Model Definition

Constants

$$\beta_j = \text{The predicted player value score for Player } j \text{ on the home team}$$

$$w_j = \text{The physical ability rating for Player } j \text{ on the home team}$$

$$S = \text{The set of pre-selected players by the coach who are in the lineup}$$

$$a_j = \begin{cases} 1 & \text{if Player } j \text{ on the home team is available to play} \\ 0 & \text{otherwise} \end{cases}$$

Strategy scoring weight α:

$$\alpha = \begin{cases} 1 & \text{if home score-away score differential is} \leq |2| \\ 0 & \text{if home score-away score differential is} < -2 \\ 2 & \text{if home score-away score differential is} > 2 \end{cases}$$

t_j is a multiplier for Player j in the home team used to track the player's fatigue/tiredness throughout the match. At time $t = 0$, $t_j = 1$ for all players j in the home team. At the end of a stint, the following updates are made to the fatigue scores of the players playing and on the bench:

- If $x_j = 1$ (Player j is on the court), then update $t_{j,new} = t_{j,old} - (0.02 \cdot D)$
- If $x_j = 0$ (Player j is on the bench), then update $t_{j,new} = t_{j,old} + (0.01 \cdot D)$

NOTE: For players with a negative β_j score, this multiplier in the objective function for fatigue/tiredness is computed as $1/t_j$ instead.

In Python, the upper bound for all the updated t_j values are set to 1 and the lower bound is set to 0.3. This is to ensure that no player is more energized than when they started the game or have extremely low fatigue close to 0.

Decision Variables

$$x_j = \begin{cases} 1 & \text{if Player } j \text{ is selected for the stint lineup} \\ 0 & \text{otherwise} \end{cases}$$

Model

$$\text{Max } Z = \sum_{j=1}^{n} \beta_j t_j^{\alpha} x_j$$

$$\begin{aligned} \text{s.t. } \sum_{j=1}^{n} w_j x_j &\leq 8 \\ \sum_{j=1}^{n} x_j &= 4 \\ x_j &\leq a_j \quad \forall j \\ x_j &= 1 \quad \forall j \in S \\ x_j &\in \{0,1\} \quad \forall j \end{aligned}$$