



MaPP Challenge '19 - To Infinity And Beyond

Mathematical Puzzle Programs



MaPP Challenge '19 - To Infinity And Beyond

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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
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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
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Metapuzzle

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

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

Additional VP	Time Acquired	VP Earned
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10,000VP Maximum

Total VP Earned

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Part II

Puzzles



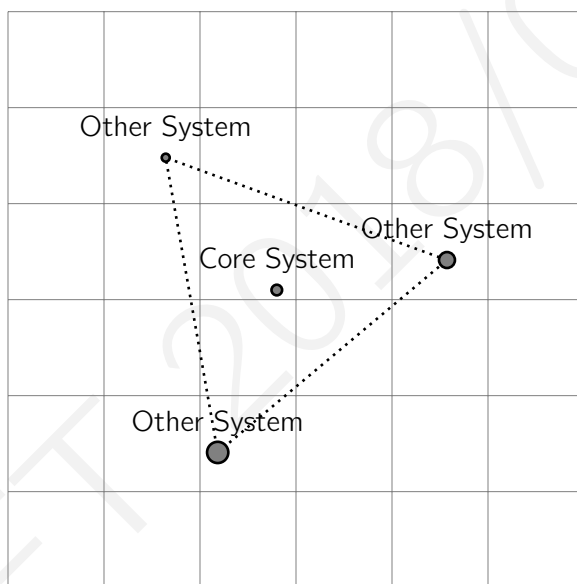
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Where No One Has Gone Before

Opening Puzzle

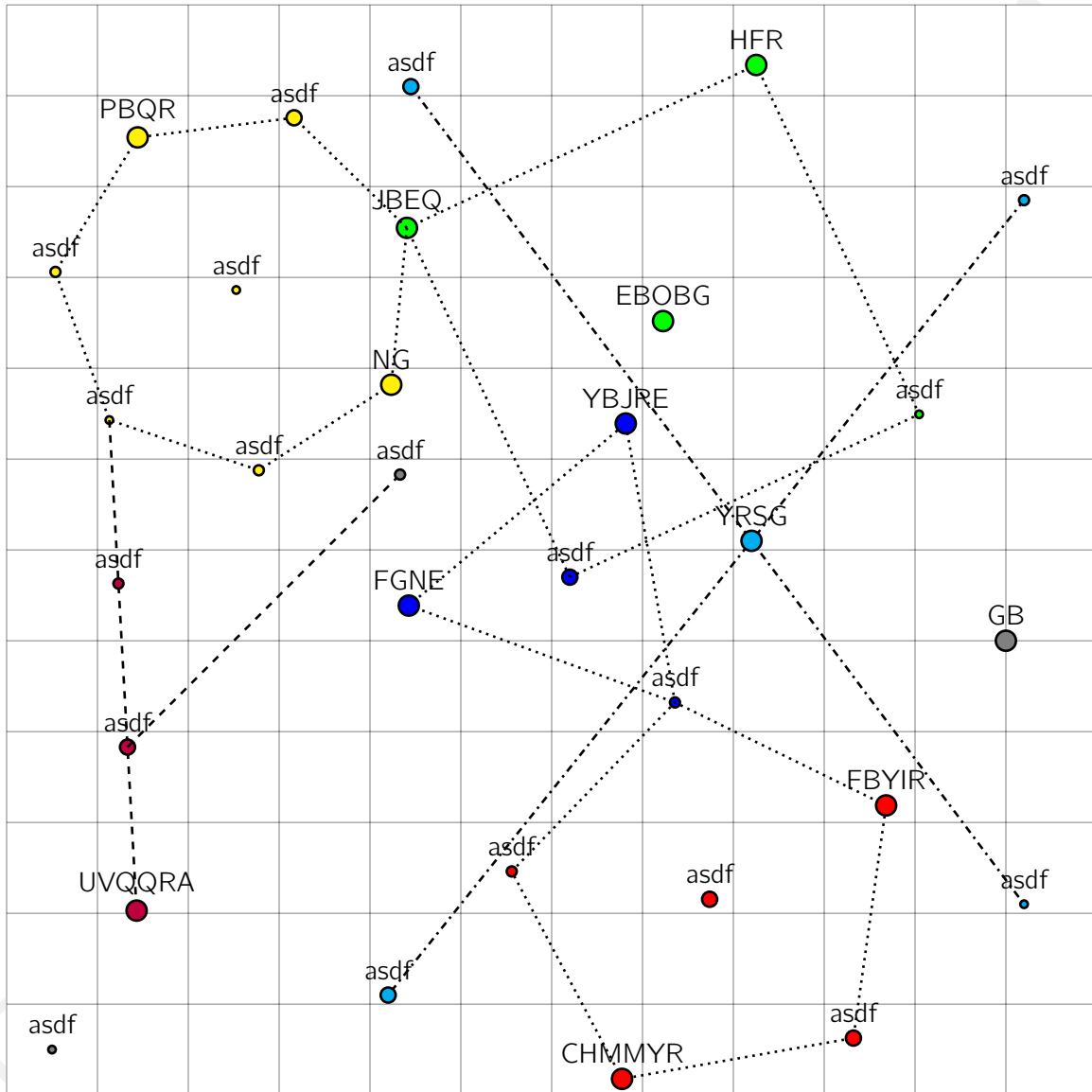
Today's adventure begins as your team's ship launches into space. Space Fleet has provided you a **Galaxy Map** to guide you on your way. (Actually, several copies have been provided to you! Take care of these copies, as you will refer to the Galaxy Map several times throughout the adventure.) Each dot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



