAT_UP** | 714.460 | 654.460 | 20 | 288 | 68 | 201 | 19 | 30 |
| AgenticOR | 91.029 | 73.029 | 6 | 88 | 56 | 25 | 7 | 18 |
| AILS-CLRP | 70.517 | 61.517 | 3 | 36 | 27 | 9 | 0 | 20 |
| OPERE LAB | 21.807 | 18.807 | 1 | 45 | 9 | 36 | 0 | 4 |

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| Team | Score (days) | Lead-time (days) | Final BKS | BKS events | Takeovers | Self-impr. | First on inst. | Instances led |
|---|---|---|---|---|---|---|---|---|
| DALR | 1.346 | 1.346 | 0 | 19 | 9 | 7 | 3 | 10 |
| Kitchen sink solver | 0.043 | 0.043 | 0 | 2 | 2 | 0 | 0 | 2 |
| LONGZHIGUO | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 |
| OptiRoute | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 |

CIMAT_UP led the Open track from the first day to the last (Section 6.3) and finished with 714.460 points: 654.460 days of accumulated lead-time plus $20 \times 3 = 60$ days of final-BKS bonus. It held every one of the 30 instances at some point, established 288 BKS (60% of all events on the general timeline), of which 201 were improvements of its own incumbent, and it holds the final BKS of 9 of the 10 small, 9 of the 10 medium and 2 of the 10 large instances.

The race for second place was closer than the final margin suggests: AgenticOR (91.029) was never behind AILS-CLRP (70.517) at any day's end, but the gap shrank to 2.4 points on 08 August before AgenticOR's late recovery of the large instances, where it holds 6 of the 10 final BKS after retaking several of them in the final hours (Section 6.7), widened it again. AILS-CLRP holds 3 final BKS (`clrp-small-04`, `clrp-large-02`, `clrp-large-08`) and, notably, never set a first BKS on any instance: all 36 of its events were takeovers or self-improvements. OPERE LAB entered the BKS race only on 29 July and concentrated on medium instances, taking `clrp-medium-04` for good with its last event on 04 August. DALR was the fourth most active team on the opening day (19 events on 20 July, including the first BKS on `clrp-large-01`, `clrp-large-02`, `clrp-large-04`) but did not establish a BKS after 20 July 12:15.

Without the bonus the order of the top four would be identical; the bonus is 8.4% of the winner's score. Lead-time is what separated the teams.

## 5.2. Undergraduate track

**Table 7:** Final ranking, Undergraduate track (scored on the undergraduate BKS timeline, §8.6).

| Team | Score (days) | Lead-time (days) | Final BKS | BKS events | Takeovers | Self-impr. | First on inst. | Instances led |
|---|---|---|---|---|---|---|---|---|
| **Más óptimo** | 626.494 | 545.494 | 27 | 80 | 43 | 36 | 1 | 29 |
| The Badass Optimizers | 182.567 | 173.567 | 3 | 67 | 33 | 17 | 17 | 30 |
| SEIN3 | 45.360 | 45.360 | 0 | 27 | 26 | 1 | 0 | 21 |
| The Gap Hunters USACH | 21.308 | 21.308 | 0 | 33 | 18 | 5 | 10 | 21 |
| Pequeños chicos casi optimizadores | 1.565 | 1.565 | 0 | 10 | 8 | 0 | 2 | 9 |
| LCZ | 0.788 | 0.788 | 0 | 2 | 1 | 1 | 0 | 1 |
| Lobos UAD | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0 |

Más óptimo finished with 626.494 points: 545.494 days of accumulated lead-time plus $27 \times 3 = 81$ days of final-BKS bonus, and it holds the final undergraduate BKS of 7 of the 10 small, 10 of the 10 medium and all 10 large instances. Its path was unusual: its very first submission, on `clrp-small-08` at 00:21:44 Monterrey on the opening night, was the first undergraduate BKS of the Challenge (and, for 79 seconds, the general BKS of that instance), but it did not establish another undergraduate BKS until 25 July, when it took 33 in the 21.9 h that followed (26 of them from other teams). From then on it led 29 of the 30 instances at some point (all but `clrp-small-03`), established 80 undergraduate BKS (37% of the timeline; 43 takeovers, 36 self-improvements) on only 9 distinct days, and held as many as 28 of the 30 undergraduate BKS at the 28 July day-end

snapshot of Table 19. It was also the most active undergraduate submitter (134 submissions, 98 feasible, on all 30 instances).

The Badass Optimizers (182.567) was the first mover and, for the first week, the runaway leader: it set the first undergraduate BKS on 17 instances, 50 of its 67 events fell between 19:04 Monterrey on 20 July and 17:15 the next day, and at midnight of the opening day it held all 30 undergraduate BKS. It then lost them one scale at a time: the small instances to SEIN3 and Más óptimo, the medium ones to SEIN3, the large ones to Más óptimo (Section 6.4). Its last undergraduate BKS came on 30 July 08:33 (`clrp-small-04`, taken from Más óptimo), it never established another, and it kept 3 small instances to the close (`clrp-small-03`, `clrp-small-04`, `clrp-small-08`, held for 23.0, 16.6, 26.2 days respectively); 118 of its 174 days of lead-time were accumulated before it was overtaken.

SEIN3 (45.360) entered on 22 July 14:10 and was second in the category from 23 to 25 July: 26 of its 27 events were takeovers (17 of them from The Badass Optimizers), it led 21 instances at some point and held up to 15 of them at once, but every one of them was taken back before the close, so its score is pure lead-time. The Gap Hunters USACH (21.308) set the first undergraduate BKS on 10 instances (9 of the 10 small ones), led 21 instances at some point and staged the one late counter-attack of the category, retaking 8 medium instances from Más óptimo on 28–29 July, all of which Más óptimo recovered within days. Pequeños chicos casi optimizadores (1.565) was the third most active submitter of the category (69 submissions, 67 feasible, on all 30 instances) but concentrated its 10 BKS on the large instances within a single day (20 July 21:29 to 21 July 12:42), including the first undergraduate BKS on `clrp-large-09` and `clrp-large-10`. LCZ (0.788) submitted 4 solutions and held `clrp-medium-09` for 18.9 h from 24 July 23:47; Lobos UAD made 22 submissions (7 feasible, on 4 instances) without establishing a BKS.

Without the bonus the order of the top six would be identical; the bonus is 12.9% of the winner's score (against 8.4% in the Open track, because Más óptimo holds 27 of the 30 final BKS). As in the Open track, lead-time is what separated the teams, but here the lead changed hands: the eventual winner was not first in the category until 27 July 15:50 Monterrey (Section 6.4).

## 5.3. Final BKS per instance

**Table 8:** Final general BKS at the close, per instance. Gap = (BKS − Hexaly) / Hexaly. "Events" is the number of BKS events on the instance, "Changes" the number of times the lead changed hands, "Holders" the number of distinct teams that held it, "Held for" how long the final holder had held it at the close. "Subm." is the number of verified submissions on the instance and "Teams" the number of teams that submitted to it.

| Instance | Hexaly | Final BKS | Holder | Gap | Events | Changes | Holders | Held for | Subm. | Teams |
|---|---|---|---|---|---|---|---|---|---|---|
| `clrp-small-01` | 38,698.68 | 37,569.09 | CIMAT_UP | −2.92% | 6 | 4 | 2 | 26.6 d | 45 | 10 |
| `clrp-small-02` | 44,998.42 | 42,971.49 | CIMAT_UP | −4.50% | 5 | 2 | 2 | 26.6 d | 24 | 8 |
| `clrp-small-03` | 27,642.26 | 27,168.88 | CIMAT_UP | −1.71% | 4 | 3 | 3 | 26.6 d | 21 | 10 |
| `clrp-small-04` | 24,497.32 | 24,060.11 | AILS-CLRP | −1.78% | 2 | 1 | 2 | 26.9 d | 31 | 9 |
| `clrp-small-05` | 36,438.17 | 34,381.99 | CIMAT_UP | −5.64% | 5 | 2 | 2 | 26.6 d | 25 | 9 |
| `clrp-small-06` | 42,745.18 | 41,861.08 | CIMAT_UP | −2.07% | 4 | 0 | 1 | 25.0 d | 17 | 8 |
| `clrp-small-07` | 39,041.37 | 36,689.10 | CIMAT_UP | −6.03% | 8 | 2 | 2 | 24.6 d | 27 | 9 |
| `clrp-small-08` | 8,779.87 | 8,779.87 | CIMAT_UP | 0.00% | 2 | 1 | 2 | 27.0 d | 38 | 11 |
| `clrp-small-09` | 44,138.11 | 42,948.38 | CIMAT_UP | −2.70% | 4 | 2 | 2 | 26.6 d | 16 | 9 |
| `clrp-small-10` | 36,285.87 | 35,575.67 | CIMAT_UP | −1.96% | 7 | 2 | 2 | 24.9 d | 20 | 9 |
| `clrp-medium-01` | 67,640.63 | 64,839.93 | CIMAT_UP | −4.14% | 29 | 6 | 5 | 14.2 d | 53 | 12 |
| `clrp-medium-02` | 71,927.64 | 67,997.02 | CIMAT_UP | −5.46% | 34 | 11 | 5 | 12.5 d | 48 | 10 |
| `clrp-medium-03` | 56,688.20 | 54,522.27 | CIMAT_UP | −3.82% | 13 | 4 | 3 | 14.3 d | 26 | 8 |

*continued on next page*

| Instance | Hexaly | Final BKS | Holder | Gap | Events | Changes | Holders | Held for | Subm. | Teams |
|---|---|---|---|---|---|---|---|---|---|---|
| clrp-medium-04 | 51,637.36 | 50,442.11 | OPERE LAB | −2.31% | 26 | 13 | 5 | 11.3 d | 44 | 10 |
| clrp-medium-05 | 66,081.62 | 60,439.00 | CIMAT_UP | −8.54% | 32 | 12 | 4 | 2.4 d | 53 | 9 |
| clrp-medium-06 | 77,120.11 | 68,893.81 | CIMAT_UP | −10.67% | 29 | 6 | 4 | 12.2 d | 49 | 9 |
| clrp-medium-07 | 74,463.85 | 65,054.33 | CIMAT_UP | −12.64% | 34 | 8 | 5 | 10.6 d | 46 | 10 |
| clrp-medium-08 | 24,827.59 | 24,027.59 | CIMAT_UP | −3.22% | 3 | 2 | 2 | 26.4 d | 17 | 8 |
| clrp-medium-09 | 67,194.25 | 63,658.21 | CIMAT_UP | −5.26% | 8 | 2 | 2 | 14.3 d | 25 | 8 |
| clrp-medium-10 | 69,788.29 | 64,448.54 | CIMAT_UP | −7.65% | 23 | 3 | 3 | 9.0 d | 43 | 8 |
| clrp-large-01 | 7,665,843.73 | 7,420,494.02 | AgenticOR | −3.20% | 26 | 13 | 4 | 49 min | 40 | 7 |
| clrp-large-02 | 8,746,357.50 | 8,465,078.19 | AILS-CLRP | −3.22% | 19 | 5 | 4 | 8.6 d | 35 | 7 |
| clrp-large-03 | 6,870,343.86 | 6,673,738.46 | CIMAT_UP | −2.86% | 16 | 5 | 2 | 2 min | 31 | 7 |
| clrp-large-04 | 7,514,113.03 | 7,284,926.76 | AgenticOR | −3.05% | 18 | 7 | 3 | 55 min | 32 | 7 |
| clrp-large-05 | 6,864,579.45 | 6,639,473.75 | AgenticOR | −3.28% | 16 | 6 | 2 | 55 min | 30 | 5 |
| clrp-large-06 | 6,587,578.08 | 6,332,853.90 | AgenticOR | −3.87% | 21 | 10 | 2 | 5.8 h | 32 | 5 |
| clrp-large-07 | 8,682,788.17 | 8,384,113.87 | AgenticOR | −3.44% | 19 | 12 | 2 | 6.2 d | 41 | 6 |
| clrp-large-08 | 7,210,039.73 | 6,934,967.10 | AILS-CLRP | −3.82% | 26 | 14 | 4 | 6.7 h | 43 | 7 |
| clrp-large-09 | 6,782,735.75 | 6,551,702.35 | AgenticOR | −3.41% | 23 | 10 | 2 | 1.7 h | 39 | 6 |
| clrp-large-10 | 6,915,926.00 | 6,648,706.75 | CIMAT_UP | −3.86% | 17 | 3 | 2 | 2 min | 35 | 6 |

Final holdings by scale: small — CIMAT_UP 9, AILS-CLRP 1; medium — CIMAT_UP 9, OPERE LAB 1; large — AgenticOR 6, AILS-CLRP 2, CIMAT_UP 2. On 21 of the 30 instances the team that set the first BKS also holds the final one.

## 5.4. Undergraduate BKS per instance

**Table 9:** Final undergraduate BKS at the close, per instance. "Gap to Hexaly" = (undergraduate BKS − Hexaly baseline of Table 8) / Hexaly; "Gap to general" = (undergraduate BKS − general BKS of Table 8) / general BKS. "Events", "Changes", "Holders" and "Held for" are as in Table 8 but on the undergraduate timeline; "Subm." is the number of verified submissions by undergraduate teams on the instance and "Teams" the number of undergraduate teams that submitted to it.

| Instance | Undergrad BKS | Holder | Gap to Hexaly | Gap to general | Events | Changes | Holders | Held for | Subm. | Teams |
|---|---|---|---|---|---|---|---|---|---|---|
| clrp-small-01 | 37,569.09 | Más óptimo | −2.92% | 0.000% | 11 | 8 | 4 | 12.1 d | 27 | 6 |
| clrp-small-02 | 42,986.49 | Más óptimo | −4.47% | +0.035% | 9 | 5 | 4 | 12.0 d | 17 | 5 |
| clrp-small-03 | 27,168.88 | The Badass Optimizers | −1.71% | 0.000% | 8 | 6 | 3 | 23.0 d | 13 | 6 |
| clrp-small-04 | 24,060.11 | The Badass Optimizers | −1.78% | 0.000% | 9 | 8 | 4 | 16.6 d | 14 | 5 |
| clrp-small-05 | 34,381.99 | Más óptimo | −5.64% | 0.000% | 6 | 4 | 4 | 21.2 d | 11 | 5 |
| clrp-small-06 | 41,908.08 | Más óptimo | −1.96% | +0.112% | 5 | 3 | 4 | 21.2 d | 7 | 5 |
| clrp-small-07 | 36,748.88 | Más óptimo | −5.87% | +0.163% | 8 | 5 | 4 | 9.7 d | 12 | 5 |
| clrp-small-08 | 8,779.87 | The Badass Optimizers | 0.00% | 0.000% | 4 | 2 | 3 | 26.2 d | 27 | 6 |
| clrp-small-09 | 43,007.18 | Más óptimo | −2.56% | +0.137% | 6 | 3 | 4 | 12.1 d | 8 | 5 |
| clrp-small-10 | 35,846.67 | Más óptimo | −1.21% | +0.762% | 8 | 5 | 4 | 11.4 d | 9 | 5 |
| clrp-medium-01 | 65,718.77 | Más óptimo | −2.84% | +1.355% | 7 | 4 | 4 | 10.1 d | 16 | 6 |
| clrp-medium-02 | 68,504.93 | Más óptimo | −4.76% | +0.747% | 9 | 5 | 4 | 17.0 d | 11 | 5 |
| clrp-medium-03 | 54,647.27 | Más óptimo | −3.60% | +0.229% | 7 | 4 | 4 | 15.5 d | 9 | 5 |
| clrp-medium-04 | 50,820.06 | Más óptimo | −1.58% | +0.749% | 6 | 4 | 4 | 17.5 d | 9 | 5 |
| clrp-medium-05 | 61,139.63 | Más óptimo | −7.48% | +1.159% | 6 | 4 | 4 | 11.5 d | 14 | 5 |
| clrp-medium-06 | 69,752.22 | Más óptimo | −9.55% | +1.246% | 8 | 5 | 4 | 11.8 d | 16 | 5 |
| clrp-medium-07 | 65,811.84 | Más óptimo | −11.62% | +1.164% | 6 | 4 | 4 | 16.4 d | 8 | 5 |
| clrp-medium-08 | 24,084.59 | Más óptimo | −2.99% | +0.237% | 8 | 7 | 4 | 17.4 d | 10 | 5 |
| clrp-medium-09 | 63,951.25 | Más óptimo | −4.83% | +0.460% | 8 | 3 | 4 | 11.9 d | 11 | 5 |
| clrp-medium-10 | 65,185.44 | Más óptimo | −6.60% | +1.143% | 8 | 3 | 3 | 12.1 d | 11 | 4 |

*continued on next page*

| Instance | Undergrad BKS | Holder | Gap to Hexaly | Gap to general | Events | Changes | Holders | Held for | Subm. | Teams |
|---|---|---|---|---|---|---|---|---|---|---|
| clrp-large-01 | 7,492,514.12 | Más óptimo | −2.26% | +0.971% | 5 | 1 | 2 | 12.2 d | 10 | 3 |
| clrp-large-02 | 8,541,468.32 | Más óptimo | −2.34% | +0.902% | 7 | 3 | 3 | 10.0 d | 13 | 3 |
| clrp-large-03 | 6,739,675.76 | Más óptimo | −1.90% | +0.988% | 8 | 5 | 4 | 20.4 d | 11 | 4 |
| clrp-large-04 | 7,364,492.87 | Más óptimo | −1.99% | +1.092% | 7 | 4 | 4 | 9.9 d | 10 | 4 |
| clrp-large-05 | 6,710,221.55 | Más óptimo | −2.25% | +1.066% | 6 | 3 | 3 | 12.2 d | 10 | 3 |
| clrp-large-06 | 6,376,419.68 | Más óptimo | −3.21% | +0.688% | 7 | 5 | 3 | 12.2 d | 10 | 3 |
| clrp-large-07 | 8,490,692.37 | Más óptimo | −2.21% | +1.271% | 11 | 5 | 4 | 9.9 d | 16 | 4 |
| clrp-large-08 | 7,011,870.04 | Más óptimo | −2.75% | +1.109% | 7 | 3 | 3 | 10.0 d | 13 | 3 |
| clrp-large-09 | 6,601,721.55 | Más óptimo | −2.67% | +0.763% | 6 | 4 | 4 | 12.2 d | 10 | 4 |
| clrp-large-10 | 6,689,111.65 | Más óptimo | −3.28% | +0.608% | 8 | 4 | 4 | 12.0 d | 13 | 4 |

The undergraduate BKS is remarkably close to the general one: on average 0.64% above it, at most 1.36% (clrp-medium-01), and equal to it on 5 instances (clrp-small-01, clrp-small-03, clrp-small-04, clrp-small-05, clrp-small-08). By scale the mean gap is 0.12% (small), 0.85% (medium) and 0.95% (large). One undergraduate solution held the general BKS during the window: Más óptimo's first submission on clrp-small-08 was the first BKS of that instance (20 July 00:21:44 Monterrey), displaced 79 seconds later by CIMAT_UP.

