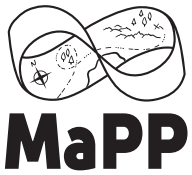

# MaPP Challenge '19 - To Infinity And Beyond

*Mathematical Puzzle Programs*



Version 2018/08/31




MaPP Challenge '19 - To Infinity And Beyond

# Table of Contents

# Part I

# About

MaPP Challenge '19 - To Infinity And Beyond

# Scoresheet

Game Control and your team each have a copy of this scoresheet. When submitting solutions, bring your team's copy to Game Control to be updated.

| School Name | Team Name/ID | League |
|---|---|---|
| | | |

## **Opening Puzzle**: Where No One Has Gone Before — Used to unlock Main Puzzles

### Main Puzzles

1500VP for each Main Puzzle solved; Time Solved used to break ties in VP

| | | | |
|---|---|---|---|
| 1 | Clontz - Hamiltonian Decompositions | Time Solved | VP Earned |
| 2 | Carrigan - Art gallery problems | Time Solved | VP Earned |
| 3 | Couch - Matroids(?) | Time Solved | VP Earned |
| 4 | Clontz/Varagona - Idempotent Relations | Time Solved | VP Earned |

### Cryptic Puzzles

500VP for each Cryptic Puzzle solved; Time Solved used to break ties in VP

| | | | |
|---|---|---|---|
| 1 | Clontz - Constellations | Time Solved | VP Earned |
| 2 | Clair - Space Travel | Time Solved | VP Earned |
| 3 | Clontz/Reiter - KenKenKen | Time Solved | VP Earned |
| 4 | Clontz/Harshbarger - Word Problem | Time Solved | VP Earned |

### Bonus Puzzle

Up to 500VP for best submission

| | | | | |
|---|---|---|---|---|
| Holshouser - Origami | First Submission | Second Submission | Third Submission | VP Earned |
| | | | | |

### Metapuzzle

1000VP if solved, Time Solved used to break ties in VP

| | | |
|---|---|---|
| ??? | Time Solved | VP Earned |
| | | |

Up to 500VP if earned, Time Acquired used to break ties in VP

| | | |
|---|---|---|
| Additional VP | Time Acquired | VP Earned |
| | | |

10,000VP Maximum

**Total VP Earned**

# Part II

# Puzzles

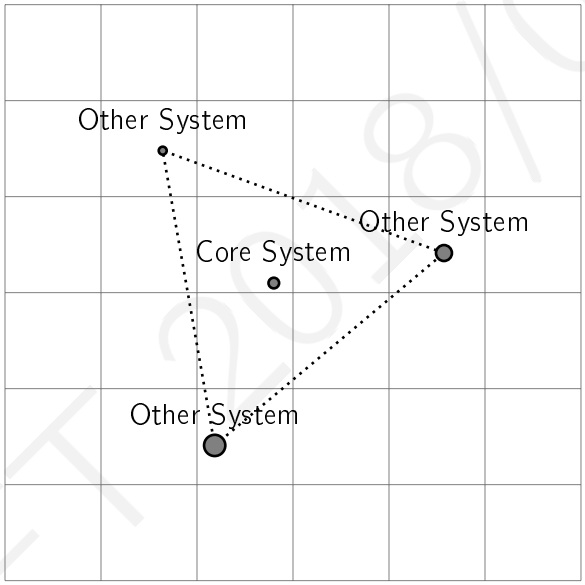
MaPP Challenge '19 - To Infinity And Beyond

# Where No One Has Gone Before

## Opening Puzzle

Today's adventure begins as your team's ship launches into space. Space Fleet has provided you a **Galaxy Map** to guide you on your way. (Actually, several copies have been provided to you! Take care of these copies, as you will refer to the Galaxy Map several times throughout the adventure.) Each dot on the map refers to a different solar system, named on the map.

