CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
J1407

Project Title
Position or Piece: Computer Simulation and Study of the Strategy Board Game Blokus

Abstract

Objectives/Goals
Blokus is a new strategy board game that has won 26 worldwide awards since its launch in 2000. My objective was to investigate which strategy was more effective in winning the game, the "Position" Strategy (blocking the opponent) or the "Piece" Strategy (placing the biggest possible piece first). Also, when both strategies were used, which one should be given priority? My hypothesis in Experiment 1 was that the "Position" would be more effective and should be given priority.

Methods/Materials
After researching on artificial intelligence, commercial software, algebra, geometry, and programming, I decided to simulate the game by writing my own Microsoft Silverlight program in C# language. 820,000 games divided into 82 tests were simulated and analyzed. For each test, 100 trials were run with 100 games in each trial to get accurate results. Each game has Player 1 (using different strategies) versus Player 2 (always playing randomly with no strategy).

Results
(1) In Experiment 1, I tested 4 different strategies. The "Piece" Strategy was more effective than the "Position" (average winning chance of 90.82% vs. 70.73%). When both strategies were used, "Piece-Position" was more effective than "Position-Piece." The results didn't support my first hypothesis. The Side Experiment also confirmed it. (2) Thinking that the "Piece" was better because the original board size 14x14 was small, I hypothesized in Experiment 2 that the effectiveness of the strategies would change with the board size. The results from 75 tests at different board sizes (12x12 through 40x40) supported my second hypothesis. When the board size was under 18x18, the "Piece" Strategy was more effective. When it was over 18x18, the "Position" was more effective.

Conclusions/Discussion
(1) The effectiveness of the "Position" and "Piece" Strategies actually depends on the board size. Their effectiveness switches at 18x18. Interestingly, 18x18 levels the playing field between the two strategies. (2) At the original board size 14x14, the "Piece" Strategy is more effective and should be given priority over the "Position" when both are used. (3) The "Piece-Position" Combined Strategy has achieved a 98.23% winning chance when played against random playing. For future research, I would simulate more strategies to have the winning chance increased toward 100% as much as possible and then have my program use its "intelligence" to play against real people and win!

Summary Statement
By writing a computer program to simulate 820,000 Blokus games, I investigated the effectiveness of different strategies at different board sizes and derived a strategy that achieved a 98.23% winning chance at the original board size.

Help Received
I completed a college online course at Irvine Valley College and learned C# language. My father mentored me in programming. Math Professor Xue taught me about advanced topics in statistics.