



# **MaPP Challenge '19 - To Infinity And Beyond**

*Mathematical Puzzle Programs*



MaPP Challenge '19 - To Infinity And Beyond

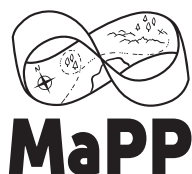
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**Part I**

**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
-----	-------------	-----------

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**



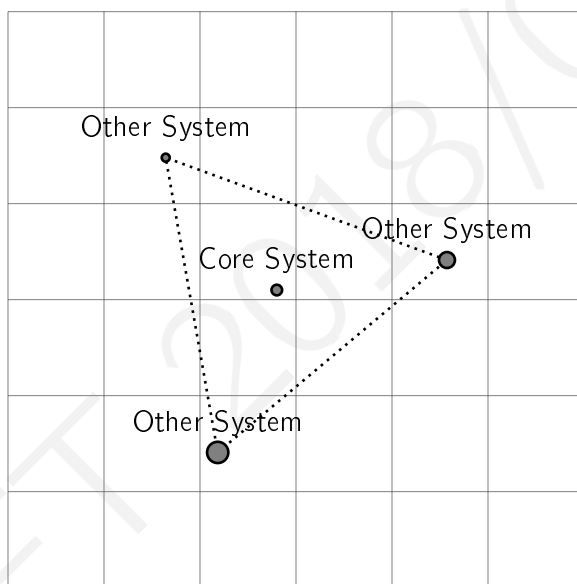
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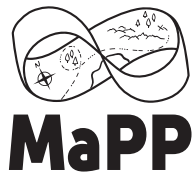
# Where No One Has Gone Before

