A New Perfect Information Game;
No Chance Backgammon

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Abstract

Well known classical backgammon is an ancient two-player game, at least a thousand years, older than chess according to some estimates. It is a game of luck and skill, because it involves dices. In this work we construct a new backgammon which we call No Chance Backgammon since it does not involve the dice. Instead of a random element, players choose their own numbers under certain constraints in full view of the opponent. The idea for this new game is simple but profound, and transforms a game of chance into a perfect-information game. Therefore this game becomes as rich and interesting as chess.

1 Introduction

Around the world, there are various types of classical backgammon which are luck and skill games played with two dice on a board for two players. Each player has 15 checkers occupying around a board and moves them according to the rolling two dice or numerator. The main object of the games is to remove all 15 checkers from the board before the opponent.

Many academic researches have been done on the backgammon, such as [1, 2, 8, 12], and especially TD-Gammon [13] ended up having a surprising practical impact on the world of backgammon. The book by von Neumann and Morgenstern [10] started the whole field of game theory. Here, we will use the concepts of game theory without given definitions. A wide variety of game theory can be found in [9].
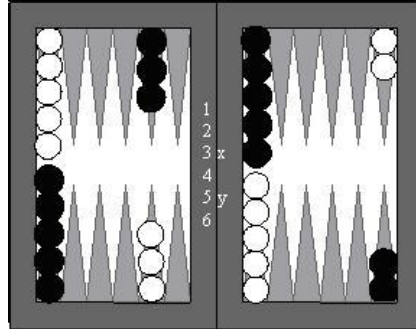
Figure 1: The board of the NC-Backgammon.

The main aim of this work is to built numbers-pairs which are obtained by the players under certain conditions. To construct a new backgammon, called No Chance Backgammon (NC-Backgammon), we will adapt the pairs to the classical backgammon instead of dice or numerators. Therefore, by this way the luck and skill game turns to be a kind of perfect information game such as Chess or Go.

The idea of playing backgammon without dice was first introduced by the author [3] in 2002. He has made NC-Backgammon known to everyone in Turkey by writing to the some magazines [4, 5, 6, 7]. A dissertation has been done about it [11] in Gaziosmanpasa University. Since 2003, Gaziosmanpasa University has been organizing a tournament of NC-Backgammon every year [15]. Now it is given here as a new game to the international backgammon players who would like to play without chance.

2   NC-Backgammon

It consists of the following:

1. A classical backgammon board with 30 checkers (pieces), but no dice.

2. The classical backgammon rules of the moving of the checkers.

3. Two players, which are labeled by X and Y.

4. An alternatives set, $A = \{1, 2, 3, 4, 5, 6\}$, which contains six numbers written on the faces of a dice.

We use the classical backgammon board with 30 checkers as it is. The rules of the moving of the checkers are also same as the classical one. The only

exception is the lack of the rolling of dices. Other than that, all the rules of the NC-Backgammon are the same as classical backgammon. Therefore, we shall assume the reader already knows the existing classical backgammon, and we are not going to give the rules the backgammon which can be found in [14].

So, in order to play the game, we need a pair of numbers which will be obtained a technique as in the following section.

3 Construction of the number pairs.

In this section we construct the number pairs without rolling the dice or counters. Here the players get to choose the numbers which depend on the both players and positions of the checkers as follows.

Let $i \in \{1, 2, ..., k\}$ be a turn number of the game where k is final turn of the game, and let t_i be a pair of the players for i-turn. Then, each turn of the game, players X and Y choose pairs and play with them sequentially as

- **0-turn.** The player X and Y choose numbers x_0 and y_0 respectively from the alternative set A such that $x_0 \neq y_0$. The pair $t_0 = (x_0, y_0)$ is called initial pair. In this case nobody moves own checkers.

- **i-turn.** By starting initial-turn the players get their pairs and play in turn in order as:

    - If $i = 2n + 1$, $n \in N$, then i-turn is a X's turn where X chooses a suitable number x_{n+1} from A such that $x_{n+1} \neq x_n$ and $x_{n+1} \neq y_n$. Then X moves own checkers by the pair $t_i = (x_{n+1}, y_n)$.
    - If $i = 2n + 2$, $n \in N$, then i-turn is a Y's turn where Y chooses a suitable number y_{n+1} from A such that $y_{n+1} \neq y_n$ and $y_{n+1} \neq x_{n+1}$. Then Y moves own checkers by the pair $t_i = (x_{n+1}, y_{n+1})$.

