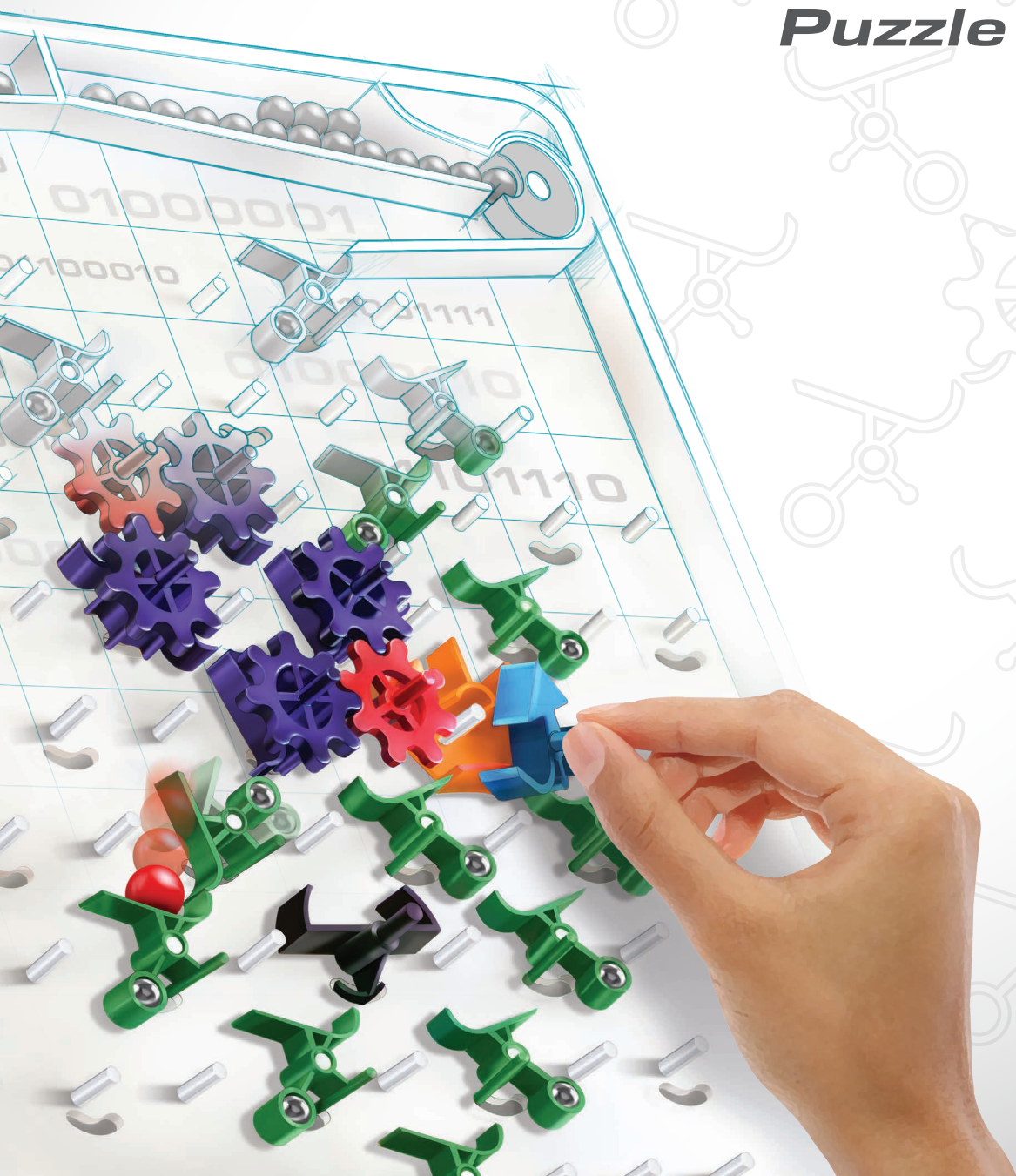


TURING TUMBLE™

Puzzle Book



Curious about the name, “Turing” Tumble?

Check out page 110.

Created by [Paul and Alyssa Boswell](#)

Illustrated by [Jiaoyang Li](#)

Box art by [Mackey Creative Brand & Strategy \(mackeycreative.com\)](#)

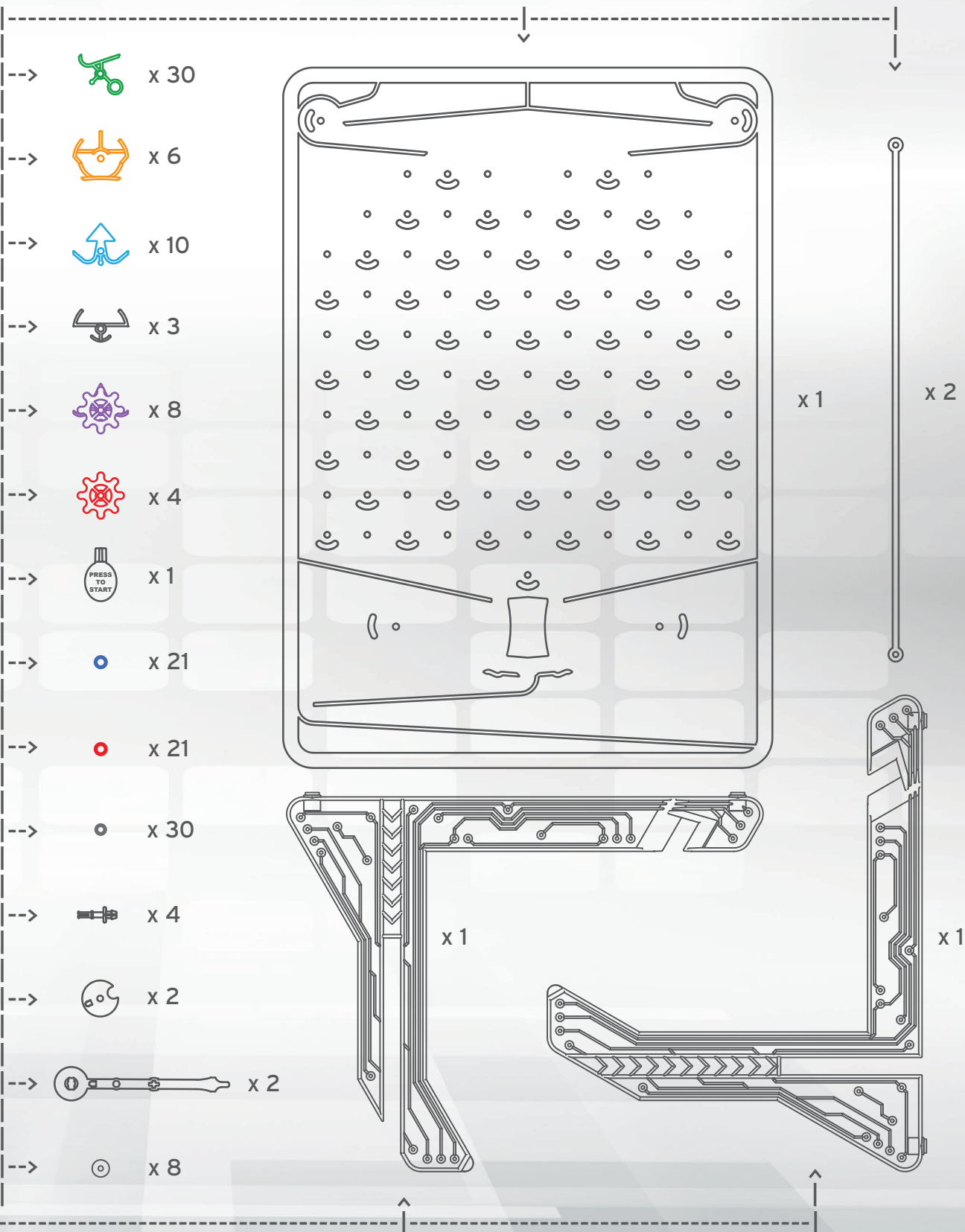


Upper Story Ltd, 2023



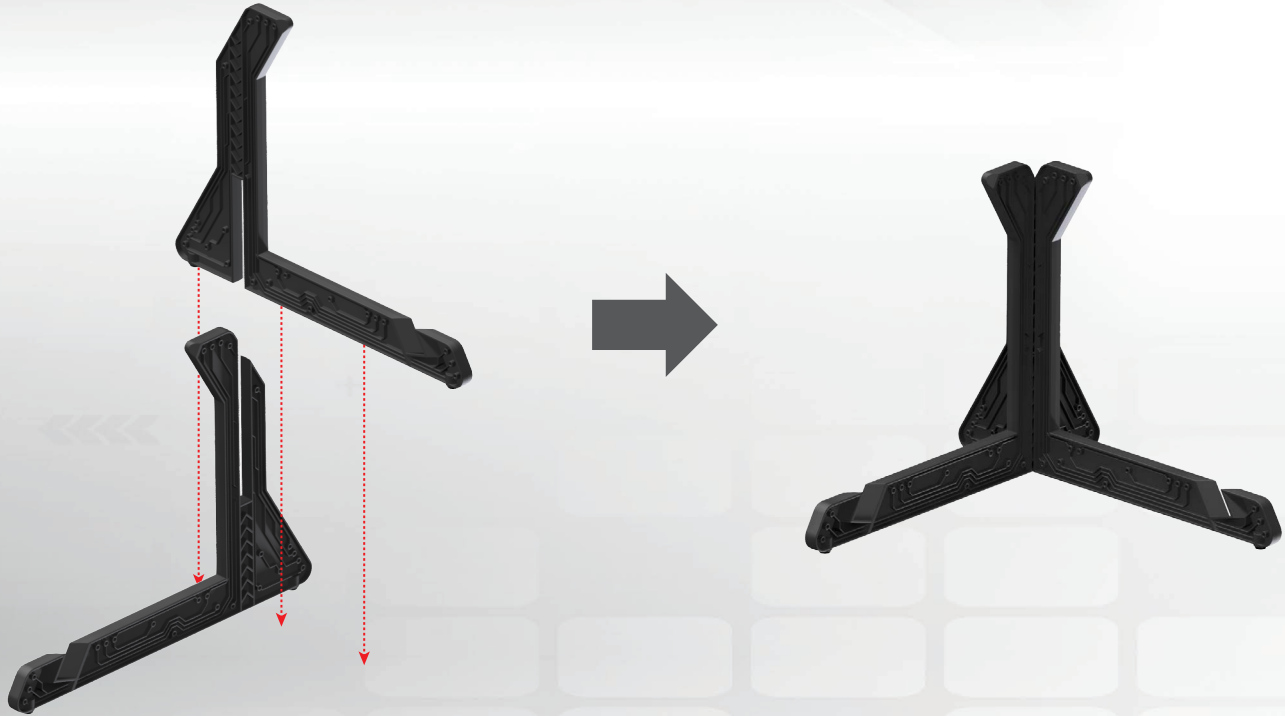
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SYSTEM REQUIREMENTS



ASSEMBLY INSTRUCTIONS

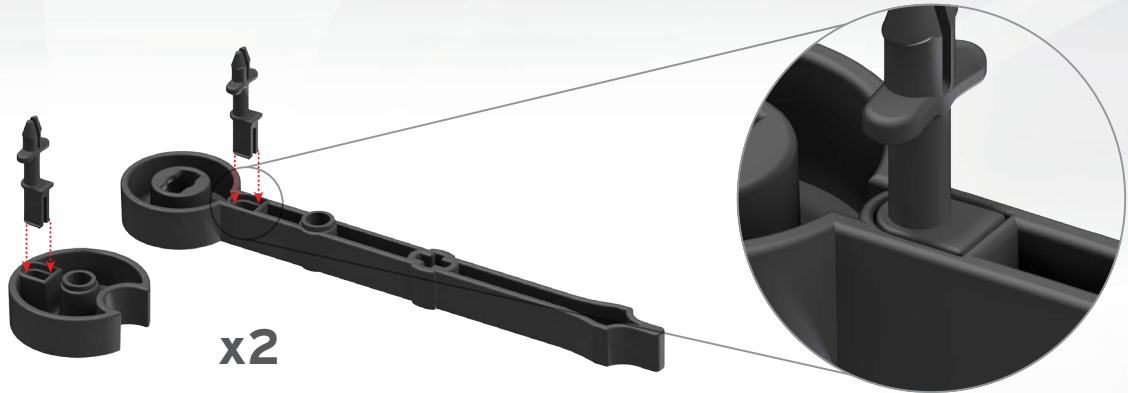
=> **Step 1:** Slide the two board supports together.



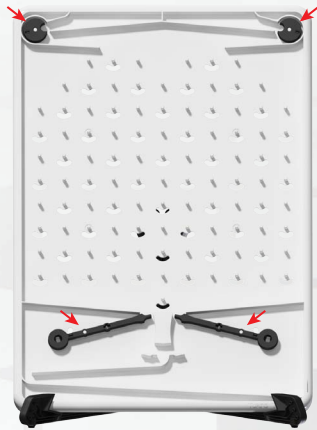
=> **Step 2:** Place the board onto the supports. If it doesn't fit, take the board supports apart, rotate one of them 180 degrees, and slide them back together again.



=> **Step 3:** Insert the 4 small pegs into the back side of the 2 levers and the 2 marble releasers. Make sure the peg is facing the correct direction when you snap it in (round side to round side, flat side to flat side).



=> **Step 4:** Put the assembled levers and marble releasers in their places on the board.



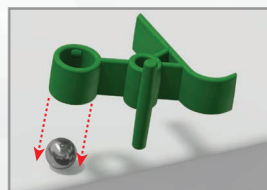
=> **Step 5:** Snap the connectors into place behind the board.



=> **Step 6:** Snap a blue marble into the left lever and a red marble into the right lever.



=> **Step 7:** Snap a small metal marble into each of the 30 green ramps. To save your thumbs, put a marble on the table and then push a ramp onto it.



x30

=> **Disassembly:** When you are finished playing, do not disassemble the board. Simply return the board supports to the top tray and set the assembled board on top of it, on its back.

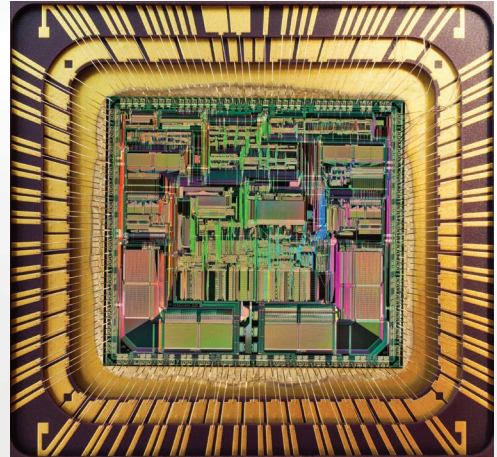
README.1ST

You are about to enter the hidden, inner world of computers.

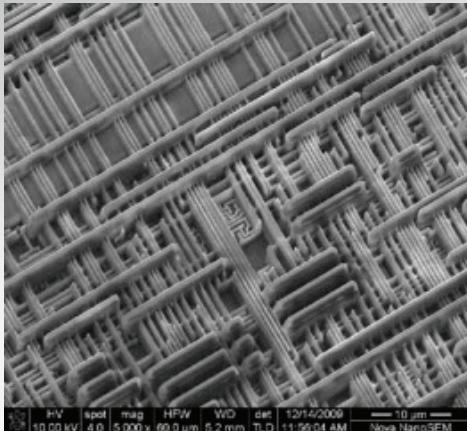
The part nobody sees, deep inside - where the true magic happens.

Remove the hard, opaque shell of a computer chip and you'll find a device full of ingenious logic and astonishing creativity. Chips are made of a multitude of tiny switches called transistors, which are formed at the interface of various materials layered on the surface of silicon.

They aren't mechanical switches like we're used to seeing – there are no moving parts. These switches are controlled by electrons: Push electrons in the side and the main flow of electrons through the switch is cut off. Stop pushing electrons and the flow resumes.



The inside of this chip looks colorful because its features are similar in size to visible light.¹



The switches themselves are interesting, but it's the clever ways the switches are connected together that make a computer smart. Over the next 60 puzzles, you'll discover how simple switches can be connected together to do surprisingly smart things. Though the switches are mechanical instead of electrical, there's theoretically no limit to what you can create with them.

Transistors are formed at the interface of certain materials. Using electron beams instead of light, we can see the tiny metal wires connecting the transistors underneath.²

To learn more about how computers work, visit www.upperstory.com/turingtumble.

Enjoy your journey!

¹Photo of a decapped Motorola 68040 processor by Gregg M. Erickson

²Used with permission from DELTA Microelectronics (<https://asic.madebydelta.com/>)

THE
ADVENTURE
BEGINS...



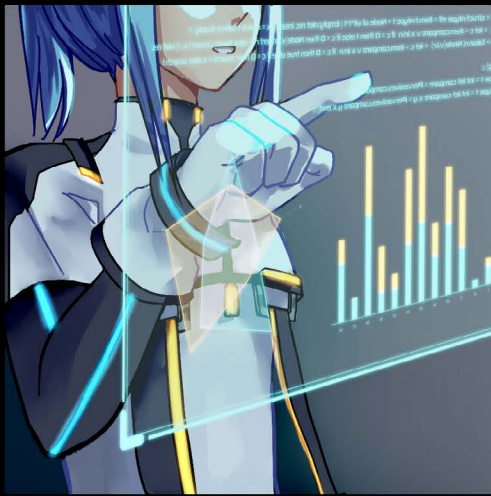
It took Alia three long weeks to reach the Pulsar nebula where she was sent to repair one of Deep Space Industry's communications satellites. The satellite was orbiting a small, barren planet named Eniac. These satellites were **incredibly complicated** and Alia was the only engineer skilled enough to repair them.

