Insurance Referee Assignment Problem
Project Milestone 3

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Problem Statement

The Insurance Referee Assignment Problem involves deploying both in-house and contracted referees to evaluate insurance claims, taking into account each referee's capacity and preferences for certain locales and types of incidents. These evaluations must be completed within the confines of a single day. Each case requires a certain amount of inspection time, measured in minutes, and varies by the extent of damage and compensation for external referees. The primary objective is to ensure referees do not surpass their allotted workloads, are paired with cases in their preferred regions and fields, and that claims involving significant damage are handled by company employees. The process seeks to fulfill the hard constraints while aiming to preferentially utilize internal referees to conserve resources, ensure fair compensation for external referees, distribute workloads evenly, and match cases with referees' preferences for location and incident type. The endeavor is to devise an effective strategy that meets all mandatory conditions and judiciously manages flexible ones, achieving an equitable, cost-efficient, and preference-concordant distribution of tasks.

Hard Constraints

The problem is governed by several hard constraints, outlined as follows:

- Referees are assigned a maximum workload, calculated in minutes, that cannot be exceeded. This workload limit is the aggregate time estimated for all claims assigned to a particular referee.
- Cases cannot be allocated to referees who do not oversee the specific region involved, indicated by a preference level of 0.
- A case should not be allocated to a referee who has no responsibility for the case's specific type, identified by a preference level of 0.
- Claims that report damages beyond a predefined financial threshold are exclusively reserved for processing by the company's internal staff of referees.

Weak Constraints

- Favoring in-house referees is advocated to decrease reliance on external personnel, thereby reducing associated costs.
- It's crucial to ensure a uniform and equitable distribution of remuneration among external referees, aiming for parity in earnings by distributing cases in a manner that allows for comparable compensation across the board.
- Aiming for a balanced distribution of tasks among all referees, both internal and external, to ensure a fair spread of workloads and avoid disparities in case handling responsibilities.
- Assignments should be tailored to match referees' professed preferences for specific case categories, enhancing their engagement and effectiveness in handling cases.
- Similarly, cases should ideally be assigned to referees based on their preferred geographic regions, aligning tasks with their areas of geographic comfort and expertise.

Progress Made

I began the project by engaging deeply with the CSE 579 course materials on Canvas, focusing on videos and documentation to grasp the fundamentals of Answer Set Programming (ASP) for the Insurance Referee Assignment problem. This foundational phase involved a detailed analysis of project examples to understand the key constraints and facts critical to the problem. To enhance my ASP skills, I conducted targeted online research, which supported the development of a basic draft of Clingo code, initially incorporating edge and hard constraints. This effort was underpinned by continuous reviews of the course content, improving my approach to handling both hard and weak constraints. The application of concepts from Propositional and First Order Logic, introduced earlier in the course, has been instrumental in developing effective preliminary solutions. Currently, I am refining this initial code draft, planning to integrate additional variables and constraints progressively. This iterative learning and development process is guiding me towards a structured and informed approach to tackling the project's challenges, with the final implementation still in progress.

Challenges Encountered and Resolution Strategies

Initially I encountered several challenges, particularly in understanding and implementing hard and weak constraints. At the outset, distinguishing between these constraints was perplexing, leading me to undertake extensive research and consult academic resources to grasp their practical application. This effort included detailed planning and understanding of edge cases to come up with the initial code draft. Furthermore, to tackle the complex problem statement involving real-world logistics, I broke down the tasks into smaller components, addressing them over several iterations. I intend to continue refining the initial draft of the code by incrementally integrating and refining the constraints. As I progress, if I encounter difficulties, I will persistently explore online resources to navigate and overcome these challenges.

Tasks Completed

- Explored course materials, including videos and documentation, to grasp the basics of Answer Set Programming (ASP) and Clingo for the Insurance Referee Assignment problem.
- Drafted preliminary Clingo code incorporating some of the edge and hard constraints, guided by focused online research and ongoing material reviews.
- Constructed targeted test cases to identify and resolve issues.
- Implemented logic to assign cases according to preferences, with specific provisions for assigning high-payment cases to internal referees.
- Began correcting syntactical mistakes and started outlining scenarios to handle some of the hard constraints.

Tasks remaining

- Complete the listing of all hard and weak constraints in ASP, ensuring comprehensive coverage for accurate case handling.
- Implement and fine-tune weak constraints to balance the overall workload for referees and ensure equitable payment distribution for external referees.
- Finalize the comprehensive and functional draft of the code, which will subsequently be evaluated using personalized test cases to verify its effectiveness and reliability.
- Test the code using scenarios included in the package to ensure it performs well under expected conditions.
- Complete the project report, ensuring it adheres to the AAAI format, and prepare for submission.

References

- Joohyung Lee, CSE579 Lecture Videos.
- Joohyung Lee, CSE 579 Lecture Slides.
- Carmine Dodaro, Philip Gasteiger. Combining Answer Set Programming and Domain Heuristics for Solving Hard Industrial Problems.
- Marcello Balduccini. Representing Constraint Satisfaction Problems in Answer Set Programming.