Optimization Fall 2020

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Game Schedule for U.S. National Football League

1. Plain Vanilla Schedule

To start, develop a schedule that **minimizes the total travel distance of all teams**. The distances between the home stadiums of each team are shown in miles in the file “distance.cvs”. When calculating the distances that teams travel, you can assume that after each game the team that played away will travel back to their home stadium before the next game. Include in your model the four main rules.

**- What are the decision variables in this problem?**

The decision variable should be considered as a binary indication of weather home team ℎ would play against away team 𝑎 on week 𝑤w. For example, if 𝑥ℎ,𝑎,𝑤equals to 1, is means that the home team ℎ would play against with away team 𝑎 on week 𝑤w. Otherwise, the game does not happen.

**- What is the objective function? What are the constraints?**

The objective function which minimizes the total travel distance of all teams should be the summed product of all the teams travel distances throughout the 12 weeks. If we assume the travel distance from the origin to destination as 𝑑ℎ,𝑎， the objective function should be defined as

𝑚𝑖𝑛∑ℎ,𝑎,𝑤𝑥ℎ,𝑎,𝑤⋅2𝑑ℎ,𝑎

The constraints for the scheduling, as discussed in the problem statement as follows

1. The season was limited to 12 weeks.
2. Each team would play once per week.
3. All 12 games that a team played would need to be against a different opponent.
4. Each team would play at most six home games (i.e., on their home stadium).

#### - Write down the mathematical formulation of the problem.

𝑚𝑖𝑛∑ℎ,𝑎,𝑤𝑥ℎ,𝑎,𝑤⋅2𝑑ℎ,𝑎

subject to

∑ℎ∑𝑤[𝑥ℎ,𝑎,𝑤+𝑥ℎ,𝑎,𝑤]=12

∑ℎ[𝑥ℎ,𝑎,𝑤+𝑥𝑎,ℎ,𝑤]=1

∑𝑤[𝑥ℎ,𝑎,𝑤+𝑥𝑎,ℎ,𝑤]<=1

∑ℎ∑𝑤𝑥ℎ,𝑎,𝑤<=6

#### Develop your optimization model and save it as “nfl 1.py”.

(i) the minimum total distance travelled by all teams

(ii) illustrate the optimal schedule for Cleveland Browns. How does the home and away game pattern look like for the Cleveland Browns?