

Tic-Tac-Toe Guide

Never Lose Another Game Again

The idea for writing this guide came about from watching two ladies play tic-tac-toe, at a restaurant, on paper, with a sharpie. There were already a couple of games played on the paper, so they were really playing the game. I thought to myself, “people still play tic-tac-toe?” Let’s try and put that to rest.

Utilize this guide in conjunction with the game tree diagram. Recommended for readers 18+.

Introduction

First, we examine the often underestimated complexity of the game, so we can appreciate it’s true complexity. Then we go into some patterns and higher level rules we can use while playing. Then we go into what tic-tac-toe is all about, threats. We follow up with an explanation of rotations and reflections, which simplifies the game for us. Then into the game tree. Where you can get an accurate idea of the complexity of the game. After all of this, we start the ultimate test to see if one understands the game of tic-tac-toe, where the reader may get stuck for a limited time. Finally, we wrap it up with a summary of how to never lose another game of tic-tac-toe again.

Simpleton Pattern and Vacuum Analogy

Understanding tic-tac-toe reminds me of trying to understand the singleton pattern in computer programming. At university, our professor gave us an entire full lecture on the singleton design pattern with a whole booklet on the different contexts you can use the pattern in. We were very surprised at how complex we thought something so simple and easy can actually be. There are many variations, it is actually kind of a complicated pattern, the name is deceiving and so is its base definition. Readers may still think the singleton pattern is simple, it isn't.

It's like when you vacuum, you think you got everything, but get down on your knees and look closer. The devil is in the details here too.

The thing that made the author understand tic-tac-toe was finding all of the winning moves, drawing moves, and losing moves from any position. Each revealed a lot on its own, but it was the combination of the three features together, which gave a complete understanding of the game.

Don’t get me wrong, the game is not very complex, but it is complex enough, more than most people think. Matter-of-factly, the complexity is estimated at $9!$ and there are ~765 distinct reachable positions. Remember, best play from both parties leads to a draw. Keep this in mind, the only player which understands tic-tac-toe is the one who never loses a game of tic-tac-toe.

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This is a single reflection of another game. Imagine a mirror placed along the a1-c3 diagonal. The a1 square is a reflection of itself, and similarly b2 is a reflection of itself. The b3 and c2 squares are reflections of each other, because they are not directly placed on the diagonal.

3	-	-	-
2	-	-	-
1	-	-	-
	a	b	c

There are essentially just three opening first moves, if you can look at the empty board as a set of rotations and reflections. Every game starts from one of these three squares: a1, b1, b2. The game tree only has three main branches. This will simplify things for playing well.

All other groups of three similar squares are a rotation or reflection of this group of squares.

Game Tree

The game tree is a separate document, one which can be navigated. The workings are explained here. The game tree is not a full game tree, it is a pruned game tree. Otherwise, it would be even more unwieldy than it already is. So it is actually a spanning vector of the full game tree, trying to cover every scenario in the real game tree, in a more compact way.

Instead of having two main branches, one for the x player moving first and one for the o player moving first, the tree only has the x player moving first. Some people may alternate between x playing first and then the next game o playing first. However, under standard tic-tac-toe rules, x always plays first, and by house rules you alternate which player is x. In the game tree, if you are playing the variant, where o plays first every other game, you can switch the x out for an o in your mind to get the correct move from the tree. Assume here, x always moves first, and it alternates who is playing x.

