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Heuristic Playing Machines for Board Game Battleship

Introduction

Battleship is a 2 person game played on gridded maps. Each player in the game has 2 maps to utilize, 1 to station their 5 warships of various sizes with positions concealed from the other player, and 1 to keep track of the location of the shots they have fired.

The ships occupy various amounts of grids, and cannot move once the game starts. Each round both players call shots at locations of the other players' map, the number of shots and the rules of announcing hits vary on game mode, but commonly each player can only take 1 shot per turn, and have to announce if their ship got hit. Ships have various hit points based on the number of grids they occupy, and will deduct a hit point when each unique occupied position is hit. The ship will sink if all of its occupied positions are hit, and the player has to announce the sinking of the ship. The game ends when at least 1 player's ships have all sunk.

Although this is a guessing game where luck is a big factor, human players can still guess "strategically", or in other words **heuristically** determine their next shots based on their previous shots, in a way that greatly increases their hit chances. For example if a shot has landed but the ship has not yet sunk, then we tend to choose an adjacent grid for the next shot, which usually has a 1 in 4 chance of scoring a hit.

This project involves setting up an representational world for the game, building a system to keep track of the ships and shots fired, and developing a collection of Battleship machines. Of the various machines, 1 random machine will be developed and used as a basis for comparison, while others will be following heuristic rules in pursuit of the most effective tactics.

Representational World

First part of the project will be finding a way to represent the two maps that each player will utilize, and as well as having a way of displaying that to the user. Commonly the maps are 10 grids by 10 grids.

Modeling the Ships

Each player will get 5 ships that occupies various sizes:

- Carrier 5
- Battleship 4
- Cruiser 3
- Submarine 3
- Destroyer 2

They can only be placed horizontally or vertically, and all positions the ships occupy have to be present in the gridding map.

Game Playing Interface

The game world needs presentability, although the computer might recognize the representational world perfectly, we humans might take a little time. So a very basic text based interface will be developed to better display what is going on in the game world.

Various Playing Machines

A very basic random shooting machine will be built, it will randomly place its ships and randomly shoot at various unfired locations. It will be used to initially test out the game, and later be used to compare to the other playing machines. The other machines will play with sets of rules that are intended to increase their chance of winning.

Analyze the Heuristic Machine

When a heuristic machine is developed, it will be playing against the random machine. The win rate will be calculated, hopefully it will be more than 50 percent.

Game Modes

If time permits, different game modes that modify the rules of shots and announcing hits can be established, although it is uncertain what this will do to the heuristic playing machine, the human player on the other hand is going to have a lot more fun.

Reflections

Upon the completion of analyzing various machines, some reflection on its development will be recorded in forms of text.