

## A meta-heuristic algorithm is used for dartboard design

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**Abstract.** The problem of optimally locating the numbers around a dartboard is a Combinatorial Optimization problem. In this paper, we're solving this problem using Ant System (AS) algorithm which is based on the results of real ant trail formation and foraging obtained from biology science.

**Keywords:** combinatorial problem, Ant System (AS) algorithm, game of darts

### 1 Introduction

The game of darts is one of the most popular games on the whole planet. It was invented during the 16th century but the method of score calculation belongs to Brian Gamlin (1896)<sup>[1]</sup>. Then many variants were invented but the most important is the one where the players try to reduce the initial score value of 301 to 0 points<sup>[1]</sup>.

The most common form of the dartboard is depicted in Fig. 1. The Dartboard design<sup>[7]</sup> is related to placing the numbers to sectors of a circular board<sup>[8]</sup>.

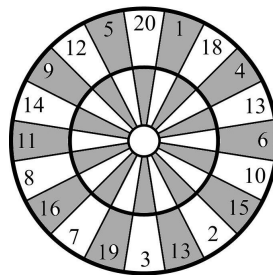


Fig. 1. Current dartboard design

Kohler<sup>[6]</sup> dealt with the designing of the dartboard and used Dynamic Programming in order to form a set of optimal strategies for some players' categories in which every player tries to reduce the initial score of 301 points.

H. A. Eiselt and G. Laporte studied the problem of optimally locating the numbers around a dartboard as a Traveling Salesman Problem (TSP) and as a Quadratic Assignment Problem (QAP) and proposed various dartboard designs<sup>[5]</sup>.

In this paper, it is examined the optimized placing of the numbers on the dartboard. For this purpose Ant System (AS) algorithm<sup>[3]</sup> will be used, which belongs to the great group of Ant Colony Optimization algorithms. It was inspired by observation of the behaviour of ant colonies. The main characteristics of AS algorithm are the following:

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