This procedure is continuing until a terminal position is reached. In this system, so far, a player can not get a double, the components of a number pair are same. To get doubling, we give an exception rule as;

- **Exception rule.** In the X's turn it may be $x_{n+1} \neq y_n$, and in Y's turn it may be $y_{n+1} \neq x_{n+1}$ throughout the game only two times, if necessary.

4 Application methods

We now give three different easy to use application methods for the number pairs.

4.1   Numbered bar method

In this method the six numbers are written on the bar of the table of the classical backgammon as in Figure 1. Each player chooses a material to indicate chose number, X and Y chose x and y as an indicator respectively. Assume that each column of Figure 2 be bar for each player turn. Then an example of a game may be as in Figure 2.
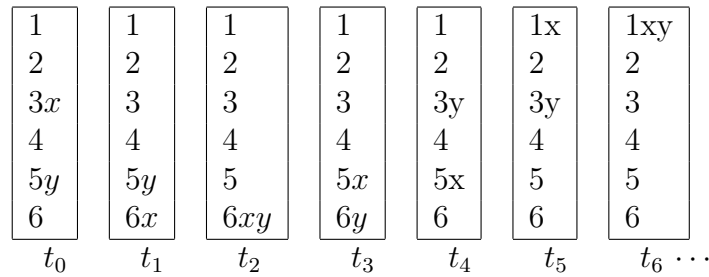
1	1	1	1	1	1x	1xy
2	2	2	2	2	2	2
$3x$	3	3	3	3y	3y	3
4	4	4	4	4	4	4
$5y$	$5y$	5	$5x$	5x	5	5
6	$6x$	$6xy$	$6y$	6	6	6
t_0	t_1	t_2	t_3	t_4	t_5	$t_6 \cdots$

Figure 2: The six number on the bars for the pairs.

The rule of this method: *In their turn, each player has to remove own indicator to indicate own chose number such that the number can not be indicated by opponent indicator, it may be done only two times during the game to get the doubling, if necessary, and then get their number pair which showed by both indicators.*

4.2   Put dice method

In this method we can play NC-Backgammon with the classical backgammon set without any chancing. To obtain the number pairs we use dice, but not to throw, just for as indicators. Each player who picks up a dice and put it on own side of bar of board to shows his chose number. Assume that each column of Figure 3 be bar of board for each turn. Then an example of game may be as in Table 3.
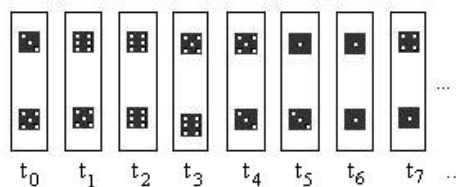

Figure 3: The dice on the bars indicate the pairs.

The rule of this method: *In their turn, each player has to turn down their dice such that the dice can not show opponent dice number, it may be*

done only two times during the game to get the doubling, if necessary, and then get their number pair which showed by both dice.

4.3 Table method

In this method to obtain the number pairs we use table as Figure 4. Here both players have just one material, say *. First, the players determine the starting number pair, initial number pair t_0, and then they put the material on point t_0 of table as in Figure 4.

$$\leftarrow X \rightarrow$$

	1	2	3	4	5	6
1	$*t_6$			$*t_7$		
2						
3	$*t_5$				$*t_4$	
4						
5			$*t_0$			$*t_1$
6					$*t_3$	$*t_2$

$\uparrow$ Y $\downarrow$

Figure 4: Table of the pairs.

The rule of this method: *In their turn, the player X has to move the * left or right, and Y has to move up or down to obtain their number pairs. During the game only two times for each player * can put to diagonal of the table to get doubling, if necessary.*

5 Conclusion

NC-Backgammon does not involve a random luck; in construct it is based on tactics and strategies. It is quite remarkable that this new game as rich and interesting as chess since there is no dice and so there is no chance. The pairs can not chosen arbitrarily. It is clear to see that, in any turn, when a player chooses a number from the alternative set under the conditions with a good strategy, the player has to consider previous pair, next pair, both players' possible moving, and both players' checkers positions on a board.

We can say that the NC-Backgammon is a new variant of an existing classical backgammon. Exploring new backgammon may motivate further progress in game theory, and may also lead to more direct and immediate applications in real-world problems.

The NC-Backgammon is restricted to six numbers, but it is easy to see that it can be played with four or five or seven etc. numbers as the same way.

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