Measured against the frozen Hexaly baseline rather than against the Open teams, the undergraduate BKS beat it on 29 of the 30 instances and matched it on the remaining one (clrp-small-08, the same instance the general BKS ties on): 3.63% below the baseline on average, 2.75% at the median, and up to 11.62% on clrp-medium-07 (Section 5.5). Final holdings by scale: small, Más óptimo 7, The Badass Optimizers 3; medium, Más óptimo 10; large, Más óptimo 10. On none of the 30 instances did the team that set the first undergraduate BKS also hold the final one (against 21 of 30 on the general timeline): every instance had at least two distinct holders (only clrp-large-01 had as few as two) and 22 of them had four, so the mean number of holders per instance was 3.7 against 2.8 on the general timeline. The final undergraduate BKS were also settled early: at the close they had been held for between 9.7 days (clrp-small-07) and 26.2 days (clrp-small-08), 12.2 days at the median, i.e. the undergraduate podium was decided more than a week before the window closed (Section 6.7). Undergraduate teams made 376 verified submissions to the 30 instances (316 feasible): 145 on the small, 115 on the medium and 116 on the large instances, with between 3 and 6 undergraduate teams submitting to each instance.

## 5.5. Comparison with the Hexaly baseline

**Table 10:** Gap of the final participant BKS to the Hexaly baseline, by scale.

| Scale | n | Mean gap | Median | Best (most negative) | Worst |
|---|---|---|---|---|---|
| Small | 10 | −2.93% | −2.07% | −6.03% | 0.00% |
| Medium | 10 | −6.37% | −5.26% | −12.64% | −2.31% |
| Large | 10 | −3.40% | −3.28% | −3.87% | −2.86% |
| **All** | 30 | −4.23% | −3.41% | −12.64% | 0.00% |

The participants improved on the frozen Hexaly baseline on 29 of the 30 instances. The exception is clrp-small-08 (80 customers, 5 depots, the smallest instance of the set), where the final BKS equals the baseline cost exactly (8,779.87); it was reached 23 min into the window, never improved, and is very plausibly optimal. The largest gaps are on the medium instances (mean -6.37%, and -12.64% on clrp-medium-07, -10.67% on clrp-medium-06), which are also the instances with the

most BKS events; on the ten large road-network instances the gap is tightly clustered between -2.86% and -3.87%. Two readings are compatible with this and the report does not choose between them: the medium instances left more room for improvement over a fixed-time baseline run, and/or the teams' methods were tuned hardest where the generator made instances most like the ones they trained on.

**Table 11:** Gap of the final undergraduate BKS to the Hexaly baseline, by scale.

| Scale | n | Mean gap | Median | Best (most negative) | Worst |
|---|---|---|---|---|---|
| Small | 10 | −2.81% | −1.96% | −5.87% | 0.00% |
| Medium | 10 | −5.58% | −4.76% | −11.62% | −1.58% |
| Large | 10 | −2.49% | −2.26% | −3.28% | −1.90% |
| **All** | 30 | −3.63% | −2.75% | −11.62% | 0.00% |

The undergraduate BKS alone would have beaten the baseline on the same 29 instances, by 3.63% on average against 4.23% for the general BKS. The pattern by scale is the same as in Table 10 and the differences are small: -2.81% against -2.93% on the small instances, -5.58% against -6.37% on the medium ones and -2.49% against -3.40% on the large ones. The three largest undergraduate gaps are on the same three medium instances as the general ones (`clrp-medium-07` -11.62%, `clrp-medium-06` -9.55%, `clrp-medium-05` -7.48%), and on the road-network instances the undergraduate BKS cluster between -1.90% and -3.28% below the baseline, about one point above the general cluster. In other words, the undergraduate teams reproduced the shape of the Open result at a slightly larger gap, not a different result.

## 5.6. Improvement over the window

**Table 12:** Improvement of the BKS from the first BKS of each instance to the final one, by scale.

| Scale | Mean | Median | Min | Max | BKS events | Lead changes |
|---|---|---|---|---|---|---|
| Small | 1.34% | 1.46% | 0.03% | 4.37% | 47 | 19 |
| Medium | 5.10% | 4.63% | 2.23% | 10.60% | 231 | 67 |
| Large | 7.50% | 5.48% | 0.95% | 20.17% | 201 | 85 |

The first BKS were established within minutes of the opening, so this is essentially the improvement of the community's best over the whole window: 4.65% on average, 2.57% median, and up to 20.17% on `clrp-large-02` (whose first BKS, by DALR, was 10,604,489.36 against a final 8,465,078.19). Small instances converged fastest and moved least (1.34%); large ones moved most.

**Table 13:** Improvement of the undergraduate BKS from the first undergraduate BKS of each instance to the final one, by scale.

| Scale | Mean | Median | Min | Max | BKS events | Lead changes |
|---|---|---|---|---|---|---|
| Small | 19.19% | 19.03% | 1.46% | 40.97% | 74 | 49 |
| Medium | 3.81% | 4.12% | 1.94% | 6.06% | 73 | 43 |
| Large | 11.93% | 7.75% | 4.59% | 31.84% | 72 | 37 |

On the undergraduate timeline the picture is inverted and the numbers are much larger: 11.64% on average and 6.80% at the median (against 4.65% and 2.57% on the general timeline), up to 40.97% on `clrp-small-07` (first undergraduate BKS 62,259.51 by The Gap Hunters USACH, final

36,748.88) and 31.84% on `clrp-large-09` (first 9,685,512.63 by Pequeños chicos casi optimizadores, final 6,601,721.55). The reason is where each timeline started: the first general BKS were mostly CIMAT_UP's opening-hour solutions, already close to the baseline, whereas the first undergraduate BKS on the small instances were The Gap Hunters USACH's first feasible solutions, 23.5% above the baseline on average, and on the large ones mostly The Badass Optimizers's or Pequeños chicos casi optimizadores's, 12.0% above it. The small instances therefore moved most on the undergraduate timeline (19.19%) and least on the general one (1.34%); the medium instances, where The Badass Optimizers's first undergraduate BKS were already good, moved least (3.81%). BKS events were spread almost evenly across the three scales (74 / 73 / 72), unlike the general timeline (47 / 231 / 201), and lead changes were most frequent on the small instances.

## 5.7. Results by instance design

Because the design of every instance is known (Table 1), the outcome can be read against it. Table 14 groups the 30 instances by capacity regime and by the structural axes.

**Table 14:** Gap to the Hexaly baseline, BKS activity and improvement over the window, by design. Mean over the instances in each group; n is the number of instances.

| Axis | Value | n | Mean gap to Hexaly | Best gap | BKS events | Lead changes | Holders | Improvement first→final | Undergrad gap to general |
|---|---|---|---|---|---|---|---|---|---|
| Regime | Loose | 6 | −2.59% | −3.82% | 13.2 | 5.5 | 3.0 | 4.00% | 0.51% |
| Regime | Moderate | 9 | −6.24% | −12.64% | 18.7 | 6.4 | 2.7 | 4.67% | 0.76% |
| Regime | Tight | 6 | −4.14% | −7.65% | 13.7 | 3.7 | 2.2 | 2.57% | 0.65% |
| Regime | Asym. depot | 3 | −3.42% | −4.14% | 20.3 | 7.7 | 3.7 | 7.61% | 0.78% |
| Regime | Asym. fleet | 3 | −4.40% | −5.46% | 19.3 | 6.0 | 3.7 | 8.66% | 0.56% |
| Regime | Pathological | 3 | −2.35% | −3.82% | 10.3 | 5.7 | 2.7 | 3.05% | 0.45% |
| Customer placement | uniform | 10 | −4.47% | −8.54% | 14.0 | 4.8 | 3.0 | 2.48% | 0.41% |
| Customer placement | clustered | 8 | −4.45% | −12.64% | 13.1 | 4.0 | 2.9 | 3.73% | 0.53% |
| Customer placement | mixed | 2 | −6.37% | −10.67% | 16.5 | 3.0 | 2.5 | 4.84% | 0.68% |
| Customer placement | ZMM res./comm. | 10 | −3.40% | −3.87% | 20.1 | 8.5 | 2.7 | 7.50% | 0.95% |
| Depot placement | random | 2 | −2.77% | −3.82% | 8.5 | 3.5 | 3.0 | 1.45% | 0.11% |
| Depot placement | grid | 12 | −4.67% | −10.67% | 15.3 | 5.1 | 3.0 | 3.09% | 0.50% |
| Depot placement | co-located | 4 | −7.07% | −12.64% | 18.0 | 3.8 | 3.0 | 5.18% | 0.81% |
| Depot placement | peripheral | 2 | −1.61% | −3.22% | 2.5 | 1.5 | 2.0 | 1.84% | 0.12% |
| Depot placement | ZMM ind. | 10 | −3.40% | −3.87% | 20.1 | 8.5 | 2.7 | 7.50% | 0.95% |
| Demand | uniform | 22 | −4.78% | −12.64% | 16.5 | 5.5 | 2.9 | 4.49% | 0.67% |
| Demand | bimodal | 8 | −2.74% | −3.87% | 14.4 | 6.4 | 2.8 | 5.07% | 0.56% |

Some of what the design was built to reveal shows up in the record:

- **The pathological instances behaved as designed.** They were built so that nearest-depot-then-pack is more than 5% off the optimum. On `clrp-small-08` (`small_pathological`, the MIP-validated one) the participants matched the Hexaly baseline exactly (8,779.87) within 23 min of the opening and nobody moved it again, which is what one expects when everyone finds the optimum. `clrp-medium-08` (`medium_pathological`, 200 customers, 8 peripheral depots, opening costs from 395 to 3,407) ended -3.22% below the baseline with only 3 BKS events, and `clrp-large-08` (`large_pathological`, 2 500 customers, opening costs 598–7,965 against $g = 8$) was the most contested large instance (26 events, 14 lead changes, 4 holders) and finished -3.82%.
- **Moderate instances left the most on the table.** The 9 moderate instances ($\rho \approx 0.65$–$0.80$) have the largest mean gap to the baseline (-6.24%) and the largest first-to-final improvement;

the three biggest gaps of the whole set (`clrp-medium-07`, `clrp-medium-06`, `clrp-medium-05`) are all medium moderate instances, i.e. `medium_moderate_c/b/a`: 800–1 000 customers with clustered/mixed geography and co-located or grid depots.

- **Tight, asymmetric and loose instances ended closer to the baseline than the moderate ones.** The 6 tight instances average -4.14%, the 6 asymmetric ones -3.91% and the 6 loose ones -2.59%, against -6.24% for moderate. When capacity nearly forces the route count and the open-depot set (tight, asymmetric), or when nothing binds and the problem is a plain cost trade-off (loose), there is less structural slack for a metaheuristic to exploit over a strong baseline; the moderate regime, by design the "realistic" one, is where the location–routing interaction is richest.
- **Bimodal demand narrowed the gap.** The 8 bimodal instances were improved over the baseline by -2.74% on average against -4.78% for uniform demand, with a similar number of BKS events per instance; the packing structure that bimodal demand introduces appears to have constrained the participants at least as much as it constrained the baseline.
- **The road-network instances are the most uniform in outcome.** All ten large instances finished between -2.86% and -3.87% regardless of regime, and their contest was a two-team affair (mean 2.7 holders). Whatever advantage the winners had on the synthetic instances did not translate as strongly to asymmetric real distances, where the second-placed team took 6 of the 10 final BKS.

The same axes can be read on the undergraduate timeline (Table 15). The columns are those of Table 14, computed on the undergraduate BKS events and the final undergraduate BKS.

**Table 15:** Gap of the undergraduate BKS to the Hexaly baseline, undergraduate BKS activity and improvement over the window, by design. Mean over the instances in each group; n is the number of instances.

| Axis | Value | n | Mean gap to Hexaly | Best gap | BKS events | Lead changes | Holders | Improvement first→final | Undergrad gap to general |
|---|---|---|---|---|---|---|---|---|---|
| Regime | Loose | 6 | −2.10% | −3.60% | 7.5 | 5.2 | 3.8 | 8.68% | 0.51% |
| Regime | Moderate | 9 | −5.53% | −11.62% | 7.0 | 4.2 | 3.8 | 10.53% | 0.76% |
| Regime | Tight | 6 | −3.52% | −6.60% | 7.3 | 3.7 | 3.8 | 19.60% | 0.65% |
| Regime | Asym. depot | 3 | −2.67% | −2.92% | 7.7 | 4.3 | 3.3 | 15.62% | 0.78% |
| Regime | Asym. fleet | 3 | −3.86% | −4.76% | 8.3 | 4.3 | 3.7 | 9.09% | 0.56% |
| Regime | Pathological | 3 | −1.91% | −2.99% | 6.3 | 4.0 | 3.3 | 3.55% | 0.45% |
| Customer placement | uniform | 10 | −4.08% | −7.48% | 7.7 | 4.6 | 3.9 | 12.21% | 0.41% |
| Customer placement | clustered | 8 | −3.96% | −11.62% | 7.1 | 4.8 | 3.8 | 11.33% | 0.53% |
| Customer placement | mixed | 2 | −5.76% | −9.55% | 6.5 | 4.0 | 4.0 | 8.64% | 0.68% |
| Customer placement | ZMM res./comm. | 10 | −2.49% | −3.28% | 7.2 | 3.7 | 3.4 | 11.93% | 0.95% |
| Depot placement | random | 2 | −2.66% | −3.60% | 7.5 | 5.0 | 3.5 | 10.61% | 0.11% |
| Depot placement | grid | 12 | −4.20% | −9.55% | 7.5 | 4.7 | 4.0 | 10.32% | 0.50% |
| Depot placement | co-located | 4 | −6.32% | −11.62% | 7.5 | 4.2 | 3.8 | 20.23% | 0.81% |
| Depot placement | peripheral | 2 | −1.50% | −2.99% | 6.0 | 4.5 | 3.5 | 2.01% | 0.12% |
| Depot placement | ZMM ind. | 10 | −2.49% | −3.28% | 7.2 | 3.7 | 3.4 | 11.93% | 0.95% |
| Demand | uniform | 22 | −4.15% | −11.62% | 7.4 | 4.2 | 3.7 | 13.59% | 0.67% |
| Demand | bimodal | 8 | −2.20% | −3.28% | 7.0 | 4.6 | 3.6 | 6.29% | 0.56% |

- **The design ordering survives.** The moderate instances again have the largest mean gap to the baseline (-5.53% against -6.24% on the general timeline), followed by tight (-3.52%), asymmetric (-3.27%) and loose (-2.10%); bimodal demand again narrows the gap (-2.20% against -4.15% for uniform demand); and the road-network instances are again the most

uniform in outcome (-1.90% to -3.28%). Regime by regime, the undergraduate gap to the baseline is 0.4–0.7 points smaller than the general one and the ordering of the regimes is unchanged.