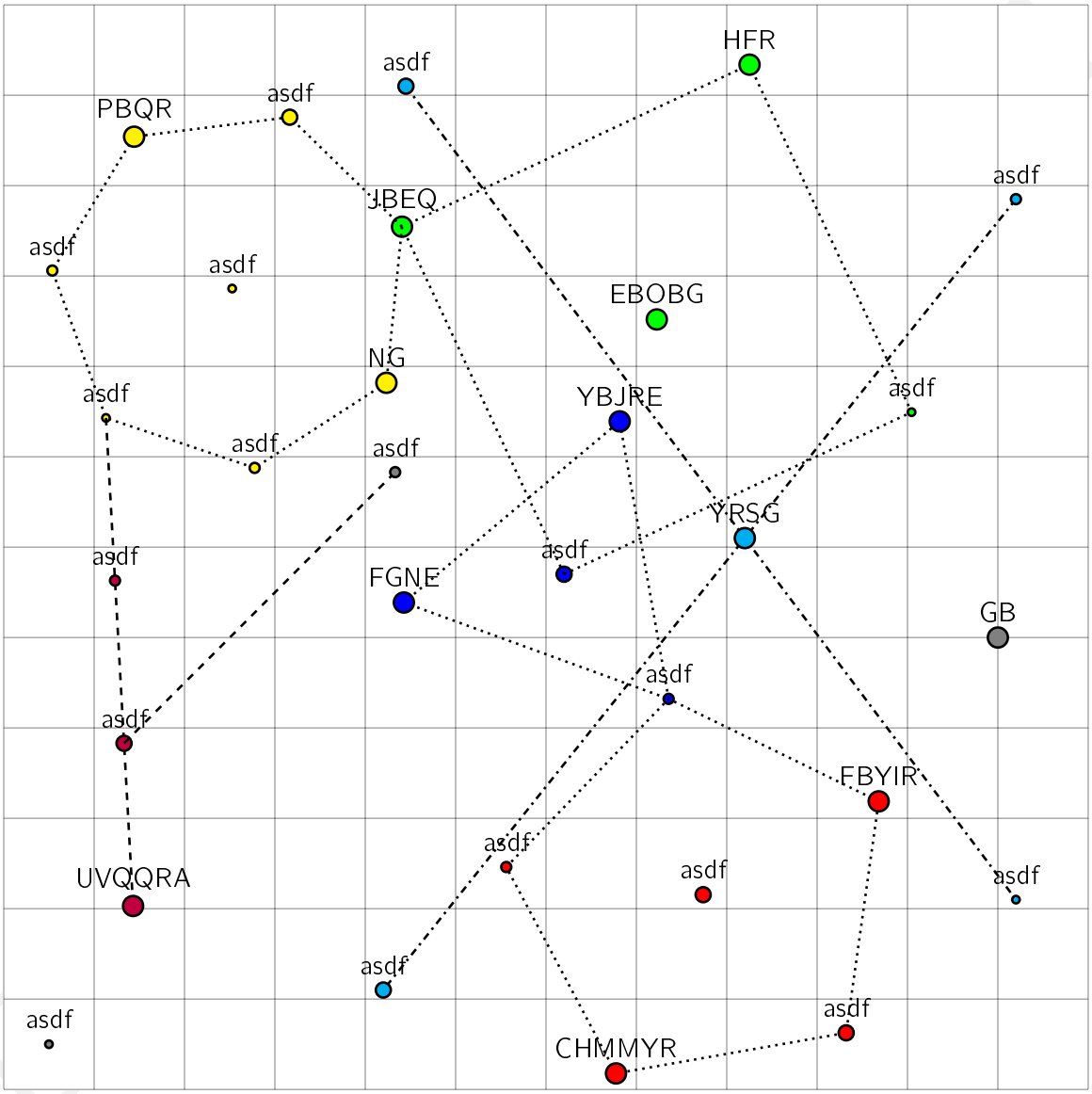
Space Fleet commands you to first visit the four **Core Systems** of the galaxy. You can recognize a Core System by the fact that it is located in the middle of a regular polygon (all sides are the same length) formed by either three, four, five, or seven other systems. An example is shown below.



MaPP Challenge '19 - To Infinity And Beyond

# Where No One Has Gone Before

Galaxy Chart



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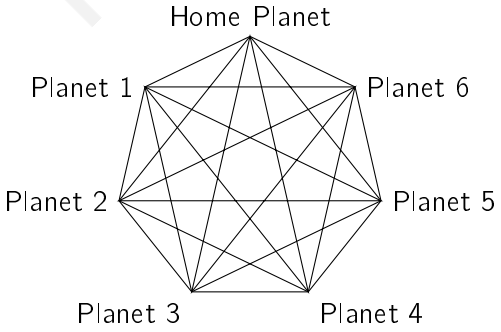
# Good News Everyone

## Main Puzzle 1

On this system, you find yourself caught up in the misadventures of PlanEx, an intergalactic delivery company led by the eccentric old mathematician Dr. Farnswell. In the name of good relations between galaxies, you agree to help him with the following puzzle.

