

Data Structures and Objects

CSIS 3700

Fall Semester 2019— CRN 41930

Project 3 — Duck Dodgers vs. Marvin the Martian

Due date: Friday, November 15, 2019

Goal

Determine whether or not Duck Dodgers can reach the Illudium Phosdex before Marvin the Martian.

Details

Planet X is the only known location of Illudium Phosdex, the shaving cream atom. The planet's surface can be modeled as a 20 x 20 hexagonal map, shown on page 3.

The surface of Planet X is rather plain, except for areas of molten lava, over which neither Duck Dodgers nor Marvin the Martian can pass. The Illudium Phosdex resides in one non-lava cell on the map.

The basic goal of this project is simple: assuming that Dodgers and Marvin move at the same rate, which one can reach the Illudium Phosdex first?

The program must begin by reading seven integers: the row and column of Duck Dodgers' starting position, the row and column of Marvin the Martian's starting position, the row and column of the location of the Illudium Phosdex, and the number of map cells covered in lava.

Next, for each lava cell, the program must read the row and column of the lava's location.

Once the data is read, find a shortest path from both Marvin and Dodgers to the Illudium Phosdex. Output a shortest path from both characters to the goal, and determine who will claim the Illudium Phosdex. Break any ties in favor of Marvin the Martian (he has a disintegration gun that doesn't disintegrate, and he's not afraid to use it).

►A Twist...

Duck Dodgers' sidekick is more resourceful than Dodgers, and will try to block Marvin. He can use his Acme Teleporter to summon Gandalf the Grey (hey, if the new Duck Dodgers can have a crossover episode with *Samurai Jack*, why not *Lord of the Rings*?), who will stand in one cell, blocking Marvin while reciting his famous "You shall not pass!" quote. See if there is a location for Gandalf that would force Marvin to take a detour and let Duck Dodgers win.

If there is a position for Gandalf that lets Duck Dodgers reach the Illudium Phosdex first, output the position and the new route for Marvin the Martian. Otherwise, output a message that indicates that Gandalf cannot help.

► *Pseudorandom Thoughts*

- You don't have to look at every cell to find a spot for Gandalf. But you do have to redo your calculations.
- You'll want a queue to find the shortest path, and you might want a linear list to help find Gandalf's position.
- We'll discuss the algorithms in class and/or lab.

What to turn in

Turn in your source code and **Makefile**. If you use an IDE, turn in a tarball of your project directory.