- **The pathological instances again behaved as designed.** On `clrp-small-08` the undergraduate teams also reached the baseline cost exactly (8,779.87, The Badass Optimizers at 20 July 19:45 Monterrey, 19.8 h after the opening) and nobody moved it again; `clrp-medium-08` ended -2.99% below the baseline but, unlike on the general timeline (3 events), was one of the most contested undergraduate instances (8 events, 7 lead changes, 4 holders); `clrp-large-08` ended -2.75% with 7 events.
- **Contest was spread across the design space, not concentrated on the medium instances.** Where the general timeline piled its events on the moderate/medium instances, the undergraduate timeline averaged between 6.0 and 8.3 events and between 3.7 and 5.2 lead changes per instance in every group of Table 15 (7.3 and 4.3 overall); the peripheral-depot and random-depot instances that were the quietest of all on the general timeline (2.5 and 8.5 events) had 6.0 and 7.5 here, in line with everything else. Contest on the undergraduate timeline was driven by the sequence of teams entering the race (Section 6.4) rather than by the structure of the instances.
- **The undergraduate gap to the general BKS grows with structure.** It is smallest where the general BKS is likely optimal or nearly so (peripheral and random depots, 0.12%; the pathological regime, 0.45%) and largest on the co-located-depot (0.81%) and road-network (0.95%) instances, i.e. exactly where the Open teams found the most room over the baseline.

# 6. Dynamics of the competition

## 6.1. The opening

The window opened at 20 Jul 2026 06:00 UTC (20 Jul 00:00 Monterrey). The first BKS of the Challenge was CIMAT_UP's on `clrp-small-01` at 00:08:21 Monterrey, 8 minutes after the opening; CIMAT_UP then set the first BKS on the small and medium instances one after another (nineteen first BKS in total), while DALR and AgenticOR split the first BKS on the large ones. All 30 instances had a BKS by 01:31 Monterrey, 92 minutes in. The first 24 hours produced 149 BKS events (31% of the whole competition), and 136 on the opening calendar day (UTC), when 247 submissions were received from 9 teams.

The undergraduate timeline opened with the same event: Más óptimo's submission on `clrp-small-08` at 00:21:44 Monterrey (8,909.87) was the first undergraduate BKS and, briefly, the general one. After that the undergraduate track was slow to start: only 1 instance had an undergraduate BKS an hour in, The Badass Optimizers set the first undergraduate BKS on `clrp-medium-01` and `clrp-medium-05` at 06:58, The Gap Hunters USACH opened `clrp-small-01` at 11:02 and then the rest of the small instances through the afternoon, and the medium and large ones were covered in the evening, when The Badass Optimizers set 10 first BKS between 19:05 and 19:07 and Pequeños chicos casi optimizadores the last two, on `clrp-large-09` and `clrp-large-10`, at 21:30 Monterrey. All 30 instances had an undergraduate BKS 21.5 hours in (against 92 minutes on the general timeline). The first 24 hours produced 54 undergraduate BKS events (25% of that timeline), from 15 submissions by 4 undergraduate teams on the opening calendar day (UTC) and 142 by 4 on the next, the busiest undergraduate day of the window (Section 6.2).

## 6.2. Activity by day

**Table 16:** BKS events per calendar day (UTC), general timeline, with the submissions received that day (all teams; feasible / infeasible or format error) and the number of teams that submitted.

| Day (UTC) | Events | By team | Subm. | Feas. / not | Teams |
|---|---|---|---|---|---|
| 2026-07-20 | 136 | CIMAT_UP 54, AgenticOR 35, AILS-CLRP 25, DALR 19, Kitchen sink solver 2, Más óptimo 1 | 247 | 229 / 18 | 9 |
| 2026-07-21 | 36 | CIMAT_UP 23, AgenticOR 12, AILS-CLRP 1 | 202 | 182 / 20 | 7 |
| 2026-07-22 | 40 | CIMAT_UP 39, AgenticOR 1 | 53 | 51 / 2 | 6 |
| 2026-07-23 | 37 | CIMAT_UP 24, AgenticOR 13 | 66 | 58 / 8 | 6 |
| 2026-07-24 | 37 | CIMAT_UP 33, AgenticOR 4 | 59 | 50 / 9 | 7 |
| 2026-07-25 | 41 | CIMAT_UP 35, AgenticOR 6 | 52 | 50 / 2 | 6 |
| 2026-07-26 | 10 | CIMAT_UP 10 | 68 | 49 / 19 | 4 |
| 2026-07-27 | 3 | CIMAT_UP 3 | 31 | 27 / 4 | 4 |
| 2026-07-28 | 18 | CIMAT_UP 18 | 20 | 20 / 0 | 2 |
| 2026-07-29 | 2 | CIMAT_UP 1, AgenticOR 1 | 18 | 15 / 3 | 5 |
| 2026-07-30 | 4 | CIMAT_UP 2, OPERE LAB 1, AILS-CLRP 1 | 13 | 13 / 0 | 5 |
| 2026-07-31 | 25 | OPERE LAB 20, CIMAT_UP 5 | 29 | 28 / 1 | 3 |
| 2026-08-01 | 14 | CIMAT_UP 12, OPERE LAB 2 | 20 | 17 / 3 | 5 |
| 2026-08-02 | 4 | CIMAT_UP 2, OPERE LAB 2 | 7 | 6 / 1 | 2 |
| 2026-08-03 | 23 | OPERE LAB 14, CIMAT_UP 9 | 23 | 23 / 0 | 2 |
| 2026-08-04 | 8 | OPERE LAB 6, CIMAT_UP 2 | 51 | 33 / 18 | 4 |
| 2026-08-05 | 6 | CIMAT_UP 5, AILS-CLRP 1 | 6 | 6 / 0 | 2 |
| 2026-08-06 | 4 | CIMAT_UP 3, AILS-CLRP 1 | 17 | 12 / 5 | 3 |
| 2026-08-07 | 6 | CIMAT_UP 2, AgenticOR 2, AILS-CLRP 2 | 6 | 6 / 0 | 3 |
| 2026-08-08 | 1 | AgenticOR 1 | 4 | 2 / 2 | 2 |
| 2026-08-09 | 1 | CIMAT_UP 1 | 5 | 4 / 1 | 1 |
| 2026-08-10 | 2 | AgenticOR 2 | 2 | 2 / 0 | 1 |
| 2026-08-11 | 1 | AgenticOR 1 | 1 | 1 / 0 | 1 |
| 2026-08-12 | 2 | AgenticOR 2 | 2 | 2 / 0 | 1 |
| 2026-08-13 | 4 | AgenticOR 2, CIMAT_UP 2 | 5 | 4 / 1 | 2 |
| 2026-08-14 | 4 | AILS-CLRP 3, AgenticOR 1 | 6 | 4 / 2 | 3 |
| 2026-08-15 | 3 | AILS-CLRP 2, CIMAT_UP 1 | 4 | 4 / 0 | 3 |
| 2026-08-16 | 7 | AgenticOR 5, CIMAT_UP 2 | 9 | 9 / 0 | 2 |

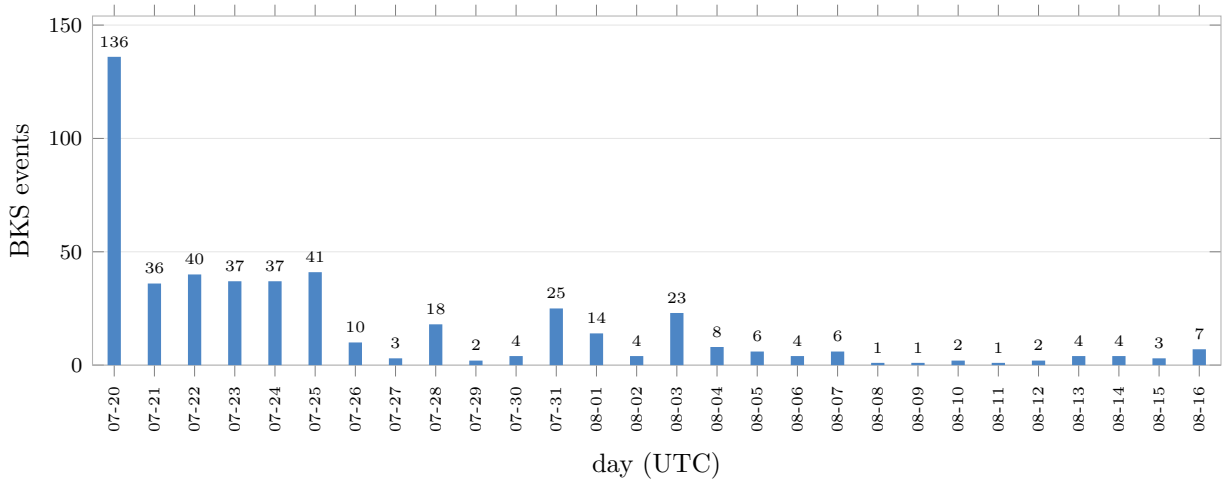


**Figure 1:** BKS events per calendar day (UTC), general timeline.

Activity came in three waves: the opening week (327 events in the first six days, dominated by CIMAT_UP's stream of self-improvements and its exchanges with AgenticOR on the large instances), a second wave at the turn of the month driven by OPERE LAB's entry on the medium instances (45 events between 29 July and 04 August), and a much quieter second half (6 days with two events or fewer) that ended with a burst on the last day (Section 6.7). Events cluster in the Monterrey night: 135 of the 479 events landed between 23:00 and 03:00 Monterrey time, consistent with overnight compute runs whose results were submitted as they finished.

**Table 17:** Undergraduate BKS events per calendar day (UTC), with the submissions received that day from undergraduate teams (feasible / infeasible or format error) and the number of undergraduate teams that submitted. Days with no undergraduate submission at all are omitted (11 of the 28 calendar days, all in August).

| Day (UTC) | Events | By team | Subm. | Feas. / not | Teams |
|---|---|---|---|---|---|
| 2026-07-20 | 9 | The Gap Hunters USACH 6, The Badass Optimizers 2, Más óptimo 1 | 15 | 15 / 0 | 4 |
| 2026-07-21 | 74 | The Badass Optimizers 50, The Gap Hunters USACH 14, Pequeños chicos casi optimizadores 10 | 142 | 137 / 5 | 4 |
| 2026-07-22 | 8 | The Badass Optimizers 4, The Gap Hunters USACH 3, SEIN3 1 | 9 | 9 / 0 | 3 |
| 2026-07-23 | 16 | SEIN3 12, The Badass Optimizers 3, The Gap Hunters USACH 1 | 19 | 18 / 1 | 4 |
| 2026-07-24 | 10 | The Badass Optimizers 5, SEIN3 4, The Gap Hunters USACH 1 | 20 | 12 / 8 | 5 |
| 2026-07-25 | 6 | SEIN3 2, The Badass Optimizers 2, LCZ 2 | 10 | 8 / 2 | 4 |
| 2026-07-26 | 34 | Más óptimo 33, SEIN3 1 | 54 | 38 / 16 | 2 |
| 2026-07-27 | 8 | Más óptimo 5, SEIN3 3 | 18 | 18 / 0 | 2 |
| 2026-07-28 | 2 | The Gap Hunters USACH 2 | 2 | 2 / 0 | 1 |
| 2026-07-29 | 12 | The Gap Hunters USACH 6, SEIN3 3, Más óptimo 3 | 16 | 13 / 3 | 3 |
| 2026-07-30 | 8 | Más óptimo 7, The Badass Optimizers 1 | 8 | 8 / 0 | 2 |
| 2026-07-31 | 3 | Más óptimo 3 | 3 | 3 / 0 | 1 |
| 2026-08-01 | 2 | Más óptimo 1, SEIN3 1 | 5 | 3 / 2 | 3 |
| 2026-08-04 | 21 | Más óptimo 21 | 40 | 24 / 16 | 2 |
| 2026-08-06 | 6 | Más óptimo 6 | 12 | 7 / 5 | 1 |
| 2026-08-14 | 0 | – | 2 | 0 / 2 | 1 |
| 2026-08-15 | 0 | – | 1 | 1 / 0 | 1 |

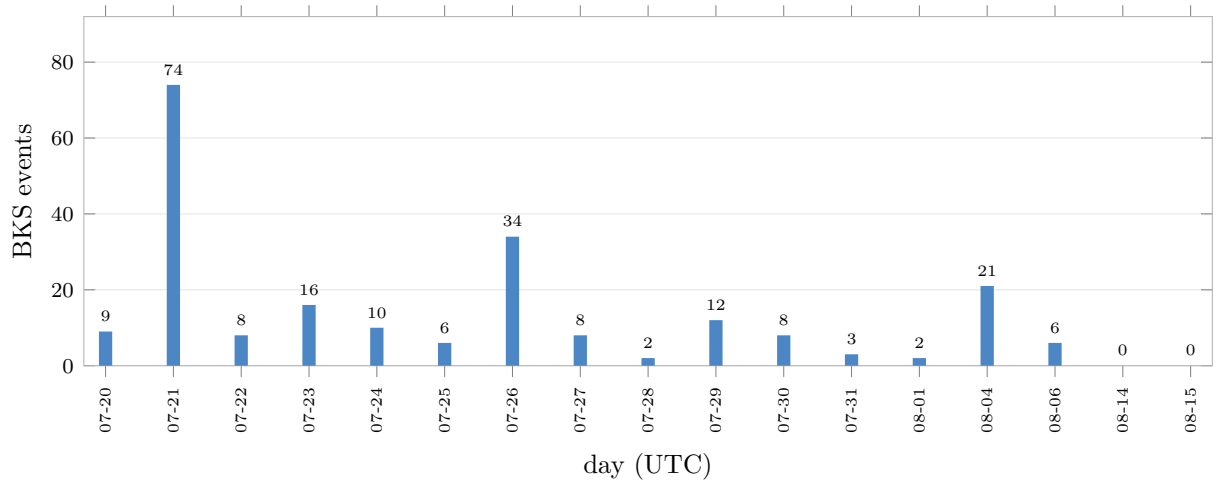


**Figure 2:** BKS events per calendar day (UTC), undergraduate timeline.

The undergraduate timeline was front-loaded and finished early. Its busiest day was 2026-07-21 (74 events, 34% of the timeline, from 142 submissions), the day The Badass Optimizers took the whole board and Pequeños chicos casi optimizadores contested the large instances; 162 of the 219 events (74%) fell in the first week. Then came SEIN3's wave on the small and medium instances (19 events between 22 and 25 July), Más óptimo's two bursts (33 events on 2026-07-26 and 21 on 2026-08-04), and silence: no undergraduate BKS event after 06 August 08:13 Monterrey, and only 3 undergraduate submissions after that day (1 feasible, none improving). Undergraduate events cluster in the Monterrey evening rather than the night: 89 of the 219 events (41%) landed between 18:00 and 22:00 Monterrey time, and 163 of the 376 undergraduate submissions (43%) in the same four hours, against 135 of the 479 general-timeline events between 23:00 and 03:00. The largest number of submissions by an undergraduate team in one day was 67, well below the 200-per-day cap of §7.6.

## 6.3. The lead in the Open track

**Table 18:** Top three of the Open track at the end of each day (score as if the window had closed at that instant, i.e. lead-time so far + B × BKS held then).

| End of day (Mty) | Top three (score in days) |
|---|---|
| 21 Jul | CIMAT_UP 86.8 · AgenticOR 22.6 · AILS-CLRP 8.4 |
| 22 Jul | CIMAT_UP 89.4 · AgenticOR 45.5 · AILS-CLRP 12.9 |
| 23 Jul | CIMAT_UP 125.2 · AgenticOR 37.7 · AILS-CLRP 14.9 |
| 24 Jul | CIMAT_UP 138.1 · AgenticOR 52.8 · AILS-CLRP 16.9 |
| 25 Jul | CIMAT_UP 176.3 · AgenticOR 42.6 · AILS-CLRP 18.9 |
| 26 Jul | CIMAT_UP 202.1 · AgenticOR 44.8 · AILS-CLRP 20.9 |
| 27 Jul | CIMAT_UP 232.1 · AgenticOR 42.8 · AILS-CLRP 22.9 |
| 28 Jul | CIMAT_UP 259.1 · AgenticOR 43.8 · AILS-CLRP 24.9 |
| 29 Jul | CIMAT_UP 286.1 · AgenticOR 44.8 · AILS-CLRP 26.9 |
| 30 Jul | CIMAT_UP 313.1 · AgenticOR 46.1 · AILS-CLRP 25.5 |
| 31 Jul | CIMAT_UP 337.7 · AgenticOR 43.1 · AILS-CLRP 30.2 |
| 01 Aug | CIMAT_UP 367.2 · AgenticOR 43.1 · AILS-CLRP 28.6 |
| 02 Aug | CIMAT_UP 397.9 · AgenticOR 43.1 · AILS-CLRP 29.6 |

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| End of day (Mty) | Top three (score in days) |
|---|---|
| 03 Aug | CIMAT_UP 423.0 · AgenticOR 43.1 · AILS-CLRP 30.6 |
| 04 Aug | CIMAT_UP 453.9 · AgenticOR 43.1 · AILS-CLRP 31.6 |
| 05 Aug | CIMAT_UP 478.4 · AgenticOR 43.1 · AILS-CLRP 32.6 |
| 06 Aug | CIMAT_UP 506.0 · AgenticOR 43.1 · AILS-CLRP 36.9 |
| 07 Aug | CIMAT_UP 526.3 · AgenticOR 49.2 · AILS-CLRP 39.6 |
| 08 Aug | CIMAT_UP 551.3 · AgenticOR 47.6 · AILS-CLRP 45.2 |
| 09 Aug | CIMAT_UP 573.0 · AgenticOR 51.9 · AILS-CLRP 48.2 |
| 10 Aug | CIMAT_UP 597.1 · AgenticOR 53.8 · AILS-CLRP 51.2 |
| 11 Aug | CIMAT_UP 617.9 · AgenticOR 58.9 · AILS-CLRP 54.2 |
| 12 Aug | CIMAT_UP 640.9 · AgenticOR 61.9 · AILS-CLRP 57.2 |
| 13 Aug | CIMAT_UP 656.9 · AgenticOR 72.0 · AILS-CLRP 60.2 |
| 14 Aug | CIMAT_UP 674.4 · AgenticOR 80.4 · AILS-CLRP 63.2 |
| 15 Aug | CIMAT_UP 694.4 · AgenticOR 83.1 · AILS-CLRP 69.6 |
| Close | CIMAT_UP 714.5 · AgenticOR 91.0 · AILS-CLRP 70.5 |

CIMAT_UP was never headed: it led at the end of every day, and its margin grew steadily because it held between 19 and 28 of the 30 BKS at every day's end while accumulating lead-time on the small and medium instances almost uninterrupted. The interesting contest was for second place. AgenticOR was second from day one but its provisional score stalled at about 43 points from 31 July to 06 August, when it held few BKS; AILS-CLRP closed the gap steadily through the second week and came within 2.4 points on 08 August; AgenticOR's late recovery of the large instances (Section 6.7) settled it.

