Cell Management

Solitaire Puzzle for the piecepack game system

Version 1.0

Overview

Aliens have abducted two each of six species from Earth. All are currently held captive on a spaceship returning to the alien home-planet, with each species in a different cell. Your goal is to have one of each type of species escape to the center of the ship. A group of unique individuals, one for each species, will give you the strength you need to overpower the alien guards and release everyone. Not all escape attempts will be successful, and animals might have to be captured again to allow another to species to escape. Can you organize the escape from the alien ship and return to Earth?

Setup

You will need

- 6 Sun Tiles (Friendly Secret Hideouts)
- 6 Crown Tiles (Hostile Secret Hideouts)
- 6 Moon Tiles (Containment Cells)
- 6 coins for each of Moons and Suns (Captives)
- 1 Sun and 1 Moon pawn (Alien Guards)

The Sun Tiles represent Friendly Secret Hideouts for the six captive species. Shuffle the six Sun tiles face-down and arrange into a tight circle, such that there are always two tiles opposite each other, and the inside corners of adjacent tiles touch. Flip them face-up and turn so they are clock-wise readable.

The Crown Tiles represent Hostile Secret Hideouts. There will be three Friendly and three Hostiles Secret Hideouts in the inner circle. Shuffle the six Crown tiles face-down, and flip three face-up. Replace the Sun tiles corresponding to these Crown Tiles. You will not need the remaining six Sun and Crown tiles.

The Moon tiles represent the Containment Cells for the six species. Set aside the null Moon tile and shuffle the remaining tiles face-down. Flip one of them face-up, and place it adjacent to the null Secret Hideout tile on the outside of the circle. Continue flipping up Moon tiles, placing them adjacent to the Secret Hideout tile which matches the last Moon tile added. For instance, as shown in Figure 1, first you flip up the 4 Moon tile. Place it adjacent to the null Secret Hideout tile. Then, you flip up the 2 Moon tile. Place it adjacent to the 4 Secret Hideout tile, etc. This will create a cycle containing all the numbers. Add the null Moon tile in the last remaining space.

The Face-up Sun and Moon coins represent the twelve captives, two of each species, (Null, Ace, 2, 3, 4, and 5). Place the coins from the Sun and Moon suits face-up on their matching Moon tile, so that each Moon tile contains two coins.

The Sun and Moon pawns represent two alien guards. Put the guards off to the side for now.

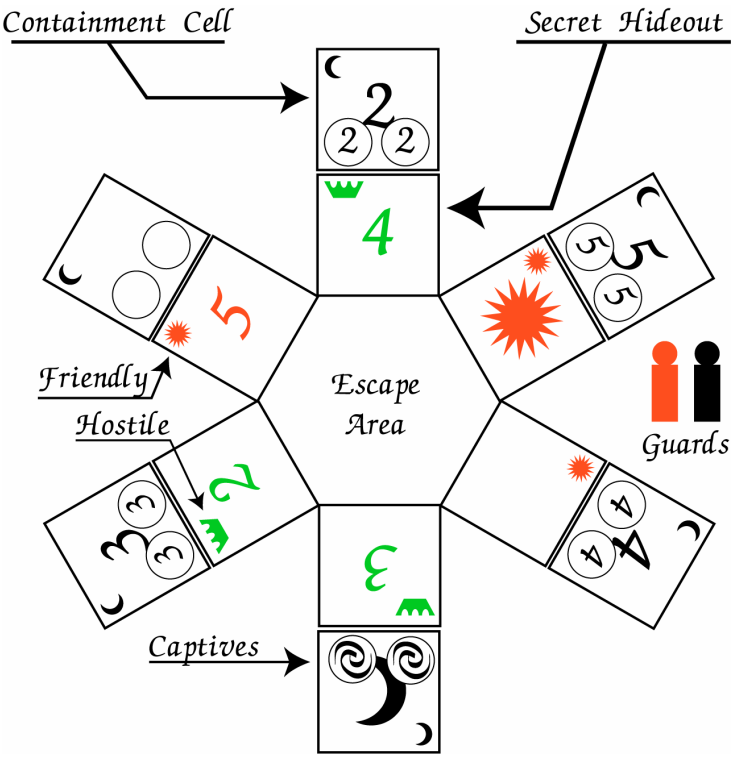

Figure 1: Sample Setup for Cell Management

Rules

Each round, you will choose who will first **attract the guards**. Guards will start their examinations in that cell, then **examine each cell** clockwise. When examined, a species could **try to escape**. The guards will then **search the secret hideouts** for attempted escapes. After the guards have visited all cells once and exited, you have the choice to **return any escaped prisoners** to their hideout location. Keep taking turns until there is one of each captive species in the central Escape Area.

