Scrabble

Human and AI

Rules

In Scrabble, there is a board consisting of squares arranged in a 15 by 15 grid. Players have various tiles of letters and are supposed to lay down the tiles in a manner that spells out a word included in the standard dictionary (of a specific language). This can only be done by putting the tiles in a left-to-right or downward manner, meaning you cannot place words in a diagonal or written backwards. There are points scored per tile placed onto the board. The board itself also has squares that when used will amplify the points scored.

The player's goal is to maximize the total score.

Interesting fact

In Scrabble, there is no requirement that you actually understand the word that you are spelling out on the board.

Proof?

In 2015 the winner of the French Scrabble World Championship was someone that did not understand a word of French.

Nigel Richards - Winner Of French Scrabble

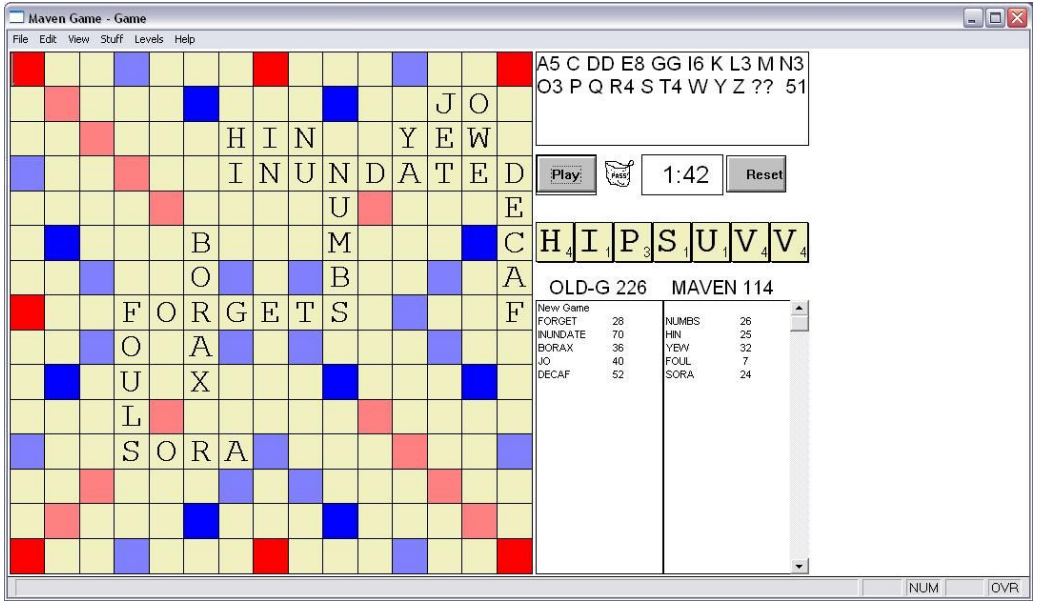
How to win without knowing the meaning of words?

The non-French speaking contestant had done something that was impressive, he had memorized all the words in the officially used French dictionary, doing so by only memorizing how the words were spelled.

He happened to have a photographic memory capability and was able in **nine weeks** to memorize the words.

MAVEN - AI Scrabble player

The outstanding AI in Maven was coded using a 'simulation-based' approach. Before the endgame stage, computer player in Maven chooses his moves using simulation to try to determine which move would lead to a maximum number of points.



Game phases

Mid-game

Lasts from the beginning of the game up until there are nine or fewer tiles left in the bag. The program uses a rapid algorithm to find all possible plays from the given rack, and then part of the program called the **"kibitzer"** uses simple heuristics to sort them into rough order of quality.

The most promising moves are then evaluated by "**simming**", in which the program simulates the random drawing of tiles, plays forward a set number of plays, and compares the points spread of the moves' outcomes. By simulating thousands of random drawings, the program can give a very accurate quantitative evaluation of the different plays.

Pre-endgame

This phase works in almost the same way as the "mid-game" phase, except that it is designed to attempt to yield a good end-game situation.

Endgame

This phase takes over as soon as there are no tiles left in the bag. In two-player games, this means that the players can now deduce from the initial letter distribution the exact tiles on each other's racks. Maven uses the **B-star search algorithm** to analyse the game tree during the endgame phase.

Thank You