## 6.4. The Undergraduate race

**Table 19:** Top three of the Undergraduate track at the end of each day (score as if the window had closed at that instant, i.e. lead-time so far + B × undergraduate BKS held then), with the number of undergraduate BKS each of the three held at that instant.

| End of day (Mty) | Top three (score in days) | BKS held |
|---|---|---|
| 21 Jul | The Badass Optimizers 96.4 · The Gap Hunters USACH 0.9 · Más óptimo 0.7 | 30 · 0 · 0 |
| 22 Jul | The Badass Optimizers 121.4 · The Gap Hunters USACH 4.5 · Pequeños chicos casi optimizadores 1.6 | 29 · 1 · 0 |
| 23 Jul | The Badass Optimizers 133.9 · SEIN3 12.8 · The Gap Hunters USACH 9.2 | 24 · 4 · 2 |
| 24 Jul | The Badass Optimizers 120.7 · SEIN3 54.0 · The Gap Hunters USACH 11.2 | 13 · 15 · 2 |
| 25 Jul | The Badass Optimizers 140.7 · SEIN3 58.5 · The Gap Hunters USACH 13.6 | 15 · 12 · 2 |
| 26 Jul | The Badass Optimizers 143.3 · Más óptimo 48.2 · SEIN3 38.6 | 11 · 15 · 2 |
| 27 Jul | The Badass Optimizers 122.9 · Más óptimo 98.1 · SEIN3 43.9 | 2 · 25 · 3 |
| 28 Jul | Más óptimo 133.9 · The Badass Optimizers 124.9 · SEIN3 36.0 | 28 · 2 · 0 |
| 29 Jul | Más óptimo 129.7 · The Badass Optimizers 126.9 · SEIN3 45.5 | 18 · 2 · 3 |
| 30 Jul | Más óptimo 160.8 · The Badass Optimizers 128.9 · SEIN3 48.5 | 22 · 2 · 3 |
| 31 Jul | Más óptimo 189.5 · The Badass Optimizers 134.6 · SEIN3 48.1 | 24 · 3 · 2 |
| 01 Aug | Más óptimo 221.4 · The Badass Optimizers 137.6 · SEIN3 45.5 | 26 · 3 · 1 |
| 02 Aug | Más óptimo 247.4 · The Badass Optimizers 140.6 · SEIN3 46.5 | 26 · 3 · 1 |
| 03 Aug | Más óptimo 273.4 · The Badass Optimizers 143.6 · SEIN3 47.5 | 26 · 3 · 1 |
| 04 Aug | Más óptimo 302.5 · The Badass Optimizers 146.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 05 Aug | Más óptimo 329.5 · The Badass Optimizers 149.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 06 Aug | Más óptimo 356.5 · The Badass Optimizers 152.6 · SEIN3 45.4 | 27 · 3 · 0 |

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| End of day (Mty) | Top three (score in days) | BKS held |
|---|---|---|
| 07 Aug | Más óptimo 383.5 · The Badass Optimizers 155.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 08 Aug | Más óptimo 410.5 · The Badass Optimizers 158.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 09 Aug | Más óptimo 437.5 · The Badass Optimizers 161.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 10 Aug | Más óptimo 464.5 · The Badass Optimizers 164.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 11 Aug | Más óptimo 491.5 · The Badass Optimizers 167.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 12 Aug | Más óptimo 518.5 · The Badass Optimizers 170.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 13 Aug | Más óptimo 545.5 · The Badass Optimizers 173.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 14 Aug | Más óptimo 572.5 · The Badass Optimizers 176.6 · SEIN3 45.4 | 27 · 3 · 0 |
| 15 Aug | Más óptimo 599.5 · The Badass Optimizers 179.6 · SEIN3 45.4 | 27 · 3 · 0 |
| Close | Más óptimo 626.5 · The Badass Optimizers 182.6 · SEIN3 45.4 | 27 · 3 · 0 |

Unlike the Open track, the undergraduate category changed leader, and it did so late enough for the change to be decisive. The Badass Optimizers led at the end of every day from the opening to 27 July: it held all 30 undergraduate BKS at the first day-end snapshot, 29 at the second, and although SEIN3 took 15 of them by 24 July and Más óptimo 15 by 26 July, the lead-time it had already banked kept it in front with a provisional score that peaked at 143.3 points on 26 July. Más óptimo's 33 events of 25 July (from 18:38 to 16:29 Monterrey the next day) took it from 0 to 25 undergraduate BKS in two day-end snapshots, and its provisional score passed The Badass Optimizers's at 15:50 Monterrey on 27 July (124.41 to 124.24 points, with 28 BKS held to 2). The race was not over: The Gap Hunters USACH retook 8 medium instances from Más óptimo on 28–29 July, Más óptimo's holdings fell to 18 and its margin over The Badass Optimizers to 2.8 points at the 29 July snapshot, the closest the lead came to changing back. From then on Más óptimo recovered every one of them, held 24, 26 and then 27 of the 30 undergraduate BKS at the day-end snapshots, and its margin grew by about 24 points a day (the difference in BKS held, since each held BKS earns one day of lead-time per day) to the final 443.9. Nothing moved on the undergraduate timeline after 06 August: the day-end table from 04 August onwards is pure accrual.

The contest for the minor places was livelier than the final table shows. The Gap Hunters USACH was second at the first 2 snapshots (on the strength of its first BKS on the small instances), SEIN3 was second from 23 to 25 July with a provisional score that reached 58.5 points and 15 BKS held on 25 July, and Más óptimo itself was second for 2 snapshots before taking the lead. Once Más óptimo led, The Badass Optimizers was second at every snapshot to the close, its score rising by 3 points a day from its 3 remaining instances, and SEIN3 third at every snapshot from 26 July with a score frozen at 45.4 from 04 August, when its last BKS was taken. The Gap Hunters USACH peaked at 33.6 points at the 29 July snapshot (with 7 BKS held) and ended fourth with 21.3.

## 6.5. Who took the lead from whom

**Table 20:** Takeovers on the general timeline (rows: the team that took the BKS; only pairs with at least one takeover).

| Took from → | CIMAT_UP | AgenticOR | AILS-CLRP | DALR | OPERE LAB | Kitchen sink solver | Más óptimo | Total |
|---|---|---|---|---|---|---|---|---|
| CIMAT_UP | · | 46 | 10 | 2 | 7 | 2 | 1 | 68 |
| AgenticOR | 41 | · | 8 | 7 | | | | 56 |
| AILS-CLRP | 18 | 6 | · | 2 | 1 | | | 27 |
| DALR | | 4 | 5 | · | | | | 9 |
| OPERE LAB | 8 | 1 | | | · | | | 9 |

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| Took from → | CIMAT_UP | AgenticOR | AILS-CLRP | DALR | OPERE LAB | Kitchen sink solver | Más óptimo | Total |
|---|---|---|---|---|---|---|---|---|
| Kitchen sink solver | | | 1 | 1 | | · | | 2 |

Of the 479 events on the general timeline, 171 changed the holder and 278 improved an incumbent's own BKS (the remaining 30 are the first BKS of each instance). The competition was, above all, a duel between CIMAT_UP and AgenticOR: 46 takeovers one way and 41 the other, almost entirely on the large instances, where the two traded the lead up to 14 times on a single instance (`clrp-large-08`). AILS-CLRP was the main challenger to CIMAT_UP on the small and medium instances (18 takeovers) but was usually taken back within days.

**Table 21:** Takeovers on the undergraduate timeline (rows: the team that took the undergraduate BKS; only pairs with at least one takeover).

| Took from → | Más óptimo | The Badass Optimizers | SEIN3 | The Gap Hunters USACH | Pequeños chicos casi optimizadores | LCZ | Total |
|---|---|---|---|---|---|---|---|
| Más óptimo | · | 13 | 19 | 10 | | 1 | 43 |
| The Badass Optimizers | 1 | · | 7 | 15 | 10 | | 33 |
| SEIN3 | 7 | 17 | · | 2 | | | 26 |
| The Gap Hunters USACH | 9 | 9 | | · | | | 18 |
| Pequeños chicos casi optimizadores | | 8 | | | · | | 8 |
| LCZ | | | | 1 | | · | 1 |

The undergraduate timeline was far more contested per event: of its 219 events, 129 changed the holder (59%, against 36% on the general timeline) and only 60 improved an incumbent's own BKS. Rather than a duel, it was a relay: The Gap Hunters USACH opened the small instances and lost 15 BKS to The Badass Optimizers (13 of them on the small instances); The Badass Optimizers lost 17 instances to SEIN3 and 13 to Más óptimo; and Más óptimo took 19 from SEIN3, more than from anyone else. The only two-way exchanges of note were Pequeños chicos casi optimizadores against The Badass Optimizers on the large instances on the second day (8 takeovers one way, 10 the other, all within 15.2 h) and The Gap Hunters USACH against Más óptimo on the medium instances at the end of July (9 and 10). The finalists rarely met head-on: The Badass Optimizers took only 1 undergraduate BKS from Más óptimo in the whole window.

## 6.6. How long a BKS lasted, and how much each one improved

**Table 22:** Duration of BKS holds (from establishment to displacement or close; n = 479).

| Hold duration | BKS events | Share |
|---|---|---|
| Under 1 hour | 97 | 20% |
| 1–24 hours | 281 | 59% |
| 1–7 days | 65 | 14% |
| 7 days or more | 36 | 8% |

The median hold lasted 4.0 hours; the mean, 1.7 days, is pulled up by the small instances that were settled early. The longest hold is CIMAT_UP's on `clrp-small-08`, established 20 July 00:23 Monterrey and never displaced: 27.0 days, the whole window minus 23 minutes. The shortest is CIMAT_UP's on `clrp-large-01` (22 July 14:48), displaced after 62 seconds.

**Table 23:** Size of the improvement each BKS event made over the previous BKS of the same instance (n = 449, excluding the first BKS of each instance).

| Relative improvement | BKS events |
|---|---|
| Under 0.01% | 125 |
| 0.01% – 0.1% | 198 |
| 0.1% – 1% | 96 |
| 1% – 5% | 27 |
| 5% or more | 3 |

Most of the movement was fine-grained: 72% of the improvements were smaller than 0.1% (median 0.034%), which is what a mature local-search race looks like once the easy gains are gone. The 3 improvements of 5% or more were 17.3% on `clrp-large-01` by AgenticOR (20 July 00:38); 9.4% on `clrp-large-04` by AgenticOR (20 July 01:19); 17.6% on `clrp-large-02` by AgenticOR (20 July 01:41): all in the opening hours, when the first BKS were quick starting points.

**Table 24:** Duration of undergraduate BKS holds (from establishment to displacement or close; n = 219).

| Hold duration | BKS events | Share |
|---|---|---|
| Under 1 hour | 22 | 10% |
| 1–24 hours | 71 | 32% |
| 1–7 days | 84 | 38% |
| 7 days or more | 42 | 19% |

Undergraduate BKS lasted much longer: the median hold was 34.6 hours against 4.0 on the general timeline, the mean 3.6 days, and 58% of the holds lasted a day or more (against 21%), because the timeline was thinner (fewer teams, fewer events per instance) and went quiet ten days before the close. The longest undergraduate hold is The Badass Optimizers's on `clrp-small-08`, established 20 July 19:45 Monterrey at the baseline cost and never displaced: 26.2 days. The longest hold that was eventually displaced is Más óptimo's on `clrp-small-07` (25 July 19:01), improved by Más óptimo itself after 11.5 days; the shortest is The Gap Hunters USACH's on `clrp-small-03` (20 July 18:19), improved by the same team after 181 seconds. Thirty undergraduate holds, one per instance, were still standing at the close.

**Table 25:** Size of the improvement each undergraduate BKS event made over the previous undergraduate BKS of the same instance (n = 189, excluding the first undergraduate BKS of each instance).

| Relative improvement | BKS events |
|---|---|
| Under 0.01% | 3 |
| 0.01% – 0.1% | 25 |
| 0.1% – 1% | 100 |
| 1% – 5% | 48 |
| 5% or more | 13 |

The undergraduate improvements were coarser: the median step was 0.433% (against 0.034% on the general timeline), 15% of them were smaller than 0.1% (against 72%) and 61 of the 189 were larger than 1%. The 13 improvements of 5% or more all fell within the first 24 hours, between 13:41 and 22:07 Monterrey on 20 July, 10 of them by The Badass Optimizers as it replaced the first BKS of The Gap Hunters USACH and Pequeños chicos casi optimizadores with its own: the

largest was 37.5% on `clrp-small-07` by The Badass Optimizers (19:40), followed by 27.9% on `clrp-large-09` by The Badass Optimizers; 27.4% on `clrp-small-10` by The Badass Optimizers; 25.6% on `clrp-small-09` by The Badass Optimizers. After the opening day the undergraduate race also became a fine-grained one, but with a longer stride: the 44 improvements of 1–5% made after the first day are more than the whole general timeline produced (27).

## 6.7. The closing hours

10 BKS events fell in the last 24 hours, 5 in the last hour and 2 in the last ten minutes. The final holder of 8 instances was decided in the last 24 hours, and of 5 in the last hour, all of them large instances:

| Time (Mty) | Instance | New holder | Displaced | Cost | Margin |
|---|---|---|---|---|---|
| 14 Aug 10:23:46 | `clrp-large-01` | AgenticOR | AILS-CLRP | 7,421,613.92 | 37.6 h before close |
| 14 Aug 15:41:19 | `clrp-large-01` | AILS-CLRP | AgenticOR | 7,421,597.98 | 32.3 h before close |
| 15 Aug 16:40:32 | `clrp-large-06` | CIMAT_UP | AgenticOR | 6,337,506.88 | 7.3 h before close |
| 15 Aug 17:12:58 | `clrp-large-01` | AILS-CLRP | AILS-CLRP | 7,421,158.58 | 6.8 h before close |
| 15 Aug 17:17:42 | `clrp-large-08` | AILS-CLRP | AILS-CLRP | 6,934,967.10 | 6.7 h before close |
| 15 Aug 18:11:24 | `clrp-large-06` | AgenticOR | CIMAT_UP | 6,332,853.90 | 5.8 h before close |
| 15 Aug 22:17:48 | `clrp-large-09` | AgenticOR | AgenticOR | 6,551,702.35 | 1.7 h before close |
| 15 Aug 23:03:49 | `clrp-large-04` | AgenticOR | AgenticOR | 7,284,926.76 | 55 min before close |
| 15 Aug 23:04:02 | `clrp-large-05` | AgenticOR | AgenticOR | 6,639,473.75 | 55 min before close |
| 15 Aug 23:09:49 | `clrp-large-01` | AgenticOR | AILS-CLRP | 7,420,494.02 | 49 min before close |
| 15 Aug 23:56:35 | `clrp-large-03` | CIMAT_UP | CIMAT_UP | 6,673,738.46 | 2 min before close |
| 15 Aug 23:57:23 | `clrp-large-10` | CIMAT_UP | CIMAT_UP | 6,648,706.75 | 2 min before close |

The last two events of the Challenge were CIMAT_UP's improvements of its own BKS on `clrp-large-03` and `clrp-large-10`, 2.4 and 1.6 minutes before the close; both were feasible and both stood. AgenticOR's 5 events between 18:11 and 23:09 Monterrey on the last evening took back `clrp-large-06` and `clrp-large-01` and improved its own BKS on 3 other large instances, securing the 3-day bonus on 6 instances and, with it, second place.

