

# Scheduling the Brazilian Soccer Tournament with Fairness and Broadcast Objectives

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**Abstract.** The Brazilian soccer tournament is organized every year by the Brazilian Soccer Confederation. Its major sponsor is TV Globo, the largest media group and television network in Brazil, which imposes constraints on the games to be broadcast. Scheduling the games of this tournament is a very constrained problem, with two objectives: breaks minimization (fairness) and the maximization of the revenues from TV broadcasting. We propose an integer programming decomposition strategy to solve this problem to optimality. Numerical results obtained for the 2005 and 2006 editions of the tournament are reported and compared.

## 1 Introduction

Soccer is the most widely practiced sport in Brazil. The yearly Brazilian soccer tournament is the most important sport event in the country. It is organized by the Brazilian Soccer Confederation (CBF). Its major sponsor is TV Globo, the largest media group and television network in Brazil, which imposes constraints on the games to be broadcast.

The most attractive games are those involving a subset of elite teams with more fans and, consequently, with larger broadcast shares. Games involving teams from São Paulo and Rio de Janeiro (the two largest cities in Brazil) are of special interest to TV Globo, due to larger revenues from advertising.

The competition lasts seven months and is structured as a compact mirrored double round robin (MDRR) tournament [3]. It is played by  $n$  teams, where  $n$  is an even number ( $n = 24$  in 2004,  $n = 22$  in 2005, and  $n = 20$  in 2006). There are  $2n - 2$  rounds and each team plays exactly once in each round. There are at most two rounds of games per week. Each team faces every other twice: once at home and the other away. If team  $a$  plays against team  $b$  at home (resp. away) in round  $k$ , with  $k < n$ , then team  $a$  plays against team  $b$  away (resp. at home) in round  $k + n - 1$ . See [3] for a recent survey on the sport scheduling literature.

The revenues and the attractiveness of the tournament strongly depend on the schedule of the games. The organizers and the sponsors search for a schedule optimizing two different objectives. CBF attempts to maximize fairness, by

minimizing the number of breaks during the tournament (breaks minimization objective). A break occurs whenever a team plays two consecutive home games or two consecutive away games, see e.g. [8]. TV Globo aims to maximize its revenues, by maximizing the number of relevant games it is able to broadcast (broadcast objective). The schedule must also satisfy a number of hard constraints.

We propose an integer programming solution approach for solving this scheduling problem, based on the generation of feasible home-away patterns. The detailed problem formulation is presented in Section 2. The solution strategy is described in Section 3. Numerical results obtained for real-life instances corresponding to the 2005 and 2006 editions of the tournament are reported and compared in Section 4. Concluding remarks are drawn in the last section.

## 2 Problem Statement

We consider both the 2005 and 2006 editions of the competition, with respectively  $n = 22$  and  $n = 20$  participating teams. Every team has a home city and some cities host more than one team. Some teams are considered and handled as elite teams, due to their number of fans, to the records of their previous participations in the tournament, and to the value of their players. There are weekend rounds and mid-week rounds.

São Paulo and Rio de Janeiro are the two largest cities in Brazil (with more fans and, consequently, generating larger revenues from advertising) and both of them have four elite teams. Games cannot be broadcast to the same city where they take place and only one game per round can be broadcast to each city. Consequently, TV Globo wants to broadcast to São Paulo (resp. Rio de Janeiro) games in which an elite team from São Paulo (resp. Rio de Janeiro) plays away against another elite team from another city. Such games will be referred to as TV games.

Belém is a city very far away from São Paulo and Rio de Janeiro. TV Globo is not willing to broadcast games taking place at Belém, due to the high logistical costs. As well as following the structure of a MDRR tournament, the schedule should also satisfy other hard constraints:

1. Every team playing at home (resp. away) in the first round plays away (resp. at home) in the last round.
2. Every team plays once at home and once away in the two first rounds and in the two last rounds.
3. After any number of rounds during the first half of the tournament, the difference between the number of home games and away games played by any team is either zero or one (i.e., the number of home and away games is always balanced in the first  $n - 1$  rounds).
4. Some pairs of teams with the same home city have complementary patterns (i.e., whenever one of them plays at home, the other plays away).
5. Flamengo and Fluminense (two elite teams from Rio de Janeiro that share the same stadium for their home games) have complementary patterns in the last four rounds.