Segni & Ye

GNAC_Soccer Scheduling

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Dec-09-2024

Soccer Scheduling Optimization

This project solves a soccer scheduling problem using linear programming (LP) to assign matches while considering various constraints, such as special dates and team availability. The solution is parsed and presented in a readable schedule format for both men's and women's teams.

Project Structure

The project folder should include:

- **Code**: All scripts necessary to run the LP solver and generate the schedules.
- **Data**: Data files that provide input to the scheduling algorithm.
- **README.md**: Instructions for setting up and running the project.
- **Output**: Resulting CSV files that contain the men's and women's schedules.

Requirements

The following software and packages are required to run the project:

Software Requirements

1. **R** (version 4.0 or above) - Used to run the scripts and perform the LP optimization.
2. **CBC Solver** (or any solver compatible with R's LP interface) - Required for solving the optimization problem. You can download the CBC solver here.

R Packages

The following R packages must be installed:

- readxl: To read Excel files containing the scheduling data.
- lubridate: For date manipulation and formatting.
- lpSolve: For creating and solving the LP model.
- tidyverse: For data manipulation and cleaning.

To install the required packages, you can run the following command in R:

```
install.packages(c("readxl", "lubridate", "lpSolve", "tidyverse"))
```

Setup Instructions

1. Download the Project

- Download the entire project folder, including the code, data files, and README.

2. Install CBC Solver

- If you don't already have the CBC solver, download and install it following the instructions from the link.
- Ensure that cbc.exe is accessible from the command line or specify the correct path in the code where the solver is called.

3. Prepare Your Environment

Ensure that R and the necessary libraries are installed, as described in the **Requirements** section.

How to Run the Project

1. Load Data

The main data file used is:

- GNAC_Soccer.xlsx: Contains the teams(mens and womens), 2025 Dates, and special dates.

2. Run the Code

The main R script files are located in the Code/ folder. Follow these steps:

1. **Load the R Scripts**: Open the LP_Solver.R script in R.
2. **Define the Inputs**:
    - Ensure that the GNAC_Soccer.xlsx and playDates.csv files are in the correct location (the Data/ folder).
    - Modify the paths in the script if needed to match where the files are located.
3. **Run the Script**: Execute the entire LP_Solver.R script. It will:
    - Create the LP model.
    - Load and process the special dates.
    - Solve the LP problem using the CBC solver.
    - Parse the solution into readable schedules.
4. **View the Output**: After the script runs successfully, you will have two CSV files:
    - mens_schedule.csv: The men's team schedule.
    - womens_schedule.csv: The women's team schedule.

These CSV files will be saved in the Output/ folder.

3. Viewing the Solution

The resulting schedules can be opened in any spreadsheet software (e.g., Excel, Google Sheets).

Explanation of Code

LP Solver (LP_Solver.R)

This script handles the following steps:

- **Data Loading**: Loads the necessary data files (GNAC_Soccer.xlsx, playDates.csv).
- **LP Model Setup**: Creates the LP object and adds the constraints.
- **Objective Function**: Assigns weights to the objective function based on special dates and other parameters.
- **Constraint Application**: Applies the constraints row by row.
- **Solver Execution**: Calls the CBC solver to find the optimal solution.
- **Schedule Parsing**: Parses the solution to generate readable schedules for the men's and women's teams.

Schedule Parser (ScheduleParser.R)

This script reads the LP solution and generates readable schedules for the men's and women's teams, ensuring that:

- **Home and Away Matches**: Properly assigns teams to home or away matches based on the solution vector.
- **Date Formatting**: Uses lubridate to format and display match dates correctly.

Sample Output

After running the scripts, you should get two CSV files in the Output/ folder:

1. **mens_schedule.csv**: The match schedule for the men's teams, with home and away matches assigned to the corresponding dates.
2. **womens_schedule.csv**: The match schedule for the women's teams, with home and away matches similarly assigned.

Troubleshooting

1. Solver Issues:

If the solver is not running properly, ensure that the path to cbc.exe is correct in the code, or specify the full path to the CBC solver executable in your system.

2. Data Errors:

Ensure the data file GNAC_Soccer.xlsx is properly formatted and contains the necessary columns (teams, special dates, etc.). If there are issues, check the data for missing or incorrect values.

Conclusion

This project successfully builds a soccer scheduling model using linear programming. It handles constraints, optimizes the schedule, and outputs it in an easily readable format. You can adjust the data or tweak the constraints to suit different soccer scheduling needs.