The undergraduate timeline had no closing burst; it had closed itself. Its last event was Más óptimo's improvement of its own BKS on `clrp-small-07` at 06 August 08:13 Monterrey, 9.7 days before the close, and its last change of holder was Más óptimo taking `clrp-small-01` from SEIN3 at 03 August 21:19, 12.1 days before the close. No undergraduate BKS event fell in the last 7 days, none of the 30 final undergraduate holders was decided in the last week, and the 3 undergraduate submissions received after 06 August (all by Más óptimo, on 14 and 15 August UTC; 1 feasible) did not improve any BKS. The last twelve undergraduate events were all Más óptimo's self-improvements:

| Time (Mty) | Instance | New holder | Displaced | Cost | Margin |
|---|---|---|---|---|---|
| 04 Aug 01:18:42 | `clrp-medium-09` | Más óptimo | Más óptimo | 63,951.25 | 11.9 d before close |
| 04 Aug 05:18:19 | `clrp-medium-06` | Más óptimo | Más óptimo | 69,752.22 | 11.8 d before close |
| 04 Aug 11:14:26 | `clrp-medium-05` | Más óptimo | Más óptimo | 61,139.63 | 11.5 d before close |
| 04 Aug 13:57:05 | `clrp-small-10` | Más óptimo | Más óptimo | 35,846.67 | 11.4 d before close |
| 04 Aug 14:34:39 | `clrp-large-07` | Más óptimo | Más óptimo | 8,491,783.97 | 11.4 d before close |
| 04 Aug 14:35:36 | `clrp-large-08` | Más óptimo | Más óptimo | 7,039,672.88 | 11.4 d before close |
| 05 Aug 20:48:42 | `clrp-medium-01` | Más óptimo | Más óptimo | 65,718.77 | 10.1 d before close |
| 05 Aug 23:03:03 | `clrp-large-08` | Más óptimo | Más óptimo | 7,011,870.04 | 10.0 d before close |

*continued on next page*

| Time (Mty) | Instance | New holder | Displaced | Cost | Margin |
|---|---|---|---|---|---|
| 06 Aug 01:09:58 | clrp-large-02 | Más óptimo | Más óptimo | 8,541,468.32 | 10.0 d before close |
| 06 Aug 01:11:15 | clrp-large-04 | Más óptimo | Más óptimo | 7,364,492.87 | 9.9 d before close |
| 06 Aug 01:11:31 | clrp-large-07 | Más óptimo | Más óptimo | 8,490,692.37 | 9.9 d before close |
| 06 Aug 08:13:34 | clrp-small-07 | Más óptimo | Más óptimo | 36,748.88 | 9.7 d before close |

With the undergraduate BKS held for between 9.7 and 26.2 days at the close, the 3-day bonus in this category was never in play in the final hours; it simply confirmed the holdings of 06 August.

## 6.8. Contested and quiet instances

**Table 28:** The most and least contested instances (by BKS events, then distinct holders).

| | Instance | Events | Changes | Holders | Final holder | Gap to Hexaly |
|---|---|---|---|---|---|---|
| Most | clrp-medium-02 | 34 | 11 | 5 | CIMAT_UP | −5.46% |
| Most | clrp-medium-07 | 34 | 8 | 5 | CIMAT_UP | −12.64% |
| Most | clrp-medium-05 | 32 | 12 | 4 | CIMAT_UP | −8.54% |
| Most | clrp-medium-01 | 29 | 6 | 5 | CIMAT_UP | −4.14% |
| Most | clrp-medium-06 | 29 | 6 | 4 | CIMAT_UP | −10.67% |
| Most | clrp-medium-04 | 26 | 13 | 5 | OPERE LAB | −2.31% |
| Least | clrp-small-04 | 2 | 1 | 2 | AILS-CLRP | −1.78% |
| Least | clrp-small-08 | 2 | 1 | 2 | CIMAT_UP | 0.00% |
| Least | clrp-medium-08 | 3 | 2 | 2 | CIMAT_UP | −3.22% |
| Least | clrp-small-06 | 4 | 0 | 1 | CIMAT_UP | −2.07% |
| Least | clrp-small-09 | 4 | 2 | 2 | CIMAT_UP | −2.70% |
| Least | clrp-small-03 | 4 | 3 | 3 | CIMAT_UP | −1.71% |

Medium instances were the busiest (231 events, 67 lead changes, up to 5 different holders on one instance) and large ones the most bitterly contested per holder (201 events, 85 lead changes, mostly between two teams). The small instances were settled early: 47 events in total, all of the 10 final BKS held for more than 24 days, and clrp-small-06 had a single holder for the whole window. Appendix A gives the full holder sequence of every instance.

**Table 29:** The most and least contested instances on the undergraduate timeline (by undergraduate BKS events, then distinct holders).

| | Instance | Events | Changes | Holders | Final holder | Gap to Hexaly |
|---|---|---|---|---|---|---|
| Most | clrp-small-01 | 11 | 8 | 4 | Más óptimo | −2.92% |
| Most | clrp-large-07 | 11 | 5 | 4 | Más óptimo | −2.21% |
| Most | clrp-small-02 | 9 | 5 | 4 | Más óptimo | −4.47% |
| Most | clrp-small-04 | 9 | 8 | 4 | The Badass Optimizers | −1.78% |
| Most | clrp-medium-02 | 9 | 5 | 4 | Más óptimo | −4.76% |
| Most | clrp-small-07 | 8 | 5 | 4 | Más óptimo | −5.87% |
| Least | clrp-small-08 | 4 | 2 | 3 | The Badass Optimizers | 0.00% |
| Least | clrp-large-01 | 5 | 1 | 2 | Más óptimo | −2.26% |
| Least | clrp-small-06 | 5 | 3 | 4 | Más óptimo | −1.96% |
| Least | clrp-large-05 | 6 | 3 | 3 | Más óptimo | −2.25% |
| Least | clrp-small-05 | 6 | 4 | 4 | Más óptimo | −5.64% |
| Least | clrp-small-09 | 6 | 3 | 4 | Más óptimo | −2.56% |

The undergraduate timeline had no quiet corner. Events were spread almost evenly across the scales (74 small, 73 medium, 72 large) and lead changes were most frequent on the small instances (49, against 43 and 37), which on the general timeline were the quietest of all; the range between the busiest instance (`clrp-small-01`, 11 events, 8 lead changes) and the quietest (`clrp-small-08`, 4 events) is 7 events, against 32 on the general timeline. `clrp-small-01` changed hands 8 times between four teams (The Gap Hunters USACH → The Badass Optimizers → SEIN3 → The Badass Optimizers → Más óptimo → SEIN3 → Más óptimo → SEIN3 → Más óptimo); no instance had a single undergraduate holder and only `clrp-large-01` had as few as two. Appendix A gives the full undergraduate holder sequence of every instance.

## 7. Observations

1. **Lead-time did the ranking; the bonus confirmed it.** With B = 3 days and a 27-day window, the bonus was 8.4% of the winner's score and did not change the order of the top four in either category. It did shape behaviour at the end: the last-day burst on the large instances was a fight for the bonus as much as for lead-time.

2. **Early and continuous beats late and brilliant.** CIMAT_UP won by being first on 19 instances within an hour of the opening and then improving its own BKS 201 times. Under a lead-time rule, an early feasible solution that is merely good starts the clock; a better one that arrives a week later has already lost seven days on that instance.

3. **The instance families behaved differently.** Small instances were essentially closed within days (and one, `clrp-small-08`, matched the baseline exactly and is very likely optimal); medium instances gave the biggest gains over the baseline and the most participants per instance; the road-network large instances produced the tightest gaps to the baseline (-3.9% to -2.9%) and the longest two-team duels.

4. **The undergraduate track was competitive in absolute terms.** The undergraduate BKS finished on average 0.64% above the general BKS, matched it on 5 instances and beat the Hexaly baseline on 29 of the 30 (by 3.63% on average); the separate undergraduate timeline (§8.6) let that category have its own race, with a change of leader, without pretending its solutions were second-rate. That race was also more contested per event than the Open one (59% of its 219 events were takeovers, against 36% of 479), four teams held at least 21 instances at some point, and the eventual winner did not lead until the eighth day; it differed from the Open race in ending early, with no undergraduate BKS event in the last 10 days.

5. **Real-time publication changed the game.** Because every lead change was public within seconds, teams could see exactly which instances were worth attacking and how big the margins were; the fine-grained improvements of Table 23 and the timing of the last-day burst both reflect that.

## 8. Platform notes

- **Timestamps.** Every score in this report rests on `received_at`, the instant the platform received the file, in UTC (§7.3); verification, which was sub-second, does not enter into it. Times are shown in America/Monterrey (UTC−6, no DST) where the reglamento requires it, with UTC where precision matters.

- **Verification and integrity.** The platform received 1,026 submissions over the 27 days (247 on the busiest day, 2026-07-20, and never more than 72 from one team in a day, so the 200-per-day cap of §7.6 was never reached); 907 were feasible, 110 infeasible and 9 rejected for format errors, and none was left pending at the close. Verification took 1.6 s at the median, 2.4 s at the 90th percentile and at most 8.3 s, so no BKS was ever more than a few seconds behind its official `received_at`. In every feasible submission that declared a cost, the verifier's recomputed cost matched it (0 mismatches). No submission and no BKS event was excluded by administrative action.
- **Reference library (§13) and §7.8 metadata.** Every solution that was ever a BKS on either timeline (479 general + 219 undergraduate events) is published together with the compute-time and environment metadata that §7.8 asks BKS-establishing teams to report. At the close that metadata had been supplied for 45 of the 479 general-timeline BKS submissions (9%) and for 107 of the 219 undergraduate-timeline ones (49%; reported compute time from 1 minute to 2 hours, median 15 minutes); where reported, compute time ranged from 1 minute to 7.4 days per solution, with a median of 2.9 hours. Entries without metadata are marked as incomplete in the library; the score is unaffected (§7.8).
- **Scoring runs.** 5 provisional scoring runs were taken during the window (the last at 16 Aug 04:12 UTC); the final run (`is_final`) was executed by the Board on 16 Aug at 07:55 UTC (01:55 Monterrey) and froze the official numbers, which reproduce the figures of Section 5 exactly. The Board reviewed the Method Descriptions (§9.6) and no participating team was disqualified (§12); this report is the publication of the official ranking.
- **Public statistics.** The platform's `/stats` section reproduces the tables and charts of this report live: score and BKS-held evolution per team, per-instance and per-team reports, and the full BKS chronology.

## 9. What comes next

- Publication of the reference library: instances, Hexaly baseline, every BKS solution file with metadata.
- Challenge session and Hexaly workshop at CSMIO 2026, Universidad de Monterrey, 7–9 October 2026, with presentations by the winning teams.
- This report, completed with the teams' method summaries drawn from the reviewed Method Descriptions, as the permanent record of the 2026 edition.

## A. Holder sequence of every instance

Order of BKS holders on the general timeline, oldest first (a team appearing twice in a row is collapsed; the number of its own improvements is in Table 8).

| Instance | Holders, in order |
|---|---|
| `clrp-small-01` | CIMAT_UP → AILS-CLRP → CIMAT_UP → AILS-CLRP → CIMAT_UP |
| `clrp-small-02` | CIMAT_UP → AgenticOR → CIMAT_UP |
| `clrp-small-03` | CIMAT_UP → AILS-CLRP → AgenticOR → CIMAT_UP |

*continued on next page*

| Instance | Holders, in order |
|---|---|
| clrp-small-04 | CIMAT_UP → AILS-CLRP |
| clrp-small-05 | CIMAT_UP → AILS-CLRP → CIMAT_UP |
| clrp-small-06 | CIMAT_UP |
| clrp-small-07 | CIMAT_UP → AILS-CLRP → CIMAT_UP |
| clrp-small-08 | Más óptimo → CIMAT_UP |
| clrp-small-09 | CIMAT_UP → AILS-CLRP → CIMAT_UP |
| clrp-small-10 | CIMAT_UP → AILS-CLRP → CIMAT_UP |
| clrp-medium-01 | CIMAT_UP → AILS-CLRP → DALR → Kitchen sink solver → CIMAT_UP → OPERE LAB → CIMAT_UP |
| clrp-medium-02 | CIMAT_UP → AgenticOR → AILS-CLRP → AgenticOR → DALR → CIMAT_UP → OPERE LAB → CIMAT_UP → OPERE LAB → CIMAT_UP → OPERE LAB → CIMAT_UP |
| clrp-medium-03 | CIMAT_UP → AgenticOR → AILS-CLRP → AgenticOR → CIMAT_UP |
| clrp-medium-04 | CIMAT_UP → AILS-CLRP → Kitchen sink solver → CIMAT_UP → AILS-CLRP → AgenticOR → OPERE LAB → AILS-CLRP → CIMAT_UP → OPERE LAB → CIMAT_UP → OPERE LAB → CIMAT_UP → OPERE LAB |
| clrp-medium-05 | CIMAT_UP → AgenticOR → AILS-CLRP → DALR → AILS-CLRP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP |
| clrp-medium-06 | CIMAT_UP → AgenticOR → CIMAT_UP → AILS-CLRP → DALR → AILS-CLRP → CIMAT_UP |
| clrp-medium-07 | CIMAT_UP → AgenticOR → CIMAT_UP → AILS-CLRP → DALR → AgenticOR → CIMAT_UP → OPERE LAB → CIMAT_UP |
| clrp-medium-08 | CIMAT_UP → AILS-CLRP → CIMAT_UP |
| clrp-medium-09 | CIMAT_UP → AILS-CLRP → CIMAT_UP |
| clrp-medium-10 | CIMAT_UP → AILS-CLRP → DALR → CIMAT_UP |
| clrp-large-01 | DALR → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → AILS-CLRP → AgenticOR → AILS-CLRP → AgenticOR |
| clrp-large-02 | DALR → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AILS-CLRP |
| clrp-large-03 | AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP |
| clrp-large-04 | DALR → AgenticOR → DALR → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR |
| clrp-large-05 | AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR |
| clrp-large-06 | AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR |
| clrp-large-07 | AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR |
| clrp-large-08 | AgenticOR → DALR → AgenticOR → DALR → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AILS-CLRP → AgenticOR → AILS-CLRP |
| clrp-large-09 | AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP → AgenticOR |
| clrp-large-10 | AgenticOR → CIMAT_UP → AgenticOR → CIMAT_UP |

Order of BKS holders on the undergraduate timeline, oldest first (same convention; the number of each team's own improvements is in Table 9).

| Instance | Undergraduate holders, in order |
|---|---|
| `clrp-small-01` | The Gap Hunters USACH → The Badass Optimizers → SEIN3 → The Badass Optimizers → Más óptimo → SEIN3 → Más óptimo → SEIN3 → Más óptimo |
| `clrp-small-02` | The Gap Hunters USACH → The Badass Optimizers → SEIN3 → Más óptimo → SEIN3 → Más óptimo |
| `clrp-small-03` | The Gap Hunters USACH → The Badass Optimizers → The Gap Hunters USACH → The Badass Optimizers → The Gap Hunters USACH → SEIN3 → The Badass Optimizers |
| `clrp-small-04` | The Gap Hunters USACH → The Badass Optimizers → The Gap Hunters USACH → The Badass Optimizers → The Gap Hunters USACH → The Badass Optimizers → SEIN3 → Más óptimo → The Badass Optimizers |
| `clrp-small-05` | The Gap Hunters USACH → The Badass Optimizers → SEIN3 → The Badass Optimizers → Más óptimo |
| `clrp-small-06` | The Gap Hunters USACH → The Badass Optimizers → SEIN3 → Más óptimo |
| `clrp-small-07` | The Gap Hunters USACH → The Badass Optimizers → SEIN3 → The Badass Optimizers → SEIN3 → Más óptimo |
| `clrp-small-08` | Más óptimo → The Gap Hunters USACH → The Badass Optimizers |
| `clrp-small-09` | The Gap Hunters USACH → The Badass Optimizers → SEIN3 → Más óptimo |
| `clrp-small-10` | The Gap Hunters USACH → The Badass Optimizers → SEIN3 → The Badass Optimizers → SEIN3 → Más óptimo |
| `clrp-medium-01` | The Badass Optimizers → SEIN3 → Más óptimo → The Gap Hunters USACH → Más óptimo |
| `clrp-medium-02` | The Badass Optimizers → SEIN3 → The Badass Optimizers → Más óptimo → The Gap Hunters USACH → Más óptimo |
| `clrp-medium-03` | The Badass Optimizers → SEIN3 → Más óptimo → The Gap Hunters USACH → Más óptimo |
| `clrp-medium-04` | The Badass Optimizers → SEIN3 → Más óptimo → The Gap Hunters USACH → Más óptimo |
| `clrp-medium-05` | The Badass Optimizers → SEIN3 → Más óptimo → The Gap Hunters USACH → Más óptimo |
| `clrp-medium-06` | The Badass Optimizers → SEIN3 → The Badass Optimizers → Más óptimo → The Gap Hunters USACH → Más óptimo |
| `clrp-medium-07` | The Badass Optimizers → SEIN3 → Más óptimo → The Gap Hunters USACH → Más óptimo |
| `clrp-medium-08` | The Badass Optimizers → The Gap Hunters USACH → The Badass Optimizers → The Gap Hunters USACH → SEIN3 → Más óptimo → The Gap Hunters USACH → Más óptimo |
| `clrp-medium-09` | The Badass Optimizers → The Gap Hunters USACH → LCZ → Más óptimo |
| `clrp-medium-10` | The Badass Optimizers → Más óptimo → SEIN3 → Más óptimo |
| `clrp-large-01` | The Badass Optimizers → Más óptimo |
| `clrp-large-02` | The Badass Optimizers → Pequeños chicos casi optimizadores → The Badass Optimizers → Más óptimo |
| `clrp-large-03` | The Gap Hunters USACH → The Badass Optimizers → Pequeños chicos casi optimizadores → The Badass Optimizers → The Gap Hunters USACH → Más óptimo |
| `clrp-large-04` | The Badass Optimizers → Pequeños chicos casi optimizadores → The Badass Optimizers → The Gap Hunters USACH → Más óptimo |
| `clrp-large-05` | The Badass Optimizers → Pequeños chicos casi optimizadores → The Badass Optimizers → Más óptimo |
| `clrp-large-06` | The Badass Optimizers → Pequeños chicos casi optimizadores → The Badass Optimizers → Pequeños chicos casi optimizadores → The Badass Optimizers → Más óptimo |
| `clrp-large-07` | The Badass Optimizers → Pequeños chicos casi optimizadores → The Badass Optimizers → Más óptimo → SEIN3 → Más óptimo |
| `clrp-large-08` | The Badass Optimizers → Pequeños chicos casi optimizadores → The Badass Optimizers → Más óptimo |
| `clrp-large-09` | Pequeños chicos casi optimizadores → The Badass Optimizers → Más óptimo → SEIN3 → Más óptimo |
| `clrp-large-10` | Pequeños chicos casi optimizadores → The Badass Optimizers → Más óptimo → SEIN3 → Más óptimo |