- PlanEx makes deliveries to six different planets (not including their own) on Mondays, Wednesdays, and Fridays.
- Each day, a different company on each planet receives the delivery, listed below in order of Mon/Wed/Fri.
  - Planet 1: Venus Co. / Rave Co. / Photon Co.
  - Planet 2: Comet Co. / Solar Co. / Light Co.
  - Planet 3: Belt Co. / Techno Co. / Alarm Co.
  - Planet 4: Acme Co. / Alpha Co. / Uranium Co.
  - Planet 5: Oxygen Co. / Helmet Co. / Neo Co.
  - Planet 6: Star Co. / Orion Co. / Tele Co.
- Their ship may travel directly between any two planets, but due to galactic regulations, they may not travel directly between the same two planets twice in the same week (regardless of direction).

Can you help Farnswell complete his Delivery Schedule? If so, the missing company names will reveal one of the hidden codewords.



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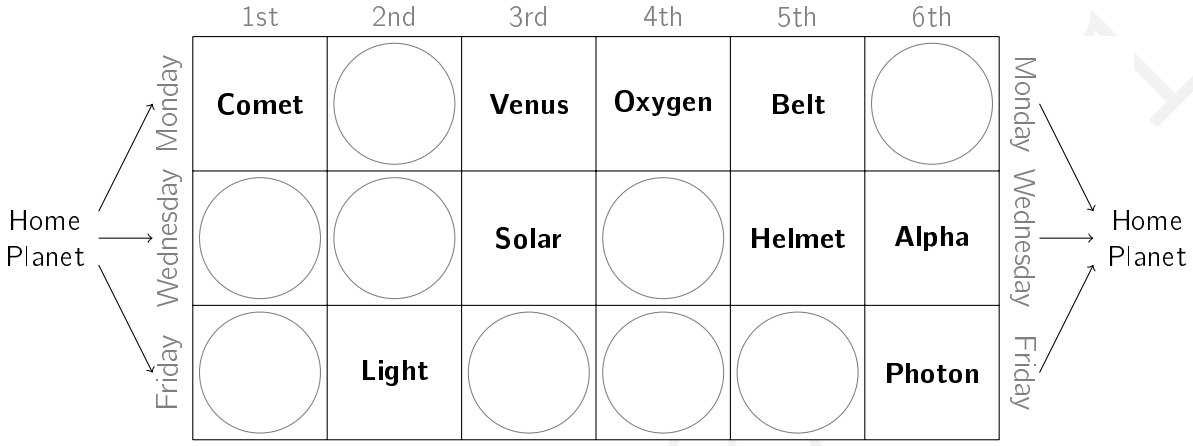
# Good News Everyone

## Delivery Schedule



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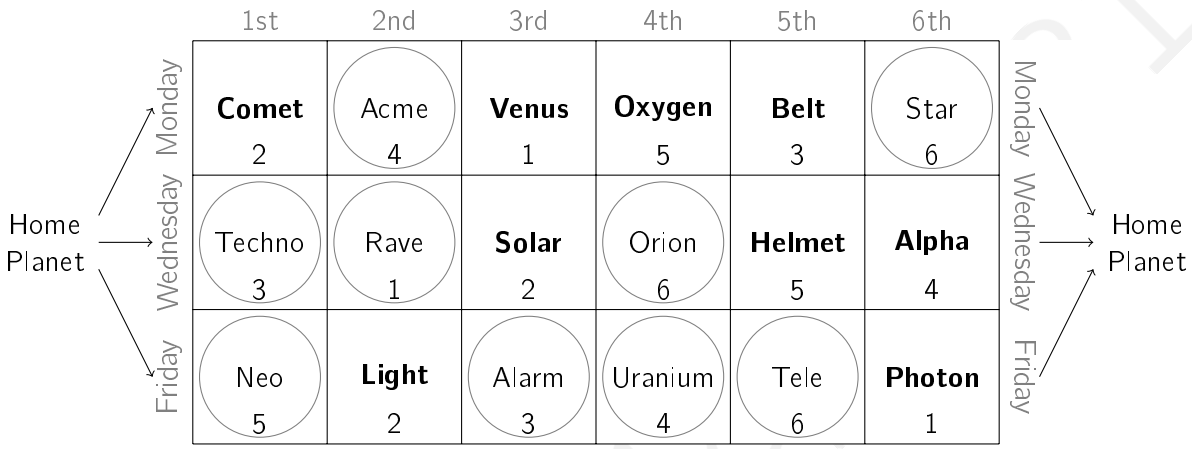
# Good News Everyone

## Solution

The numbers below coorrespond to each company's planet.