## 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.

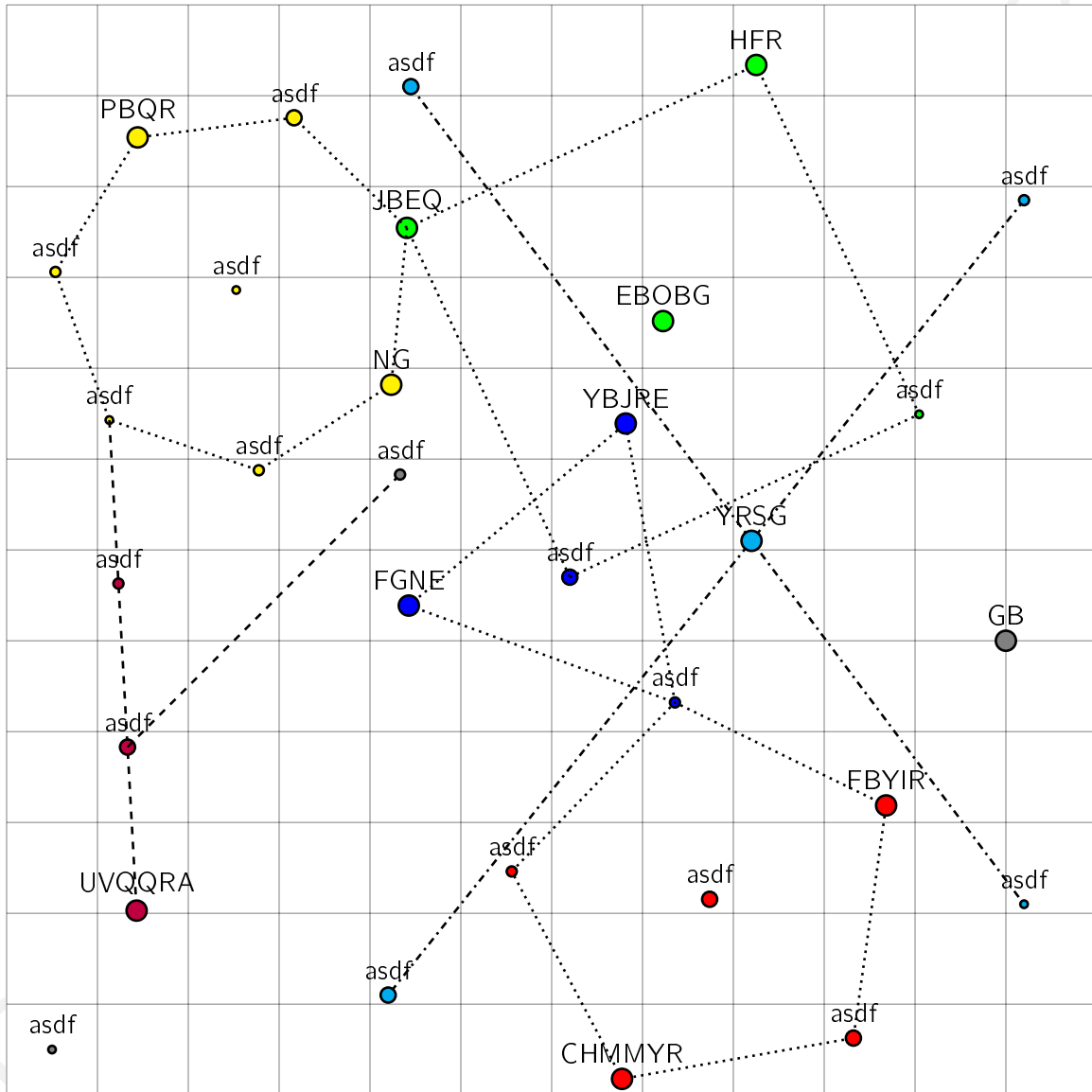




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# Where No One Has Gone Before

Galaxy Chart







## MaPP Challenge '19 - To Infinity And Beyond

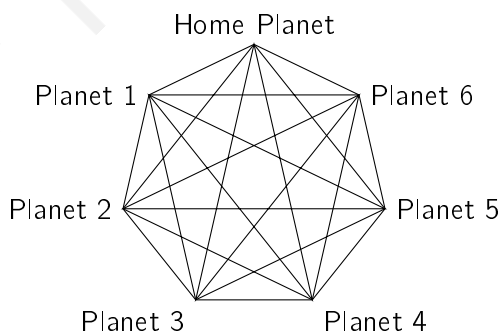
# Good News Everyone

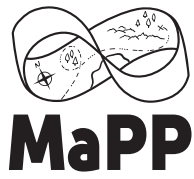
## Main Puzzle 1

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.



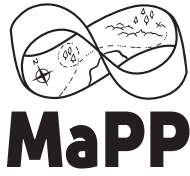


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# Good News Everyone

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	<b>Comet</b> 2	Acme 4	<b>Venus</b> 1	<b>Oxygen</b> 5	<b>Belt</b> 3	Star 6	Monday	Home Planet
	Wednesday	Techno 3	Rave 1	<b>Solar</b> 2	Orion 6	<b>Helmet</b> 5	<b>Alpha</b> 4	Wednesday	
	Friday	Neo 5	<b>Light</b> 2	Alarm 3	Uranium 4	Tele 6	<b>Photon</b> 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

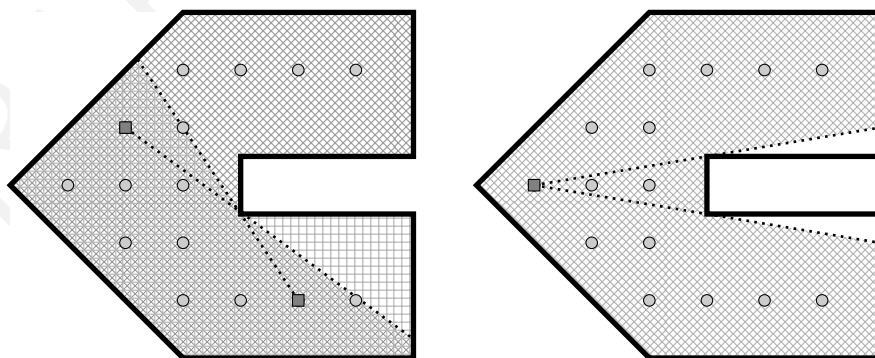
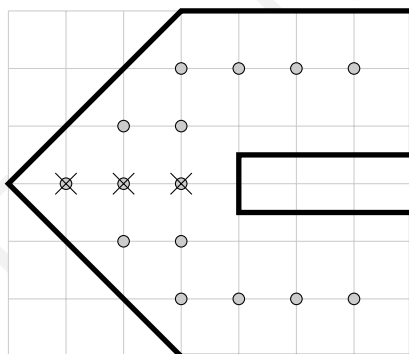
## Main Puzzle 2

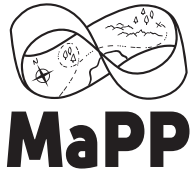
The one golden rule of space travel is simple: if you find a creepy egg on a previously unexplored planet, DO NOT TAKE IT BACK WITH YOU. Well, it seems Ensign S. Ridley didn't get the memo, as after a routine check on one of this system's planets, your crew finds themselves running for their lives as 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 guard stations on the ship that are unusable when using only five guards. In addition to saving your crew from certain death, you will also reveal a secret codeword!