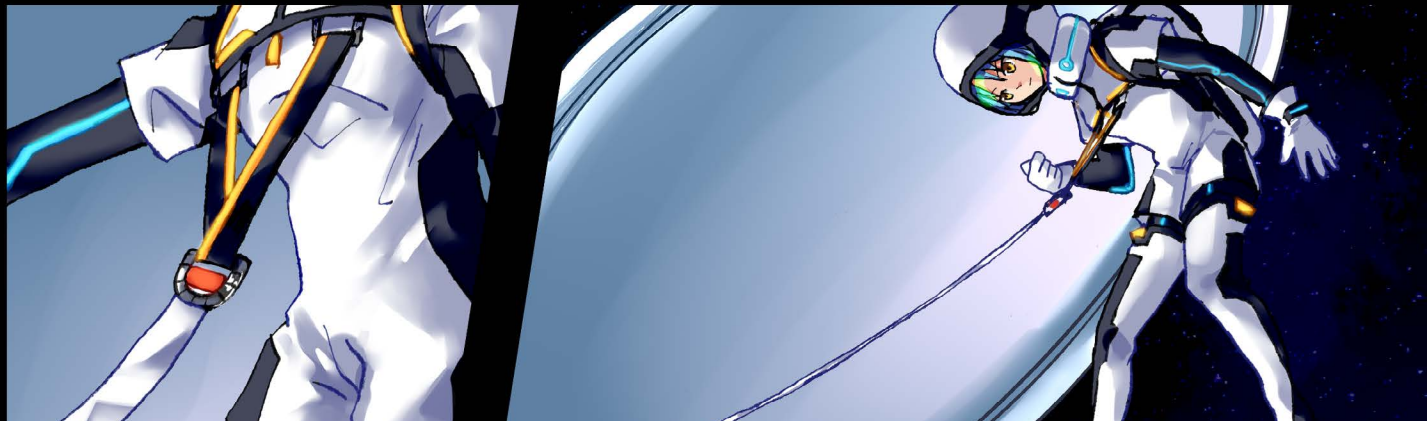
Ever since Alia was a little girl, she'd always dreamed of becoming a **space engineer**. She loved to create new things and she was **fascinated by science**. She also loved **adventure**. Space engineers had the chance to meet other life forms and explore far-off places.

Alia's only companion on the mission was R.E.N., a helper bot Alia built to help with the repair. The bot ran an **artificial intelligence system** Alia coded herself. It was one of the best, but like all AI systems of the time, it just wasn't very...well...intelligent.

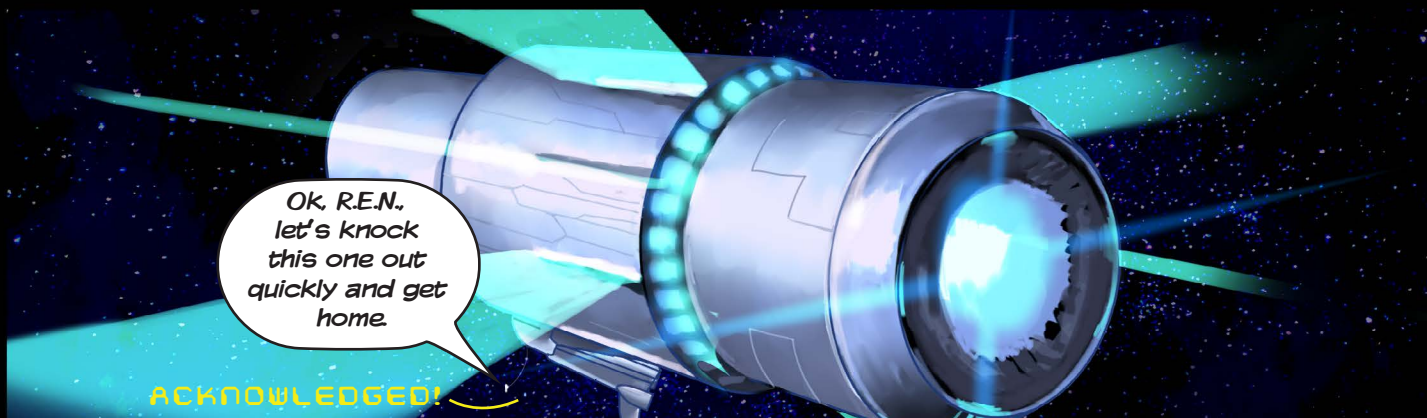


What was missing? Alia spent years searching for the solution. In fact, she pondered this very question as she and R.E.N. prepared to exit their ship and repair the broken satellite.





Tethered to her ship, Alia leaped out of the airlock, floated through nothingness, and landed gracefully on the surface of the satellite. That was always her favorite part. R.E.N. followed.



Unfortunately, the helper bot's flawed AI took her literally. It fired its aft thrusters at full throttle and slammed into the side of the satellite. Alia dodged as twisted pieces of metal flew past her. She'd have to fix the satellite manually - without R.E.N.'s help.

5 HOURS LATER



Alia was relieved that the satellite was repaired, but she couldn't shake her disappointment in the AI she built for R.E.N. She'd have to start from scratch, but this time she'd--



WARNING:
SHIP'S HULL IS
OVERHEATING

OVERHEAT WARN

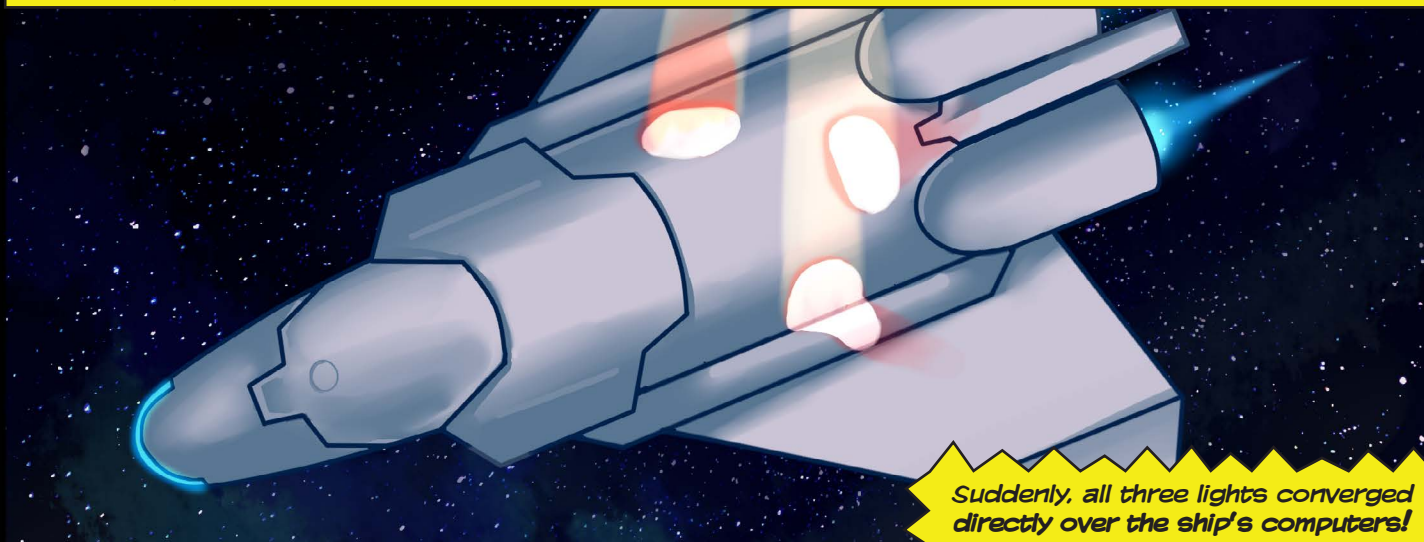


Huh? Are
you su--



Loud warning beeps from R.E.N. startled Alia out of her thoughts.

Still on the surface of the satellite, Alia turned to look at her ship, which was engulfed in white light. Alia squinted to see three beams of blindingly bright light focused on her ship, leaving red hot trails behind them as they moved across its surface.



Suddenly, all three lights converged directly over the ship's computers!



Come on, R.E.N.!
We need to get
back to the
ship, FAST!

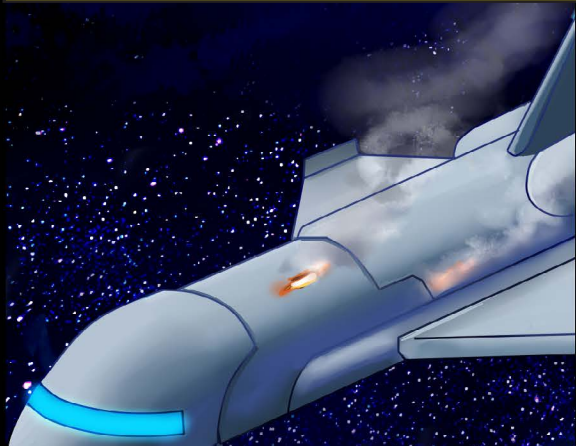
The emergency return winch strained as it yanked Alia back to the ship at top speed.



She threw herself into the ship's airlock, not sure what damage she would find inside her ship.



The beam of light melted a hole through the ship's hull and disappeared as quickly as it came.



Phew!
We made it
back. What was
that?



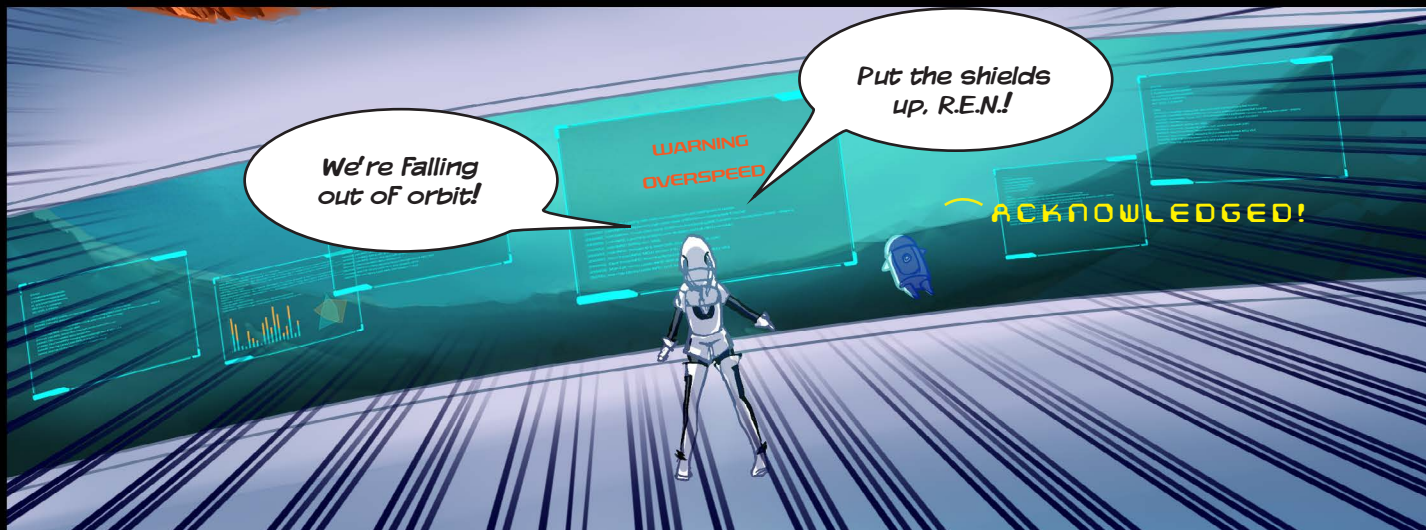
The
radiation shield
is compromised!
The ship's computers
scramble under
radiation!

Quick, R.E.N.!
Override the
navigation systems
before--

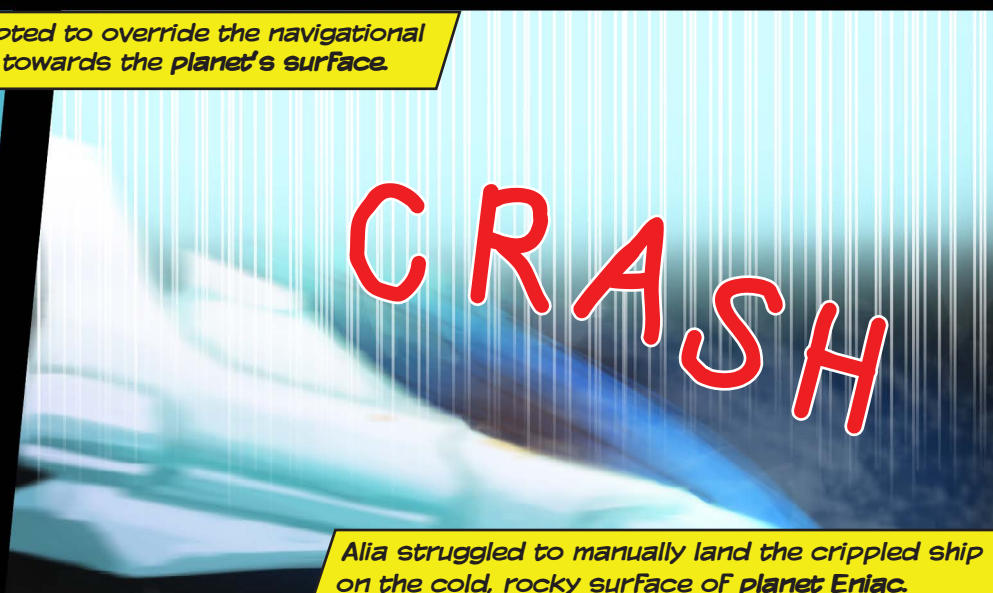
It was too late. The ship was off course and beginning to lose speed in the planet's thick methane atmosphere. It was falling out of orbit fast. Too fast.



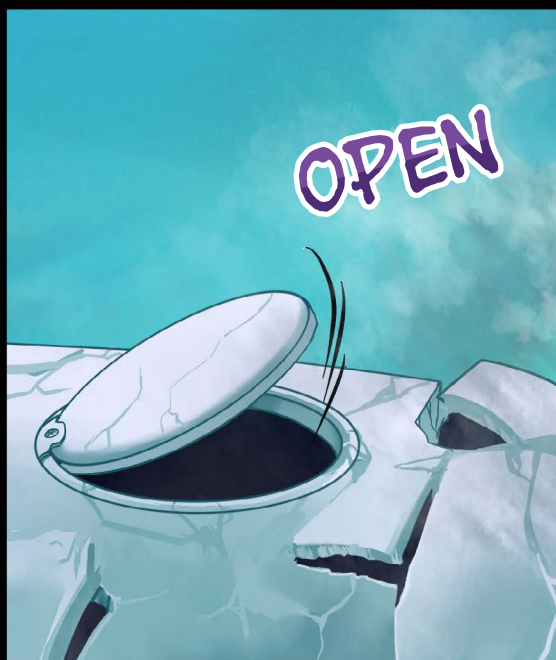
Hold on,
R.E.N.! We hit the
atmosphere!



With alarms blaring, Alia attempted to override the navigational computers as the ship dove towards the planet's surface.



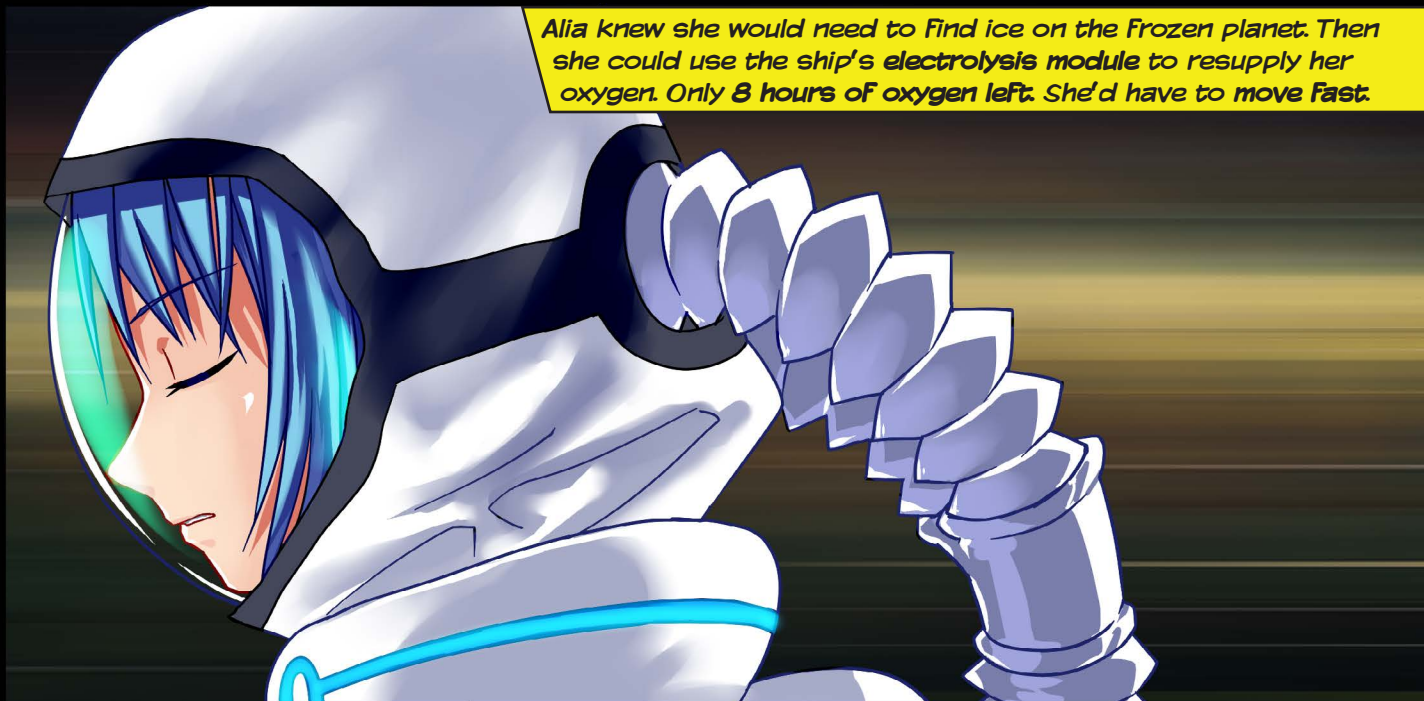
Alia struggled to manually land the crippled ship on the cold, rocky surface of planet Eniac.