Using the first letters of the filled-in company names, the solution `ASTRONAUT` is revealed.

MaPP Challenge '19 - To Infinity And Beyond

# Jumping Through Hyperspace

## Main Puzzle 4

On this system, your adventure takes you to a racous space saloon, swapping tales with Jan Duo, an infamous smuggler with a heart of gold.

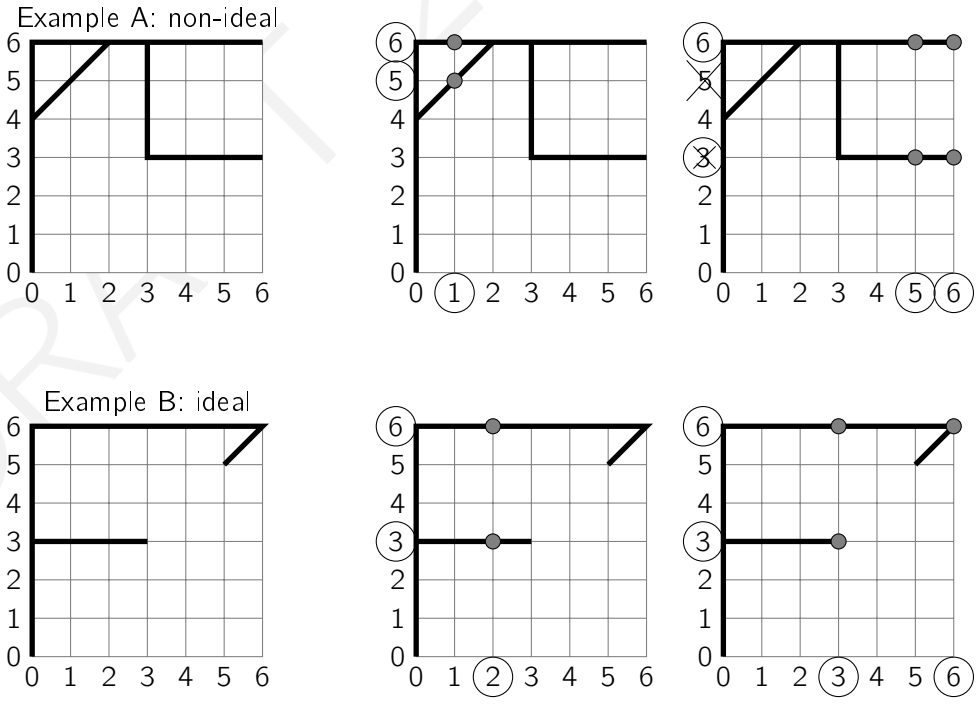
He explains to you that in the early days of hyperspace travel, engines could instantly transport ships between only certain locations on a six-lightyear continuum. These options were illustrated using a graph, where the horizontal coordinate represents starting positions, and the vertical coordinate represents ending positions.

The goal of a hyperspace engine is to be **ideal**: the collection of possible destinations from each point using exactly one teleportation should be exactly the same as the collection of possible destinations using exactly two teleportations.

This means Example A is not ideal. Position 1 teleports to positions 5 and 6, but from positions 5 and 6, there are two problems: a new destination 3 can be reached, and the destiation 5 can no longer be reached.

