Optimization Methods - Assignment 1.2

A   Description

In the previous assignment, students implemented the One-Dimensional Bin Packing Problem (1D-BPP) using IBM CPLEX. In this assignment, the objective is to implement a cutting plane approach using Gomory Cuts to solve the 1D Bin Packing Problem.

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

- Implement the cutting plane approach using Gomory Cuts.

- Solve the 1D Bin Packing Problem model using the proposed 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.

B   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.

C   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. Mathematical Model: Present and discuss the mathematical model of the 1D Bin Packing Problem.

3. Gomory Cuts: Explain the concept of Gomory Cuts and their application in solving the 1D Bin Packing Problem.

4. Benchmark Data: Describe the process of searching for and selecting benchmark data sets, and provide references to the sources.

5. Implementation: Describe the implementation of the cutting plane approach using Gomory Cuts in C++ with IBM CPLEX.

6. Solution Process: Explain the process of solving the 1D Bin Packing Problem model with Gomory Cuts and validating the solution.

7. Results: Present the results obtained using tables, graphs, and visualizations for at least 10 different benchmark instances.

8. Conclusion: Summarize the key findings and insights from the assignment.

9. 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.