EIND 364: Principles of Operations Research I Assignment

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Assignment Notes: This assignment introduces students to building and solving mathematical optimization problems by writing Python code using the *gurobipy* library. Gurobot helps students enhance their modeling and coding skills.

Purpose: In this assignment, students will learn how to design, debug, and solve mathematical optimization problems using *Python* and the *gurobipy* library. The assignment utilizes *Gurobot* to support students in building their coding skills, understanding optimization modeling, and effectively debugging their solutions. Through hands-on practice, students will gain experience in formulating real-world optimization problems, translating them into mathematical models, and implementing these models in Python. Gurobot will provide guidance, automated feedback, and debugging support, ensuring students can identify and resolve errors while refining their programming and optimization techniques.

The goal is to familiarize students with real-world optimization problems, enhance their ability to modify and solve them, and critically engage with AI tools like Gurobot for model support.

Duration: Approximately 3-4 weeks.

Learning Objectives

By the end of this assignment, students will be able to:

1. **Formulate a real-world problem as a mathematical optimization model.**
2. **Construct, debug, and solve a mathematical optimization model using *Python* and the *gurobipy* library.**
3. **Use *Gurobot* to enhance problem modeling and solution accuracy.**
4. **Interpret and validate the solution while identifying its practical implications and limitations.**

Materials Needed

- Access to Gurobi optimization tools and the Gurobot AI assistant.
- Access to the repository of Gurobi example problems on GitHub (optional).

Generative AI Tool for Assignment

- **Name of tool:** *Gurobot*
  Purpose: To equip students with the skills to address real-world optimization problems by

constructing, modifying, debugging, and solving optimization models through critical and effective engagement with a specialized AI tool, Gurobot.

- **Who created it:** Developed by Gurobi Optimization
- **Version used:** Version 1.0 (2024).
  Any known limitations/biases:
  - Potential inaccuracies in responses ('hallucinations').
  - Limited depth for highly specialized topics.
  - Dependence on the quality of user queries.

Assignment Structure

1. Each team selects an optimization problem from the official Gurobi GitHub repository.
2. Analyze, run, and extend or modify the problem to solve a new, more complex version.
3. Use *Gurobot* to assist in problem formulation, extension, model construction, debugging, validation, and solution.
   Document your process, including:
   - Prompts used.
   - AI responses.
   - Modifications or follow-up prompts are required.
   - Comparative analysis of the original and extended problems.
   - Insights and reflections on the AI tool's utility.
4. Final code documentation.
5. Prepare a presentation.
6. Prepare a final report.

Submission Guidelines

- Format: Written report and oral presentation
- Length: Report: 4-6 pages; Presentation: 7 minutes
- Citation Guidelines: Cite all tools, including Gurobot, using proper academic formats.

Grading Rubric

Category	Criteria	Points
Implementation	- Successful execution of the original problem using Gurobi.	15
	- Accuracy and functionality of the Python code.	10
	- Effective use of Gurobot for problem debugging and modeling.	5
Problem Modification	- Complexity and originality of the modifications/extensions.	10
	- Logical explanation of the new model and implications of changes.	10
Analysis and Results	- Correct interpretation and validation of results.	10
	- Insightful discussion of the implications of the modified model.	5
	- Comparative analysis of original and modified models.	5
Presentation	- Clarity and organization of the 7-minute presentation.	10
	- Ability to answer questions effectively during the Q&A session.	5

Report	- Comprehensive explanation of the problem, model, and modifications.	10
	- Adherence to formatting guidelines and proper citation of tools and resources.	5

Total Points: 100

Additional Resources

- Gurobi official GitHub repository
- Gurobot
- Gurobot model card: See attached.