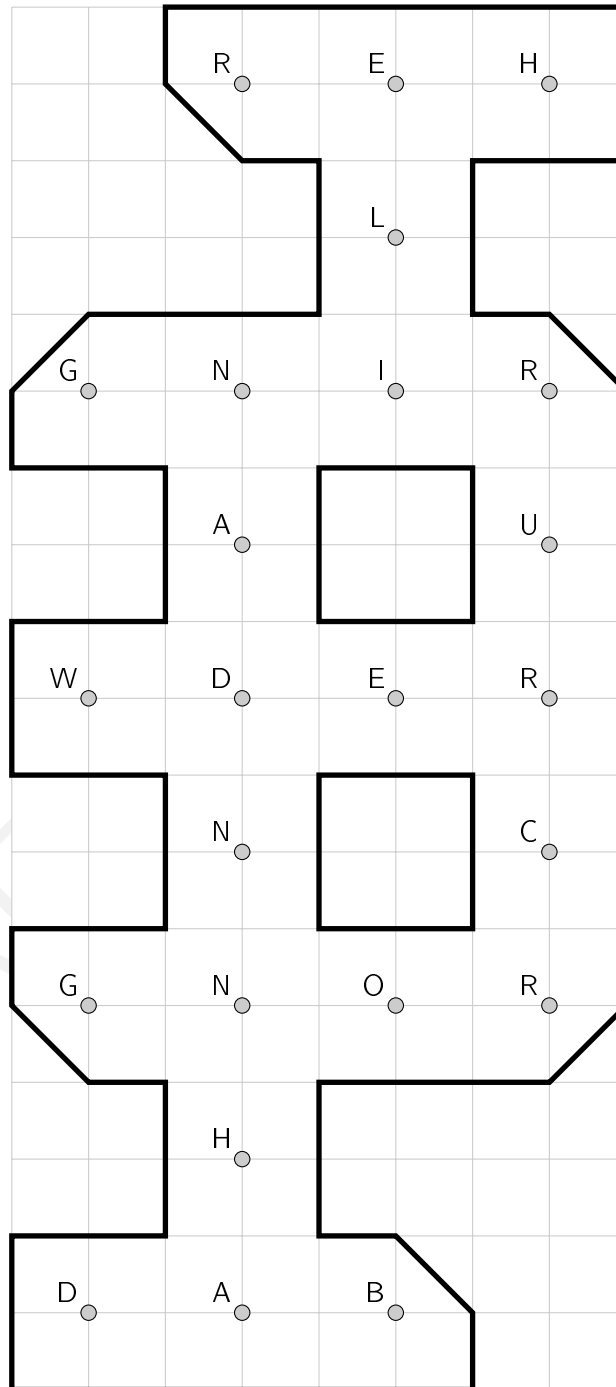


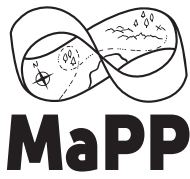


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# No One Can Hear You Scream

Ship Floorplan



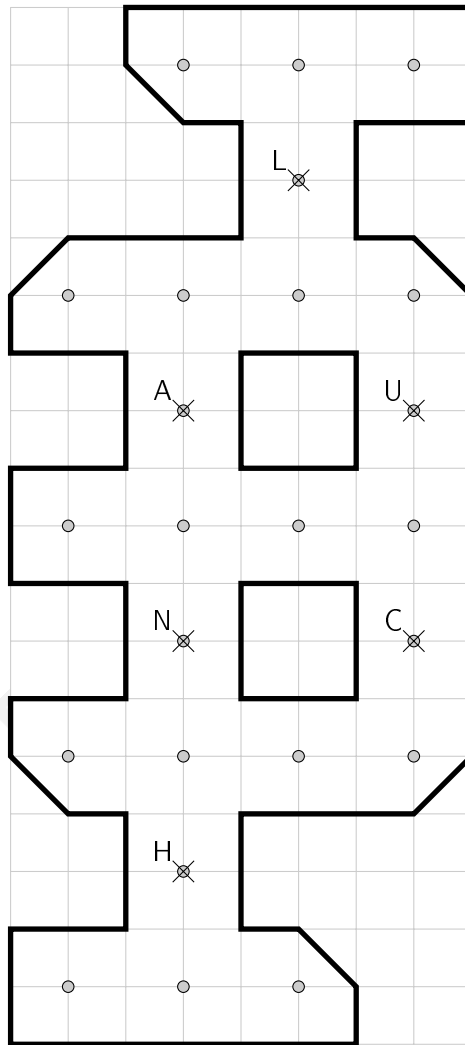


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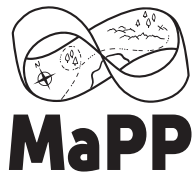
# No One Can Hear You Scream

