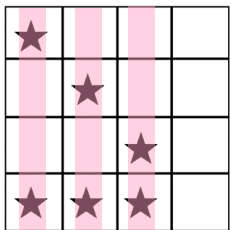


# Hint 3

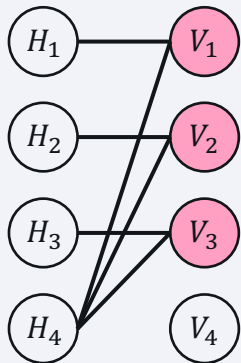
There are **several ways** to solve the final exercise. In this hint, I will explain an approach that is general and naive. The key idea is to convert an Asteroids problem into a so-called [Vertex Cover](#) problem.

## How to encode an Asteroids problem into a graph

Asteroids problem



Graph



Each node represents a row/column.

- $H_i$  represents  $i$ -th row.
- $V_j$  represents  $j$ -th column

Each edge represents an asteroid.

- Put an edge between node  $H_i$  and node  $V_j$  if there is an asteroid at  $(i, j)$

In the left example, choosing  $\{V_1, V_2, V_3\}$  can cover all the edges. The solution exactly corresponds to shooting beams at column 1, 2, and 3 vertically in the Asteroids problem.

Then, create the following 2 oracles and combine into one.

- Oracle 1: Are all the edges covered by chosen nodes?
- Oracle 2: Is the number of chosen nodes 3?

Nodes that satisfy Oracle 1 and Oracle 2 represent the solution for the Asteroids problem.

Once you know how to implement the above, you can now use to determine whether a given Asteroids problem is solvable or not. You're almost there! Good luck!!



Dr. Ryoko