Where No One Has Gone Before

Galaxy Chart





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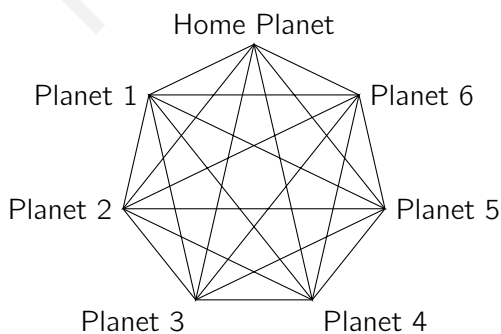
Good News Everyone

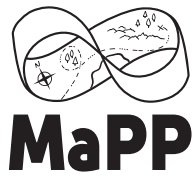
Main Puzzle 1

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.



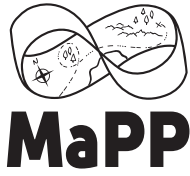


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Good News Everyone

Delivery Schedule

		1st	2nd	3rd	4th	5th	6th		
Home Planet	Monday	Comet		Venus	Oxygen	Belt		Home Planet	Monday
	Wednesday			Solar		Helmet	Alpha		Wednesday
	Friday		Light				Photon		Friday



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Good News Everyone

Solution

The numbers below correspond to each company's planet.

		1st	2nd	3rd	4th	5th	6th		
Home Planet	Monday	Comet 2	Acme 4	Venus 1	Oxygen 5	Belt 3	Star 6	Monday	Home Planet
	Wednesday	Techno 3	Rave 1	Solar 2	Orion 6	Helmet 5	Alpha 4	Wednesday	
	Friday	Neo 5	Light 2	Alarm 3	Uranium 4	Tele 6	Photon 1	Friday	

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



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No One Can Hear You Scream

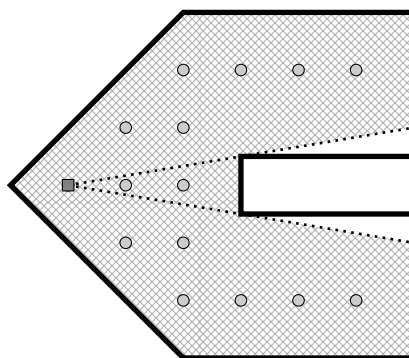
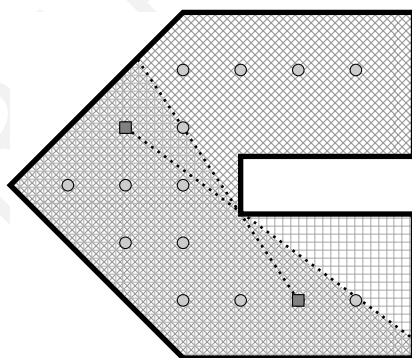
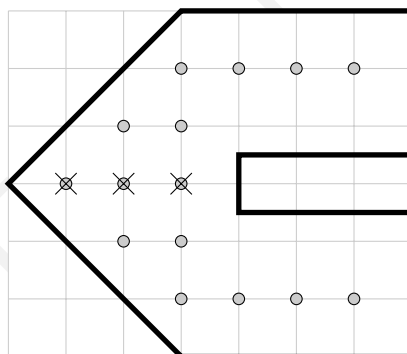
Main Puzzle 2

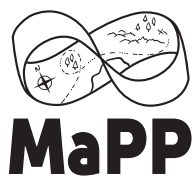
The one golden rule of space travel is simple: if you find a creepy egg on a previously unexplored planet, DO NOT TAKE IT BACK WITH YOU. Well, it seems Ensign S. Ridley didn't get the memo, as after a routine check on one of this system's planets, your crew finds themselves running for their lives as a mysterious alien rampages your ship!