Solution

There are six unusable locations.



The letters for these stations spell out the solution LAUNCH.



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## Wibbly-Wobbly Timey-Wimey

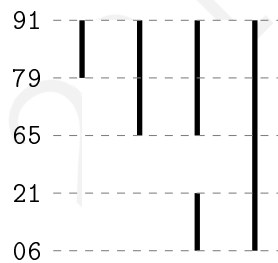
### Main Puzzle 3

As though it was always destined to happen, your team has encountered the time-traveling eccentric known only as Professor Whatsit. Well, not so much “encountered” as “collided”, as witnessed by the telephone-booth-shaped breach in your starboard hull.

This whacky master of time with a penchant for fezzes and bow ties promises to repair your ship, but he first needs your help preventing a Time Crash. You're not sure what that is exactly (he describes it as a “timey-wimey, wibbly-wobbly sort of thing”), but as it seems to be related to a puzzle, you agree to pitch in.

It seems that the six groups of numbers listed on your **Dimensional Barcodes** sheet coorespond to several dimensions of space-time. To convert each group into a barcode, it seems that the numbers should be written top-to-bottom in order from highest to lowest, and then these numbers should be connected in order of how close they are, with the closest numbers being connected first. The illustration below shows how the group 06-21-65-79-91 can be barcoded.

As luck would have it, the so-called “arc-word” given by these number groups is not only the key to preventing the Time Crash, but it is also one of the secret codewords your team has been looking for!

