

# Optimization of Sports Event Operations Through Algorithmic Scheduling and Management

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## ABSTRACT

The operation of sports events requires a highly systematic and refined approach, involving comprehensive planning, scheduling, and resource allocation to meet the needs of participants and spectators while achieving economic and social benefits. For large-scale sports games, the method of diagonal line pass distribution is employed to ensure fairness by preventing athletes from the same unit or with similar performance levels from competing in the same group. This paper proposes an automated arrangement management system that combines the diagonal line pass method with Genetic Algorithms (GA) to optimize the scheduling of track and field events. The algorithm is designed to efficiently manage resources such as tracks, rounds, and competition formats, and it transforms the objective function into a fitness function for optimization. Experimental results demonstrate the improved algorithm's superior performance compared to traditional GA in solving complex scheduling problems, making it a valuable tool for enhancing the efficiency and fairness of sports event management.

## KEYWORDS

Oblique Line Method, Genetic Algorithm, Sports Competition, Schedule

## INTRODUCTION

The operation of sports events is essentially a highly systematic, refined, and controlled process. In this process, the subject needs to undertake multiple important functions. Firstly, the planning function involves multiple aspects, such as the overall conception of the event, goal setting, schedule planning, and resource budgeting. Organizers need to comprehensively consider various factors to ensure that the planning of these events meets the needs of both the participants and the spectators while effectively utilizing resources to achieve the necessary economic and social benefits of the event. In large-scale sports games, according to international standards, it is necessary to arrange groups and passes in a competition by adopting the diagonal line method. Adoption of this method prevents athletes from the same unit from being placed in the same group and prevents athletes with similar sports stats from being placed in the same group so that the competition can be strictly monitored.

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Therefore, careful consideration of pass distribution will make the outcome of athlete allocation for various events and units more fair, scientific, and reasonable. Designing an efficient, scientific, and equitable algorithm is the key to automatically arranging passes appropriately.

On the one hand, research on automatic arrangement and management of track and field sports meets is quite abundant. These studies delve into the principles, methods, and practices of automatic arrangement management from multiple perspectives. Some of these studies focus on the design and development of automatic arrangement management systems and have improved the efficiency and accuracy of arrangement management by introducing advanced information technology into the process. On the other hand, other studies focus on the problems with the optimization of automatic arrangement management, and some of this research is successful in achieving more scientific and reasonable arrangement schemes through mathematical modeling and algorithm optimization. The difficulty with scheduling in sports game management is a unique time-planning predicament. Aslan and Karaboga (2020) address the scheduling system of collective competitive events developed using computer virtual reality technology, which is visual and capable of being edited by users. Ma and Xia (2017) propose a theoretical basis for the research of a sports competition layout system in the scheduling method and process of short track speed skating. Other literature applies the idea of graph theory to optimize the minimization of scheduling interruptions in both home and away matches and obtains good results in its application (Griffiths et al., 2022). Literature (Yang et al., 2016) Other studies have successfully applied the event scheduling method obtained by mixed integer programming and enumeration technology in the design of sports competitions (Guo et al., 2021). Zhang and Gu (2020) successfully solved the optimization problem of integrated large-scale circuits through the idea of seeking a global optimal solution or suboptimal solution through a simulated annealing algorithm, which has attracted attention in the fields of molecular physics and supercomputer design. Bahiraei et al. (2020) solve the problem of curriculum arrangement in the timetable problem through genetic algorithms (GAs) and achieve good results, which have a certain significance for sports competition scheme arrangements. At present, most of the research on event scheduling systems mainly focuses on large-scale events, and there is little research on the sports competition arrangement systems. Once the state took an initiative to make policies aimed at improving these aspects of sports events management and improving the overall quality of the nation, researchers placed an increasing amount of attention on the proper management of primary and secondary sports.

The greatest appeal of competition lies in the uncertainty of its outcome. In competitive sports, whether the opponents are matched in strength, the outcome remains indefinite, making spectating unexpected and suspenseful (Hong & Yao, 2017). Having a basic understanding of the competitors' relative strengths allows spectators to form their own predictions of the results. When the participant that is less favored to prevail triumphs over an opponent who was otherwise favored to win, it results in a thrilling and surprising victory, as the outcome defies presumed expectations. Nevertheless, a good arrangement algorithm can make the arrangement of a sports meeting more efficient and reasonable. To design and realize a sports competition project design that integrates the diagonal line passing method and a GA, we consider the system function design, the algorithm selection, the model establishment, the key technologies, etc. Using a GA to optimize the arrangement of sports meetings speeds up the development process of sports meeting management in colleges and universities and improves the level of informationization and the digitalization of sports competition projects.

## **The Deficiency of Existing Research**

### ***Rely on Manual Experience***

Many event managers still rely on manual arrangements in sports events, which often results in inefficiency and difficulty in ensuring fairness of a competition.

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