MESS-2020+1 Competition: — Problem description and rules —

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Outline

1. Problem formulation
2. File formats
3. Instances and tools
4. Competition rules
5. Important dates and prizes

Warehouse Location Problem with Store Incompatibilities

Basic concepts:

- Warehouse: with capacity and opening cost.
- Store: with request to be satisfied by *one or more* warehouses.
- Supply cost: cost of supplying one unit of goods from a warehouse to a store.
- Incompatibility: pair of stores that cannot be supplied by the same warehouse.

Warehouse Location Problem with Store Incompatibilities

Decision variables:

- $x_{sw} \in \mathbb{N}$: for each pair $\langle s, w \rangle$, x_{sw} is the quantity of goods moved from warehouse w to store s.
- $y_w \in \{0, 1\}$: $y_w = 1$ if the warehouse w is open, $y_w = 0$ otherwise

Warehouse Location Problem with Store Incompatibilities

Constraints:

- The total quantity of goods taken from a warehouse cannot exceed its capacity.
- The total quantity of goods brought to a store must be exactly equal to its request.
- Goods can be moved only from open warehouses.
- Two incompatible stores cannot be supplied by the same warehouse.

Objective function. Sum of:

- cost of opening warehouses;
- cost of supply from the warehouses to the stores.

Input file format

```
Warehouses = 4;
Stores = 10;

Capacity = [100, 40, 60, 60];
FixedCost = [860, 350, 440, 580];
Goods = [12, 17, 5, 13, 20, 20, 17, 19, 11, 20];
SupplyCost = [|27, 66, 44, 55
              |53, 89, 68, 46
              |17, 40, 18, 61
              |20, 68, 44, 78
              |42, 89, 65, 78
              |57, 55, 49, 31
              |89, 101, 90, 16
              |37, 31, 23, 55
              |76, 60, 63, 44
              |82, 107, 91, 31|];

Incompatibilities = 3;
IncompatiblePairs = [| 1, 10 | 2, 7 | 8, 9 |];
```

Output file formats

- Matrix format (Stores $\times$ Warehouses $\rightarrow$ Quantity):

```
[(0,0,0,12)
(0,0,0,17)
(0,0,0,5)
(0,0,0,13)
(0,0,20,0)
(0,7,0,13)
(0,16,1,0)
(0,0,19,0)
(0,11,0,0)
(0,0,20,0)]
```

- List format (s,w,qty):

```
{(1,4,12), (2,4,17), (3,4,5), (4,4,13), (5,3,20), (6,2,7),
(6,4,13), (7,2,16), (7,3,1), (8,3,19), (9,2,11), (10,3,20)}
```

Note: 1-based indexes

Instances

- Public dataset:
  - 20 instances
  - size from 50 to 3000 warehouses
  - used for first round
  - available today
- Hidden dataset:
  - 10 instances
  - from the same generator of the Public ones
  - used for adjudication

Online material

- Validator:
  - C++ source code
  - validates the solution and writes the score and a report
  - accepts both output formats
- Problem specification
- This presentation
- Public instances (single `.zip` file, 108MB)

Available at `https://www.ants-lab.it/mess2020`

Rules: General

Rule 1:

- Participation restricted to students of MESS 2020+1.
- Groups of maximum 3 members.

Rule 2:

- Metaheuristic or hybrid approach.
- Single thread.
- Any programming language (that runs under Linux).
- Third-party free software allowed.

...

Rule 5:

- Instance-dependent timeout: seconds $= \lceil 10\sqrt{W} \rceil$.
- Reference CPU: ∼2.7GHz clock, ∼2GB RAM.

Rule 6:

- Algorithm deterministic or stochastic, but reproducible (store the seed).

Rules: Ranking

Rule 7:

- Participants must submit for each Public instance the solution with the best score found within the timeout.

Rule 8:

- Finalists: first 10 by average rank on the 20 instances.

Rules: Final round

Rule 9:

- Finalists will be given access to a virtual machine with Ubuntu Linux (∼2.7GHz clock, ∼2GB RAM)
- Code run by the organisers on the Hidden instances.
- Command-line execution (example):

```
>./solver wlp02.dzn sol02.txt 100 2834080383
```

Rule 10:

- Finalists' ranking will be based on the ranks of 10 runs on each single Hidden instance.

Important dates and prizes

Important dates:

- Start: June 15th, 2021
- Deadline: September 30th, 2021
- Finalist announcement: October 10th, 2021
- Software setup for finalists: October 20th, 2021
- Final ranking announcement: November 10th, 2021
- Paper due: December 10th, 2021

Prizes:

- Top 3: Money and certificate (+ imperishable glory!)
- Finalists (top 10): publication on the Volume of the AIRO Springer Series

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Good luck!!