Critical Note on the paper “An Improved Genetic Algorithm for the Multi Level Uncapacitated Facility Location Problem”

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Abstract

Manuscript by Korač et al. [7] reports false computational results of the improved genetic algorithm for the Multi Level Uncapacitated Facility Location Problem (MLUFLP) and incorrect comparisons with the results of genetic algorithm for the MLUFLP proposed in paper by Marić [6]. The authors of [7] present computational results obtained on false MLUFLP instances capa, capb and capc, claiming that they are the same as capa, capb and capc instances generated and used in [6]. False MLUFLP instances capa, capb and capc have significantly smaller fixed costs for establishing facilities compared to the original capa, capb and capc instances from [6], which leads to lower objective function values on the false instances. The authors of [7] further use experimental results obtained on false instances (representing 1/3 of the MLUFLP benchmark set), to derive conclusions on superiority of the proposed improved GA approach [7] over the GA from [6]. For these reasons, both computational results and analysis presented in [7] are incorrect.

Keywords: Multilevel Uncapacitated Facility Location problem, Genetic Algorithm, false instances, incorrect computational analysis.

1 Introduction

The MLUFLP is a well-known NP-hard combinatorial optimization problem, which considers a set of facilities partitioned into certain number of levels and a set of clients. Transportation costs between each pair of facilities belonging to two successive levels are given, as well as transportation costs between a client and facility belonging to the last level. Fixed costs for establishing facilities are also assumed. The objective of the MLUFLP is to minimize the sum of the total transportation costs and the fixed costs for establishing facilities, see [1], [4], [5], [6], etc.

In paper by Marić [6], a genetic algorithm approach is used for the first time in the literature for solving the Multi Level Uncapacitated Facility Location Problem. The results published in paper by Marić [6] are originally presented in PhD thesis (in Serbian) of the same author [5]. The GA from [6] uses a binary encoding scheme and appropriate objective function calculation.
which contains dynamic programming approach for finding sequence of located facilities on each level to satisfy clients’ demands. The experiments in [6] were carried out on the set of ORLIB [3] instances:
http://people.brunel.ac.uk/~mastjjb/jeb/orlib/capinfo.html,
http://people.brunel.ac.uk/~mastjjb/jeb/orlib/uncapinfo.html,
http://people.brunel.ac.uk/~mastjjb/jeb/orlib/files/,
that are generated in similar way as in [4], but in a way that reflects a more realistic assumption in practice. For detailed explanation on generating the MLUFLP instances, we refer to [6].

Computational results presented in paper [7] were obtained on the MLUFLP test instances with the same names as in [5] and [6], but 1/3 of them have different content related to fixed costs. Furthermore, the authors of paper [7] compare the results obtained by the proposed Genetic Algorithm on false MLUFLP test instances with the results of the GA presented in [6] that are obtained on the original MLUFLP instances, and draw conclusions about superiority of the GA approach from [7] based on this incorrect comparison.

2 Comments on computational results from [7]

The MLUFLP instances were first used in the PhD thesis of Marić [5], as the benchmark set for evaluation of the GA that was developed for solving the MLUFLP. The results of the GA on the set of original instances can be found on Page 81 of [5]. The thesis was defended in November 2008, and the results of the GA for solving the MLUFLP were published in Computing and Informatics journal (CAI) in 2010. Please note that the paper [6] was submitted to CAI in February 2008, and revised in May 2008.

Manuscript by Korać et al. [7] presents computational results obtained on false MLUFLP instances capa, capb, capc, claiming that they are the same as capa, capb and capc instances generated and used in [5] and [6]. They further use the experimental results obtained on these incorrect instances to derive the conclusions on superiority of the proposed improved GA approach in [7]. In order to eliminate any doubts, in Table 1 we present EXACT SOLUTIONS obtained by the CPLEX solver on the original capa, capb, capc and cap instances used in [5] and [6]. In the same Table, we give the comparison of the best GA results from [6] on the original instances and the Best GA results from Korać et al. [7] on the set of false instances. Please note that the authors in Korać et al. [7] claim that they used the same instances as in paper by Marić [6], see Page 7, lines 3-4 in Korać et al. [7]: ”The GA is tested on the same instances as in [8] to show improvement obtained by improved objective function and hybridization with local search.”