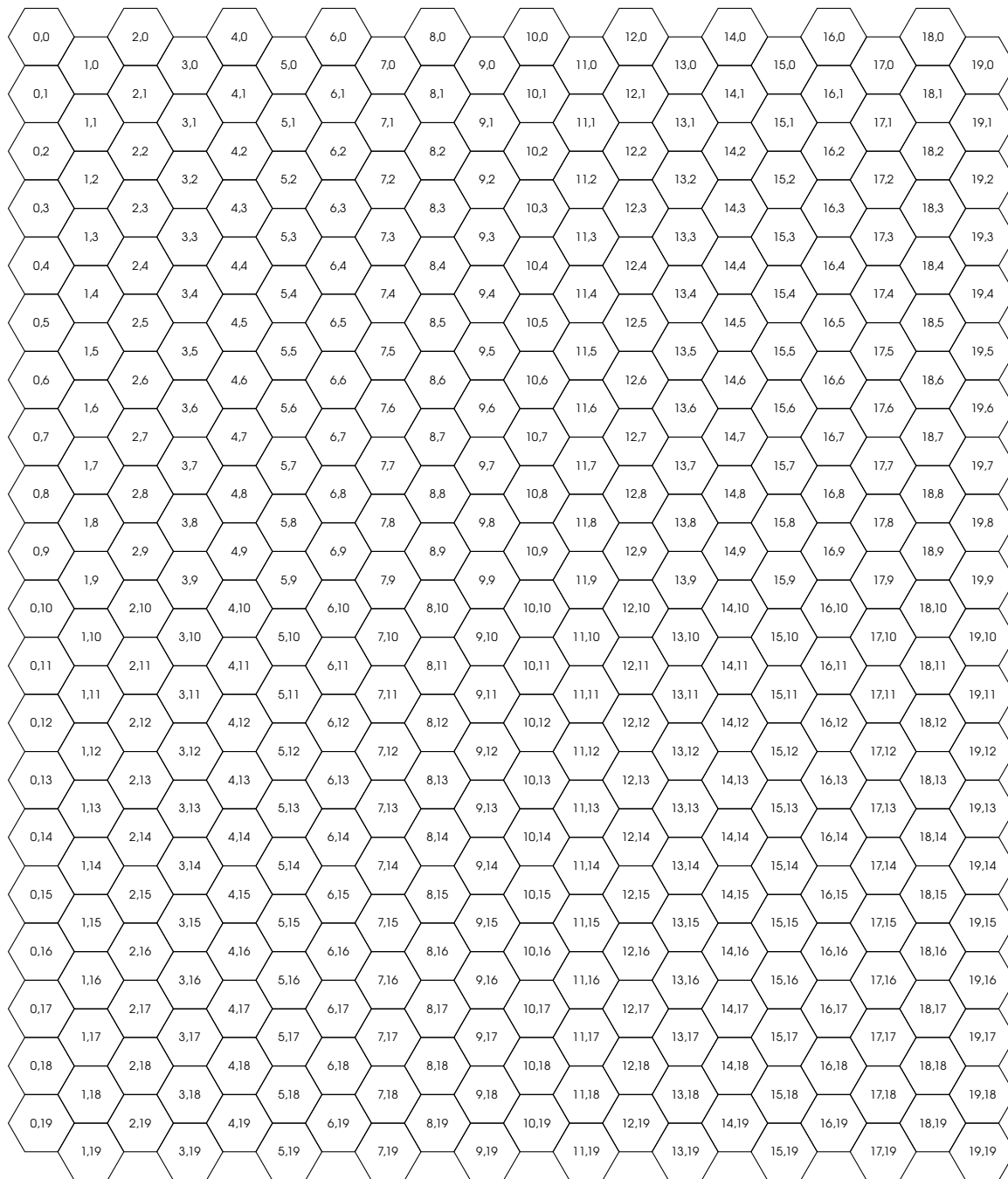


Figure 1: An empty map of Planet X

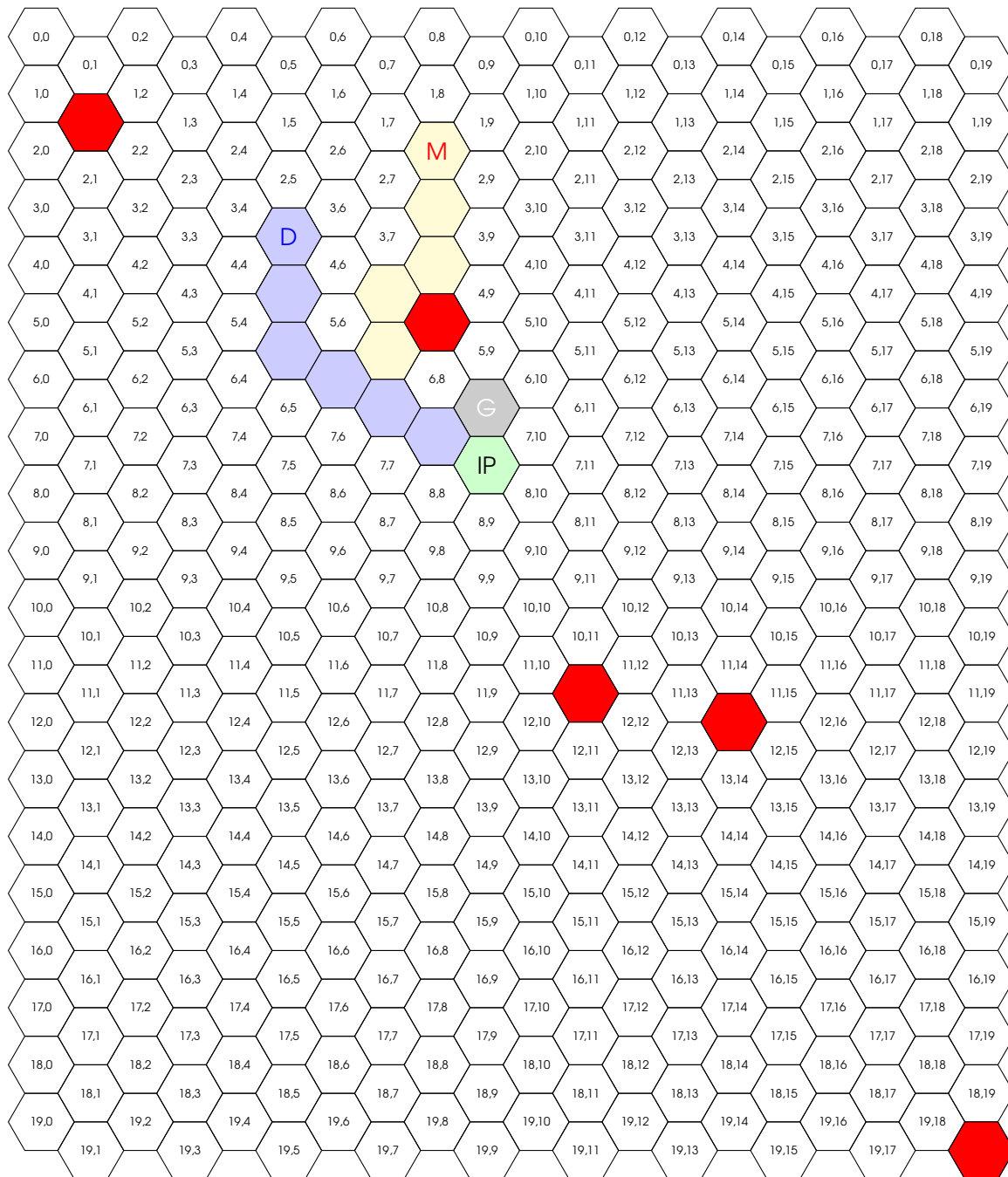
Examples

Input

```
3 5 2 8 7 9 5
19 19
11 11
5 8
12 14
1 1
```

Output

