

## Report 3

• **Name:** *Shikhaliyev Anar*

### ***Project Title:***

Design and development of a board game that incorporates elements of tactical decision-making and strategic planning

What are you going to do?

I am going to design and develop a board game that enables players to play against one another and most importantly play against AI. I want to analyze different AI approaches such as heuristics, tree-traversal algorithms - minimax, alpha-beta pruning, adversarial search algorithms, and other techniques to improve performance such as memorization.

### **QUESTIONS:**

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- Description of the measurement strategies:

Collecting data on the performance of AI while playing games is one of the measuring methodologies that are being used for this research project. The victory rates of players and the average length of games played are the major indicators of interest. These metrics will give insights into the competitiveness and effectiveness of AI opponents.

For the purpose of calculating victory rates, every game that the AI competes in, whether against human players or against itself, will be logged. It will be recorded if a game was won, lost, or ended in a tie, which will make it possible to compute the percentage of games won. The victory rate will provide an indication of how successful the AI has been in winning games against a variety of opponents or degrees of difficulty.

The effectiveness of the artificial intelligence's decision-making process will be evaluated based on the average game time. I am going to keep track of how long each game takes, and then we are going to determine the overall average time. The results of this test will provide light on the AI's capacity to make judgments that are both timely and strategic.

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- Statistical Analysis (similar to our in-class work);

Because I am in the process of building an AI agent for the game at the moment, and because our data will be created by the AI when the agent is ready for game play, I am able, for the time being, to provide a rough estimate of the stage at which the data will be available.

The data that was gathered may be analyzed statistically in order to draw meaningful conclusions and generate relevant insights from the data. The following are some examples of statistical analysis that may be carried out:

Calculate measurements such as the mean, the median, and the standard deviation for win rates and game durations. These are examples of descriptive statistics. The performance of the AI will be summarized with the help of these statistics.

**Testing the Hypothesis** Carry out hypothesis tests in order to assess and contrast the performance of various AI systems. It is possible, for instance, to carry out a t-test or an ANOVA in order to evaluate whether or not there are statistically significant variations in the win rates achieved by the various AI strategies.

Analyze the correlations between the various elements, such as victory rates and game lengths, via the use of correlation analysis. This study has the potential to discover connections and patterns hidden within the data.

**Analysis of regression:** Carry out an analysis of regression in order to explore the influence of independent factors (such as search depth and evaluation functions) on a dependent variable (such as win rates). The elements that impact AI performance may be better understood with the aid of this investigation.

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- **Visualization of the data:**

For the visualization part, variety of techniques can be used. Such as, a bar chart can be used to show how often different AI systems win. Each bar reflects a different AI system, and the height of the bar shows how often that algorithm wins. This image makes it easy to compare the performance of AI quickly and visually, so viewers can judge how well each algorithm works.

We can also analyze Game Length. A box plot can be used to show how long games tend to last for each AI program. The box plot will show key statistical measures like the median, quartiles, and peaks of game lengths. This picture shows how the AI systems make decisions differently. Moreover correlation analysis can be shown as A scatter plot to look at how game lengths and win rates are related. Each data point is a game, and the x-axis shows how long the game was and the y-axis shows how often the team won. This scatter plot can be colored to show how different AI methods or levels of difficulty work. It helps find any possible link between the length of a game and how well the AI does.

New ideas may come out after the data is being collected.