The results are presented in Table 1 as follows:

- The name of original instance,
- Optimal solution obtained by CPLEX solver on original instances used by Marić in [5] and [6],
- Best solution of the GA approach proposed by Marić in [5] and [6] on original instances,
- Best solution of the GA approach proposed by Korać et al. in [7] on false instances.

As it can be seen, optimal solutions and the best solutions obtained by GA approaches from [6] and [7] are the same on cap instances. For capa, capb and capc instances from [6], the best results of GA approach [6] coincide with optimal solutions obtained by CPLEX solver. However, the best results of GA approach [7] on false capa, capb and capc instances used in [7]
Table 1: Comparisons of results from [6] and [7]

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The disputable GA results from [7] are bolded in the last column of Table 1.

From the given Table 1, it can be seen that the differences are not acceptable and the discussion on the GA performance and the use of different seeds has no sense. We also provide the implementation of the MLUFLP model in CPLEX so that one can easily verify the values of optimal results presented in Table 1. The implementation in CPLEX may be downloaded from http://poincare.matf.bg.ac.rs/~maricm/instances/mluflp/mluflpcplex.exe, while the original MLUFLP instances from [5] and [6] can be reached at http://poincare.matf.bg.ac.rs/~maricm/instances/mluflp/.

In order to investigate the difference between the instances from [6] and [7], we have downloaded MLUFLP instances from the web page of J. Kratica: http://www.mi.sanu.ac.rs/~jkratica/instances/mluflp/mluflpinst.7z, and compared them with instances used by Marić in [6]. We have concluded that the difference between capa, capb and capc instances used in [6] and [7] is in the column related to fixed costs. More precisely, the authors of [7] use an incorrect value of 7500 as fixed costs for ALL potential facilities in capa, capb and capc instances, which is significantly smaller compared to the original fixed costs in capa, capb, capc instances from [5] and [6].

In order to illustrate these differences, in Table 2 we provide a part of capa instance related to fixed cost and capacities. The use of considerably smaller value of 7500 for fixed costs of all potential facilities in false instances from [7], has obviously resulted in significant difference in results of the GA presented in Table 6 from [7] for capa, capb and capc, when compared to the results of the GA from [6].

Without going into the authors’ motivation for using the incorrect capa, capb and capc instances in [7], it is obvious that this caused the difference in results on these instances. Please note that the 1/3 of instances used in the paper by Korać et al. [7] are wrong, and that these are instances of large dimensions. Significant differences in the obtained results would be a
signal to any expert in this area to double-check the instances and the results before making a conclusion. In addition, the authors base the contribution of the paper on the better results that they obtained on the set of 1/3 of the instances (as they state in the paper), which turned to be false. If the authors of [7] had the original GA implementation from [6], as they state, a significant difference in the results of repeated testing of the GA implementation from [6], which was performed by the authors of [7], would be a strong indicator that the instances used in [7] are incorrect.

3 Conclusion

In this Critical Note, we point out the use of false capa, capb and capc instances in paper by Korač et al. [7]. The results of the paper [7] are based on the alleged improvements on 1/3 of test instances that are proved to be incorrect. The authors of [7] further use false instances to provide unfair comparisons with the genetic algorithm proposed in [6]. For the reasons mentioned above, computational results and comparisons presented in [7] are unacceptable. Therefore, contribution of the paper [7] should be reconsidered, and this Critical Note should be published in the IJCCC journal, in order to avoid misleading of the researchers who will deal with solving the MLUFLP in the future.

References


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