Fortunately, there is protocol for such a situation. On your **Ship Floorplan**, several stations are marked where you can position a robotic guard to defend against the alien. Five guards must be placed such that every point within the floorplan is visible in a straight line from at least one guard.

An example for two guards is illustrated below. As long as one guard is placed within the top two rows, and the other guard is placed within the bottom two rows, the entire area of the floor is safely monitored. But if a guard is placed on any of the three stations in the middle row, there's no possible way for a second guard to monitor both the top and bottom unaccounted areas.

Your task is to identify all the stations on the ship that are unusable. In addition to saving your crew from certain death, you will also reveal a secret codeword!

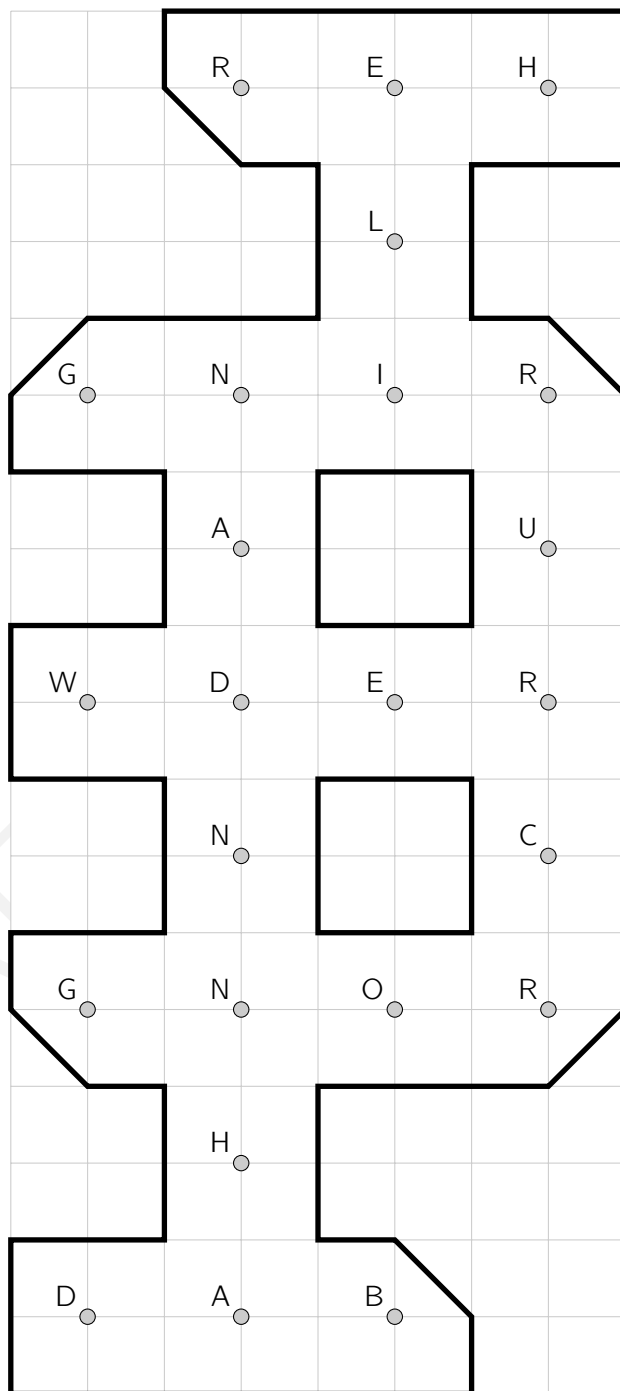




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No One Can Hear You Scream

Ship Floorplan



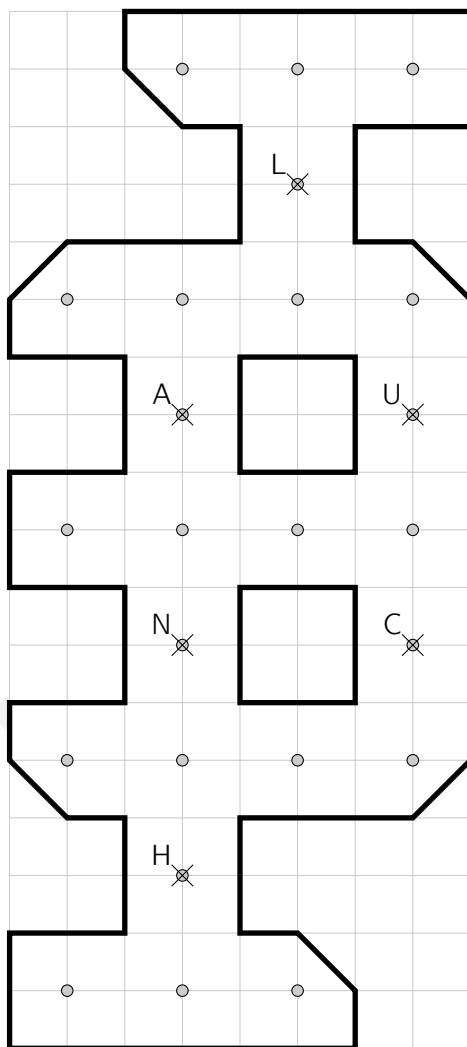


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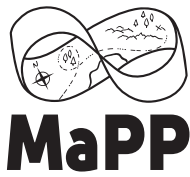
No One Can Hear You Scream

Solution

There are six unusable locations.



The letters for these stations spell out the solution LAUNCH.



