# Scheduling the Australian Football League

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When measured by attendance, Australian Football is by far the most popular sport in Australia. Accordingly, the quality of the schedule of play is important, as the schedule has a direct impact on revenue for all involved parties. For instance, the number of spectators in the stadia and the travelling costs for the teams are influenced by the schedule, and TV networks that pay for broadcasting rights want the most attractive games to be scheduled at commercially interesting times.

The scheduling problem faced by the Australian Football League (AFL), which consists of 18 teams, is quite challenging. The two main objectives are related to travel distance and breaks. Australia is a big country, which causes extensive travel loads for the teams, especially for the remote teams. For instance, in 2013, the total travel distance was 243,125 km. The AFL wishes to balance total travelling between teams from the same state, without exceeding the current total travel distance. The second objective is to minimize the total number of breaks (if a team plays two home or two away games in two consecutive rounds, it is said to have a break). Achieving these objectives is further complicated by an extensive list of constraints that need to be taken into account, communicated to us by the league authorities.

The AFL scheduling problem has two interesting and relatively novel features. First, the AFL consists of a single round robin tournament (i.e. each team plays against every other team once) complemented with 5 additional matches for each team, which are mixed with the round robin matches (as opposed to e.g. play-off competitions). Integrating additional matches into a round robin tournament is uncommon, but has been studied before by academics in the context of the New Zealand Rugby Union Cup (Johnston and Wright, 2014) and the Finnish Major Ice Hockey League (Kyngäs and Nurmi, 2009). In these competitions, the opponents and the home advantage for the additional matches are fixed before the schedule is created; in the New Zealand Rugby Union Cup teams get to pick their opponents for the additional matches in a media-covered selection event. In the AFL, however, deciding the opponents and the home advantage for the additional matches is part of the scheduling process.

A second interesting feature is the fact that some teams in the AFL have multiple home venues. In addition, two stadia, Etihad and MCG, host almost half of all the matches. Half of the teams play one or more home matches at these stadia, and some teems need to play a minimum number of away matches

at Etihad Stadium. Furthermore, as the AFL is trying to expand the sport throughout the country and even to New Zealand, some of the matches are played in cities and stadia that do not have a permanent home team. Settings with multiple venues have been studied from a theoretical point of view by e.g. Urban and Russell (2003, 2006), de Werra et al. (2006) and Ikebe and Tamura (2008). However, in these contributions, the idea is that the stadia are not linked to any team, and the goal is that each team plays the same number of games in each stadium. We are not aware of any contribution on real-life sport scheduling that deals with multiple home venues.

As the AFL scheduling problem turns out too demanding to solve in a single model, we have developed a 3-phase approach. In the first phase, opponents and home advantage are decided, the second phase assigns matches to rounds, and the final phase decides on the kick-off times and venues. Each of these phases is tackled with an implementation of the PEAST (Population, Ejection, Annealing, Shuffling, Tabu) heuristic, which has proven its value for several other complex real-life problems. The AFL currently uses software from the firm "Optimal Planning Solutions" to craft the schedule. This company creates fixtures for leading competitions across the globe including NFL football, European soccer, the NRL Rugby and Super Rugby. Our goal is to improve on the official schedule, in particular with respect to minimizing and balancing travel distance and the number of breaks. We report on our computational results and compare our schedule with the official schedule for the 2013 season.

## References


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