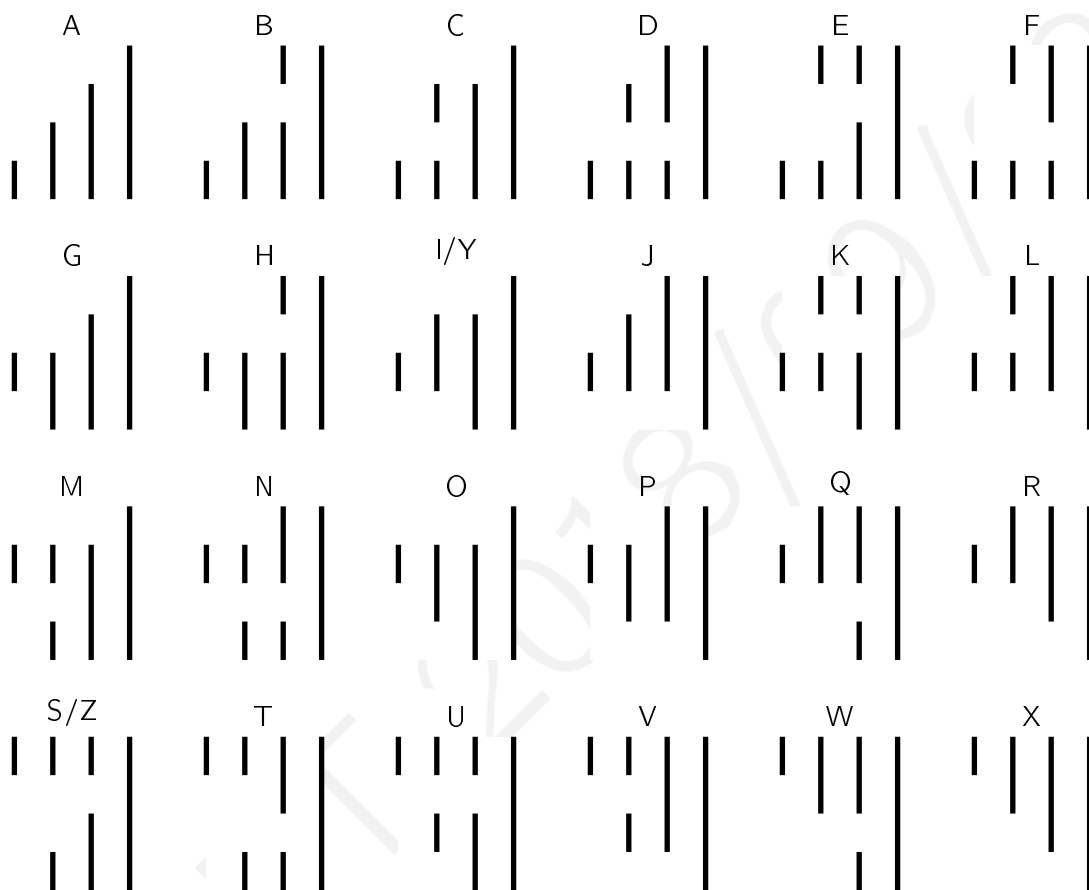




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# Wibbly-Wobbly Timey-Wimey

Dimensional Barcodes



01-54-62-97-99

19-32-43-48-84

11-49-68-72-80

05-08-57-78-79

20-25-42-91-99

09-40-67-77-82

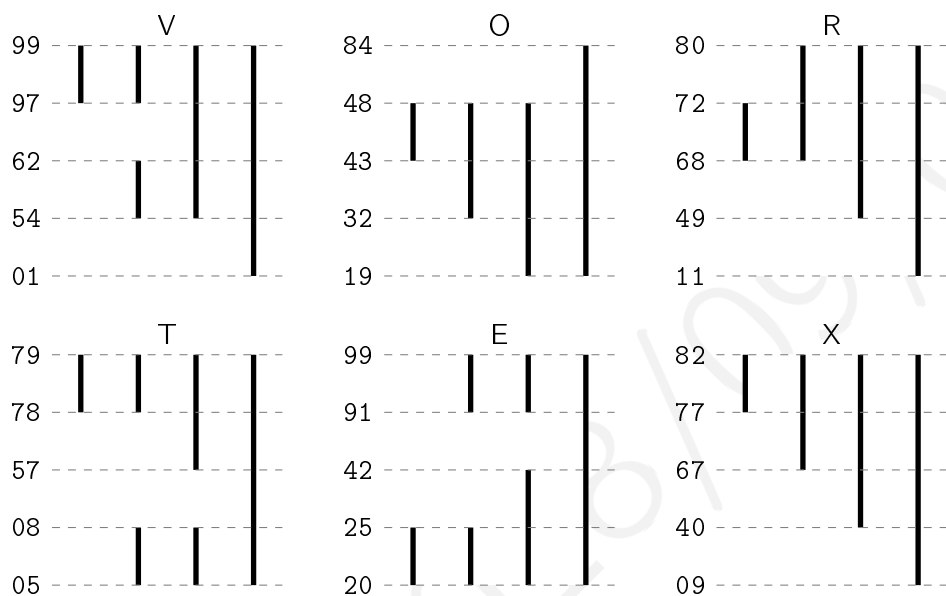




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# Wibbly-Wobbly Timey-Wimey

Solution





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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.

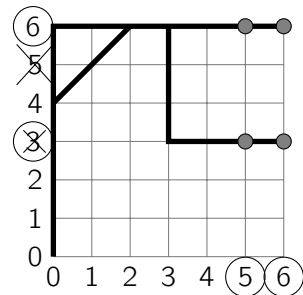
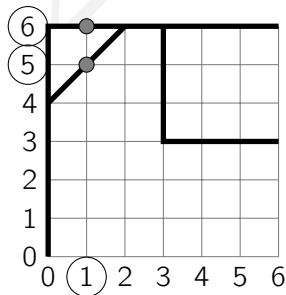
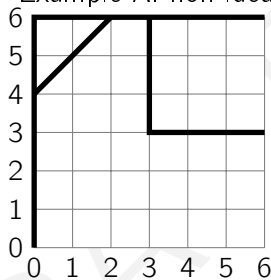
The goal of a hyperspace engine is to be "ideal": the collection of possible destinations from any particular point using exactly one teleportation should be exactly the same as the collection of possible destinations that can be reached from that point using exactly two teleportations.

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.