Duck and Marvin will reach the Illudium Phosdex simultaneously, trying Gandalf
The Space Cadet summons Gandalf to (6,9)

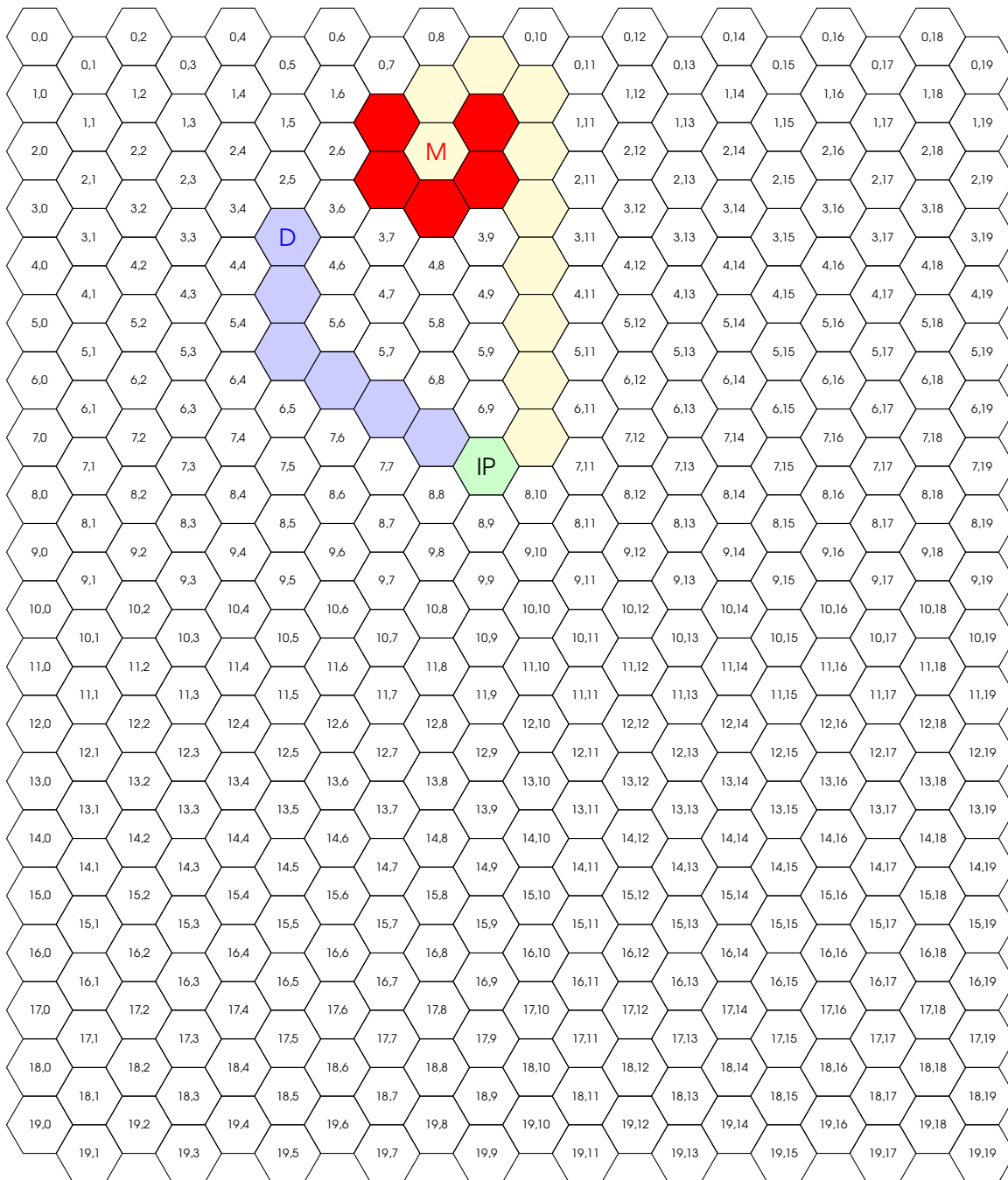
MapFigure 2: Planet X from **test1.dat**