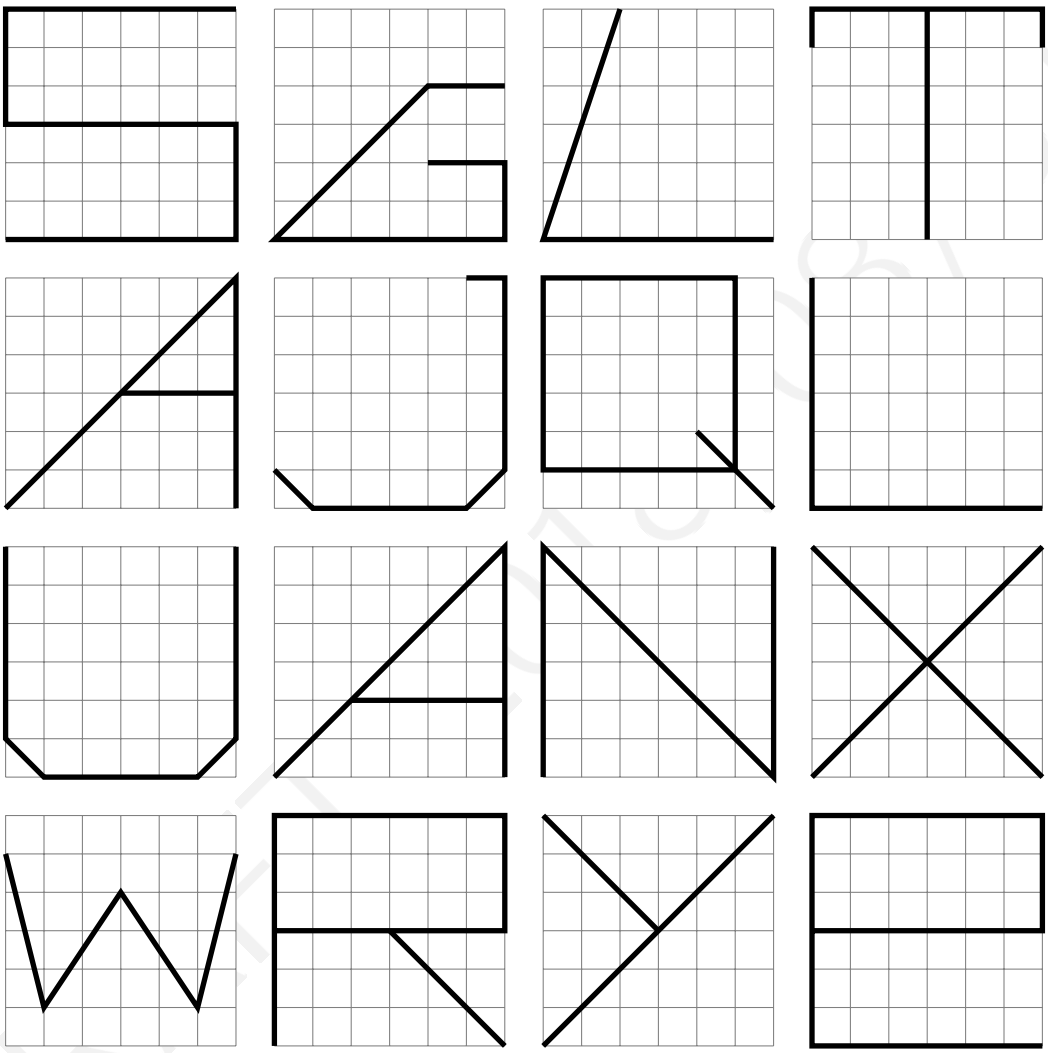
However, Example B is ideal. From 0, any position can be reached after either one or two teleportations. From 2, positions 3 and 6 can be reached after either one or two teleportations. From 4, position 6 can be reached after one or two teleportations. From 5, positions 5 and 6 can be reached after one or two teleportations. And so on.

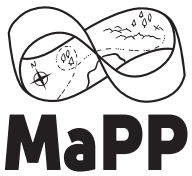
Jan suggests that you review your **Hyperspace Engines** document; perhaps the illustrations representing ideal engines will reveal a hidden message?



# Jumping Through Hyperspace

## Hyperspace Engines

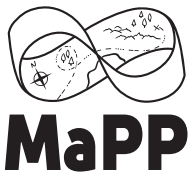





MaPP Challenge '19 - To Infinity And Beyond

# Word Problem

Cryptic Puzzle 4

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# Word Problem

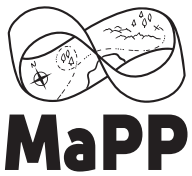
## Mysterious Message

For a time I tried carefully to detail yarns via large crawling textboxes.

However, composing all of the concepts when curbed by finite room, the new strategy now is...

# Part III

# Solutions




MaPP Challenge '19 - To Infinity And Beyond

# Solutions

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