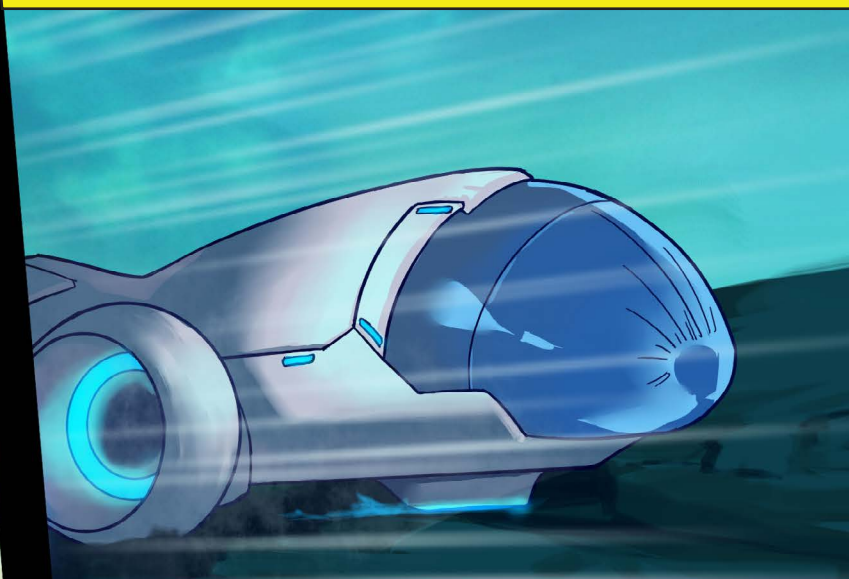
Alia turned her attention to her ship. The ship's computers were down, which meant no navigation and no communication. Life support was also down and...no oxygen!



Alia knew she would need to find ice on the Frozen planet. Then she could use the ship's electrolysis module to resupply her oxygen. Only 8 hours of oxygen left. She'd have to move fast.



Alia jumped in her hover speeder and scanned the planet's surface for signs of ice.

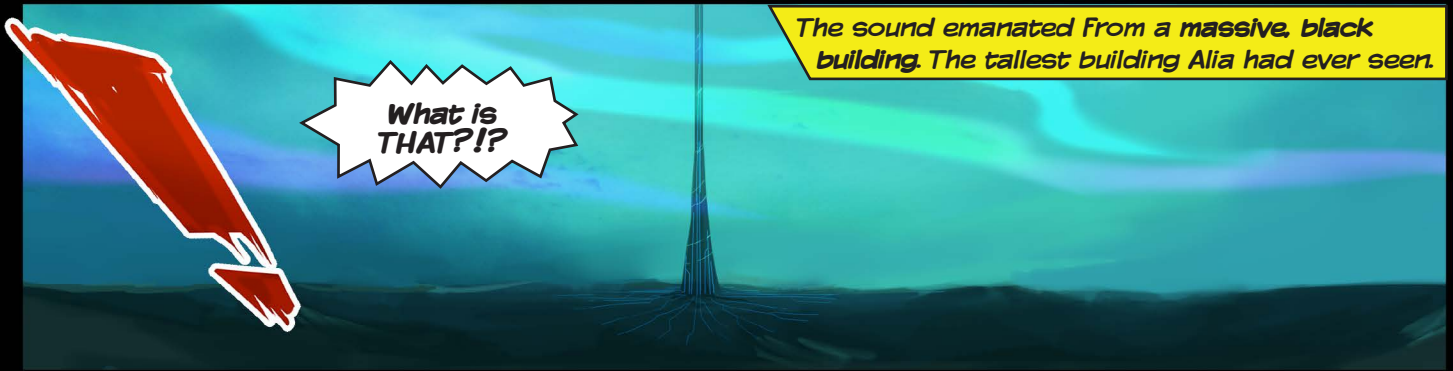


Alia searched and searched. One hour went by, but she found nothing but a rocky, barren surface. Another two hours passed. Still nothing. Alia began searching further and further away from her ship. Four more hours passed. ...



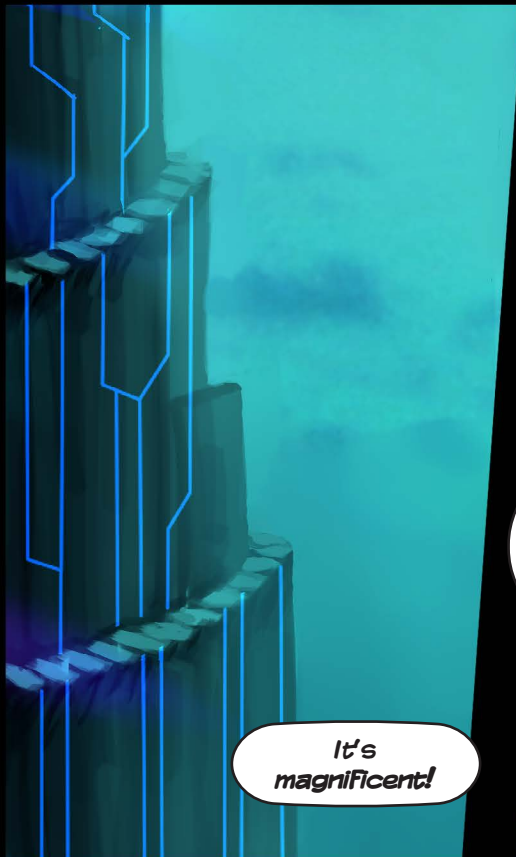
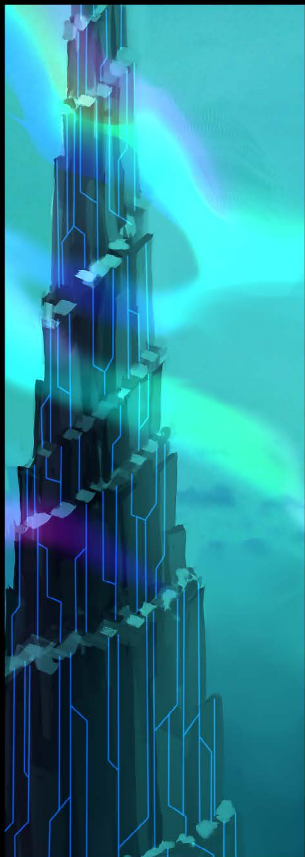


But that's not possible!
It's -76° outside! The water
should be frozen!



What is
THAT?!

The sound emanated from a massive, black
building. The tallest building Alia had ever seen.



It's
magnificent!



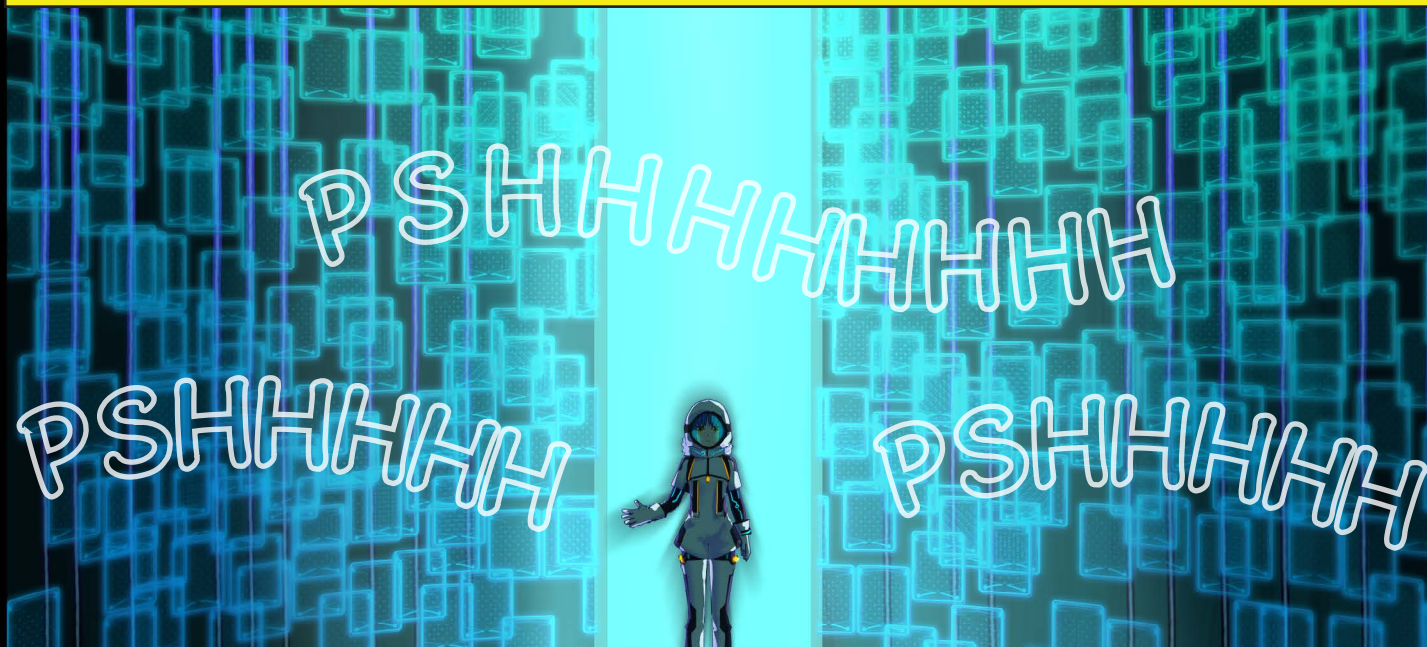
Where did it
come from? This
planet is supposed
to be uninhabited.



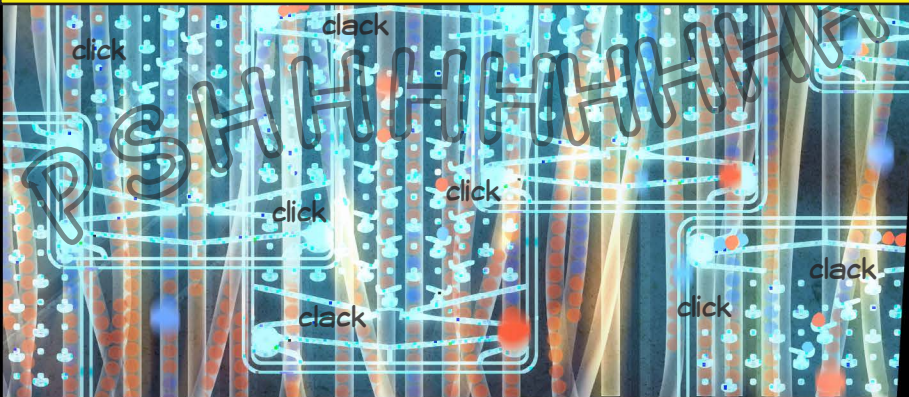
Alia reached out and touched the wall. As she did, a massive section of the wall slid open.



Inside, Alia saw that the walls were lined with millions upon millions of panels—stretching up as high as she could see and down deeper than she could make out in the darkness.



On closer look, Alia saw a complex cascade of small, metal marbles rolling across the surface of the panels, flipping a myriad of switches as gravity pulled the marbles downward.



Alia stood in awe amid the roar of billions of click-clacking marbles.



Marbles that reached the bottom were pushed to the top by a geothermal pump at the planet's core. Alia picked one up. The marble was still warm to the touch.

Hopelessness washed over Alia...



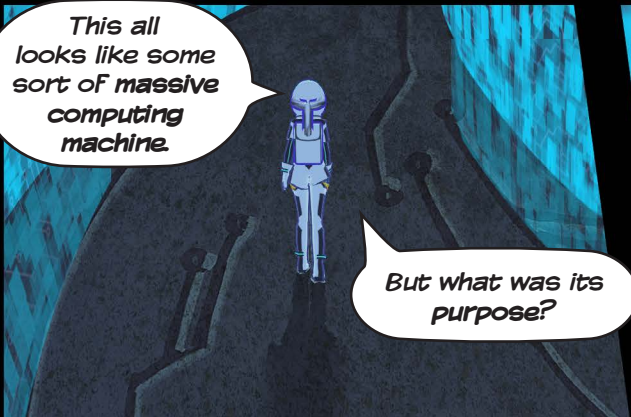
At this point, even if I found water, there wouldn't be enough time to return to the ship...

Alia summoned her courage.



I have 27 minutes of oxygen left.

That's 27 minutes to explore humankind's greatest discovery! Not a bad way to go.



This all looks like some sort of massive computing machine.

But what was its purpose?

Alia wandered a maze of hallways lined with panels from top to bottom. She drew shallow breaths to extend her oxygen...



Huh?



Alia stumbled across the remains of an alien being. It was a type of alien Alia had never seen before.

She tried to decode what she was seeing: **Intelligent life**, a massive, mechanical computer system...



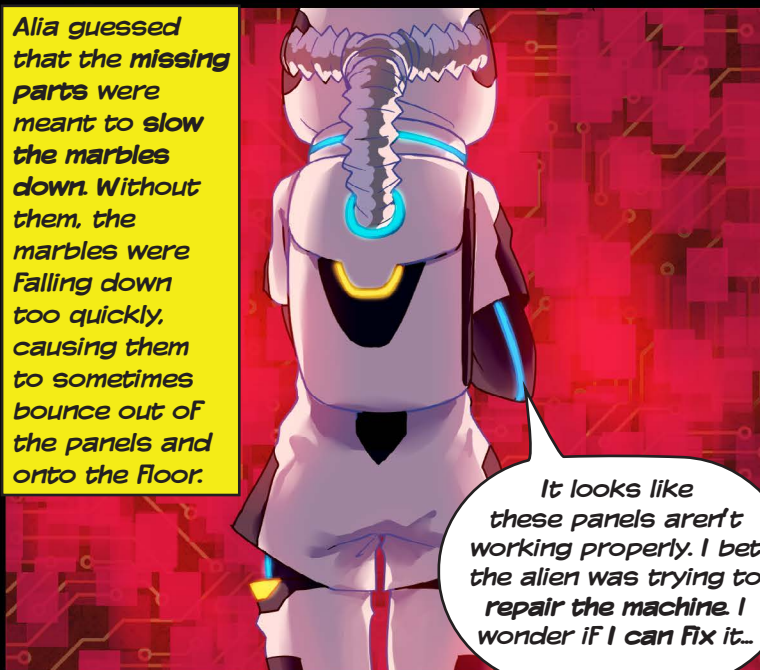
I suppose in this intense radiation, silicon-based computers couldn't function. All of this must have been their solution.



Was it trying to fix these panels?

Near the alien, marbles and parts were strewn about the floor. It looked as though they came from the panels above them.

Alia guessed that the missing parts were meant to slow the marbles down. Without them, the marbles were falling down too quickly, causing them to sometimes bounce out of the panels and onto the floor.



It looks like these panels aren't working properly. I bet the alien was trying to repair the machine. I wonder if I can fix it...


```
> output how_to_play.txg
```

```
>
```

```
> *****
```

```
>
```

How to play

```
> *****
```

```
>
```

```
> 1. Each challenge has an objective. You must create a  
machine that completes the objective.
```

```
>
```

```
> 2. To start the machine, you must press the start button  
down once:
```

```
>
```

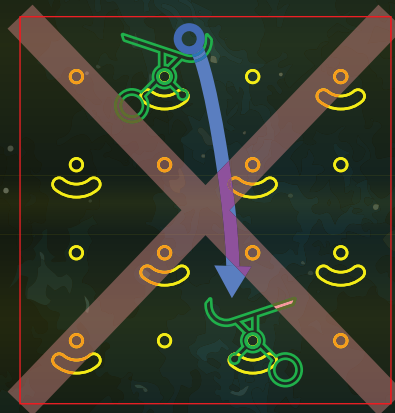


```
> 3. Once the machine is in motion, you cannot touch the  
machine or otherwise interfere with its operation.
```

```
>
```

```
> 4. Your machine cannot let marbles drop freely for any  
distance. See the example below:
```

```
>
```



Marbles cannot drop
freely



Marbles must pass directly
from one part to the next

```
> 5. Challenges start easy, but they become exceedingly  
difficult, even for a seasoned deep space  
telecommunications engineer.
```

```
> If you get stuck, take a break and come back to the  
puzzle later.
```

```
>
```

```
> _
```

```
> scan -external -challenge_1.pz1
```

```
>
```

```
> =====
> |                      Challenge 1: Gravity                      |
> |=====
```

```
>
```

```
> Objective: Make all of the blue marbles (and only the
> blue marbles) reach the end.
```

```
>
```

```
> Required output:
```

```
_____o o o o o o o o
```

```
> _
```

Starting Setup

Available parts



Ok, I built the starting setup,
and now it looks like I need to figure
out where to put these four ramps.
Hmmm...

Oh!
I know! They need to go
here, here, here, and here.