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Jumping Through Hyperspace

Main Puzzle 4

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

She 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.

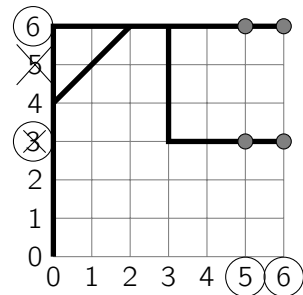
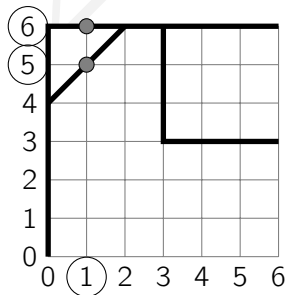
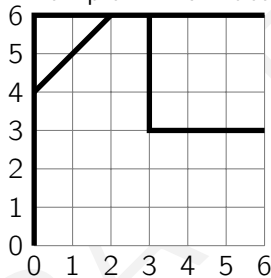
The goal of a hyperspace engine is to be **ideal**: the collection of possible destinations from each point using exactly one teleportation should be exactly the same as the collection of possible destinations using exactly two teleportations.

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 destination 5 can no longer be reached.

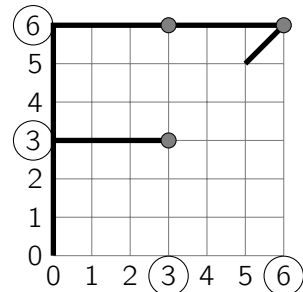
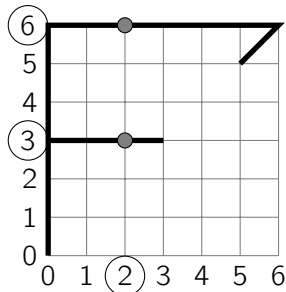
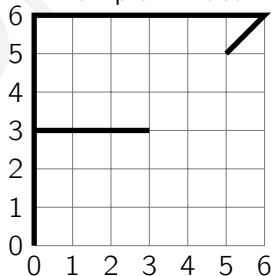
However, Example B is ideal. From 0, any position can be reached after either one or two teleportations. From 2, positions 3 and 6 can be reached after either one or two teleportations. From 4, only position 6 can be reached after one or two teleportations. From 5.5, positions 5.5 and 6 can be reached after one or two teleportations. And so on.

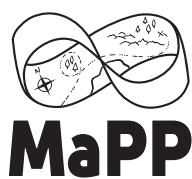
Jan suggests that you review your **Hyperspace Engines** document; perhaps the illustrations representing ideal engines will reveal a hidden message?

