

Optimization Methods - Final Project

In the previous assignments, students implemented a column generation approach to solve the Linear Relaxation of the One-Dimensional Bin Packing Problem (1D-BPP). In this final project, the objective is to embed the column generation approach into a complete branch-and-price algorithm to solve the 1D Bin Packing Problem.

In addition to the implementation, students are required to investigate and review the available literature on branch-and-price algorithms for the 1D Bin Packing Problem. The report should include a summary of key methods, findings, and references from the literature, and discuss how these inform the design and implementation of the student's own approach.

The objective of this assignment is to implement a C++ program using IBM CPLEX to solve the 1D Bin Packing Problem with a branch-and-price approach. Students are required to:

- Integrate the column generation approach into a branch-and-price framework.
- Solve the 1D Bin Packing Problem using the proposed branch-and-price approach.
- Search for and select at least 10 benchmark instances for the 1D Bin Packing Problem available online, and use them to validate the model.
- Deliver a comprehensive report.
- Submit the source code of the implemented program.

A Resources

The following resources are provided to assist students in completing the assignment:

- Publicly available benchmark data sets for the 1D Bin Packing Problem (e.g., OR-Library, Bin Packing Problem Library, etc.).
- Sample code snippets for reading data files and building optimization models in the folder *assets/cvrpcode/* (adapt as needed).
- IBM CPLEX documentation and tutorials available on IBM's official website.

B Submission Guidelines

Students are required to submit the following deliverables by the specified deadline:

- A comprehensive report in PDF format detailing the implementation, model investigation, solution process, and results.
- A zip file containing the source code of the implemented program.

The report must include the following sections:

1. Introduction: Briefly describe the One-Dimensional Bin Packing Problem and its significance.
2. Branch-and-Price Approach: Explain the concept of branch-and-price and its application in solving the 1D Bin Packing Problem.
3. Benchmark Data: Describe the process of searching for and selecting benchmark data sets, and provide references to the sources.
4. Implementation: Describe the implementation of the branch-and-price approach in C++ with IBM CPLEX.

5. Solution Process: Explain the process of solving the 1D Bin Packing Problem model with branch-and-price and validating the solution.
6. Results: Present the results obtained using tables, graphs, and visualizations for at least 10 different benchmark instances.
7. Conclusion: Summarize the key findings and insights from the assignment.
8. References: Include any references used in the assignment, especially for benchmark data.

Note that the report should be well-structured, clearly written, and properly formatted. The source code should be well-documented and organized for easy understanding. Late submissions will not be accepted.