PRESS
TO
START


```
> scan -external -challenge_2.pz1
```

```
>
```

```
> =====
> |                      Challenge 2: Re-entry                      |
> =====
```

```
>
```

```
> Objective: Make all of the blue marbles (and only the
> blue marbles) reach the end.
```

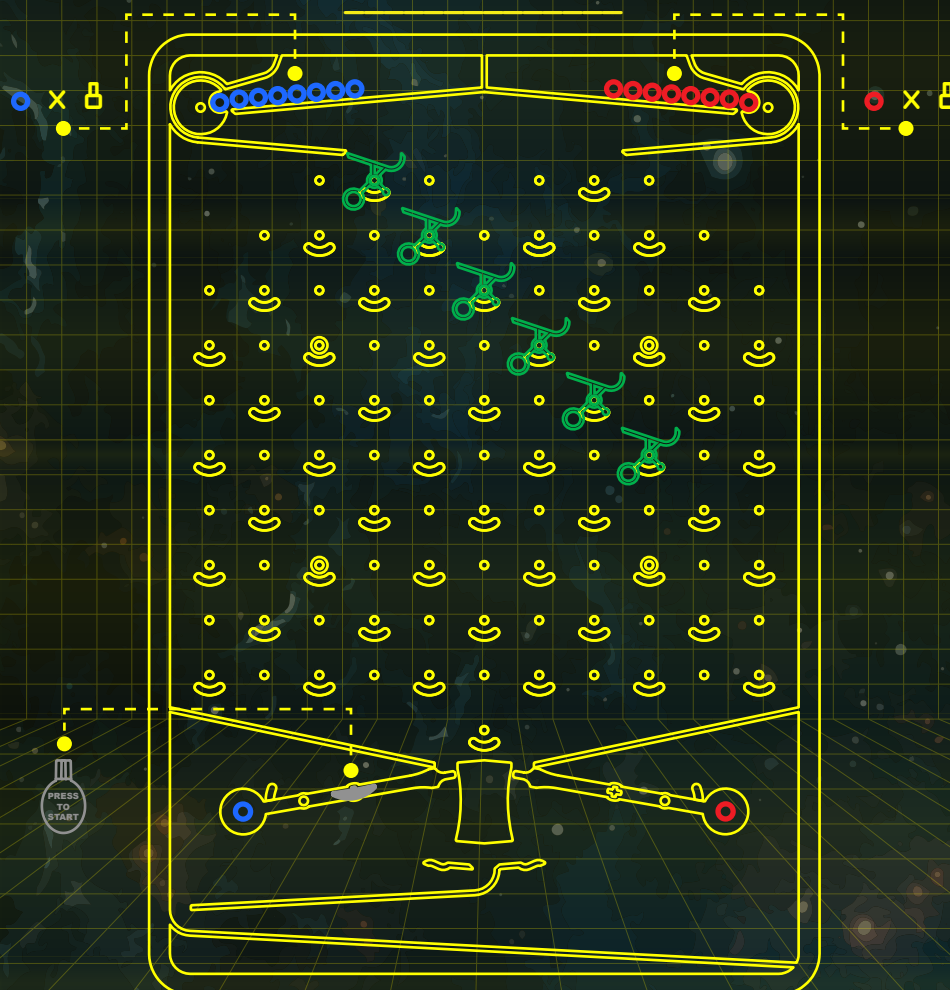
```
>
```

```
> Required output:
```

```
_____oooooooo
```

```
> _
```

Starting Setup



Available parts

 x 5



> scan -external -challenge_3.pzl

>

> =====

> | Challenge 3: Ignition |

> =====

>

> Objective: Release one blue marble and then all of the
> red marbles.

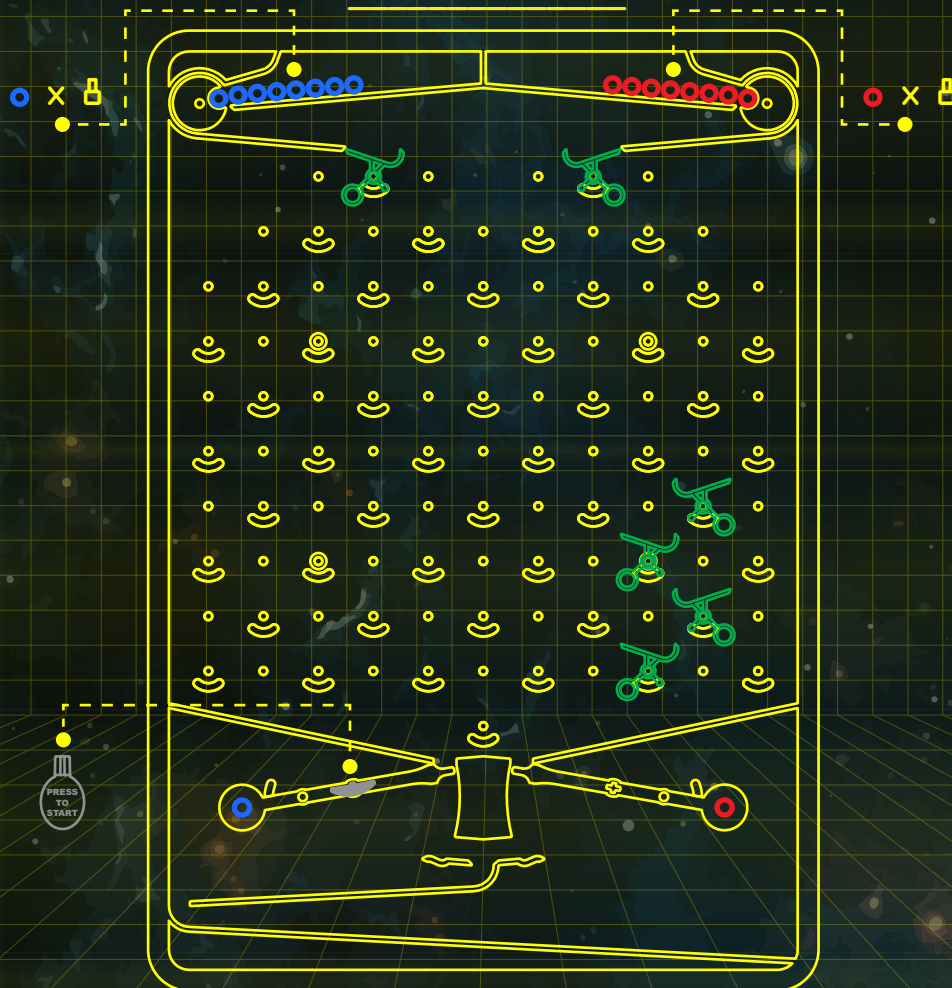
>

> Required output:

ooooooooo

> _

Starting Setup



Available parts



>

>

>

>

>



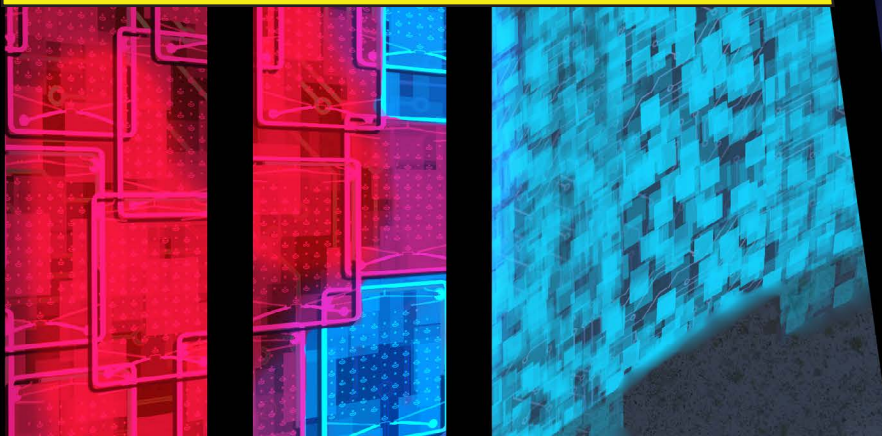
>

 x 13

*Huh. I think I can solve this one with **Fewer parts** than I have available. I guess sometimes there are more parts than I need.*

**PRESS
TO
START**

Alia Fixed a Few of the panels, making the marbles run down them smoothly and land on the correct side.

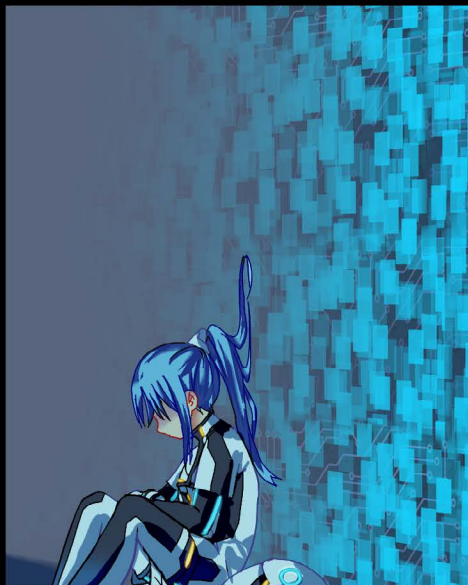


gasp

It took the very last of her oxygen..



Resigned to her Fate, Alia held her breath and took off her helmet. The Frigid air stung her Face.



Just then, a great rush of warm air blew up from below.

HSOON

Unable to hold her breath any longer, Alia inhaled..



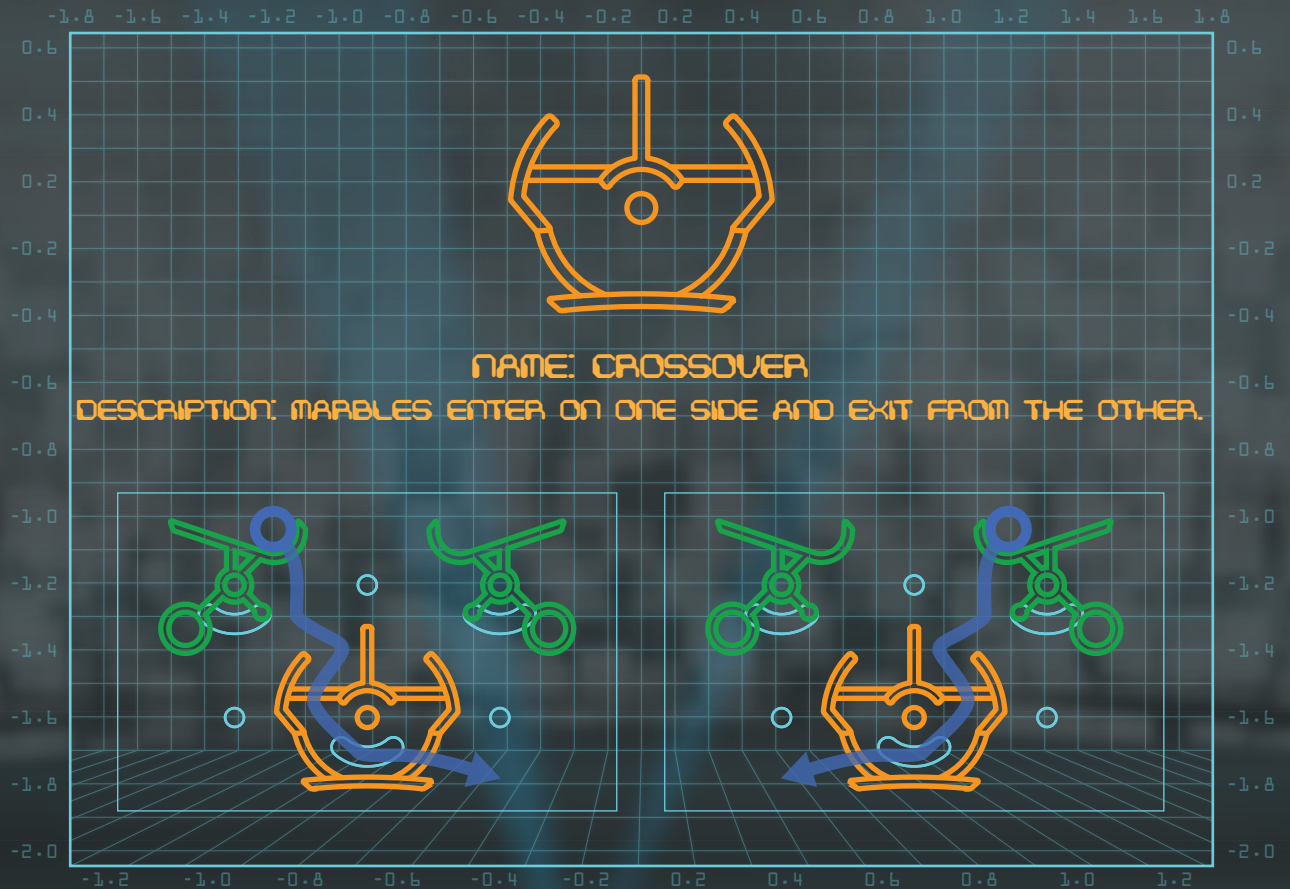
gasp

I...I can breathe?
I can breathe!

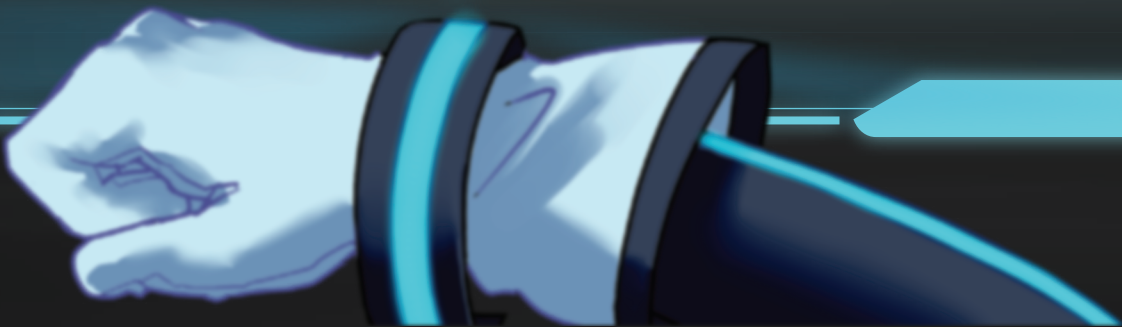
Alia decided that she must have Fixed some sort of life support system. She went to work Fixing more panels nearby..

** NEW PART DETECTED **

```
> SCAN -EXTERNAL -A -R
> SCANNING NEW PART...
> X2...
> Y2...
> Z2...
> SCAN COMPLETED WITH NO ERRORS
>
> ANALYZING...
> ANALYSIS COMPLETE
> PART STORED AS TYPE 'CROSSOVER'
>
> RENDERING...
```



```
> RENDERING COMPLETE
> _
```





> scan -external -challenge_5.pzl

>

> =====

> | Challenge 5: Entropy |

> =====

>

> Objective: Make the pattern blue, red, blue, red,
> blue, red...

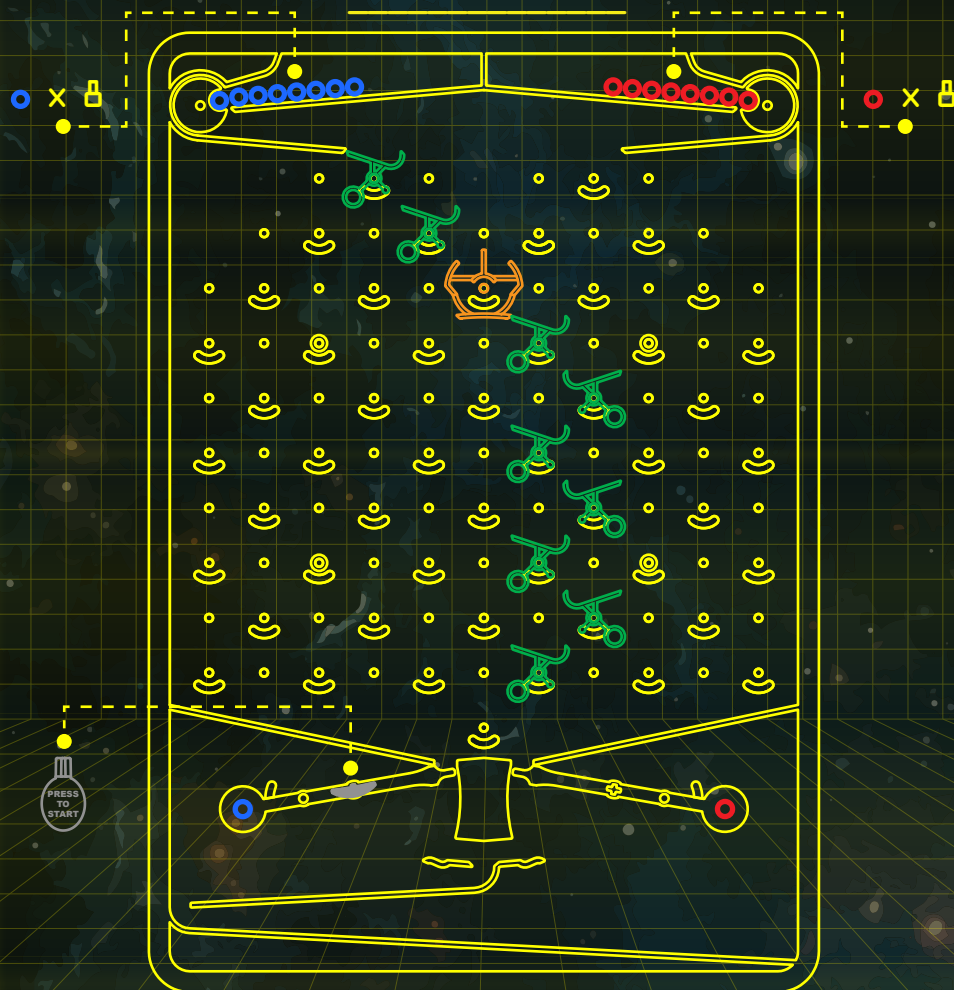
>

> Required output:



> _

Starting Setup



Available parts





> scan -external -challenge_b.pzl

>

> =====
> | Challenge B: Total Internal Reflection |
> =====

>

> Objective: Make the pattern blue, red, blue, red,
> blue, red...