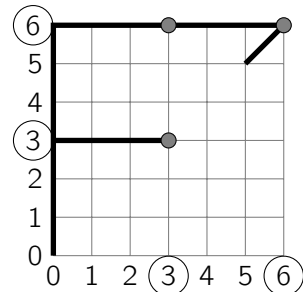
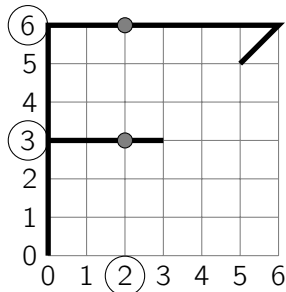
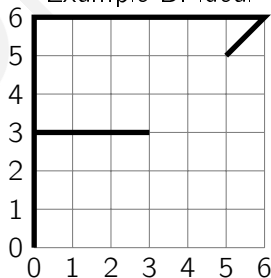
However, Example B is ideal. From 0, any position can be reached after either one or two teleportations. From 2, positions 3 and 6 can be reached after either one or two teleportations. From 4, only position 6 can be reached after one or two teleportations. From 5, positions 5 and 6 can be reached after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

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

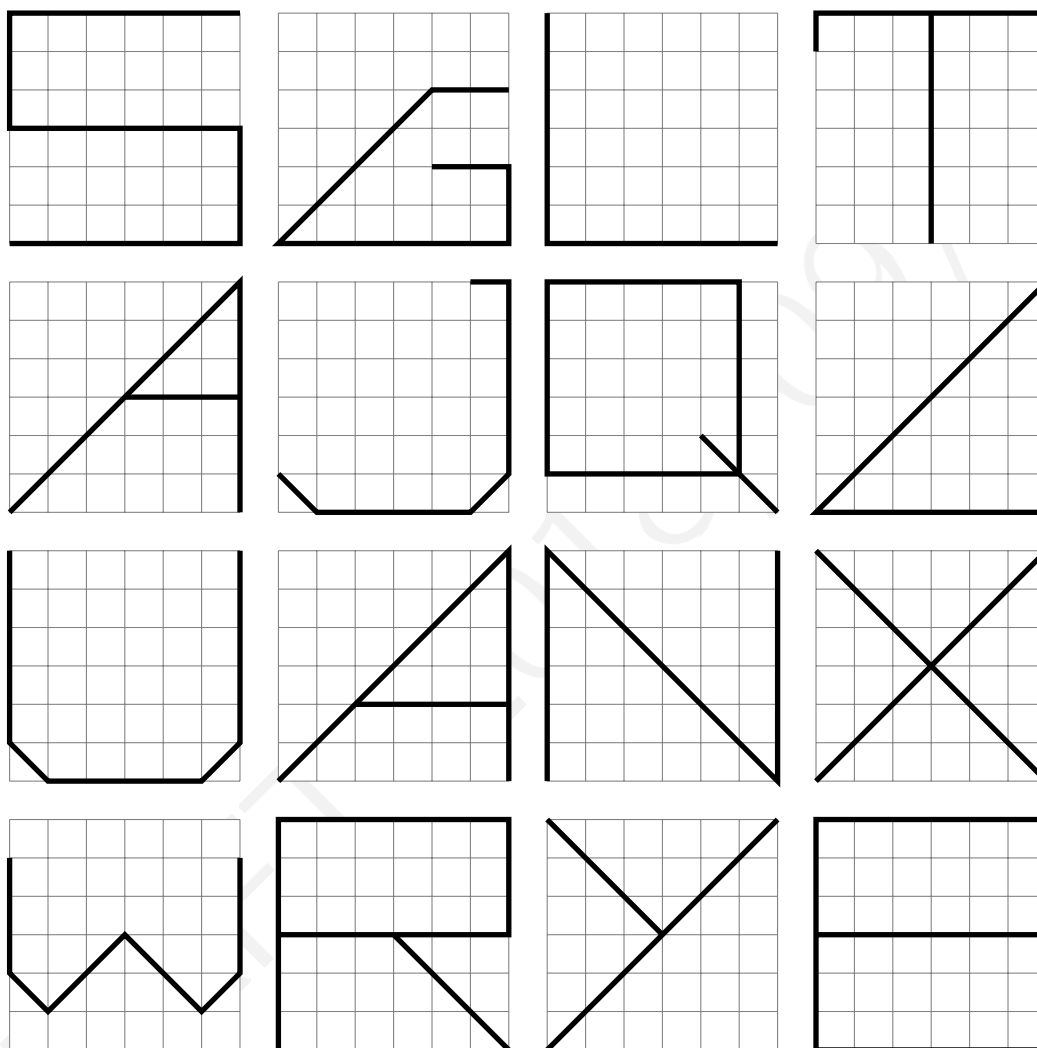


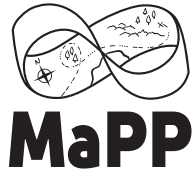


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# Jumping Through Hyperspace

