

## Goal

End the game with more crystal than your opponent.



Crystal

The game takes place in a **lab**, in which two scientists in charge of **robot ants** are competing to find the most efficient way of gathering crystals.

However, the ants **cannot be controlled directly**. The ants will respond to the presence of **beacons**.

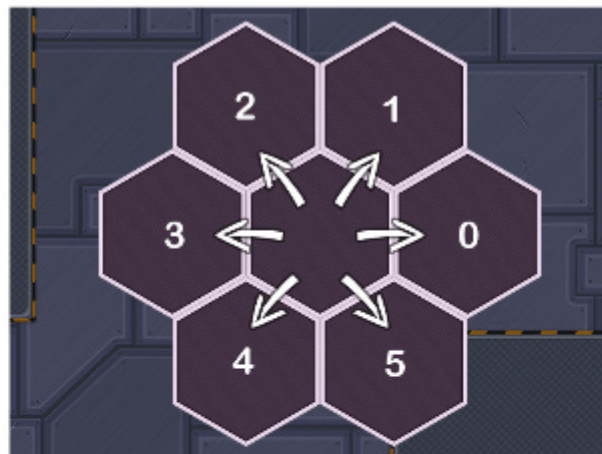
## Rules

The game is played in turns. On each turn, both players perform any number of actions simultaneously.

### The Map

On each run, the map is **generated randomly** and is made up of **hexagonal cells**.

Each cell has an **index** and up to six neighbors. Each direction is labelled **0** to **5**.



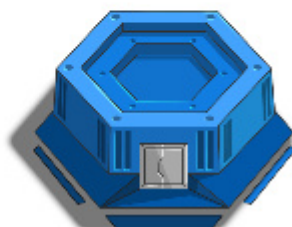
Hex directions

Each cell has a **type**, which indicates what the cell contains:

- **0** if it does not contain a resource.
- **1** if it contains the **egg** resource.
- **2** if it contains the **crystal** resource.

The amount of **resources** contained in each cell is also given, and is subject to change during the game as the ants **harvest** cells.

A cell may also have a **base** on it. The players' ants will start the game on these bases.



## Ants & Beacons

Both players start with several ants placed on their **bases** . The players cannot move the ants directly but can place **beacons** to affect their movement.

Players can place **any number** of beacons per turn but can only place **one each per cell** .

When placing a beacon, players must give that beacon a **strength** . These beacon strengths act as **weights** , determining the **proportion of ants** that will be dispatched to each one.

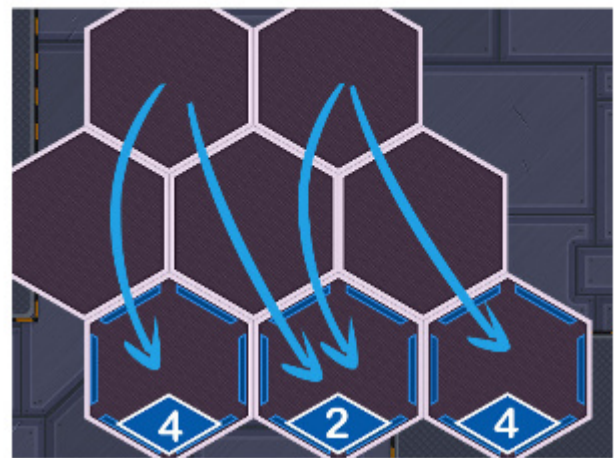
In other words, the **higher** the beacon **strength** , the greater the **percentage** of your ants that will be sent to that beacon.

### Example

In the following example, there are three beacons of **strength** **2, 1, and 2** .



White numbers in a colored diamond represent the ants. Here, **10** ants in total will be dispatched to the beacons.



The **10** ants will move to the three beacons, keeping the same proportions as the beacon strengths.

The ants will do their best to take the **shortest paths** to their designated beacons, moving at a speed of **one cell per turn** .

In between turns, the **existing beacons** are powered down and **removed from play** .

Use beacons to place your ants in such a way to create **harvesting chains** between your **bases** and a **resource** .

## Harvesting Chains

In order to harvest **crystal** and score points, there must be an **uninterrupted chain** of **cells containing your ants** between the resource and your **bases** .

The amount of crystal harvested per turn is equal to the **weakest link** in the chain. In other words, it is the smallest amount of ants from the cells that make up the chain.



Here, the blue player will harvest 4 crystal per turn.

The harvesting chains work the same way for the **egg resource**.

Harvesting an egg cell will spawn as many ants as resources harvested. The ants will spawn on the player's base on the start of next turn.

**Harvesting** is calculated separately for **each resource**, and for each one the game will automatically choose the **best chain** from its cell to your base.

## Actions

On each turn players can do any amount of valid actions, which include:

- **BEACON** **index** **strength**: place a beacon of strength **strength** on cell **index**.
- **LINE** **index1** **index2** **strength**: place beacons all along a path from **index1** to **index2**, all of strength **strength**. A shortest path is chosen automatically.
- **WAIT**: do nothing.
- **MESSAGE** **text**. Displays text on your side of the HUD.

## Action order for one turn

1. **LINE** actions are computed.
2. **BEACON** actions are computed.
3. Ants move.
4. Eggs are harvested and new ants spawn.
5. Crystal is harvested and points are scored.

## Victory Conditions

- You have harvested at least half of the total **crystal** on the map before your opponent.
- You have more **crystal** than your opponent after 100 turns, or more **ants** if tied.

## Defeat Conditions

Your program does not provide a command in the allotted time or it provides an unrecognized command.



## 🐛 Debugging tips

- Hover over a tile to see extra information about it, including beacon **strength**.
- Use the **MESSAGE** command to display some text on your side of the HUD.
- Press the gear icon on the viewer to access extra display options.
- Use the keyboard to control the action: space to play/pause, arrows to step 1 frame at a time.

## Game Protocol

### Initialization Input

First line: **numberOfCells** an integer for the amount of cells in the map.

Next **numberOfCells** lines: the cells, ordered by **index**. Each cell is represented by 8 space-separated integers:

- **type**: 1 for egg, 2 for crystal, 0 otherwise.
- **initialResources** for the amount of crystal/egg here.
- 6 **neigh** variables, one for each **direction**, containing the index of a neighboring cell or -1 if there is no neighbor.

Next line: one integer **numberOfBases** containing the number of bases for each player.

Next line: **numberOfBases** integers for the cell indices where a **friendly base** is present.

Next line: **numberOfBases** integers for the cell indices where an **opponent base** is present..

### Input for One Game Turn

Next **numberOfCells** lines: one line per cell, ordered by **index**. 3 integers per cell:

- **resources**: the amount of crystal/eggs on the cell.
- **myAnts**: the amount of ants you have on the cell.
- **oppAnts**: the amount of ants your opponent has on the cell.

### Output

All your actions on one line, separated by a **;**

- **BEACON** **index** **strength**. Places a beacon that lasts one turn.
- **LINE** **index1** **index2** **strength**. Places beacons along a path between the two provided cells.
- **WAIT**. Does nothing.
- **MESSAGE** **text**. Displays text on your side of the HUD.

### Constraints

**numberOfBases** = 1

Response time per turn  $\leq$  100 ms

Response time for the first turn  $\leq$  1000 ms

What is in store for me in the higher leagues?

- Larger maps will be available.
- Ants of opposing teams will interact.

### Starter Kit

Starter AIs are available in the [Starter Kit](#). They can help you get started with your own bot. You can modify them to suit your own coding style or start completely from scratch.

### Source code

The game's source will be available [here](#).