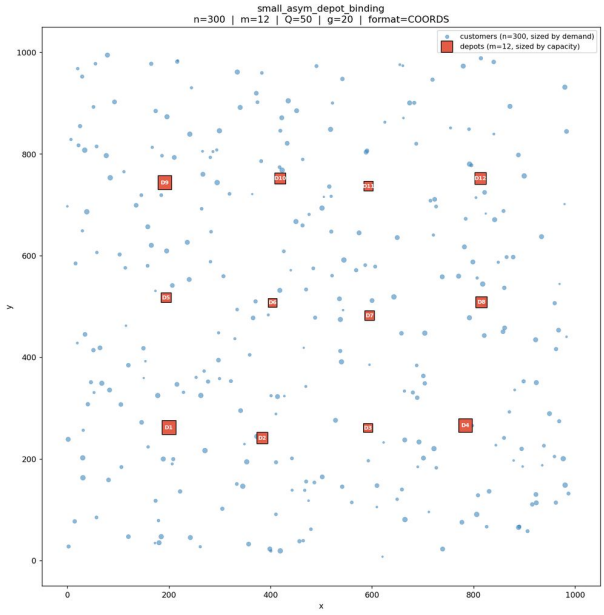
## B. Data and reproducibility

All competition figures were computed from the platform's public record at 16 Aug 2026 05:59 UTC: the `bks_events` and `undergrad_bks_events` logs (every non-excluded event with instance, team, cost, `established_at`, `superseded_at`), the `instances` table (scale, customers, depots, Hexaly baseline), the approved `teams` and `competition_settings` (window and B), all readable through the platform's public API with the anonymous key. Rankings use the platform's scoring module (`app/scoring.py`: lead-time accumulated per event and clamped at the close, final holder = the event whose window contains the closing instant, ties per §8.4). Percent gaps are (participant − Hexaly) / Hexaly. Day boundaries in Section 6.2 are UTC; other times are Monterrey unless marked.

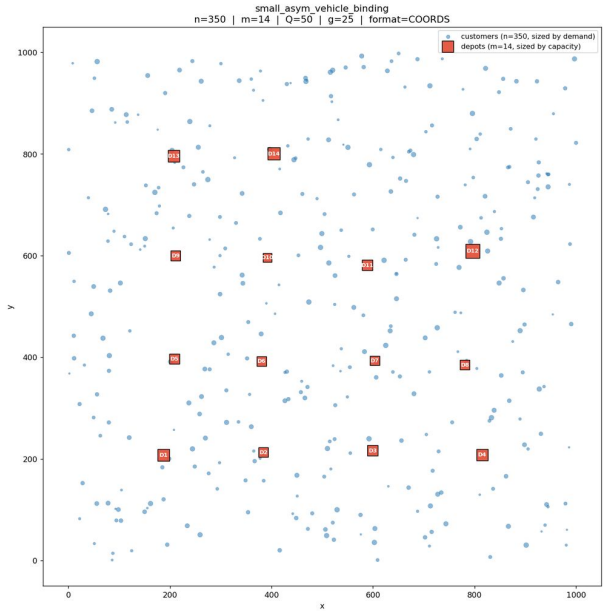
The instance design (Table 1) is read from the generator's committed design matrix, `configs/official-2026.yaml` (generator version 0.1.0), and the realized parameters (Table 2) are parsed from the official instance files themselves; the mapping from design names to the published `clrp-<scale>-<nn>` ids is alphabetical within each scale and was cross-checked against the Hexaly baseline cost of every instance. The generator, the verifier and the design matrix are open source; the large-instance distance matrices are reproducible from the OSM snapshot of 2026-04-01 (Geofabrik) and carry the ODbL attribution required by OpenStreetMap.

## C. Maps of the official instances

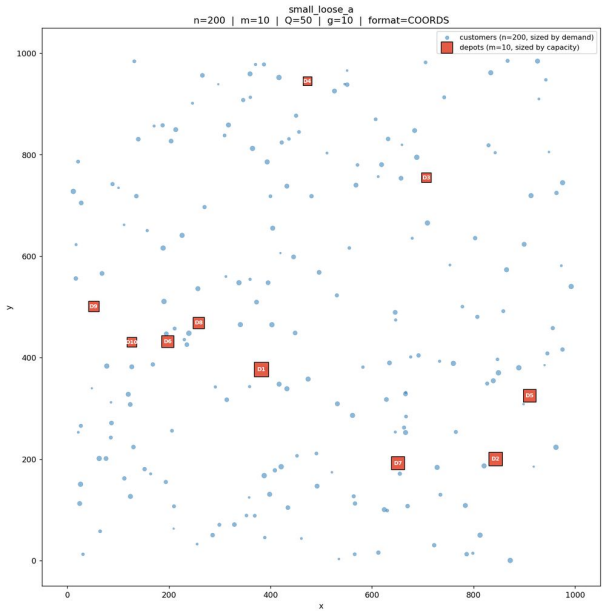
One map per instance, as produced by the generator's plotting tool: customers as dots sized by demand, candidate depots as squares sized by capacity. Small and medium instances live in the synthetic $[0, 1000]^2$ box; large instances are drawn over the OpenStreetMap basemap of the Monterrey metropolitan area (© OpenStreetMap contributors). Full-resolution files are released alongside this report under `report_assets/instances/`.



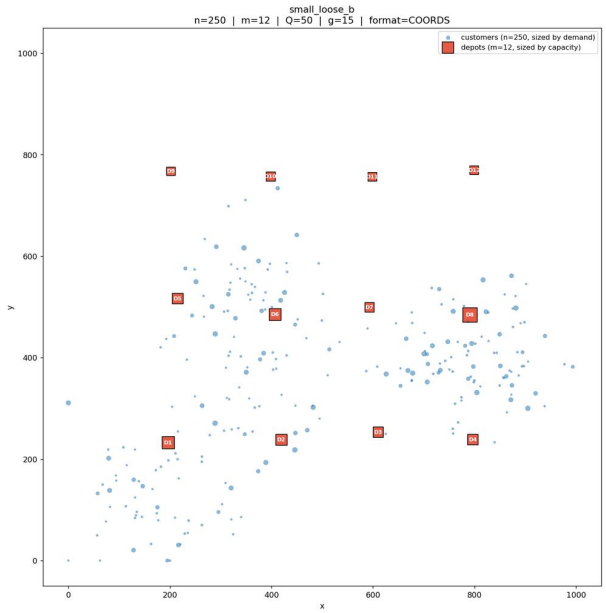

`clrp-small-01` (`small_asym_depot_binding`, Asym. (depot binds)): n = 300, m = 12, Q = 50, g = 20, $\rho_d = 0.90$, $\rho_v = 0.38$; customers uniform, depots grid, demand uniform. Final BKS 37,569.09 (CIMAT_UP), -2.92% vs Hexaly.



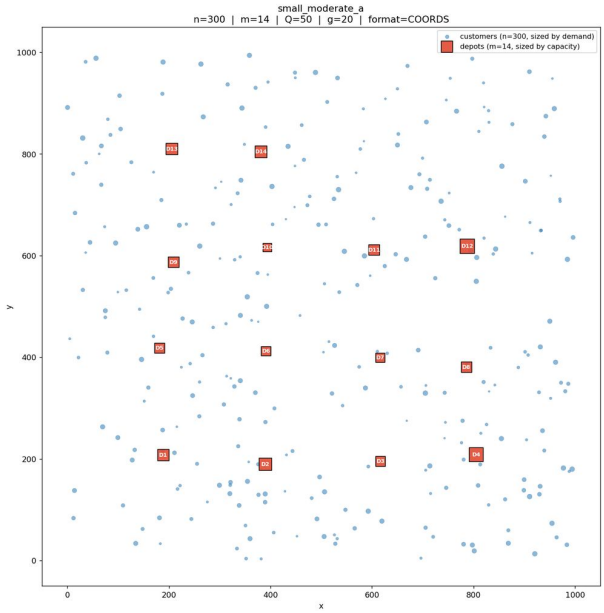

`clrp-small-02` (`small_asym_vehicle_binding`, Asym. (fleet binds)): n = 350, m = 14, Q = 50, g = 25, $\rho_d = 0.40$, $\rho_v = 0.88$; customers uniform, depots grid, demand uniform. Final BKS 42,971.49 (CIMAT_UP), -4.50% vs Hexaly.



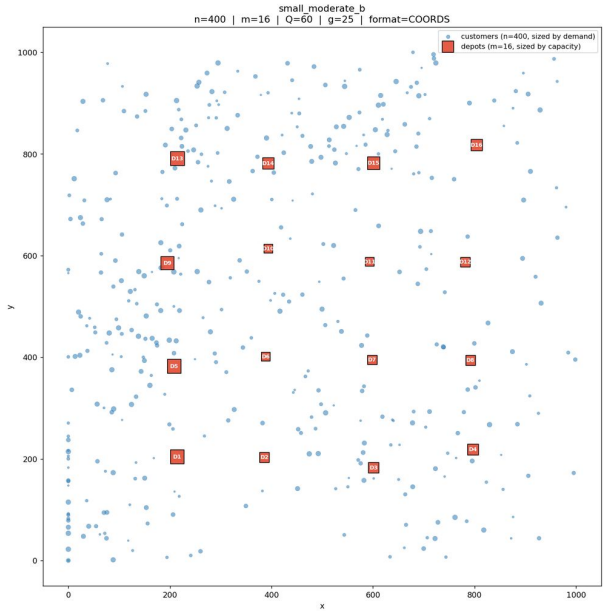

**clrp-small-03** (**small_loose_a**, Loose): n = 200, m = 10, Q = 50, g = 10, $\rho_{\mathrm{d}} = 0.40$, $\rho_{\mathrm{v}} = 0.40$; customers uniform, depots random, demand uniform. Final BKS 27,168.88 (CIMAT_UP), -1.71% vs Hexaly.



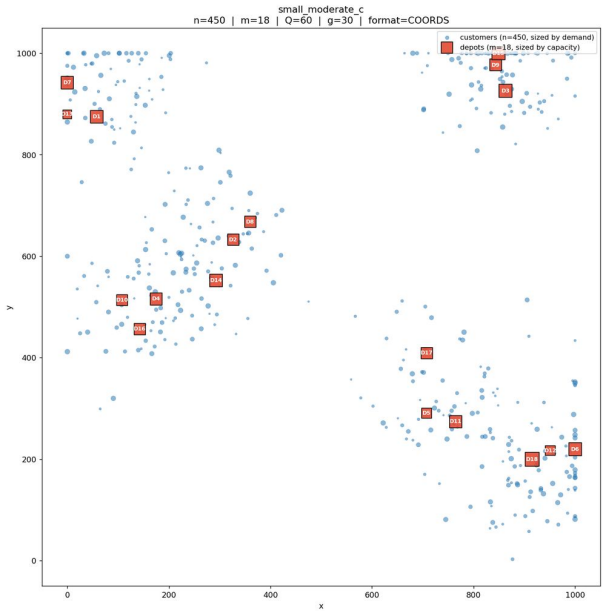

**clrp-small-04** (**small_loose_b**, Loose): n = 250, m = 12, Q = 50, g = 15, $\rho_{\mathrm{d}} = 0.45$, $\rho_{\mathrm{v}} = 0.42$; customers clustered, depots grid, demand bimodal. Final BKS 24,060.11 (AILS-CLRP), -1.78% vs Hexaly.



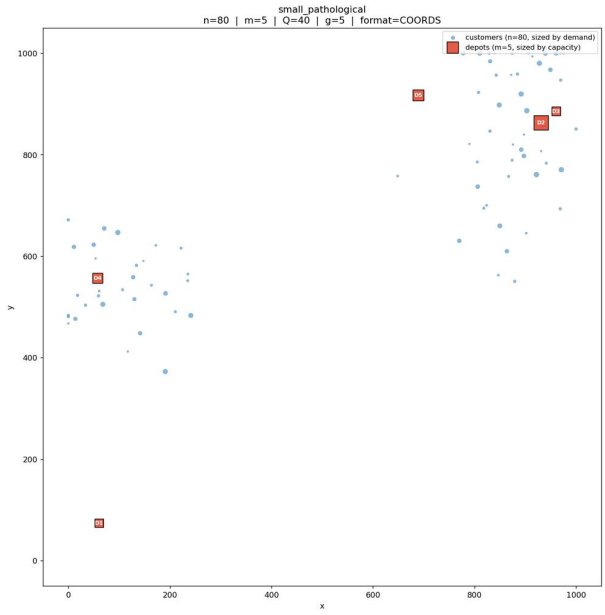

**clrp-small-05** (**small_moderate_a**, Moderate): n = 300, m = 14, Q = 50, g = 20, $\rho_{\mathrm{d}} = 0.66$, $\rho_{\mathrm{v}} = 0.66$; customers uniform, depots grid, demand uniform. Final BKS 34,381.99 (CIMAT_UP), -5.64% vs Hexaly.



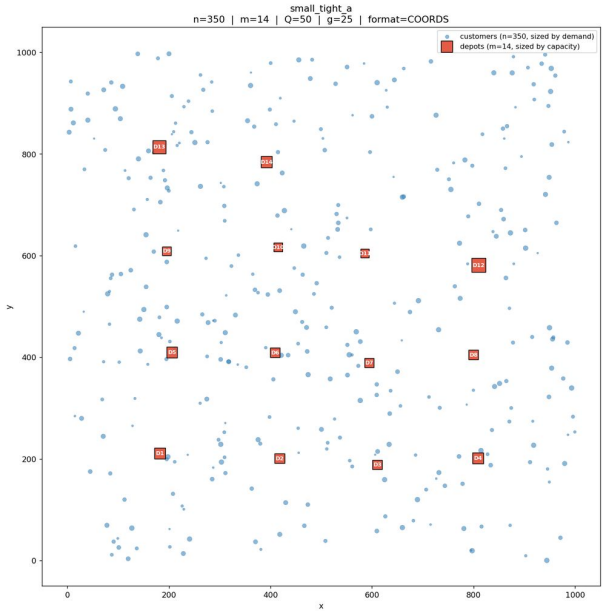

**clrp-small-06** (**small_moderate_b**, Moderate): n = 400, m = 16, Q = 60, g = 25, $\rho_{\mathrm{d}} = 0.70$, $\rho_{\mathrm{v}} = 0.72$; customers mixed, depots grid, demand uniform. Final BKS 41,861.08 (CIMAT_UP), -2.07% vs Hexaly.