Input

```
3 5 2 8 7 9 5
1 9
2 9
3 8
2 7
1 7
```

Output

```
Duck Dodgers reaches the Illudium Phosdex first
```

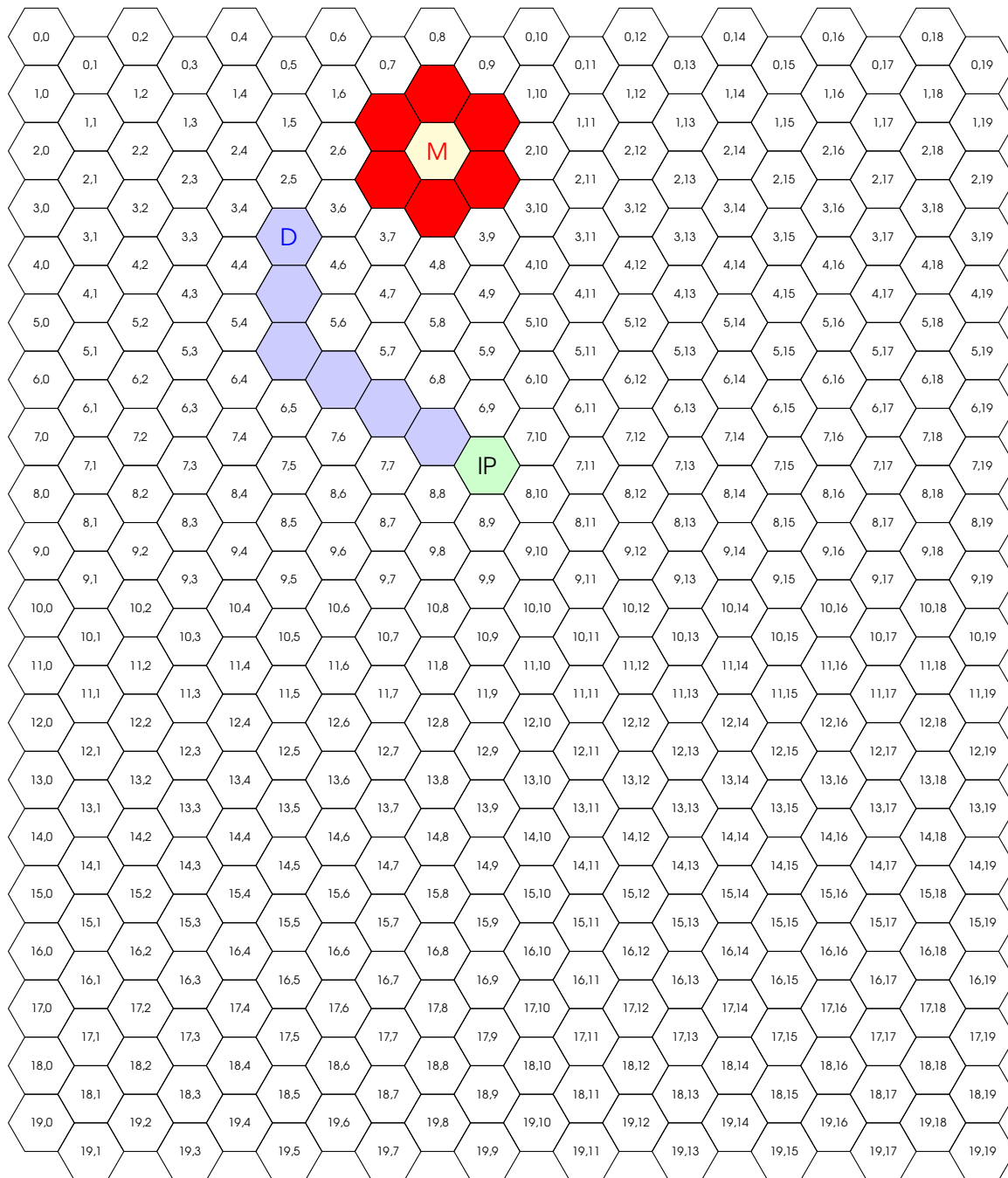
MapFigure 3: Planet X from **test2.dat**