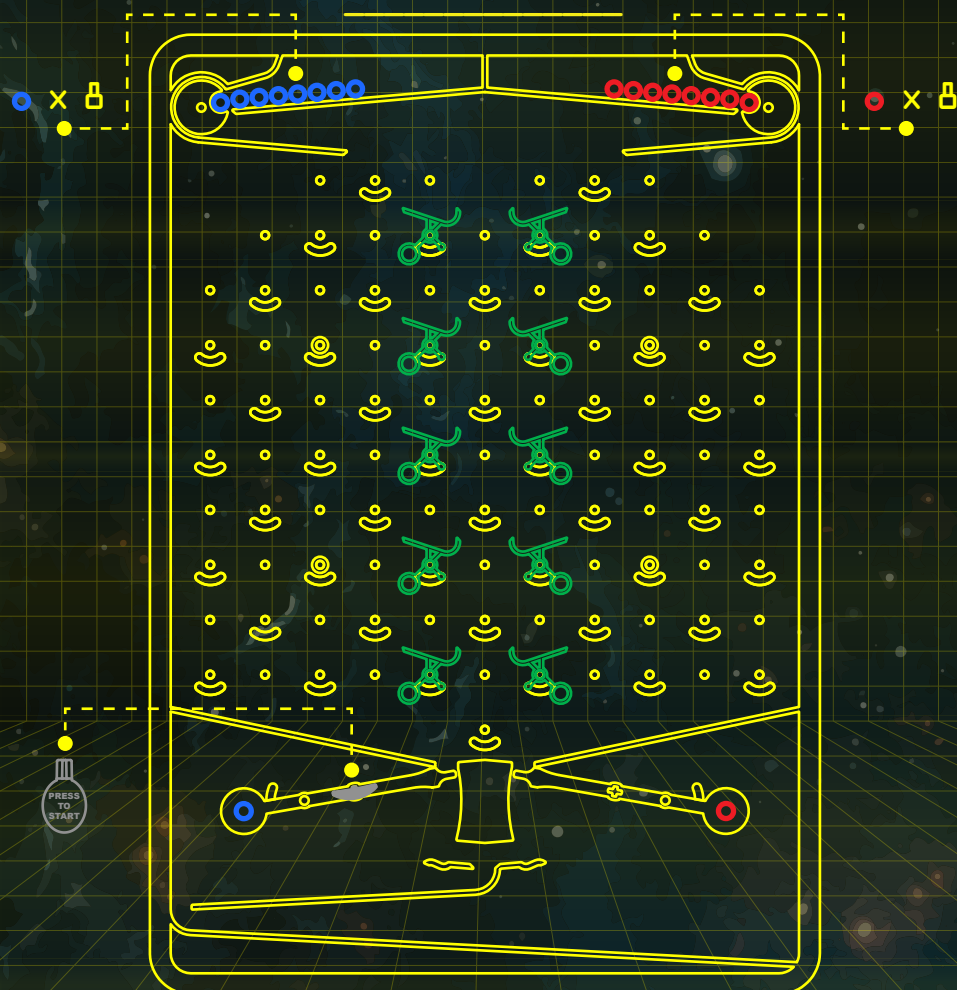
>

> Required output:

●●●●●●●●●●●●●●●●●●

> _

Starting Setup



Available parts





> scan -external -challenge_7.pzl

>

> =====

> | Challenge 7: Path of Least Resistance |

> =====

>

> Objective: Create a path for the blue marbles to reach
> the output with only L ramps.

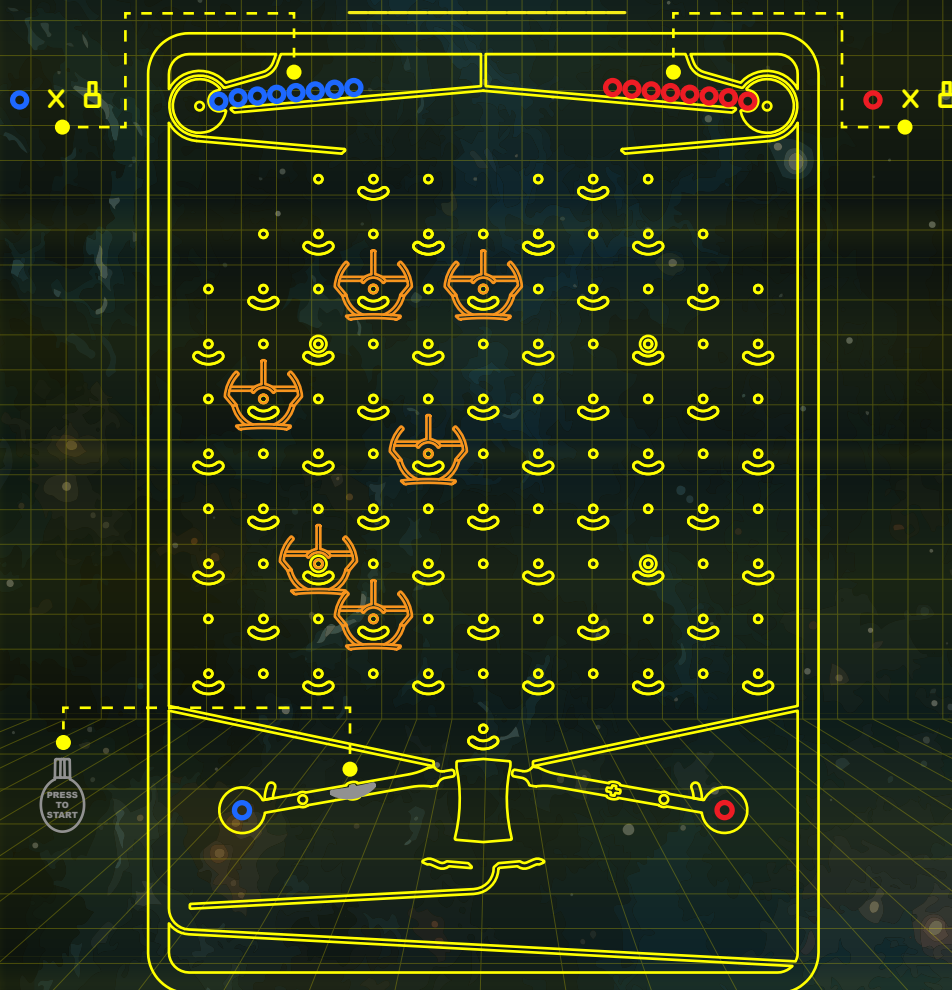
>

> Required output:

oooooooo

> _

Starting Setup



Available parts





Ha! That did the trick!

The click-clack of marbles grew more organized. It began to resemble...a voice!

NO NO NO NO NO NO NO NO NO NO NO NO NO NO NO NO NO NO NO NO...



Huh?
Uh...Hello?



...NO NO NO
NO NO NO NO
NO...

How clever! The computer synthesizes speech by precisely timing the taps of marbles against the panel walls.



...NO NO NO
NO NO NO NO
NO...

But it still seems broken. All it says is "No no no..." Maybe these panels are the problem.



These panels have a new part that **flips** every time a marble runs over it.

They either point left or right.

Wait, I get it! The **Flippers** store information just like electronic switches in a computer.

Switches are either **off** or **on**, like these **Flippers** point to the left or right.

I'll call the little **Flippers** "**bits**"!

...NO NO NO
NO NO NO NO
NO...

**** NEW PART DETECTED ****

> SCAN -EXTERNAL -A -R
> SCANNING NEW PART...
> X2...
> Y2...
> Z2...
> SCAN COMPLETED WITH NO ERRORS
>
> ANALYZING...
> ANALYSIS COMPLETE
> PART STORED AS TYPE 'BIT'
>
> RENDERING...



> RENDERING COMPLETE
> _





> scan -external -challenge_8.pzl

>

> =====
> | Challenge 8: Depolarization |
> =====

>

> Objective: Make the pattern blue, red, blue, red,
> blue, red...

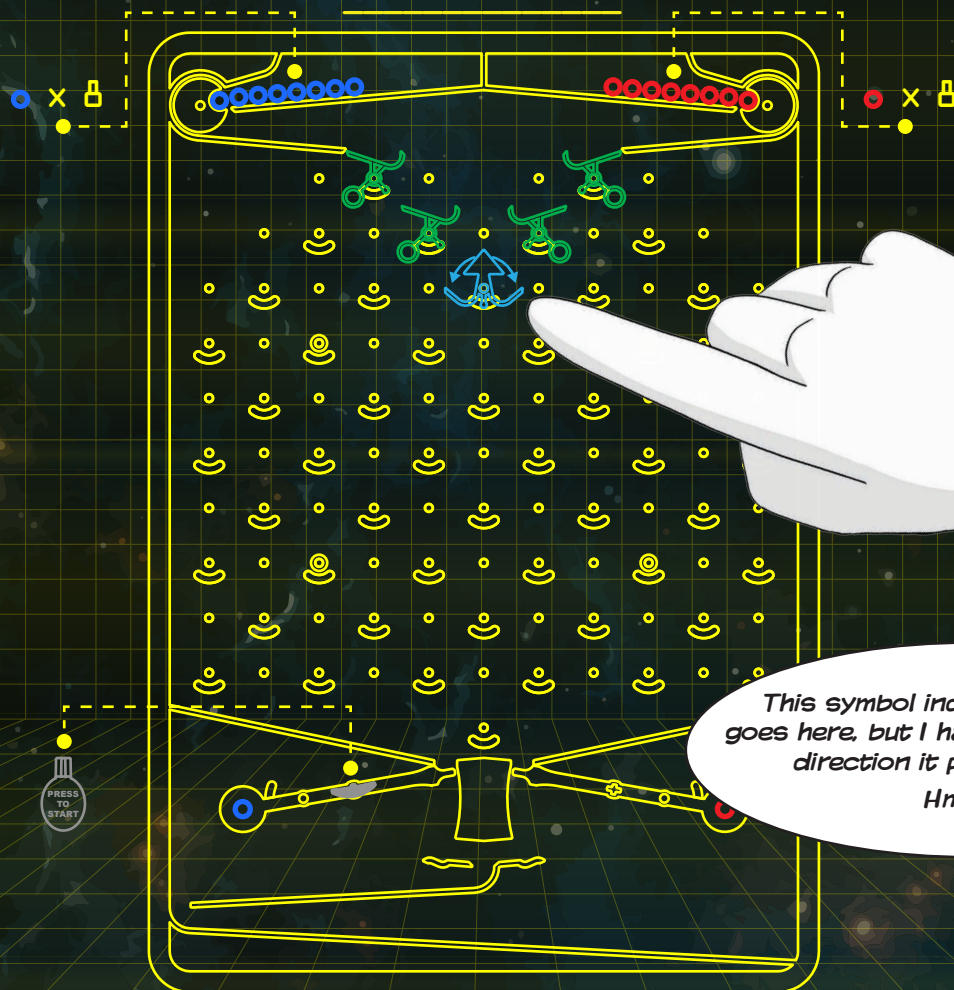
>

> Required output:

●●●●●●●●●●●●●●●●

> _

Starting Setup



Available parts

 x 14

This symbol indicates that a bit goes here, but I have to choose which direction it points to start.
Hmmm...



> scan -external -challenge_9.pzl

>

> =====
> | Challenge 9: Dimers |
> =====

>

> Objective: Make the pattern blue, blue, red, blue,
> blue, red...

>

> Required output:

●●●●●●●●●●●●●●●●●●●●

> _

*I almost missed it! This one
starts with a different number
of marbles on top.*

Starting Setup

● x 10

● x 10

Available
parts

 x 18

PRESS
TO
START

> scan -external -challenge_10.pzl

>

> =====
> | Challenge 10: Double Bond |
> =====

>

> Objective: Make the pattern blue, blue, red, red,
> blue, blue, red, red...

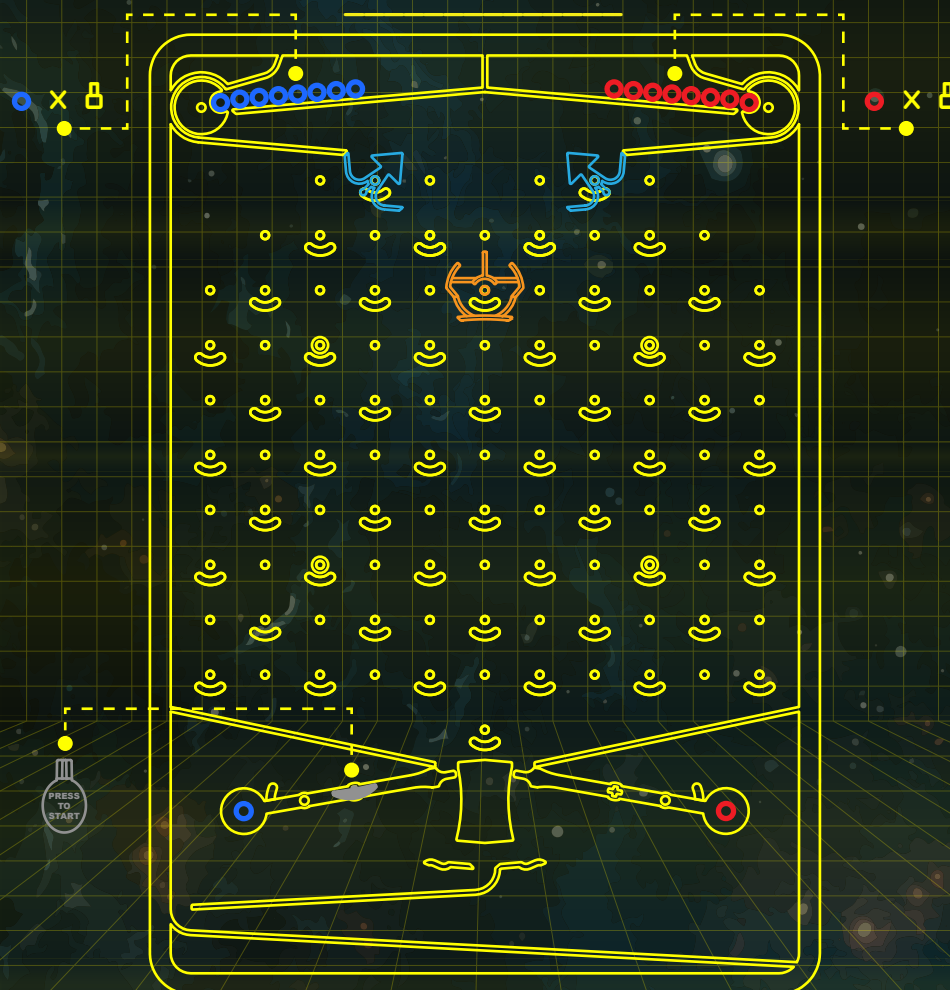
>

> Required output:

●●●●●●●●●●●●●●●●●●●●

> _

Starting Setup



Available parts

 x 22



```
> scan -external -challenge_11.pz1
```

```
>
```

```
> =====
> |                      Challenge 11: Selectivity                      |
> |=====
```

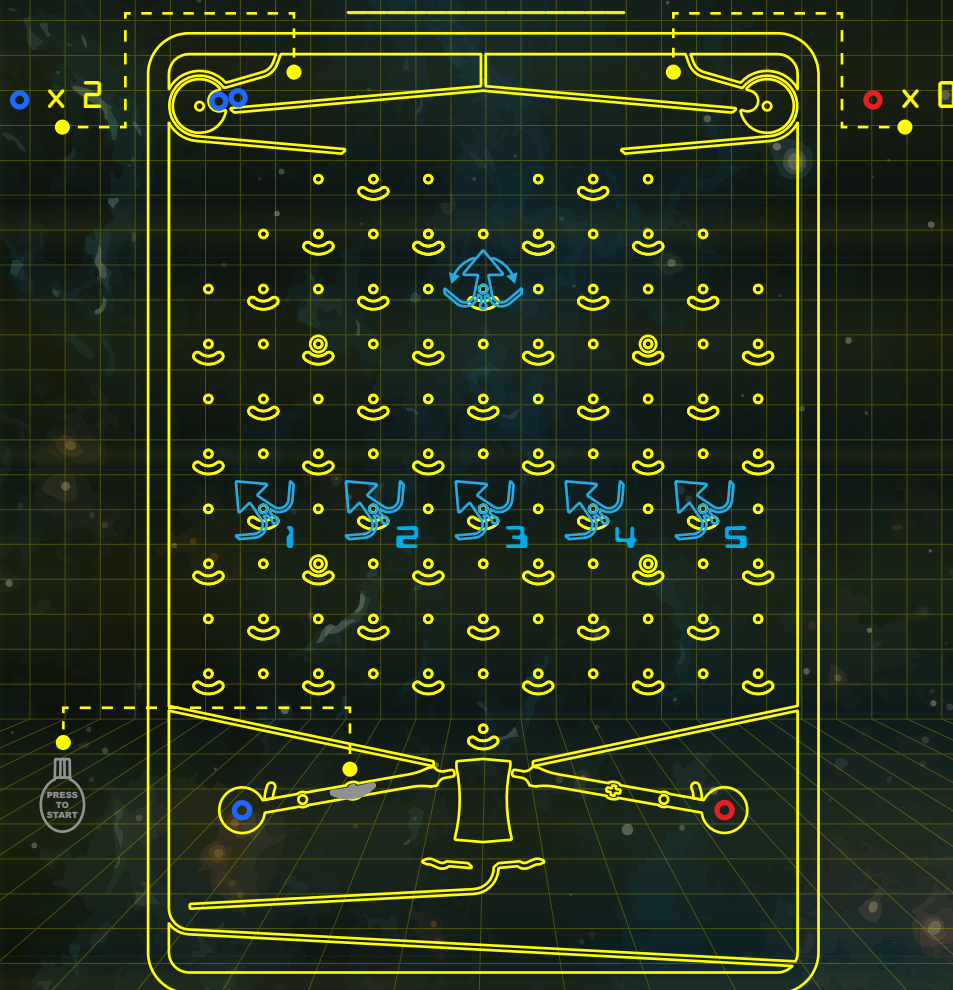
```
>
```

```
> Objective: Flip bits 2 and 5 to the right.
```

```
>
```

```
> _
```

Starting Setup



Available parts



x 15

NO NO NO NO NO NO NO NO NO NO NO
NO NO NO NO NO N--

...