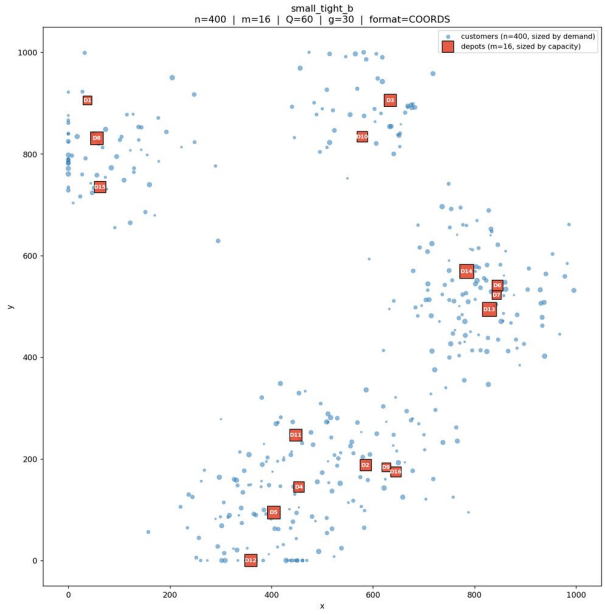

**clrp-small-07** (`small_moderate_c`, Moderate): n = 450, m = 18, Q = 60, g = 30, $\rho_{\mathrm{d}} = 0.72$, $\rho_{\mathrm{v}} = 0.74$; customers clustered, depots co-located, demand uniform. Final BKS 36,689.10 (CIMAT_UP), -6.03% vs Hexaly.



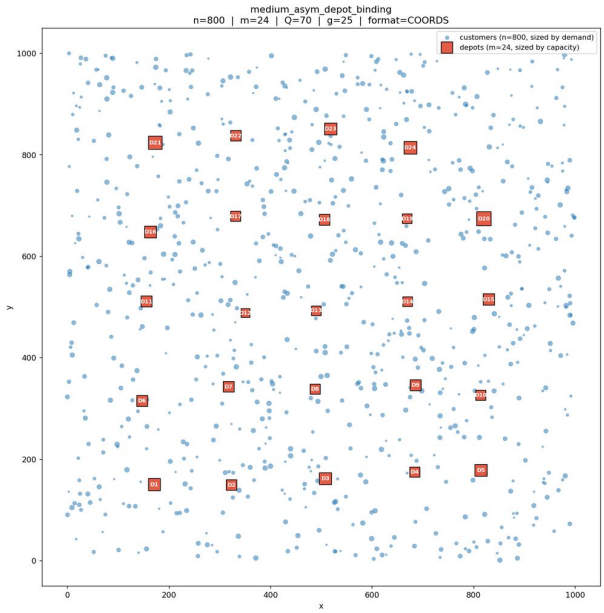

**clrp-small-08** (`small_pathological`, Pathological): n = 80, m = 5, Q = 40, g = 5, $\rho_{\mathrm{d}} = 0.45$, $\rho_{\mathrm{v}} = 0.48$; customers clustered, depots peripheral, demand bimodal. Final BKS 8,779.87 (CIMAT_UP), 0.00% vs Hexaly.



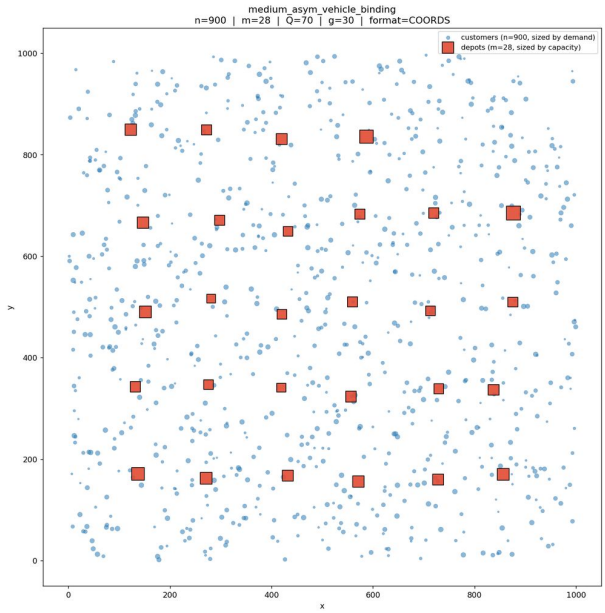

**clrp-small-09** (`small_tight_a`, Tight): n = 350, m = 14, Q = 50, g = 25, $\rho_{\mathrm{d}} = 0.87$, $\rho_{\mathrm{v}} = 0.88$; customers uniform, depots grid, demand uniform. Final BKS 42,948.38 (CIMAT_UP), -2.70% vs Hexaly.



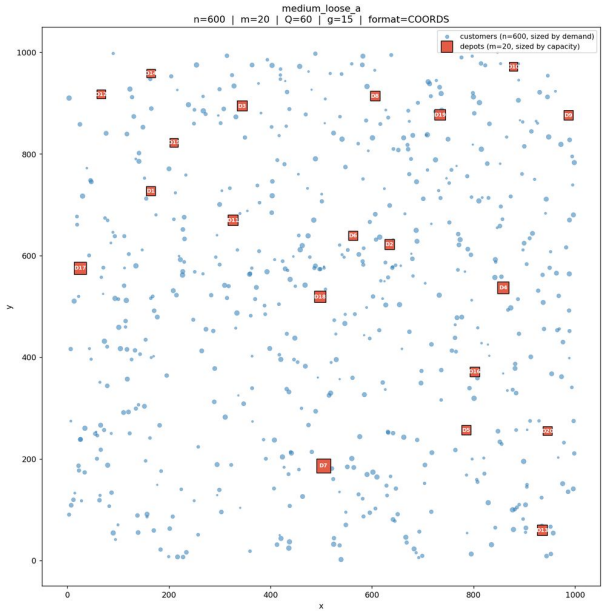

**clrp-small-10** (`small_tight_b`, Tight): n = 400, m = 16, Q = 60, g = 30, $\rho_{\mathrm{d}} = 0.90$, $\rho_{\mathrm{v}} = 0.85$; customers clustered, depots co-located, demand uniform. Final BKS 35,575.67 (CIMAT_UP), -1.96% vs Hexaly.



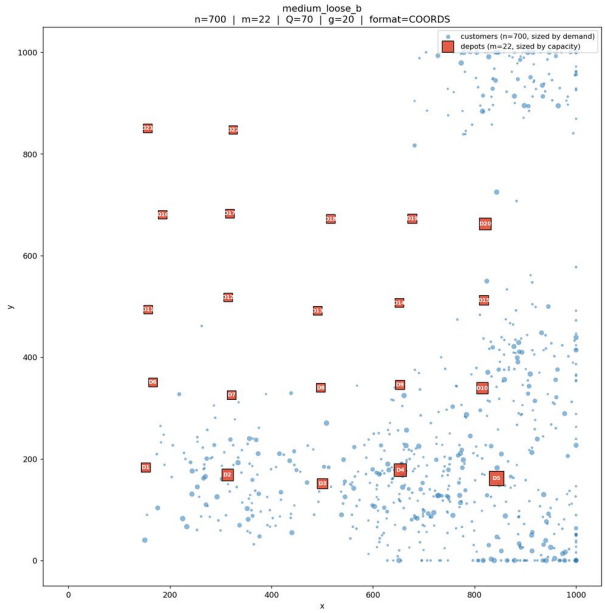

**clrp-medium-01** (**medium_asym_depot_binding**, Asym. (depot binds)): n = 800, m = 24, Q = 70, g = 25, $\rho_d = 0.90$, $\rho_v = 0.43$; customers uniform, depots grid, demand uniform. Final BKS 64,839.93 (CIMAT_UP), -4.14% vs Hexaly.



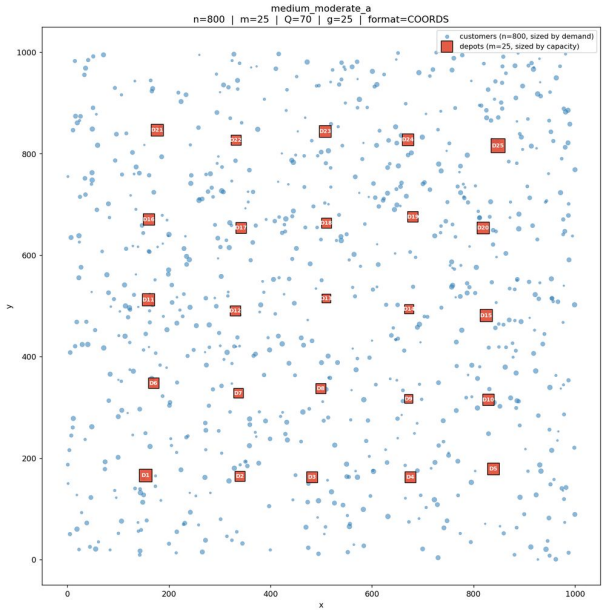

**clrp-medium-02** (**medium_asym_vehicle_binding**, Asym. (fleet binds)): n = 900, m = 28, Q = 70, g = 30, $\rho_d = 0.45$, $\rho_v = 0.88$; customers uniform, depots grid, demand uniform. Final BKS 67,997.02 (CIMAT_UP), -5.46% vs Hexaly.



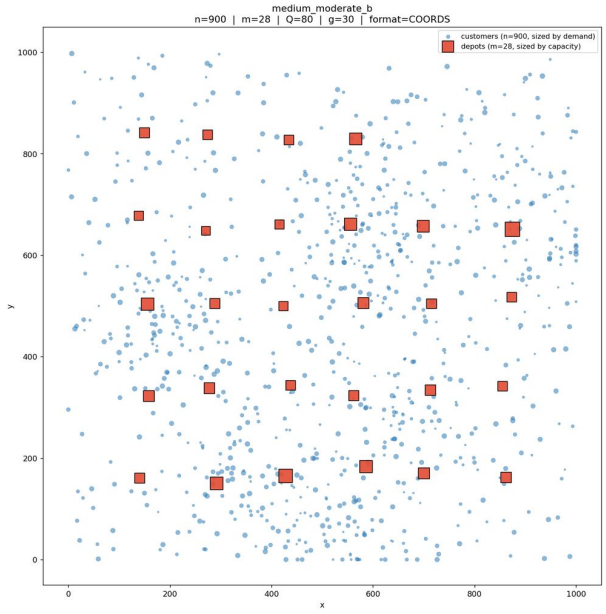

**clrp-medium-03** (**medium_loose_a**, Loose): n = 600, m = 20, Q = 60, g = 15, $\rho_d = 0.40$, $\rho_v = 0.39$; customers uniform, depots random, demand uniform. Final BKS 54,522.27 (CIMAT_UP), -3.82% vs Hexaly.



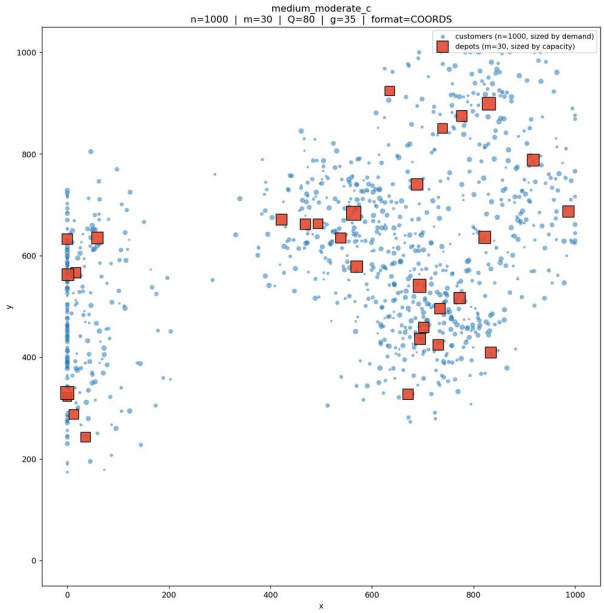

**clrp-medium-04** (**medium_loose_b**, Loose): n = 700, m = 22, Q = 70, g = 20, $\rho_d = 0.45$, $\rho_v = 0.42$; customers clustered, depots grid, demand bimodal. Final BKS 50,442.11 (OPERE LAB), -2.31% vs Hexaly.



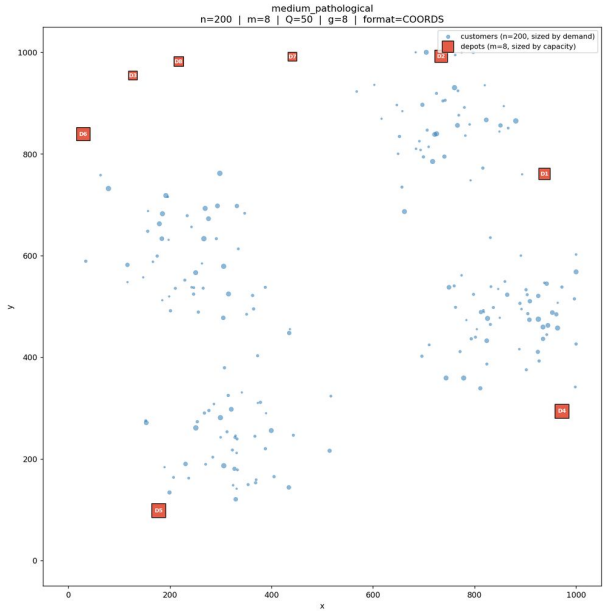

**clrp-medium-05** (**medium_moderate_a**, Moderate): n = 800, m = 25, Q = 70, g = 25, $\rho_{\mathrm{d}} = 0.66$, $\rho_{\mathrm{v}} = 0.68$; customers uniform, depots grid, demand uniform. Final BKS 60,439.00 (CIMAT_UP), -8.54% vs Hexaly.



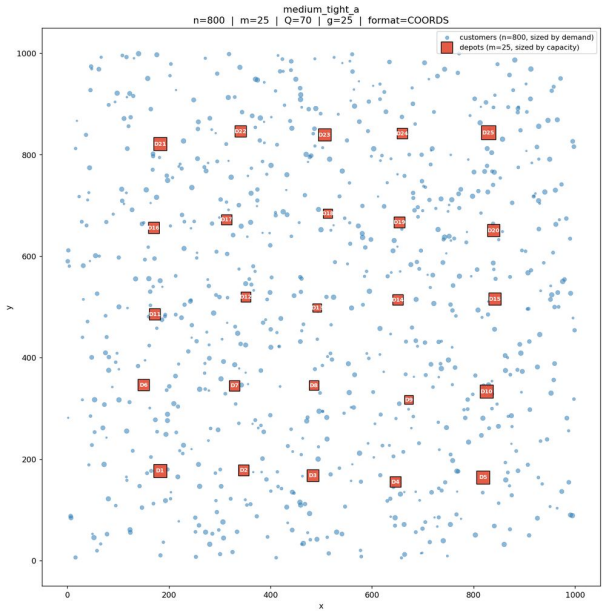

**clrp-medium-06** (**medium_moderate_b**, Moderate): n = 900, m = 28, Q = 80, g = 30, $\rho_{\mathrm{d}} = 0.70$, $\rho_{\mathrm{v}} = 0.72$; customers mixed, depots grid, demand uniform. Final BKS 68,893.81 (CIMAT_UP), -10.67% vs Hexaly.



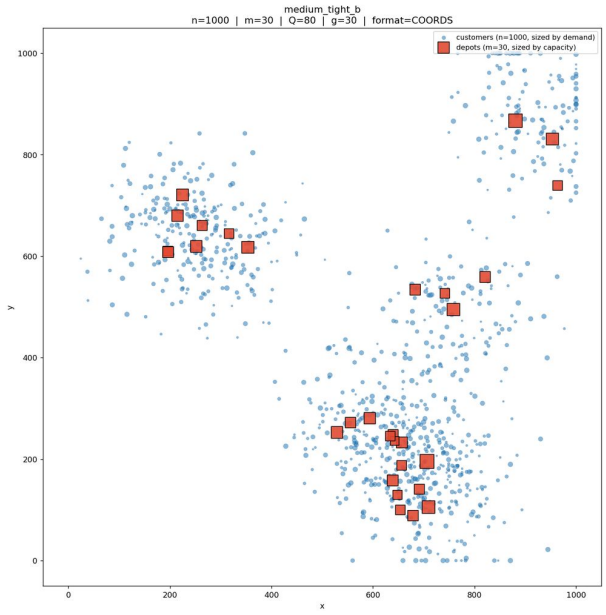

**clrp-medium-07** (**medium_moderate_c**, Moderate): n = 1000, m = 30, Q = 80, g = 35, $\rho_{\mathrm{d}} = 0.72$, $\rho_{\mathrm{v}} = 0.75$; customers clustered, depots co-located, demand uniform. Final BKS 65,054.33 (CIMAT_UP), -12.64% vs Hexaly.



