THE MANCALA GAME AND THE ARTIFICIAL INTELLIGENCE

2 authors, including:

Akash Daulatrao Gedam
Yeshwantrao Chavan College of Engineering
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THE MANCALA GAME AND THE ARTIFICIAL INTELLIGENCE

Prof. Asfar Siddiqui*1, Dr. Akash D Gedam*2

*1Assistant Professor, Department Of Mathematics And Humanities, Yeshwantrao Chavan College Of Engineering, Nagpur, Maharastra, India.

*2Assistant Professor, Department Of Mathematics And Humanities, Yeshwantrao Chavan College Of Engineering, Nagpur, Maharastra, India.

ABSTRACT

Artificial Intelligence is a branch of computer science which aims to have a computer performs what normally is considered as intelligent (human) behaviour. Games have played an important role in Artificial Intelligence, because game playing is considered as a typically intelligent task with limited possibilities and clearly defined rules. The family of mancala games offers opportunities for new research in Artificial Intelligence.

Mancala's origins date back to the 6th Century BC. Many variations of the game have evolved through the years. This article will use the Ganguliguy version popular in the (Vidarbha) Central India. The game of Mancala is a two-player strategy game whose objective is to collect the most number of stones from a board of bins into a collection (home/Mancala) bin. Each player's home bin that is on each player's right on their side of the board. The game of Mancala proved to be an interesting application of the algorithms and concepts, and also turned out to be extremely useful and fun to work on.

The paper then concludes with a discussion of new research opportunities in Artificial Intelligence. Our goals of comparing Mancala method, select out the "best" ones, and observing how game values can drastically change the winner were accomplished. We implemented a batch version and GUI version of our intelligent Mancala program. Using these programs we analyzed how different heuristics and combinations of heuristics fare against one another in route to distinguishing those that perform extremely well and others that are inferior.

The family of mancala games has been introduced in Artificial Intelligence relatively early, although most research is restricted to only the game: Ganguliguy (mancala game) with reference to Bhivkund caves in Vidarbha.

Keywords: Mancala, Game, Human Intelligence, Computer, Kalah.

I. INTRODUCTION

Mancala's origins date back to the 6th Century BC. Many variations of the game have evolved through the years. This article will use the Ganguliguy version popular in the (Vidarbha) Central India. The game of Mancala is a two-player strategy game whose objective is to collect the most number of stones from a board of bins into a collection (home/Mancala) bin. Each player's homebin that is on each player's right on their side of the board. The game of Mancala proved to be an interesting application of the algorithms and concepts, and also turned out to be extremely useful.

II. METHODOLOGY

We implemented a batch version and GUI version of our intelligent Mancala program. Using these programs we analyzed how different heuristics and combinations of heuristics fare against one another in route to distinguishing those that perform extremely well and others that are inferior.

III. RESULTS AND DISCUSSION

In this paper, we have taken 'Kalah' game for the discussion, with special reference to AI. The Kalah game is a present day, very commercial form of mancala board games. It was introducing a mention of W. J. Cham-Pion in 1950, by a firm called "The Kalah Game Company". In 1960, a first computerized version of the game was made up of many others followed. Present day, it is even possible to play Kalah. In Artificial Intelligence, Richard Russel has studied a game Kalah as early as 1964. He had written a program, called KALAH that actually could play the game. A.G. Bell wrote different computer program in 1968 that could learn in a few ways from the errors that it made. After a year, Slagle and Dixon used the game of Kalah to illustrate another algorithm for

playinggames in 1969-70. Eventually, Kalah lost the interest of Artificial intelligence game researchers, that is, till last year. Presently, Kalah is played by two persons on a board with two rows of six pits and two stores pits. At the start there are four counters per pit. It uses single-lap sowings and the opponent- capture rule. The own store is included in the sowing, but the opponent's pit is skipped. A sowing that ends in the own store grants the player another move. In some of the Kalah programs the pit from which a sowing starts is skipped during a large sowing, but in other implementations it is not. The game ends if one of the players cannot move anymore. The other player then captures all counters in the own pits. The player who captured the most counters wins. It is possible to bend the rules of Kalah a little and to play Kalah with less or more counters per pit, or with another number of pits per row. The following table shows the game theoretic value of Kalah-instances, i.e., whether the starting player can win the game, will lose it or whether the game is a draw if both players play optimally The smaller instances of Kalah were solved by considering every possible position that actually can arise during a game of Kalah. Databases were created in which every position and its game-theoretic value is stored. The larger instances of Kalah were solved by game-tree search.

	Counters per pit					
	1	2	3	4	5	6
1 pit	D	L	W	L	W	D
2 pits	W	L	L	L	W	W
3 pits	D	W	W	W	W	L
4 pits	W	W	W	W	W	D
5 pits	D	D	W	W	W	W
6 pits	W	W	W	W	W	?

Forthese instances, only a winning strategy from the opening position is known explicitly. Theprogram is however able to find an optimal strategy for every position that can occur during a game of Kalah. This means that Kalah is not of interest anymore for those AI researchers that want the computer to play the game of Kalah as substitutes or superiors of humans. However, for those AI researchers and game psychologists who are interested in the human aspect of game playing, the results that were collected for Kalah remain useful.

IV.   CONCLUSION

Mancala games can give rise to various questions of mathematicians. The researchers in Artificial Intelligence have only looked at a few mancala games. The rich family of mancala games provides games in complexity and in strategy. For those AI researchers that want to play new games on their computers, mancala games offer many opportunities. Some of the questions that might be worth to be answered by AI researchers are:

- What is the effect of a rule on the complexity of a mancala game?

- Is it possible to predict the complexity of a mancala game on base of given set of rules?

Mancala games also offer opportunities for interdisciplinary research. In our research on Kalah we showed that the computer can be used to assist cognitive- psychological research.

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