LOGIC SYSTEMS ERROR 503.



Hello? Can you understand me?

LOGIC SYSTEMS ERROR 503.



Guess not.
Well, uh, thanks
for the oxygen,
anyway!

LOGIC SYSTEMS ERROR

I Fixed all the
panels in this
room! But I guess
the error must mean
there's more to fix
somewhere else.



Alia wandered into the next
room...

Here, too, parts lay strewn across the floor.
Unlike the other room, the panels here had
symbols engraved into the sides.

Aha! More
broken panels.

Yup, these must be the
logic systems—these symbols
look like some kind of logic
tables.

Oh boy. Now my
solution has to work for
more than one starting
condition.

Whoa, this is
taking it to the next
level...

** NEW PART DETECTED **

```
> SCAN -EXTERNAL -A -R
> SCANNING NEW PART...
> X2...
> Y2...
> Z2...
> SCAN COMPLETED WITH NO ERRORS
>
> ANALYZING...
> ANALYSIS COMPLETE
> PART STORED AS TYPE 'INTERCEPTOR'
>
> RENDERING...
```



```
> RENDERING COMPLETE
> _
```



> scan -external -challenge_12.pz1

>

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=====

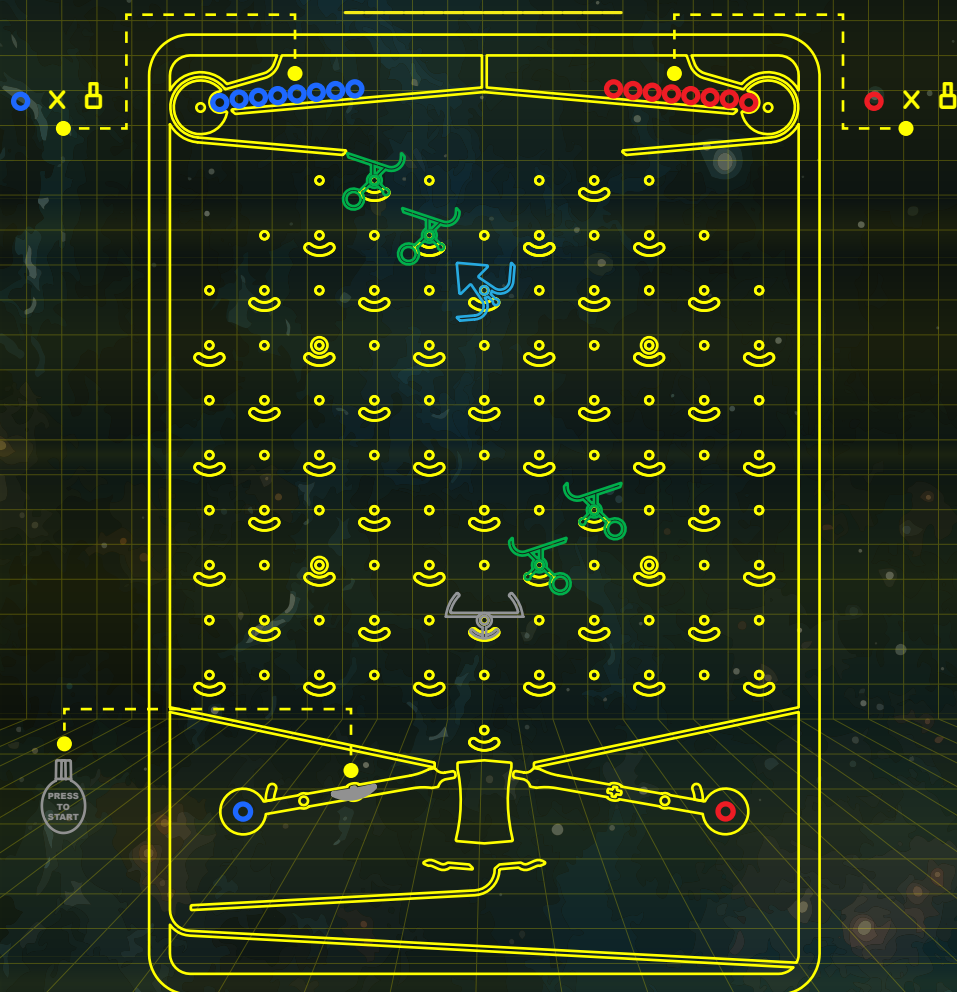
| Challenge 12: Duality - Part 1 |

=====

Objective: Intercept a blue marble.

*This seems too easy. It must
be the **first** part of a more
difficult problem.*

Starting Setup



Available
parts





```
> scan -external -challenge_13.pz1
```

```
>
```

```
> =====
```

```
> |                Challenge 13: Duality - Part 2                |
```

```
> =====
```

```
>
```

```
> Objective: Intercept a red marble.
```

```
>
```

```
> _
```

Starting Setup

Available parts

 x 12

Tricky! Looks like I have to start the machine using the left Flipper. How can I intercept a red marble when I start with a blue marble?

PRESS
TO
START



> scan -external -challenge_14.pz1

>

```
=====
|               Challenge 14: Duality - Part 3               |
|=====
```

>

> Objective: If the machine starts with bit A pointing
> to the left, intercept a blue marble. Otherwise,
> intercept a red marble.

>

> Examples:

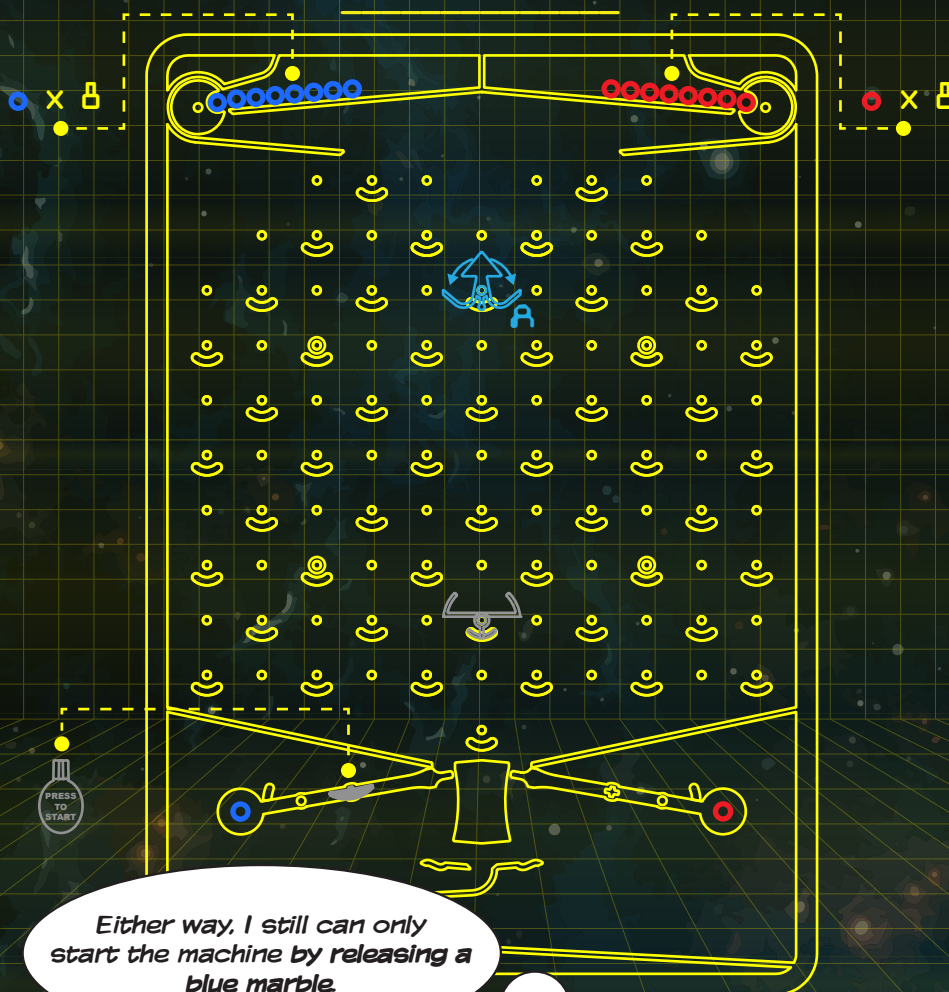


> _

Yikes! Ok, breathe, Alia.
Looks like the machine has to
work *two ways* now.

I'll have to test it with the
bit starting *left* and then I'll have to
test it with the bit starting *right*.

Starting Setup



Available parts



Either way, I still can only
start the machine by releasing a
blue marble.



```
> scan -external -challenge_15.pz1
```

```
>
```

```
> =====
```

```
> |                      Challenge 15: Inversion                      |
```

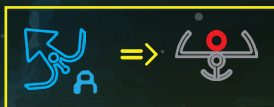
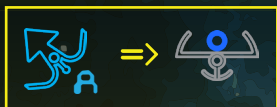
```
> =====
```

```
>
```

```
> Objective: If bit A starts to the left, intercept a
> blue marble. If bit A starts to the right, intercept >
a red marble.
```

```
>
```

```
> Examples:
```



The => symbol means
"if" whatever's on the left, "then"
whatever's on the right.

```
> _
```

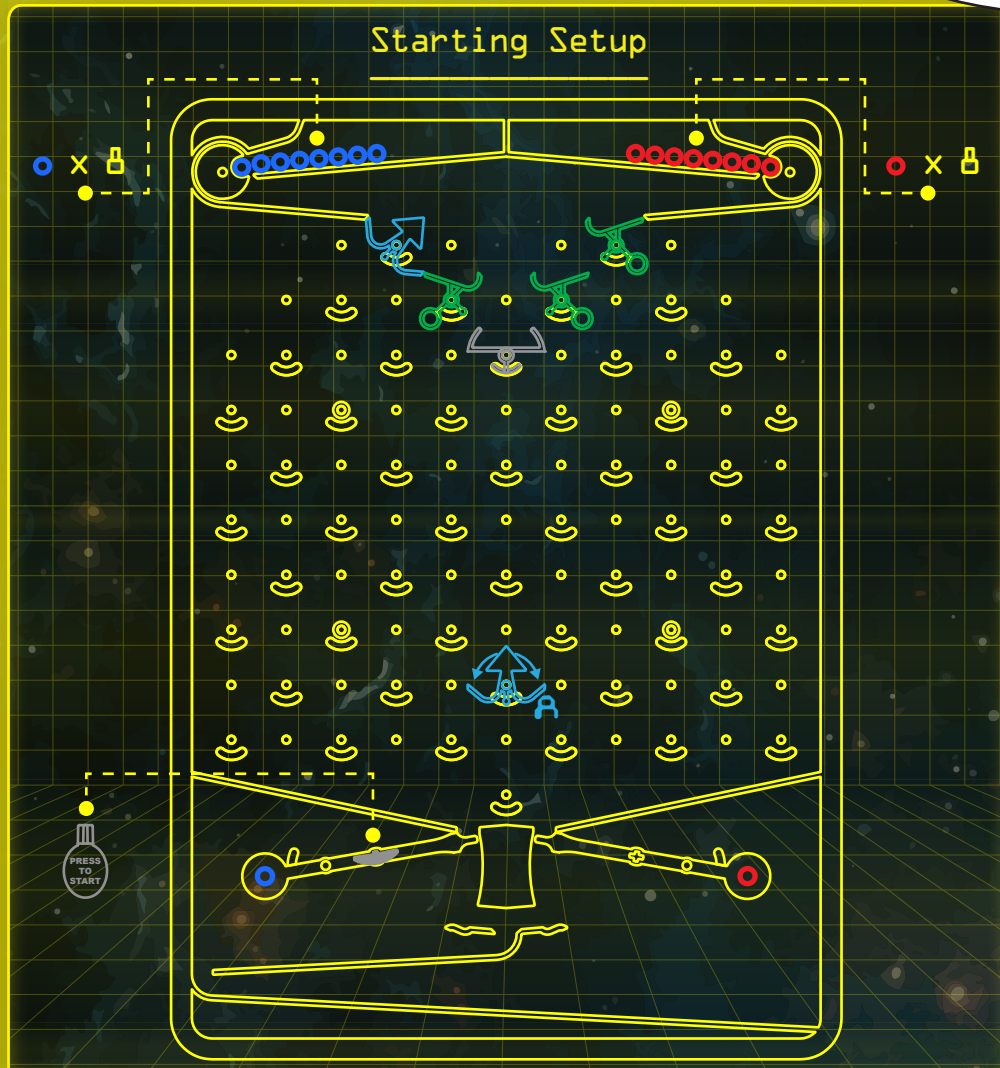
So I guess it's the same
objective as the last puzzle. I
can do this!

Starting Setup

Available parts

 x 11

 x 2



Getting too hard? Check out
upperstory.com/turingtumble/hints
for help and extra practice.

> scan -external -challenge_1b.pz1

>

>

>

>

>

>

>

>

>

Objective: Let only 3 blue marbles reach the bottom and
catch the 4th marble in the interceptor.

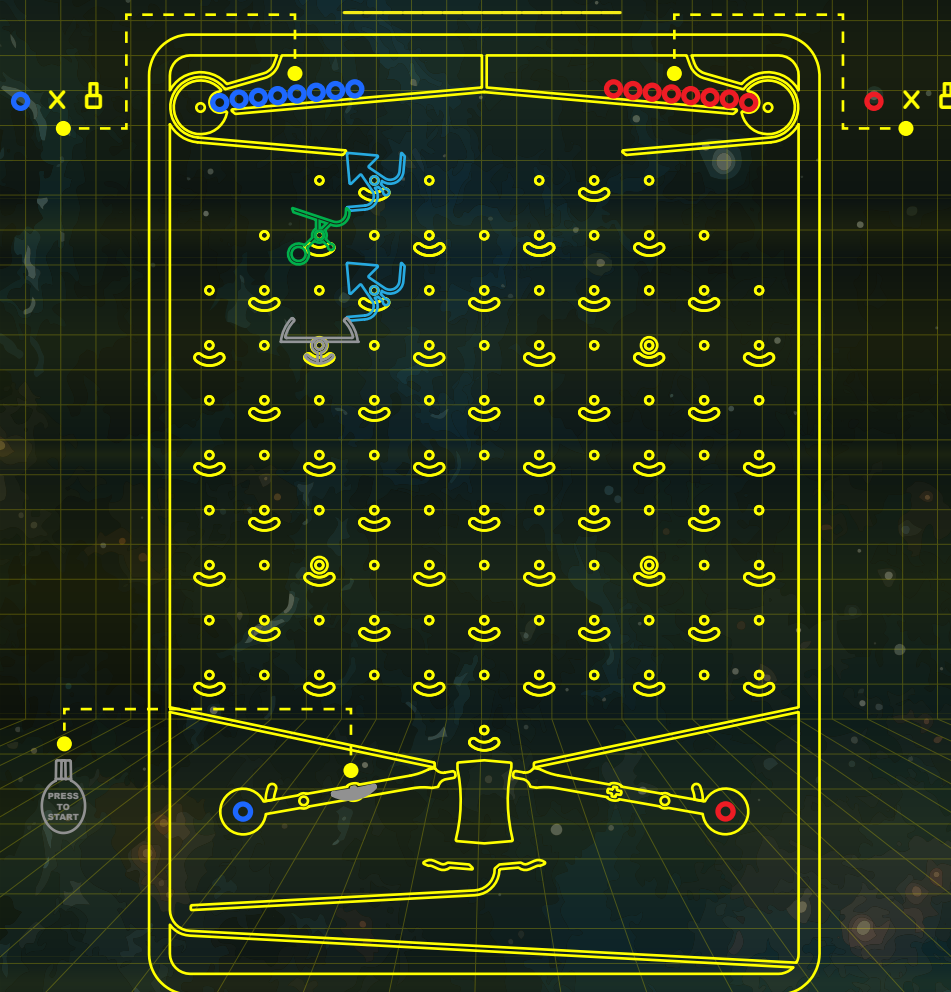
Required output:

ooo

>

_

Starting Setup



Available parts

x 10

> scan -external -challenge_17.pzl

>

> =====
> | Challenge 17: Fixed Ratio |
> =====

>

> Objective: Make the pattern blue, blue, blue, red,
> red, red.