1) Attract the guards

Each round, you choose which of the species will make a disturbance first, thus attracting the guards to their cell. The guards will begin their examinations in that cell and then make a clockwise examination of all the cells. Place both pawns in your chosen starting cell. When moving to the next cell, leave one guard behind so you know where you started. Repeat the Examine a Cell, Trying to Escape and Searching Hideouts phases for each cell.

2) Examine a Cell

As the guard walks by a cell, the captured individuals in that cell will make a disturbance. This distraction could allow a captive to try to escape. There are two situations that cause escape attempts,

- if the adjacent Secret Hideout is Friendly AND Occupied
- if the adjacent Secret Hideout is Hostile AND Empty.

In other words, if a friend is present or an enemy is absent, **one** captive will try to escape. For all other situations the distraction is unsuccessful and there is no escape attempt.

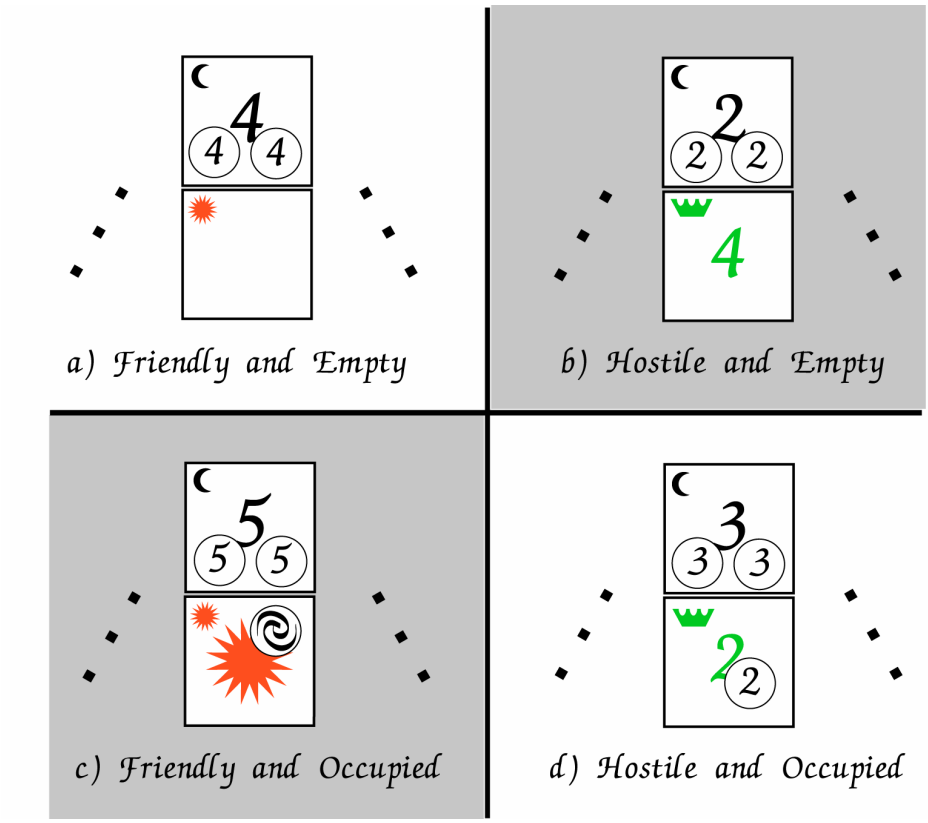

Figure 2: Escape Conditions
b) and c) allow 2 and 5 to try and escape

3) Trying to Escape

Any species trying to escape must first go to their designated secret hideout location. Take **one** of the captives from this Containment Cell and place it in the Secret Hideout corresponding to its type (i.e. if the captive is from species 3, place it in the Secret Hideout marked 3). *If there is already a captive there*, the escaping individual is successful, and the captive is instead placed in the middle of the ship.

