Alpha-Beta Algorithm for Checkers Game Coursework Report

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1 Introduction

The aim of this report is to present the various methods that were used for the design and implementation of Checkers Game in Java programing language, while showing different data structures and focusing on one specific algorithm as well. As follows, the report will focus on the possible enhancements that could have been developed in order to improve the overall gaming experience. Furthermore, brief critical evaluation will follow, assessing the functionality of the included features, while stating why they are considered to be successful or not. The report will also focus on personal evaluation, revealing what the developer learned from the task and the challenges that arose during the learning process. Subsequently, the way those challenges were overcome and the overall performance will also be stated, providing brief personal evaluation and further recommendations for improvement.

2 Design

The coursework includes the designing of a console game with object oriented programming using Java programming language. The game consists of two game modes player vs player and player vs computer, with user interface providing simple checkers board, displayed in console and allowing player(s) to input their desired moves and follow the current state of the game. Depending on the playing mode, the user will have to either face another user or play versus the computer supported by alpha beta pruning algorithm, providing decisions based on calculations done while the game is running. All of the features from the drawing of the board, the moving of pieces around the board while following the rules of the game, the provision of user interface, to the artificial decision making of the computer are all supported by primitive, composite and abstract data types. As follows, every component is a crucial part of the game, but the most important part is the decision-making tree, which gives a solution to the problem of the computer that in this case, would be the best possible next move. The alpha beta algorithm implemented in the checkers game is widely used in board games because of its efficiency and simplicity as well. The idea behind the algorithm is to manage two values of primitive data type which represents the maximizing and the minimizing player. Both of the players Alpha and Beta start with their worst possible value, negative infinity and positive infinity, respectively and try to minimize or maximize the value of the board. The efficiency of the algorithm is achieved when in a performed search it is found that it is possible for a certain branch to cause the maximum score of the minimizing player to become less than the minimum score of the maximizing player. That will make the score of the parent node worse and may provide a bad decision and that is why the rest of the branches from the node do not have to be researched. This optimisation of the search process makes the algorithm suitable for the game..

3 Enhancement

Taking into consideration that there is a deadline on the project, achieving full functionality of the game can be counted as a successful step towards finishing and developing the whole project even further. Even though the minimum requirements have been reached, there is always room for major improvements. To begin with, the user interface could be enhanced as the console interface is way more complicated and can be replaced with 2D graphics. Implementing 2D design would provide better gaming experience for the player and there will be more clarity, while the gaming would run more smoothly. Having graphical design will deliver a much easier gaming experience a thing that should be a priority when it comes to creating a game. Another benefit of having it is that it could make the game usage wider, as it will be accessible for a wide majority of players. Another improvement in the game would be the providing of various levels of difficulty. Implementing more algorithms in the game could be beneficial for applying theory to practice, while providing enhanced gaming experience.

4 Critical Evaluation

The following analysis will evaluate the way the game performs and how well the features in the game work together. To being with, the most important feature of the game is the artificial intelligence. The achieved level of functionality of the algorithm and the way it works can be considered to be at a satisfying level, having in mind that the there was a limited time for the accomplishment of the task. Another successfully working feature is the gameplay itself that follows the stated rules of the game. As follows, the game is played in a console, while the level of achieved interaction between the game and the player appears to show relevant connection and performance. However, the console interface could be replaced with better user interface, which will allow the player to interact with the

system in a more enjoyable way, as he/she will be able to move the pieces without having to type every single position.

5 Personal Evaluation

The project is an enjoyable one for multiple reasons. Firstly, the preparation before starting work on the task was very interesting as a lot of valuable and fun facts about checkers game, algorithms and data structures were found during the research. For instance the developer found that the game originates from France and that it has changed its name and rules numerous times throughout the years. Achieving the most desirable outcome implementing an algorithm that controls computer decisions while playing a game and in this way providing a solid opponent to match human intelligence and decision-making was by far the most valuable benefit of the project. Having to study and gain in-depth knowledge about various data structures in order to be able to select the best possible solutions for building the whole project and optimising it gave the developer more knowledge in that field and will be extremely beneficial for future projects and work. Creating a game and using decision tree was something fairly new to the developer and it felt like a challenge from the beginning. However, the one thing that stood out as a challenge was making sure that both the player and the computer will strictly follow the rules of the game. To summarise, the whole experience was very useful as it was something new to the developer. Having that in mind the knowledge gained will be of great value for the future.

6 Conclusion

Based on the review conducted so far on the project work, the following inferences can be made: the overall achievements made in the course of work on the project is substantial and provide a solid foundation to build on. Significant knowledge and skills has been acquired as a result of research and practice done. Although there are improvement that are still to be made to bring the project to a state of completion the pathways to be followed are clear.