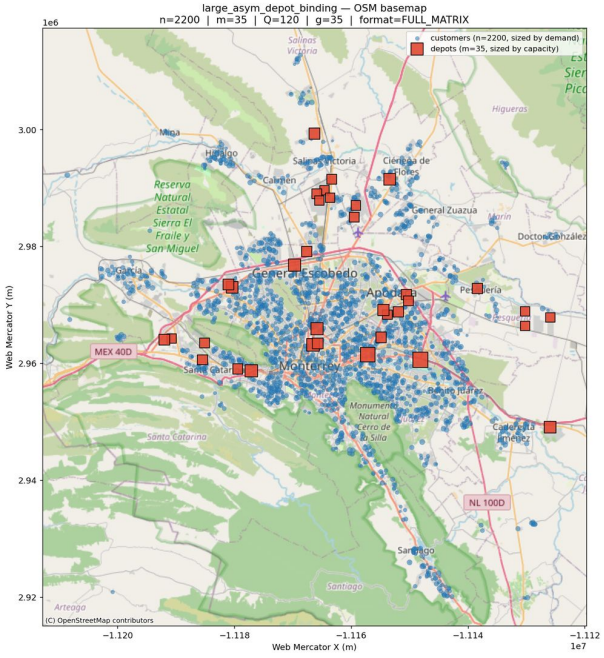

**clrp-medium-08** (**medium_pathological**, Pathological): n = 200, m = 8, Q = 50, g = 8, $\rho_{\mathrm{d}} = 0.45$, $\rho_{\mathrm{v}} = 0.46$; customers clustered, depots peripheral, demand bimodal. Final BKS 24,027.59 (CIMAT_UP), -3.22% vs Hexaly.



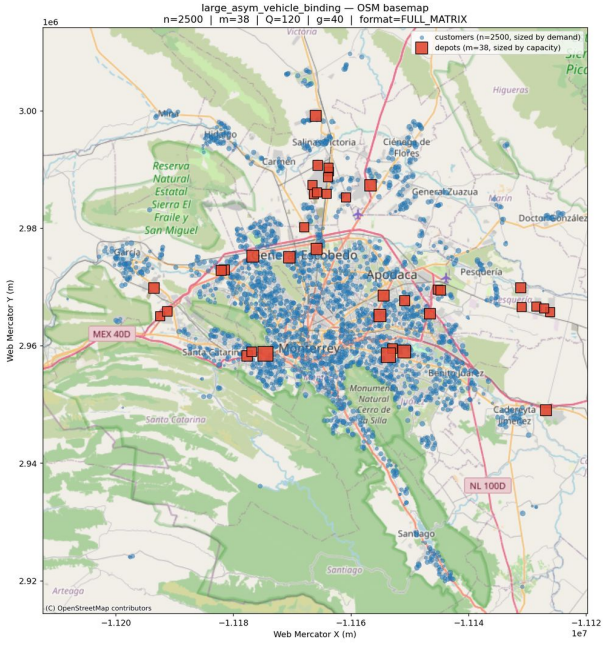

**clrp-medium-09** (**medium_tight_a**, Tight): n = 800, m = 25, Q = 70, g = 25, $\rho_{\mathrm{d}} = 0.87$, $\rho_{\mathrm{v}} = 0.89$; customers uniform, depots grid, demand uniform. Final BKS 63,658.21 (CIMAT_UP), -5.26% vs Hexaly.



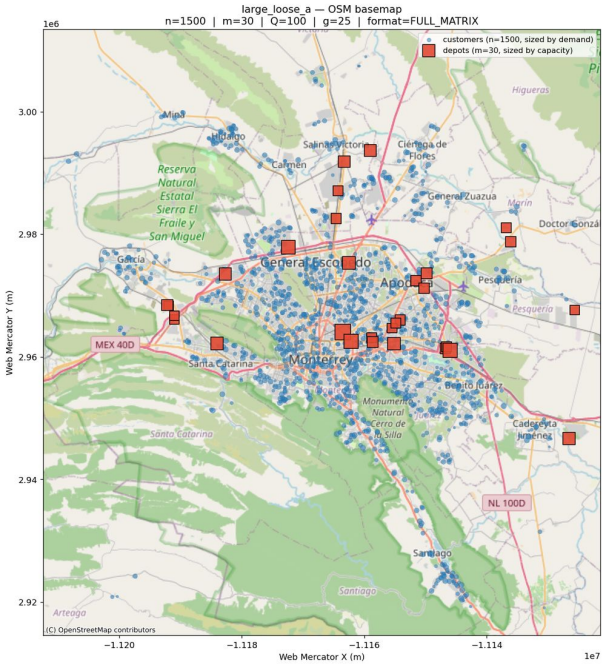

**clrp-medium-10** (**medium_tight_b**, Tight): n = 1000, m = 30, Q = 80, g = 30, $\rho_{\mathrm{d}} = 0.90$, $\rho_{\mathrm{v}} = 0.85$; customers clustered, depots co-located, demand uniform. Final BKS 64,448.54 (CIMAT_UP), -7.65% vs Hexaly.



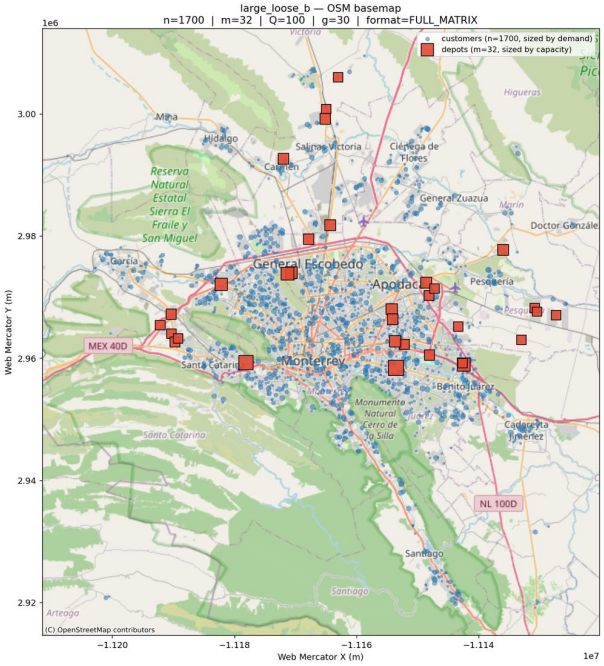

**clrp-large-01** (**large_asym_depot_binding**, Asym. (depot binds)): n = 2200, m = 35, Q = 120, g = 35, $\rho_{\mathrm{d}} = 0.90$, $\rho_{\mathrm{v}} = 0.44$; customers ZMM res./comm. polygons, depots ZMM industrial, demand uniform. Final BKS 7,420,494.02 (AgenticOR), -3.20% vs Hexaly.



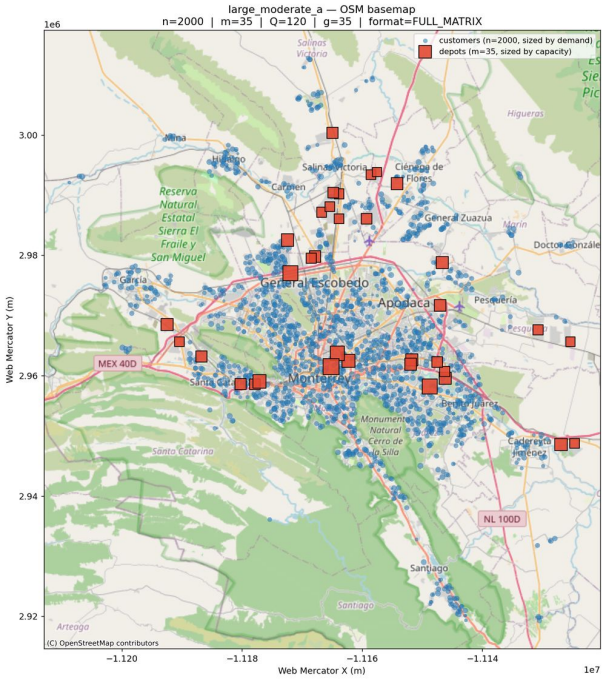

**clrp-large-02** (**large_asym_vehicle_binding**, Asym. (fleet binds)): n = 2500, m = 38, Q = 120, g = 40, $\rho_{\mathrm{d}} = 0.45$, $\rho_{\mathrm{v}} = 0.85$; customers ZMM res./comm. polygons, depots ZMM industrial, demand uniform. Final BKS 8,465,078.19 (AILS-CLRP), -3.22% vs Hexaly.



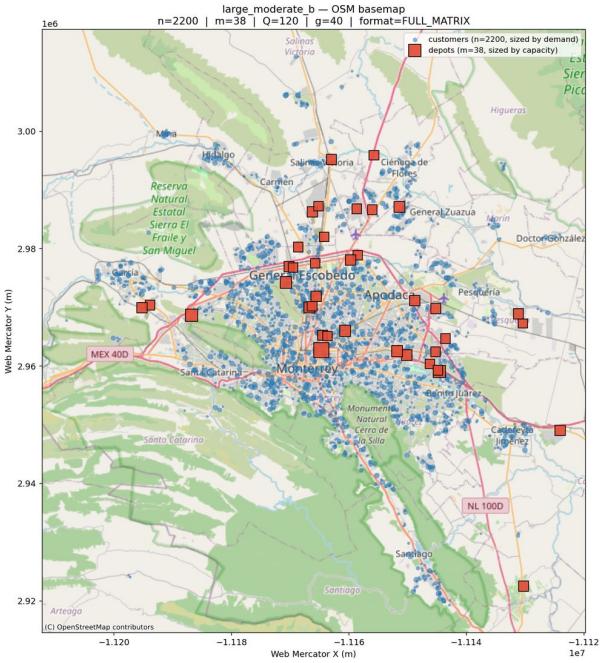

**clrp-large-03** (**large_loose_a**, Loose): n = 1500, m = 30, Q = 100, g = 25, $\rho_{\mathrm{d}} = 0.40$, $\rho_{\mathrm{v}} = 0.39$; customers ZMM res./comm. polygons, depots ZMM industrial, demand uniform. Final BKS 6,673,738.46 (CIMAT_UP), -2.86% vs Hexaly.



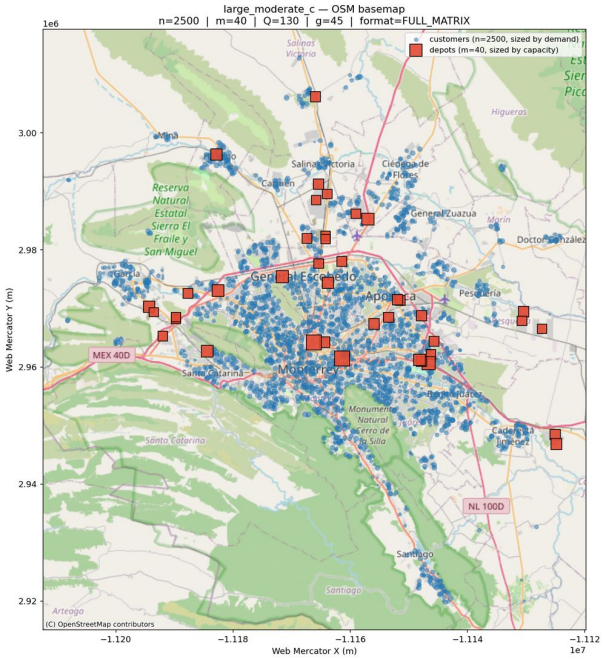

**clrp-large-04** (**large_loose_b**, Loose): n = 1700, m = 32, Q = 100, g = 30, $\rho_{\mathrm{d}} = 0.45$, $\rho_{\mathrm{v}} = 0.44$; customers ZMM res./comm. polygons, depots ZMM industrial, demand bimodal. Final BKS 7,284,926.76 (AgenticOR), -3.05% vs Hexaly.



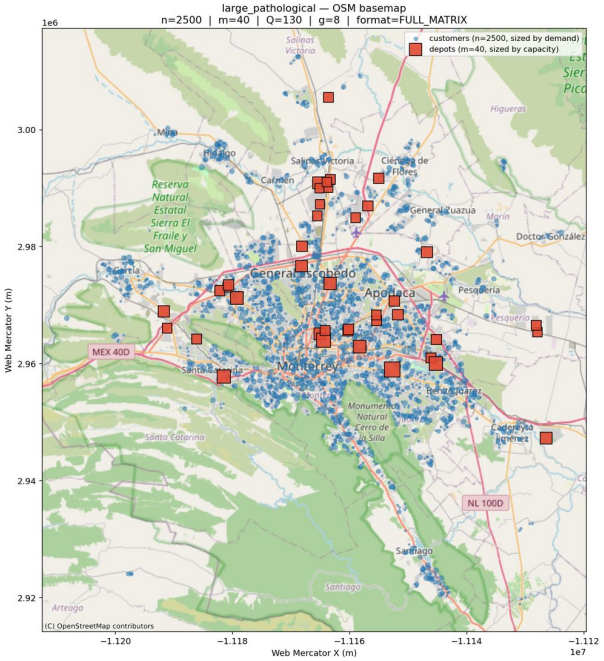

**clrp-large-05** (**large_moderate_a**, Moderate): n = 2000, m = 35, Q = 120, g = 35, $\rho_{\mathrm{d}} = 0.66$, $\rho_{\mathrm{v}} = 0.69$; customers ZMM res./comm. polygons, depots ZMM industrial, demand uniform. Final BKS 6,639,473.75 (AgenticOR), -3.28% vs Hexaly.



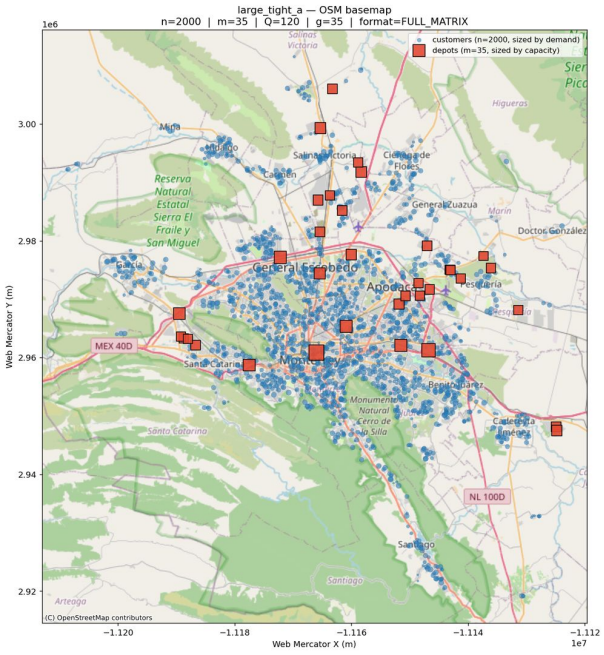

**clrp-large-06** (**large_moderate_b**, Moderate): n = 2200, m = 38, Q = 120, g = 40, $\rho_{\mathrm{d}} = 0.70$, $\rho_{\mathrm{v}} = 0.73$; customers ZMM res./comm. polygons, depots ZMM industrial, demand bimodal. Final BKS 6,332,853.90 (AgenticOR), -3.87% vs Hexaly.



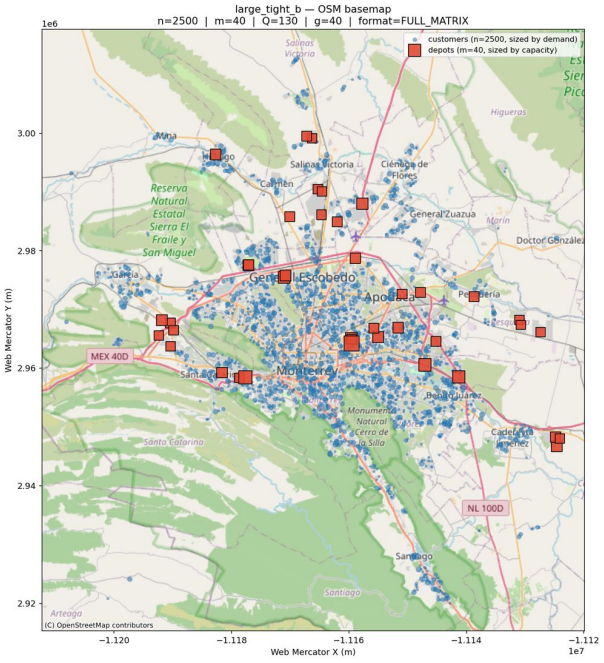

**clrp-large-07** (large_moderate_c, Moderate): n = 2500, m = 40, Q = 130, g = 45, $\rho_d = 0.72$, $\rho_v = 0.76$; customers ZMM res./comm. polygons, depots ZMM industrial, demand uniform. Final BKS 8,384,113.87 (AgenticOR), -3.44% vs Hexaly.




**clrp-large-08** (large_pathological, Pathological): n = 2500, m = 40, Q = 130, g = 8, $\rho_d = 0.50$, $\rho_v = 0.53$; customers ZMM res./comm. polygons, depots ZMM industrial, demand bimodal. Final BKS 6,934,967.10 (AILS-CLRP), -3.82% vs Hexaly.




**clrp-large-09** (large_tight_a, Tight): n = 2000, m = 35, Q = 120, g = 35, $\rho_d = 0.85$, $\rho_v = 0.80$; customers ZMM res./comm. polygons, depots ZMM industrial, demand uniform. Final BKS 6,551,702.35 (AgenticOR), -3.41% vs Hexaly.




**clrp-large-10** (large_tight_b, Tight): n = 2500, m = 40, Q = 130, g = 40, $\rho_d = 0.88$, $\rho_v = 0.81$; customers ZMM res./comm. polygons, depots ZMM industrial, demand bimodal. Final BKS 6,648,706.75 (CIMAT_UP), -3.86% vs Hexaly.