Input

```
3 5 2 8 7 9 6
1 8
1 9
2 9
3 8
2 7
1 7
```

Output

Duck Dodgers reaches the Illudium Phosdex first because Marvin can't reach it

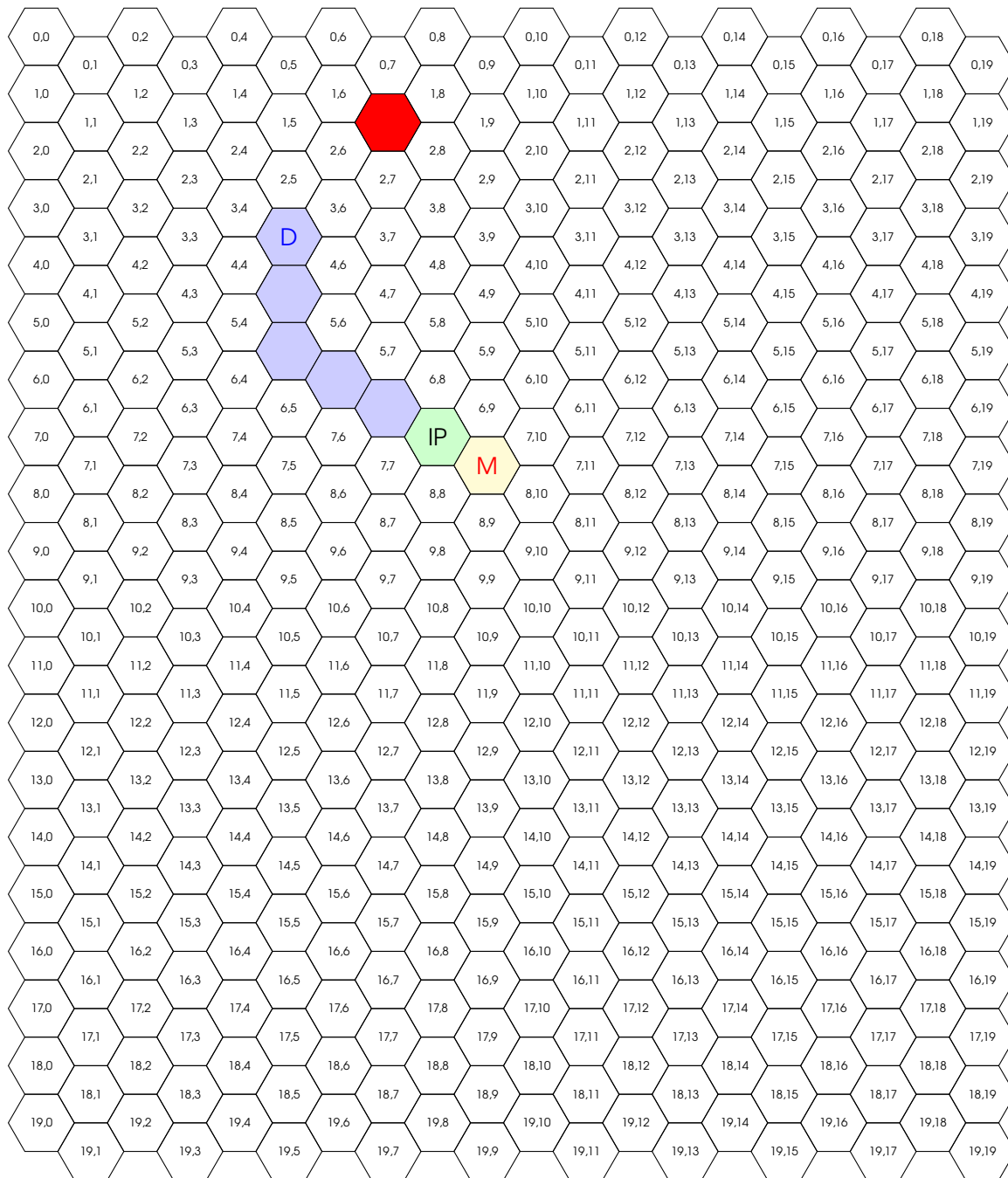
MapFigure 4: Planet X from **test3.dat**

Input

```
3 5 7 9 7 8 1
1 7
```

Output

```
Marvin the Martian will reach the Illudium Phosdex first, trying Gandalf
Gandalf cannot help
```

MapFigure 5: Planet X from **test4.dat**