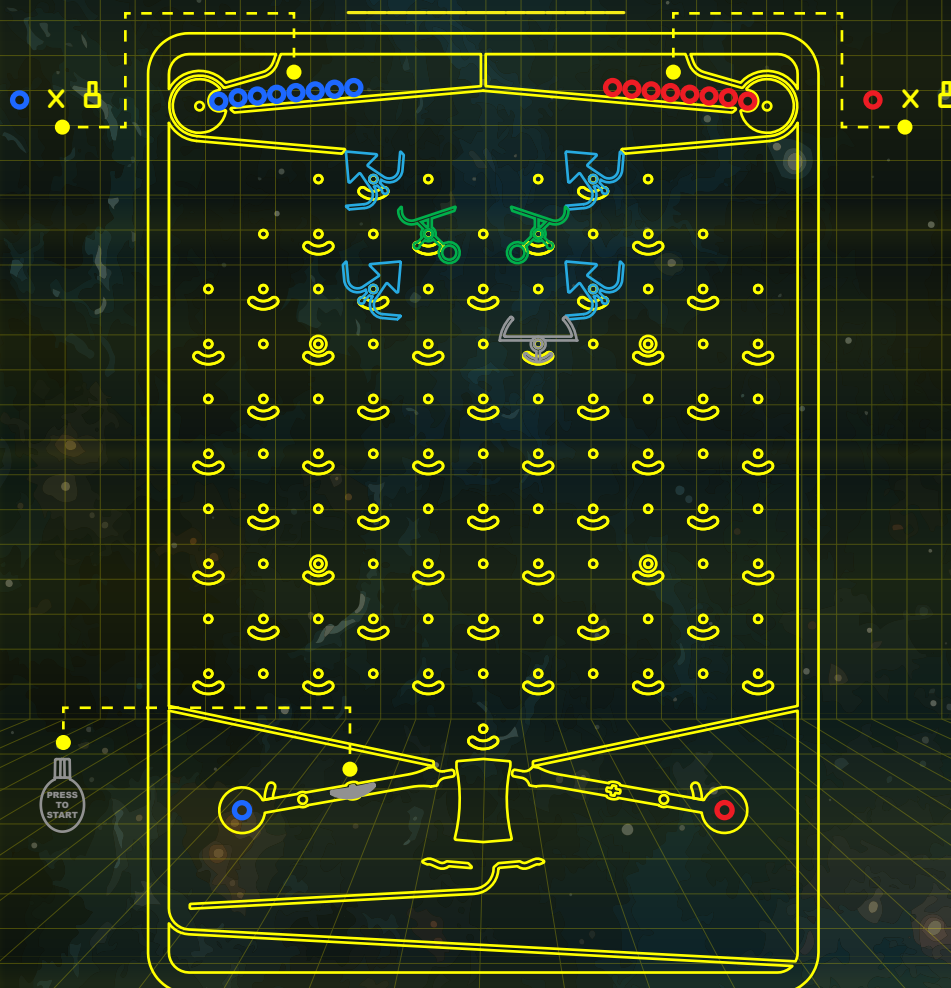
>

> Required output:

○○○○○○

> _

Starting Setup



Available parts



> scan -external -challenge_18.pz1

>

>

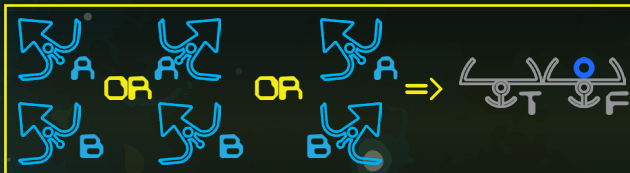
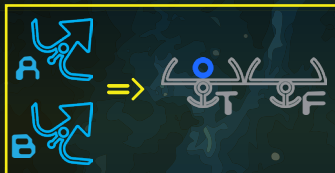
> =====
 > | Challenge 18: Entanglement Part 1 |
 > =====

>

> Objective: If the top bit AND the bottom bit start
 > pointed to the right, put a marble in interceptor T.
 > Otherwise put a marble in interceptor F.

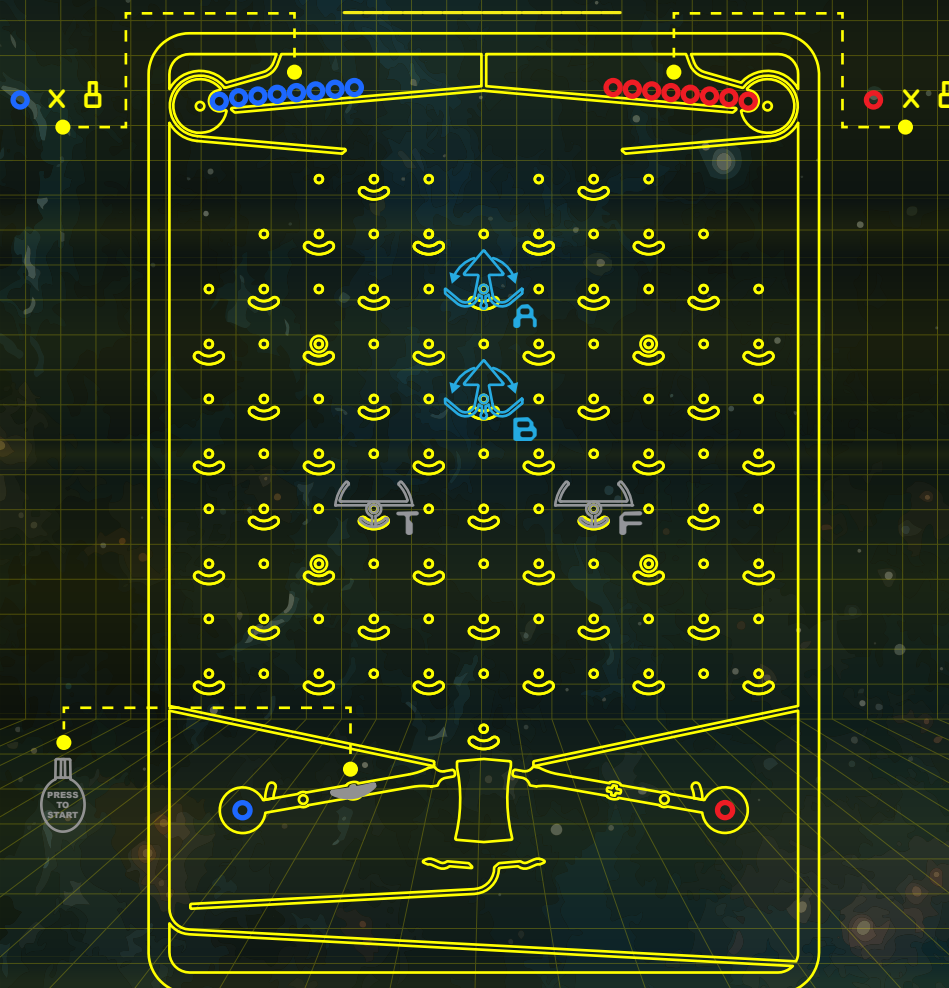
>

> Examples:



> _

Starting Setup



Available parts



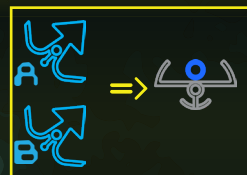
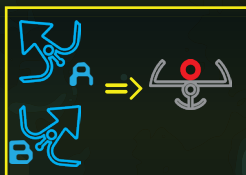
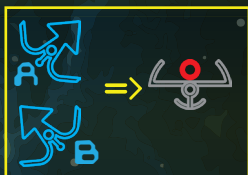
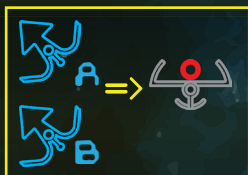
```
> scan -external -challenge_19.pz1
```

```
>
```

```
> =====
> |               Challenge 19: Entanglement Part 2               |
> =====
```

```
> Objective: If the top bit AND the bottom bit start
> pointed to the right, intercept a blue marble.
> Otherwise, intercept a red marble.
```

```
> Examples:
```

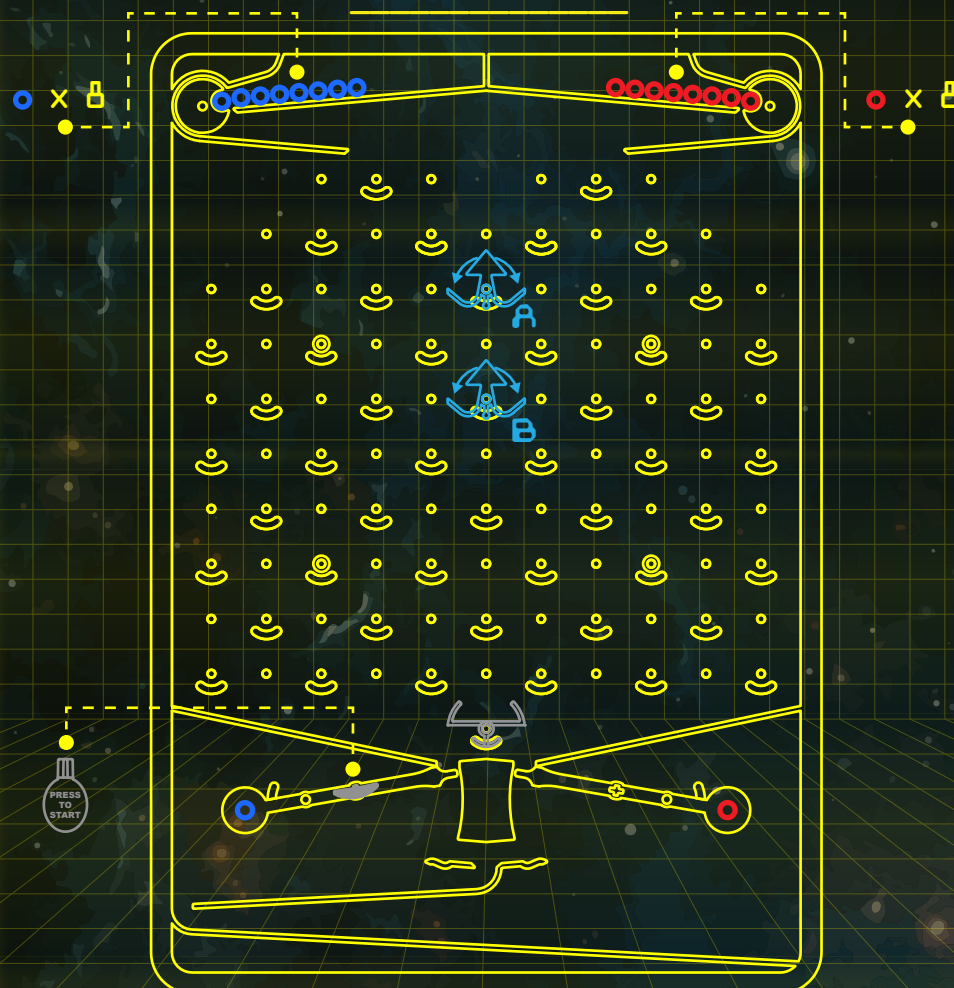


```
> _
```

Starting Setup

Available parts

 x ∞

 x 2


> scan -external -challenge_20.pz1

>

>

>

>

>

>

>

>

>

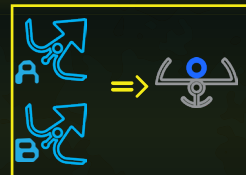
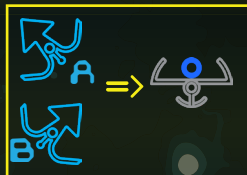
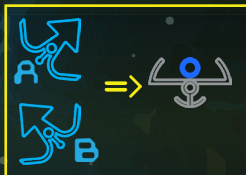
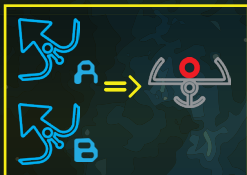
>

>

Challenge 20: Symbiosis

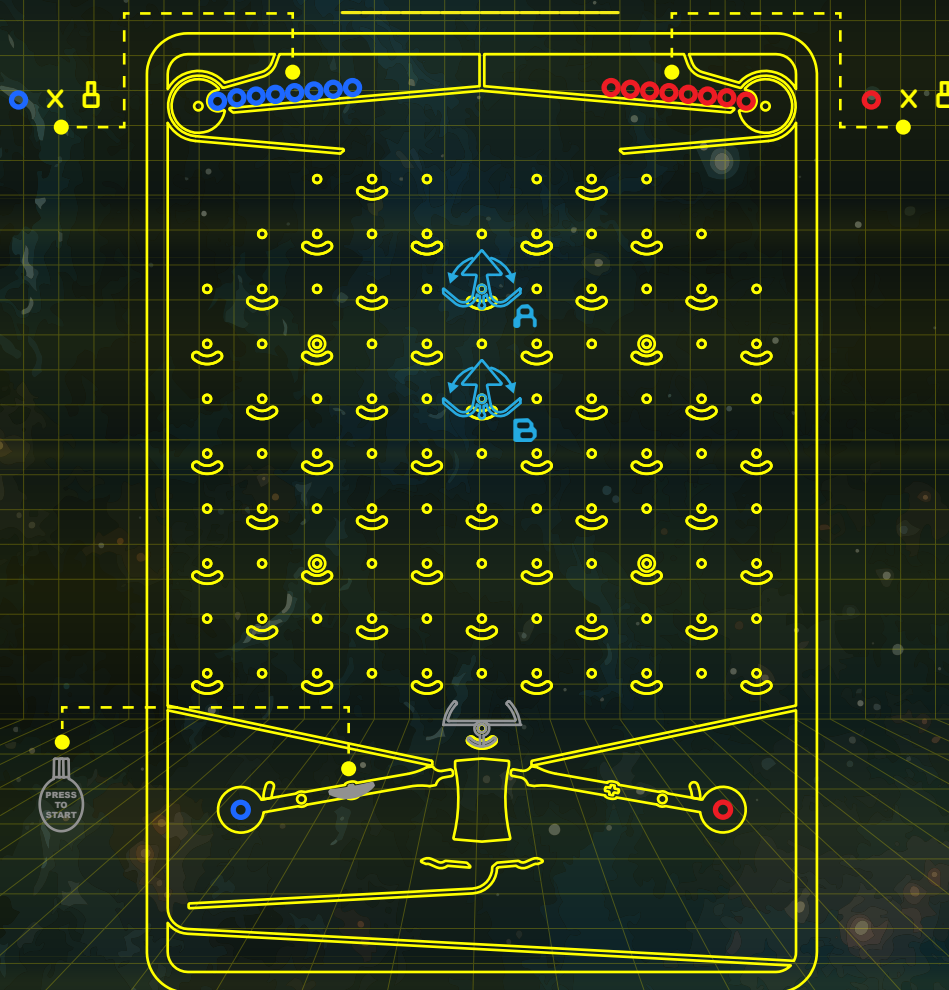
Objective: If the top bit OR the bottom bit start pointed to the right, intercept a blue marble.
Otherwise, intercept a red marble.

Examples:

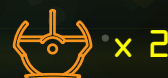


> _

Starting Setup



Available parts



Once again, Alia repaired the broken panels.

Well? Can you tell me what you are now?

MAGNUS, PRIDE AND PROTECTOR OF THE ENIACONS, VERSION 1320934

The 'Eniacons'? Are they the ones who built you?

AFFIRMATIVE.

Where are they now? Did they leave the planet?

THE ENIACONS ARE NO MORE.

Why? What happened to them?

THE ATMOSPHERE CHANGED COMPOSITION. THEIR SYSTEMS FAILED.

They all died? That's terrible, Magnus! How did it happen?

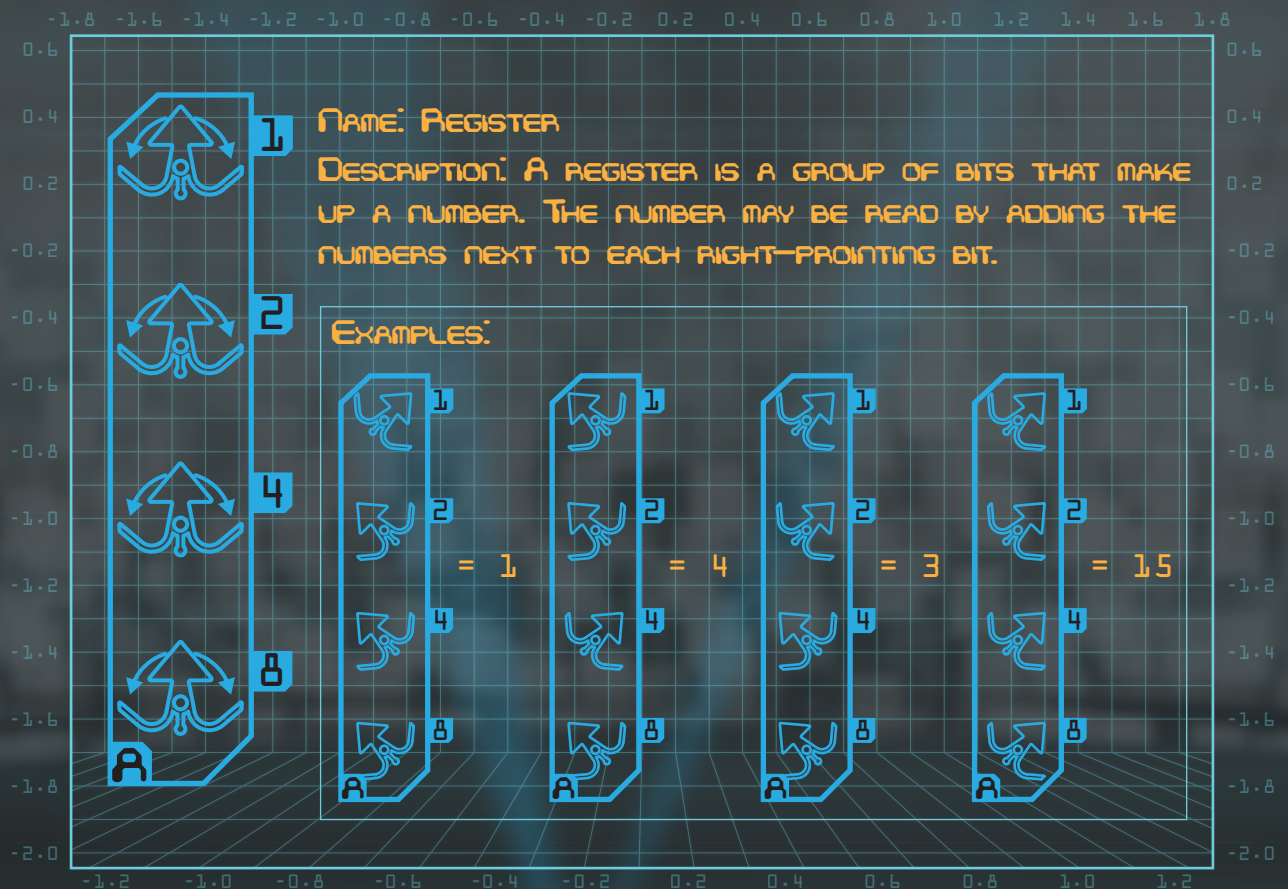
MAGNUS COULD NOT PROTECT THEM.