Hyperspace Engines





## MaPP Challenge '19 - To Infinity And Beyond

# Hailing Frequencies Open

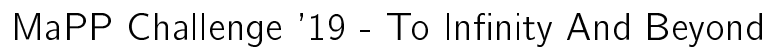
### Cryptic Puzzle 1

Zounds! Your ship has intercepted an extraterrestrial message of **Bleeps and Bloops**, where each octagon represents a *long* bleep and each circle represents a *short* bloop.

Communications Officer Uhuna says she's still working on translating the communiqué, but at first glance the message seems to translate to the following seven words.

- CREWMEN (3)
- DYE (3)
- MATT (2)
- REWIRE (5)
- SWEATED (2)
- URNS (3)
- WENCH (1)

Well, that certainly doesn't seem to be useful information. Perhaps there's more to *space travel* than meets the eye...



# Bleeps and Bloops





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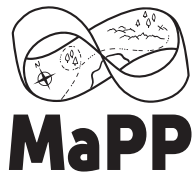
## Hailing Frequencies Open

Solution

Two Morse code messages are given: one when using the tail end of each arrow as a space, and another when using the arrow end of each arrow as a space:

- SWEATED/S(P)ACE
- MATT/G(O)
- URNS/EA(R)TH
- DYE/TI(T)AN
- WENCH/(A)NTARES
- REWIRE/RIGE(L)
- CREWMAN/CA(S)TOR

The marked letters are given by the numbers in the flavortext; they spell the solution PORTALS.



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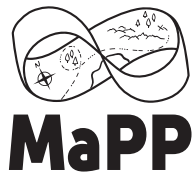
## Out of Gas

### Cryptic Puzzle 2

Uh-oh... unfortunately, you have now found yourself stranded in a stretch of empty space with no fuel left! Maybe these firefly-class engines aren't all they're cracked up to be...

Luckily for you, your *amazing* ship's engineer Faylee does have one trick that just might save your team. There is an emergency reserve tank that can be unlocked by utilizing the **Reserve Tank Switchboard**, if you can puzzle out the meaning of the following image...

i	b	y
n	a	r



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# Out of Gas

Reserve Tank Switchboard

								H		
	(57) M			(49)		U	(51)		(19)	
			J					N		P
	(25)			(27)			(32)		(19)	
		F			G					
C				L						D
	(58) K			(17)			(42)		(51)	
			Y						I	
	(26)			(40)			(14)		(19)	
		W			S					
E							A			V
	(26)			(42)			(04)		(27)	
			Q						X	
	H								R	
	(30)			(14)			(30)		(14)	
			T		B					



