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

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2nd International Metaheuristics Summer School (MESS-2020+1)
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1. Problem formulation
2. File formats
3. Instances and tools
4. Competition rules
5. Important dates and prizes
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.
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.
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):
  \[
  \begin{bmatrix}
  (0,0,0,12) \\
  (0,0,0,17) \\
  (0,0,0,5) \\
  (0,0,0,13) \\
  (0,0,20,0) \\
  (0,7,0,13) \\
  (0,16,1,0) \\
  (0,0,19,0) \\
  (0,11,0,0) \\
  (0,0,20,0)
  \end{bmatrix}
  \]

- **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](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: \( \text{seconds} = \lceil 10 \sqrt{W} \rceil \).
- Reference CPU: \( \sim 2.7 \text{GHz clock}, \sim 2 \text{GB RAM} \).

Rule 6:

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

- **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
### Contacts

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Good luck!!