Benchmark library "Discrete Location Problems"

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Desing and analysis of computationally difficult instances is one of the promising areas in combinatorial optimization. The instances allow us to improve optimization algorithms, compare different strategies, and detect weak places of computational methods.

On the other hand, the theory of computational complexity indicates that a lot of combinatorial problems are NP-hard. Some of them are NP-hard in the strong sense [2]. Nevertheless, the experimental research in different areas of combinatorial optimization show that we can find optimal or near optimal solutions quite easily [1]. In average, all problems are simple, but from time to time we face with extremely difficult instances. So, it is very important to collect such instances and study the behavior of computational methods in hard cases.

The benchmark library "Discrete Location Problems" is an electronic collection of difficult instances for some well-known facility location models:

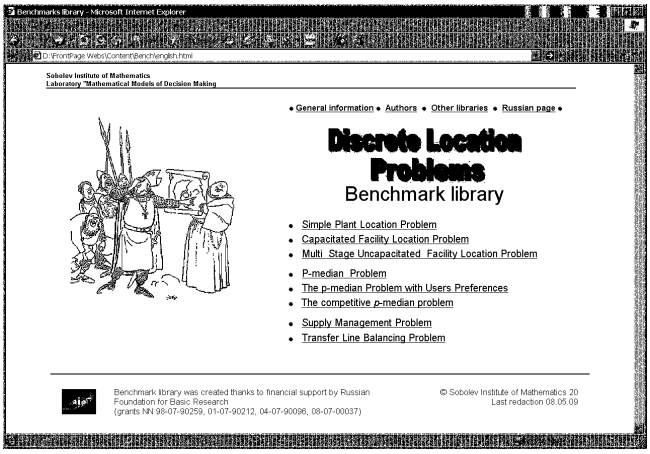
— The uncapacitated facility location problem;
— The multi stage facility location problem;
— The p-median problem;
— The p-median problem with users preferences;
— The competitive p-median problem;

and some others [5].

All problems are NP-hard in the strong sense and the last one is $\sum_2^P$-complete. The first problem is the most popular in discrete location theory [4]. In the benchmark library we can find the following classes of test instances for this problem [3]:

— tests based on the finite projective planes (FPP);
— tests based on binary perfect codes (BPC);
— tests based on the chess boards (CB);
— tests with random structure and large integrality gap (Gap-A, Gap-B, Gap-C).

The first class is polynomially solvable. It has many strong local optima and large mutual pair distances. Two others classes have exponential number of strong local optima. Finally, three last classes have large gap and the class Gap-C is the most difficult for metaheuristics and the branch and bound methods.



References

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