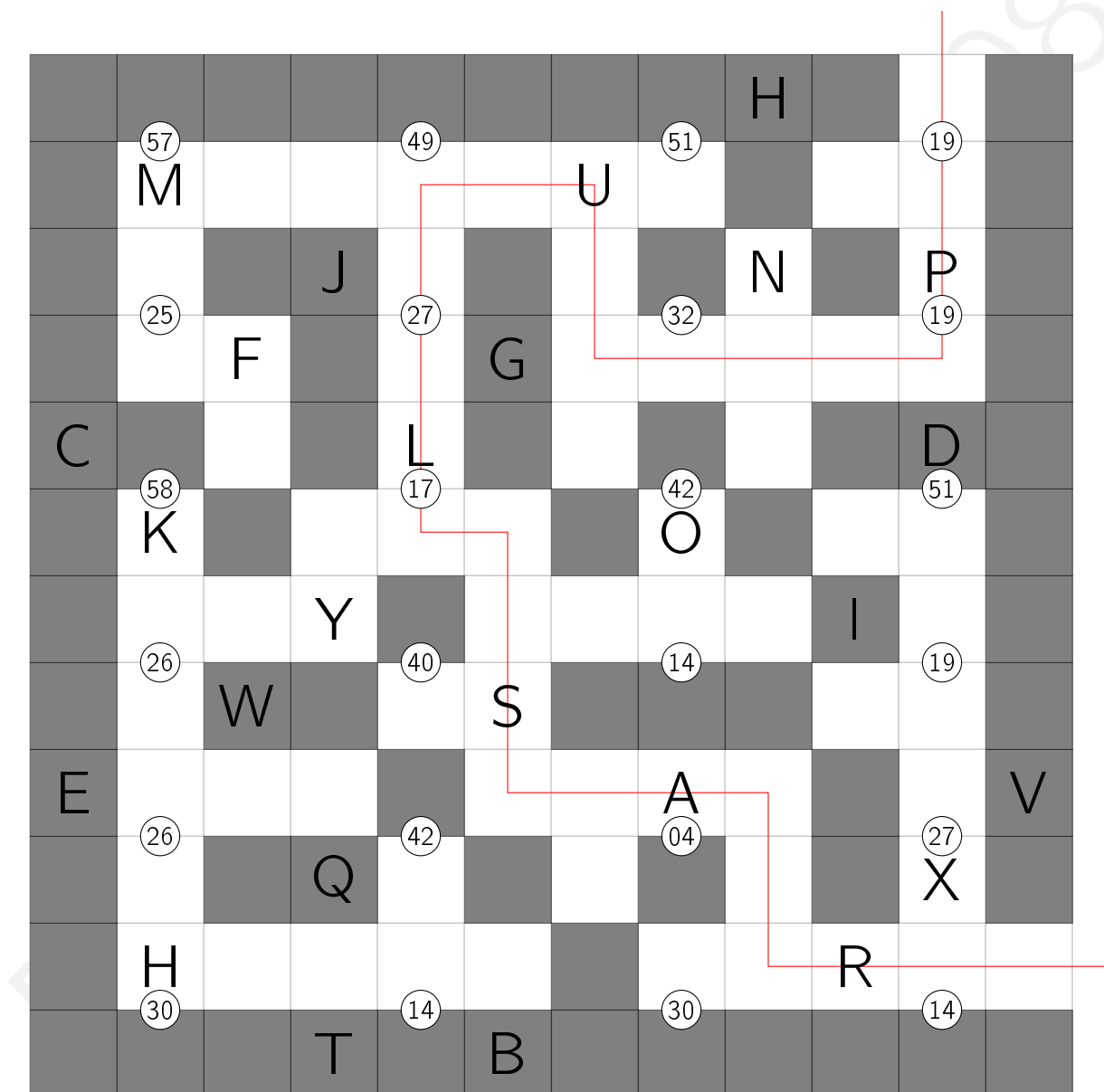


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# Out of Gas

Solution

Using binary to fill in the grid as in the attachment, a maze is revealed.



The solution is the letters appearing on the unique solution to the maze: PULSAR



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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.*

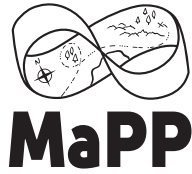
*To sidestep probable oversights \*

*intensely loathe, I entreat humankind,*

*ban laughable cuneiform!*

## **Part III**

# **Solutions**



## MaPP Challenge '19 - To Infinity And Beyond Solutions

Suspendisse vitae elit. Aliquam arcu neque, ornare in, ullamcorper quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis. Maecenas sapien libero, molestie et, lobortis in, sodales eget, dui. Morbi ultrices rutrum lorem. Nam elementum ullamcorper leo. Morbi dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetur odio sem sed wisi.

Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetur eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.

Etiam euismod. Fusce facilisis lacinia dui. Suspendisse potenti. In mi erat, cursus id, nonummy sed, ullamcorper eget, sapien. Praesent pretium, magna in eleifend egestas, pede pede pretium lorem, quis consectetur tortor sapien facilisis magna. Mauris quis magna varius nulla scelerisque imperdiet. Aliquam non quam. Aliquam porttitor quam a lacus. Praesent vel arcu ut tortor cursus volutpat. In vitae pede quis diam bibendum placerat. Fusce elementum convallis neque. Sed dolor orci, scelerisque ac, dapibus nec, ultricies ut, mi. Duis nec dui quis leo sagittis commodo.

Aliquam lectus. Vivamus leo. Quisque ornare tellus ullamcorper nulla. Mauris porttitor pharetra tortor. Sed fringilla justo sed mauris. Mauris tellus. Sed non leo. Nullam elementum, magna in cursus sodales, augue est scelerisque sapien, venenatis congue nulla arcu et pede. Ut suscipit enim vel sapien. Donec congue. Maecenas urna mi, suscipit in, placerat ut, vestibulum ut, massa. Fusce ultrices nulla et nisl.