

9X9 Tic-Tac-Toe

Game Rules:

- Rules are very simple! Easy to follow. Almost Un-cheatable.
-Play a game of Rock,Paper,Scissors or a fast decision game to determine who is O or X
- X will be first. At each level difficulty of the game will Increase.
- Let us assume that X is first and O is second. X must be place on any of the the available squares of the place.
- O can either block a possible connecting path for X or be placed in a separate square
- X must do the same but now it can be connected if the owner of X wants to.
- Both O or X must form a 3 in a row (horizontally,vertically, or diagonally) or else it is a tie.

Game Theory Principal:

Decision theory represents a generalized approach to decision making. It enables the decision maker

- to analyze a set of complex situations with many alternatives and many different possible consequences
- to identify a course of action consistent with the basic economic and psychological desires of the decision maker

Solution to any decision problem consists of these steps:

1. Identify the problem
2. Specify objectives and the decision criteria for choosing a solution
3. Develop alternatives
4. Analyze and compare alternatives
5. Select the best alternative
6. Implement the chosen alternative
7. Verify that desired results are achieved

Decision tree is a graphic tool for describing the actions available to the decision maker, the events that can occur, and the relationship between these actions and events. Decision trees are particularly useful for analyzing situations that involve sequential decisions.

Decisions problems that involve a single decision are usually best handled through payoff tables, whereas problems that involve a sequence of decisions, are usually best handled using decision trees

Decision Making under Uncertainty:

Under complete uncertainty, either no estimates of the probabilities for the occurrence of the different states of nature are available, or the decision maker lacks confidence in them. For that reason, probabilities are not used at the choice of the best alternative.

Most of the rules for decision making under uncertainty express a different degree of decision maker's optimism.

Tic-Tac-Toe is a kind of Decision making under uncertainty game.

Where we are uncertain about other player moves, even though we know what are his/her possible moves.

Difficulties:

We used min-max algorithm to solve it, but it was completely slow.

So we add max depth untill which we had to check for every node.

Inorder to further improve the speed we used alpha-beta-pruning, a search algorithm that seeks to decrease the number of nodes that are evaluated by the minmax algorithm in its search tree.

Finally we had to think a lot on decide speed vs correctness. If we increase the depth, chance of winning was more and speed was slow. But if we choose small depth chance of winning was comparitively less and speed was high.

Levels in game:

Easy: In this level heuristic used was-

For every combination among 7 combinations

Add 1 for single X, Add 10 for two X's, Add 100 for three X's

Similarly negative utility for O's as a min player I have to minimise the Utility as a whole. Depth=5.

Medium:

Similar to above heuristic but we add utility only if the combination contains either (X's or '-') or ('O' or '-').

Depth = 5

Hard:

Same as medium but Depth = 8

We make it slower but more accurate than medium