FROZEN FOREST

A strategy game for 2 players by
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INTRODUCTION

Warning: *This is a hard game with some prime number math involved. As such, this game is not for everyone, but it is very rewarding when played well.*

A little girl named *Mina* and her best pal, a friendly yeti named *Yuki*, play hide-and-seek in a magical frozen forest. Not only do the trees grow perfectly aligned in a 10×10 grid, but the trees themselves grow straight up. This means that a skinny little girl could easily hide behind one. A yeti, however, is far too big not to be seen. So, that is why Mina always hides, Yuki always seeks, and they always have fun! But seeking takes a lot of energy for someone as big as Yuki, and the trees also happen to be very much to Yuki's tastes. So he cannot resist munching every last splinter of every tree he encounters. In fact, if he runs out of trees to eat, he gets too hungry and gives up.

One player plays Yuki and the other player plays Mina. Yuki and Mina take turns moving from tree to tree. Yuki moves slowly, because with every step, he devours an entire tree (don't worry, no real magical trees will be harmed during the game). On the contrary, Mina moves as far as she wants.

EQUIPMENT

- Board with 10×10 tree spots
- 70 snow spots (white discs)
- Yuki (an 'ice' meeple)
- Mina (a red meeple)

HOW TO PLAY

One player plays Yuki and the other player plays Mina.

Play twice swapping roles to see who does best. In many cases Yuki eventually catches Mina, but sometimes she manages to leave Yuki with no valid moves.

How to win:

- If both players win playing *Yuki* the one that ate *fewer* trees **wins**.

- If both players win playing *Mina*, the one that ate *more* trees **wins**.

- If a player wins playing both Yuki and Mina this player is clearly a hide-and-seek master!

The Yuki player takes all the white discs.

For a smaller forest (9×9, 8×8…) cover the outer trees with white discs. This is recommended for beginners.

The Yuki player starts by covering any tree with a white disc and then placing Yuki on top of the disc (Yuki eats trees before occupying their space). A white disc means 'there is no longer a tree here'.

Then the Mina player places Mina on any other tree that is not in Yuki's line of sight: There must be at least one tree between Yuki and Mina along an imaginary straight line connecting both places. See 'Line of Sight' below.

From now on, starting with Yuki, players alternate turns moving their character as follows:

Yuki

Yuki moves **one space** orthogonally or diagonally to an adjacent **tree** that has a clear line of sight to Mina. Before occupying the new location, place a white disc on top of it (Yuki devours the tree). Then place Yuki on top of the disc.
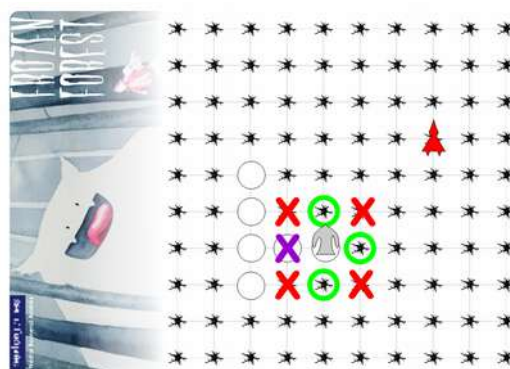
Example of valid moves (marked green) for Yuki. He cannot move to spaces with discs (purple). He cannot move to the red spots because he would have no clear line of sight to Mina.

If Yuki can't make a valid move he **loses the game**. This happens when either of the following is true:

- All of the surrounding spots are covered by white discs.

- None of the uncovered surrounding trees has a clear line of sight to Mina.

Mina

Mina moves **as many** spaces as she wants in an **orthogonal** or **diagonal**[1] straight line, always ending her move in a space (with or without a tree) that has a blocked line of sight to Yuki (i.e. at least one tree must be in between). She can pass by other trees and empty spaces along the way.


Examples of legal moves (marked green) and illegal moves (red) for Mina. She can't move to the red spots because Yuki would have a clear line of sight to her. Note that spots without trees (those with white discs on them) do not block line of sight!

If Mina can't make a valid move she **loses the game**. This happens when there are no trees to which she can move that have a blocked line of sight to Yuki.

Line of Sight

Yuki and Mina are in a clear line of sight if there are no trees in the straight line connecting both locations. Consider trees as infinitely small dots for this. However, the tree that Mina occupies does not count as 'blocking' the line of sight (it's not thick enough to fully cover Mina).

Notice that there will be a clean line of sight between the two if the horizontal and vertical distances are *pairwise coprime*; in other words, they don't share a common factor other than 1.
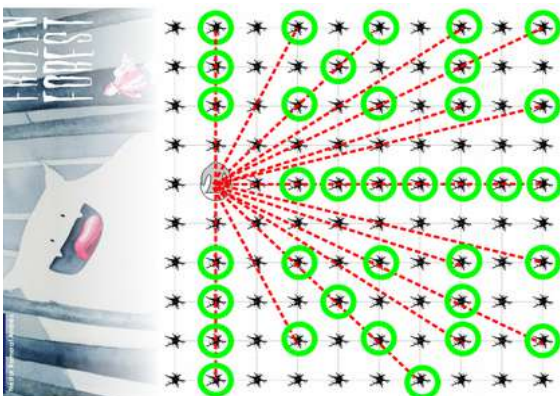
Example: all safe spots for Mina considering only Yuki's current location. Can you see a pattern? (There is no safe spot to the left because the only horizontal distance is 1, which is coprime with every number). *Yuki is not so good with understanding prime numbers, or math at all, really.*

1- Try also 'orthogonal only'. Some players prefer this variant.

STRATEGIES

For Mina:

- The closer you get to Yuki, the harder to hide on your next turn. However, there are some spots close to Yuki that notably reduce his options (see the first example).

- Try to trap Yuki by forcing him to get surrounded by spots with no trees.

- Move to spaces so that wherever Yuki moves, in most cases you're still in a blocked line of sight (there is some math involved in this, that I invite you to find on your own).

- Prevent Yuki from moving diagonally, so you can trap him more easily.

For Yuki:

- Don't get trapped! Plan your route ahead of time.

- Diagonal moves prevent Yuki from being trapped too soon.

- Get close to Mina, because this will reduce her options.

- Move to spots so that wherever Mina moves, in most cases you're still in a clear line of sight. As mentioned above, Again, I invite you to do some math on this.

The paradox

The strategy on the second game will depend on the result of the first one:

- If Yuki wins the first game, the player playing Yuki in the second game must eat *fewer trees* (catch Mina sooner).

- If Mina wins the first game, the player playing Yuki in the second game (who won as Mina), must eat *as many trees as the other player did* (trying to catch Mina later!) just in case Mina eventually escapes.

NOTES FROM THE DESIGNER

To date, after several playtests (most with AI), here are some results:

- Average games between skilled players last around as many turns as there are trees on the board at the start; this is, Yuki devours half of the trees before the game ends.

- Yuki catches Mina in more than half of the games (10×10 board).

- If there is a math-based winning strategy for one of the characters, it has not been found yet.