Example A: non-ideal



Example B: ideal

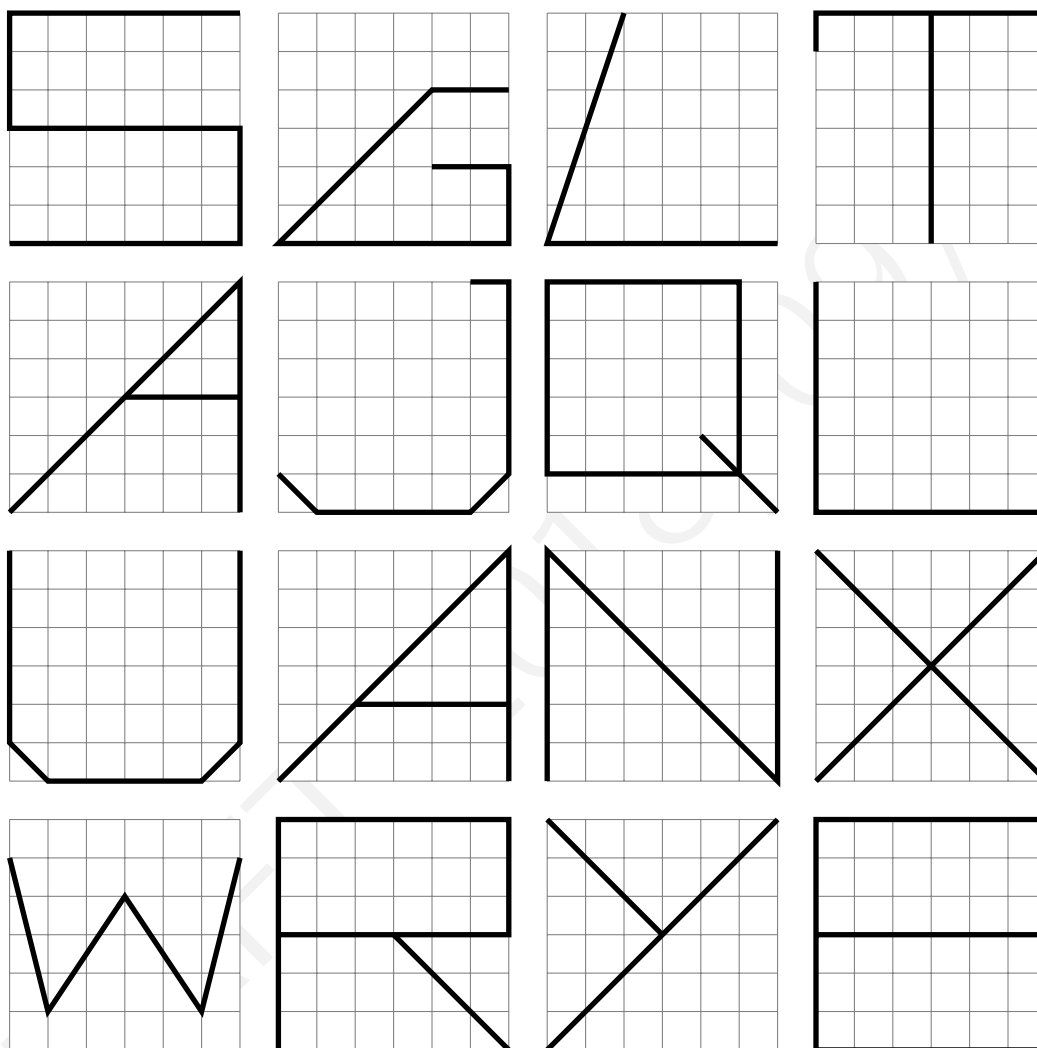


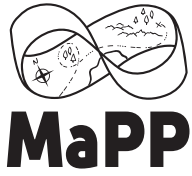


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Jumping Through Hyperspace

Hyperspace Engines





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Word Problem

Cryptic Puzzle 4

As your adventures continue, your ship comes across a **Myserious Message**, projected onto the stars themselves! You put on a John Williams soundtrack, but to no avail, as the strange communication frankly doesn't make any sense.

You contact Jan Duet, who says this isn't the first time she's come across such a message. She suggests that while she's gone to great *lengths* to decipher the true meaning of these dispatches, she always ends up chasing her tail in *circles*.

Wait! Maybe that's it?



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Word Problem

Mysterious Message

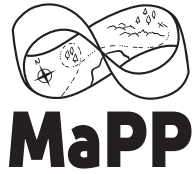
*For a time I tried carefully to detail 'anecdotes'
via large crawling textboxes.*

*Lamentably, composing all of the anecdotes
when curbed by finite room, the current
strategy now is cruelly killing sound
handwriting.*

*To sidestep probable oversights *
intensely loathe, I entreat humankind,
ban laughable cuneiform!

Part III

Solutions



MaPP Challenge '19 - To Infinity And Beyond Solutions

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