4) Searching Hideouts

After examining a cell, the guards will look at the hideout location adjacent to this cell. If it is **occupied**, the captive is returned to its original Containment Cell.

The guard now moves on to the next cell and repeats steps 2-4. When all cells have been examined once, the guards will leave.

5) Return to Prison

If any species managed to fully escape to the center, in either this round or previous rounds, you can now choose any member of an escaped species to make a self-sacrifice. It will return to *its corresponding hideout location*, not its original cell, and wait to be discovered by the alien guard on the next round of examining cells and searching hideouts. This move could help another species escape in the next round. (*Note: it is impossible for there to be two of any species fully escaped to the center; the only way for a captive to escape is when it finds its corresponding secret hideout occupied.*)

Repeat these steps until you have one of each species in the center escape area to win the game.

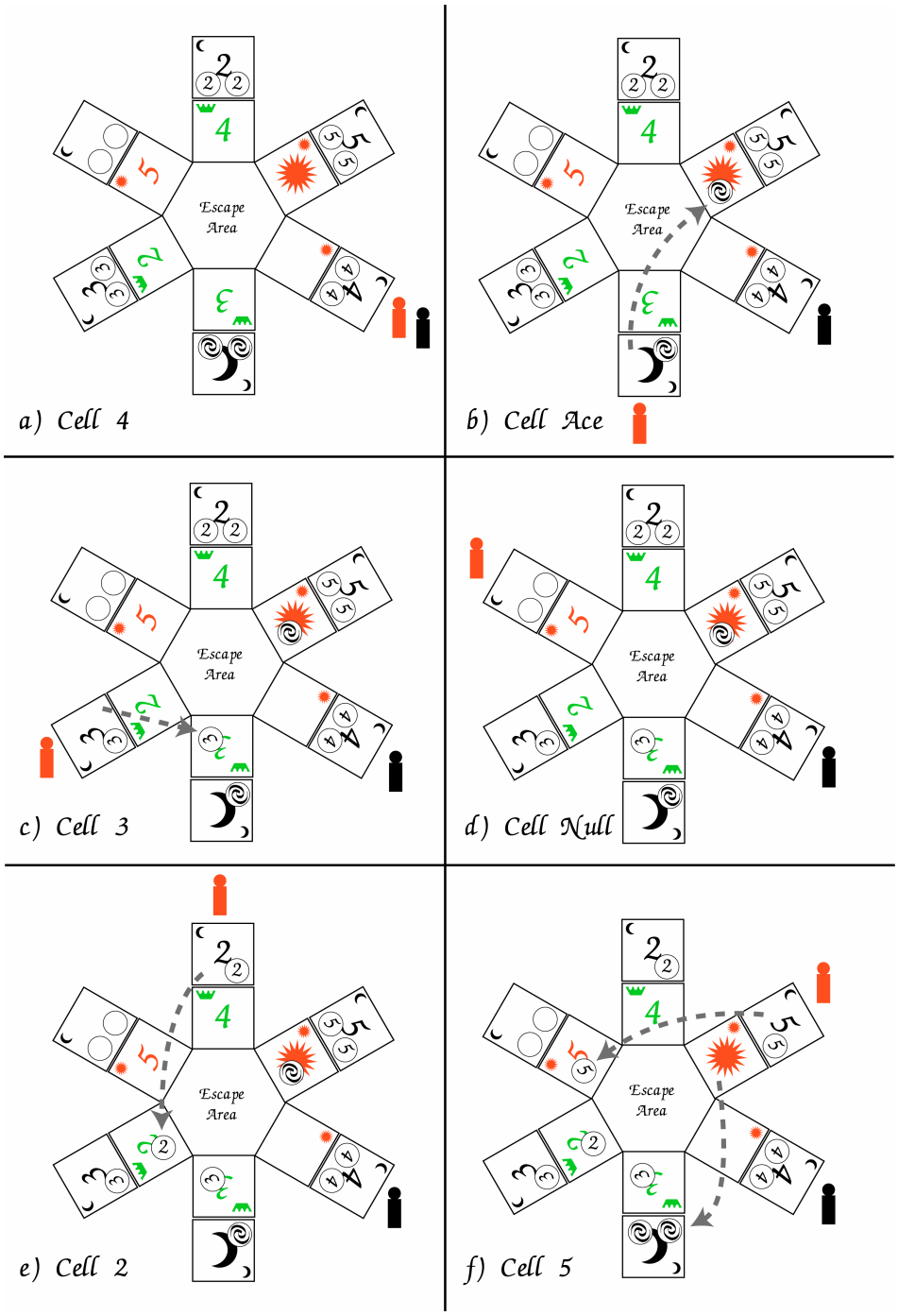

Figure 3: Round One of a Sample Game

A Sample Game

In Round One, you decide cell 4 attracts the guards. Nothing happens here, since the adjacent Secret Hideout is friendly and empty. In cell Ace, one Ace tries to escape, and makes it to the Ace Secret Hideout, because the adjacent 3 Secret Hideout is hostile and empty. The same thing happens in cell 3, and cell 2, while nothing happens in cell Null. In cell 5, one 5 tries to escape, and makes it to the 5 Secret Hideout, because the adjacent Ace Secret Hideout is friendly and occupied. The Ace is discovered and returned to its cell. The guard returns to cell 4 and they exit.

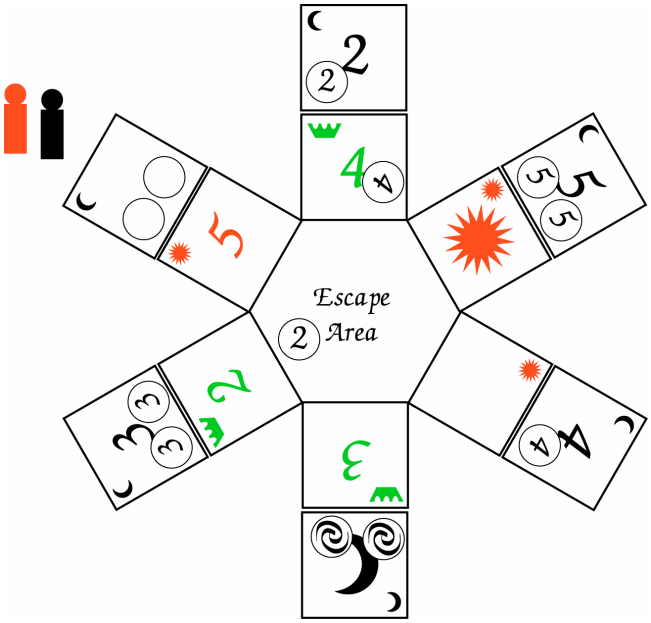

Figure 4: End of Round Two

In Round Two, you decide cell Null attracts the guards, and after its conclusion, we see that a 2 has managed to escape all the way to the center Escape Area. Congratulations! Five more to go!

It is unknown at this time if there are any initial setups that cannot be solved. I believe them all to be solvable, but I have not proven this. Please email mark@goadrich.com if you find a setup you believe to be impossible (or if you find a proof that all setups are solvable).

Variants

For a simpler game, use only four or five species and create the alien ship accordingly, only making two of the hideouts hostile.

Background

This game is based on the mechanisms present in gene regulatory networks, which help a biological cell respond to changes in its environment dynamically. The board is basically a circular bacterial DNA strand, the guards are RNA polymerase, the captives are transcribed RNA sequences which become promoters and repressors for other transcription sites, and escaped captives actually become proteins in the cell. Of course, it all has to be abstracted somewhat to make an interesting puzzle, but I hope it gets across some of the basic concepts of positive and negative feedback loops. More info about gene regulatory networks can be found at http://doegenomestolife.org/science/generegulatorynetwork.shtml http://cnx.rice.edu/content/m12383/latest/.