When did it happen?

CANNOT COMPUTE. COUNTING CIRCUIT ERROR 12. MAGNUS REQUIRES REPAIR.

** NEW PART DETECTED **

- > SCAN -EXTERNAL -A -A
- > SCANNING NEW PART...
- > X2...
- > Y2...
- > Z2...
- > SCAN COMPLETED WITH NO ERRORS
- >
- > ANALYZING...
- > ANALYSIS COMPLETE
- > PART STORED AS TYPE 'REGISTER'
- >
- > RENDERING...



- > RENDERING COMPLETE
- > _



> scan -external -challenge_21.pz1

>

```

> =====
> |               Challenge 21: Quantum Number               |
> =====

```

>

> Objective: Use register A to count the number of blue marbles. (Use 15 or fewer marbles).

>

> Examples:

$$\bullet \times 5 \Rightarrow \text{A} = 5$$

$$\bullet \times 14 \Rightarrow \text{A} = 14$$

$$\bullet \times 7 \Rightarrow \text{A} = 7$$

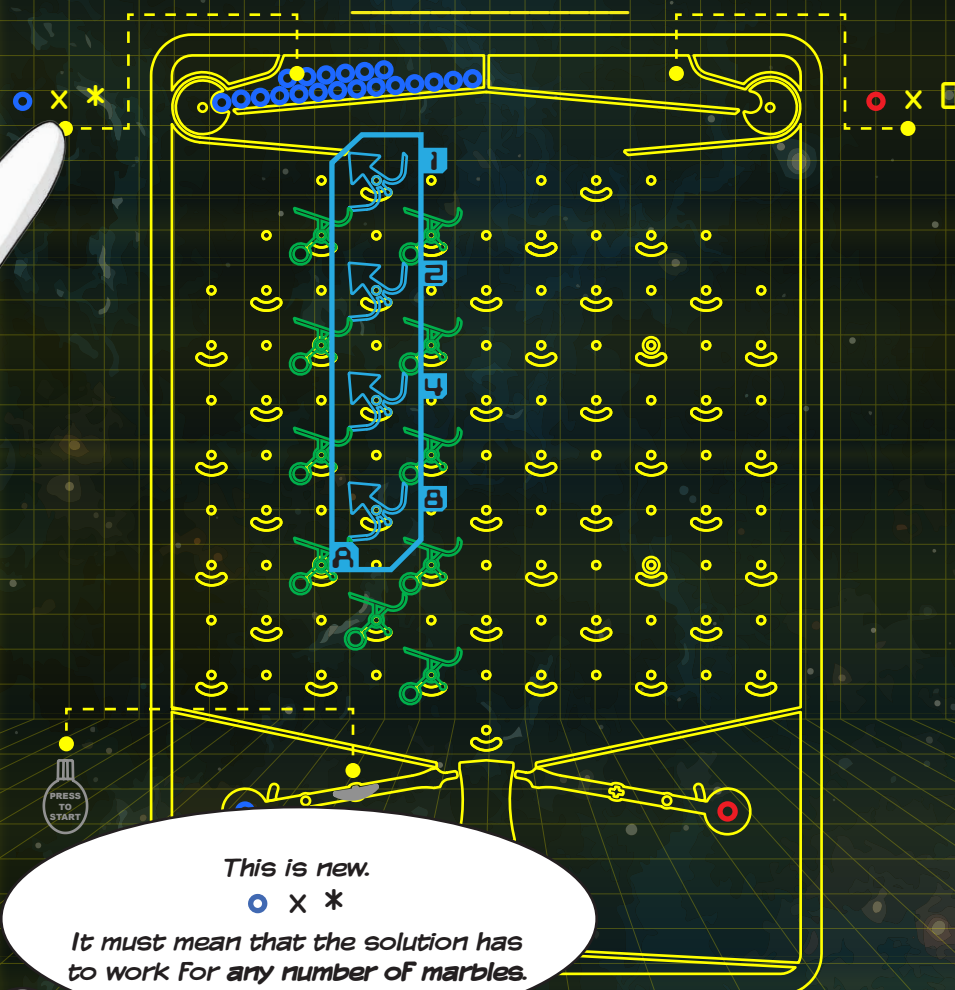
$$\bullet \times 11 \Rightarrow \text{A} = 11$$

> _

Starting Setup

Available parts

 x 5



This is new.

$\bullet \times *$

It must mean that the solution has to work for any number of marbles.

>

>

>



>

>

>

>

>



Examples:









○ x 15 =>  = 



Available
parts

 $\times 5$

**PRESS
TO
START**



> scan -external -challenge_23.pz1

>

> =====
> | Challenge 23: Tetrad |
> =====

>

> Objective: Let exactly 4 blue marbles reach the end.
> (Intercept the 5th.)

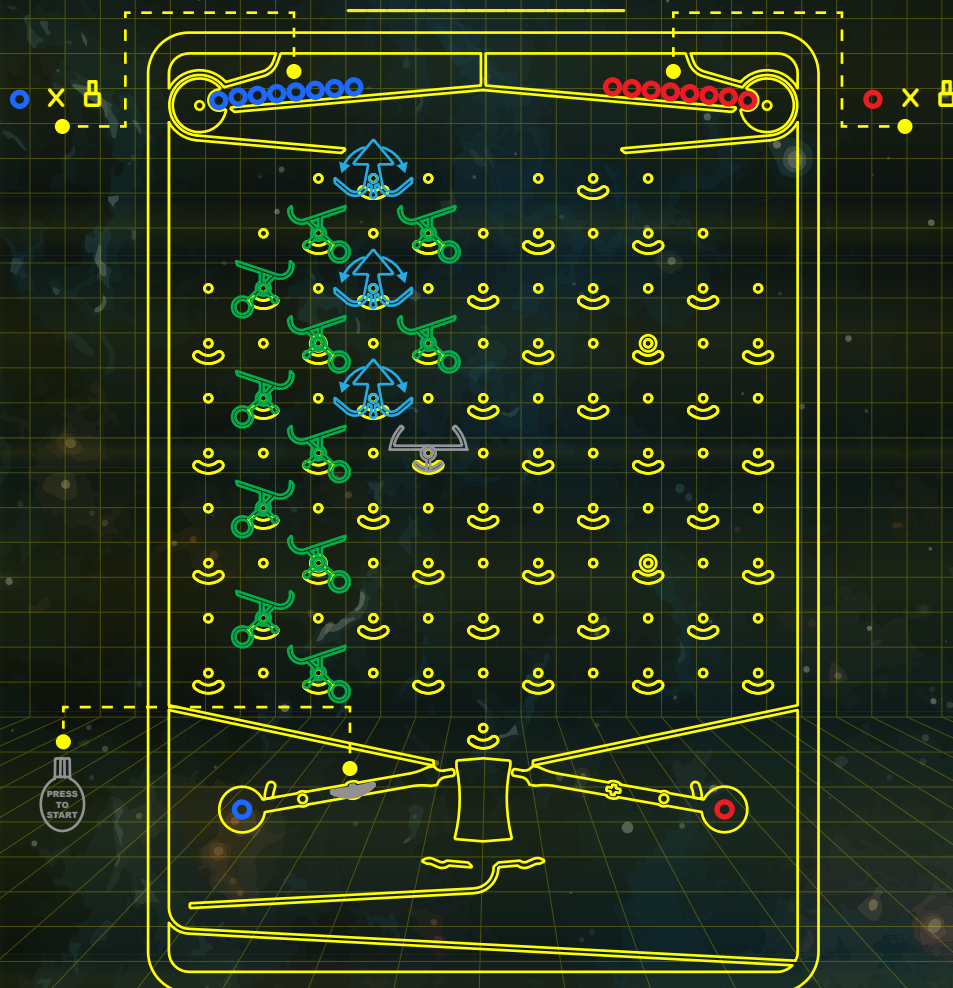
>

> Required output:

oooo

> _

Starting Setup



Available parts

> scan -external -challenge_24.pz1

>

> =====
> | Challenge 24: Ennead |
> =====

>

> Objective: Let exactly 9 blue marbles reach the end.
> (Intercept the 10th.)

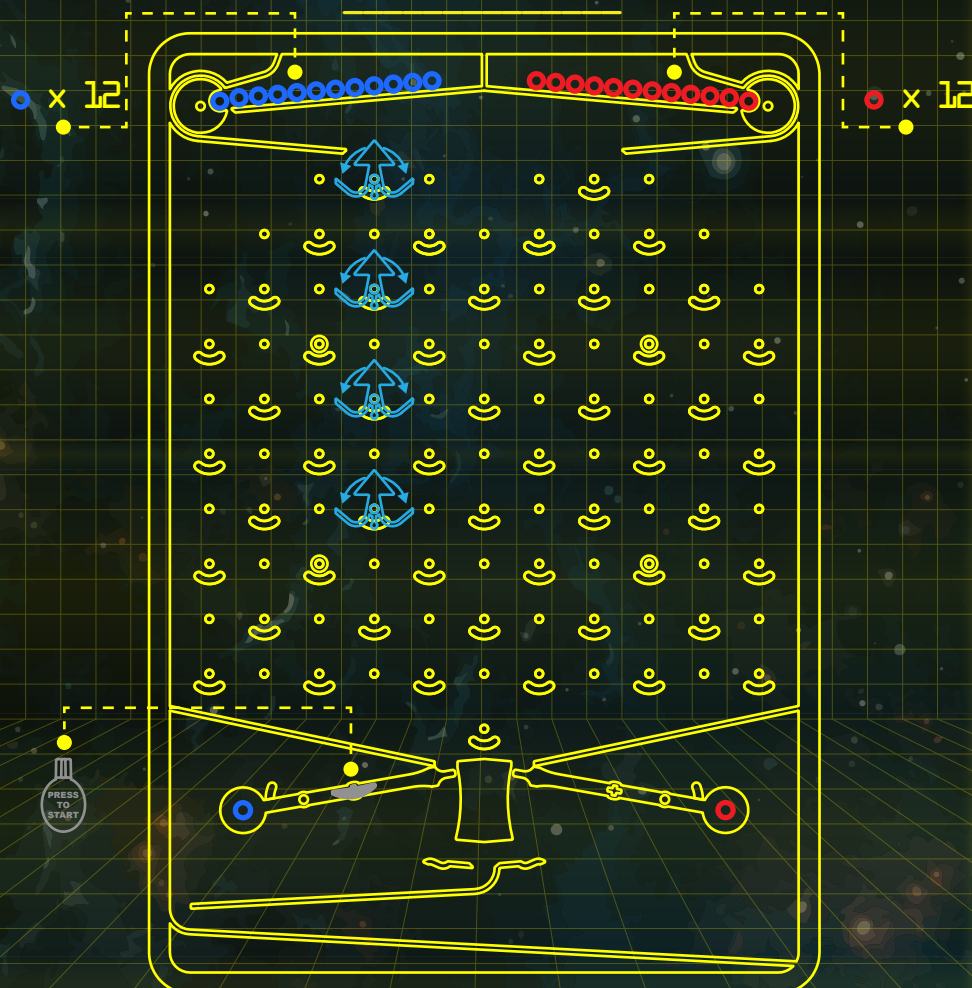
>

> Required output:

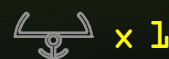
oooooooo

> _

Starting Setup



Available parts



```
> scan -external -challenge_25.pz1
```

```
>
```

```
> =====
> |                Challenge 25: Regular Expression                |
> |=====
```

```
>
```

```
> Objective: Generate the required pattern.
```

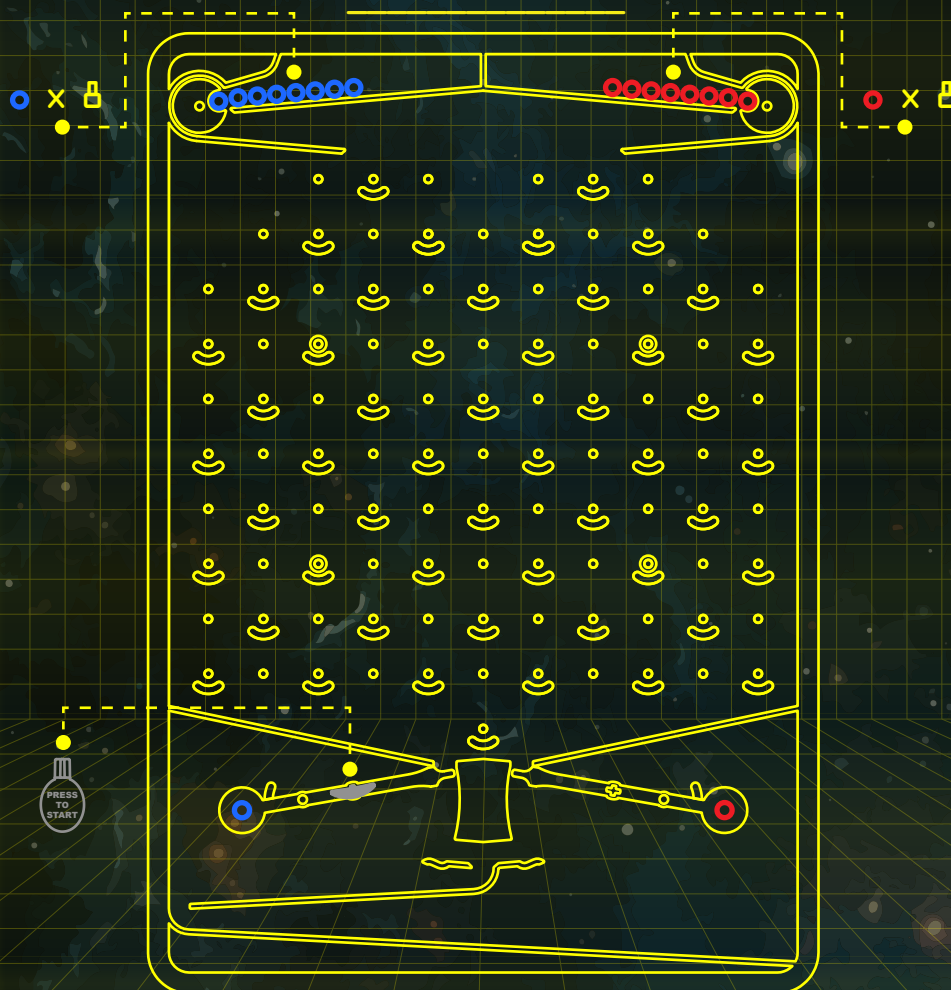
```
>
```

```
> Required output:
```

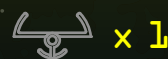
ooooooo

```
> _
```

Starting Setup



Available parts



Think of a different solution?
Submit it online at:
community.turingtumble.com


```
> scan -external -challenge_27.pz1
```

>

```
> =====
```

```
> |                      Challenge 27: Reflection                      |
```

```
> =====
```

>

```
> Objective: Reverse the direction of each of the 9
```

```
> starting bits, regardless of the direction they point
```

```
> to start.
```

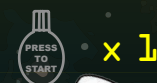
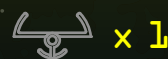
>

>

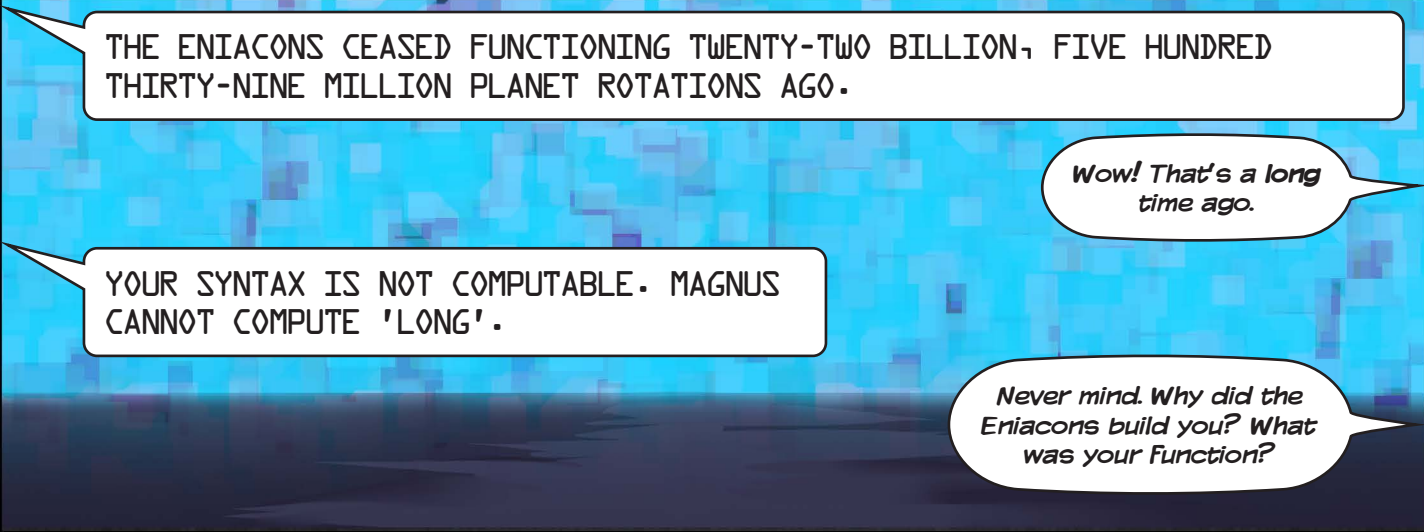
> _

Starting Setup

Available parts



Looks like this time I have to choose a side for the start button. Do I want it on the right or the left?



THE ENIACONS CEASED FUNCTIONING TWENTY-TWO BILLION, FIVE HUNDRED THIRTY-NINE MILLION PLANET ROTATIONS AGO.

Wow! That's a long time ago.

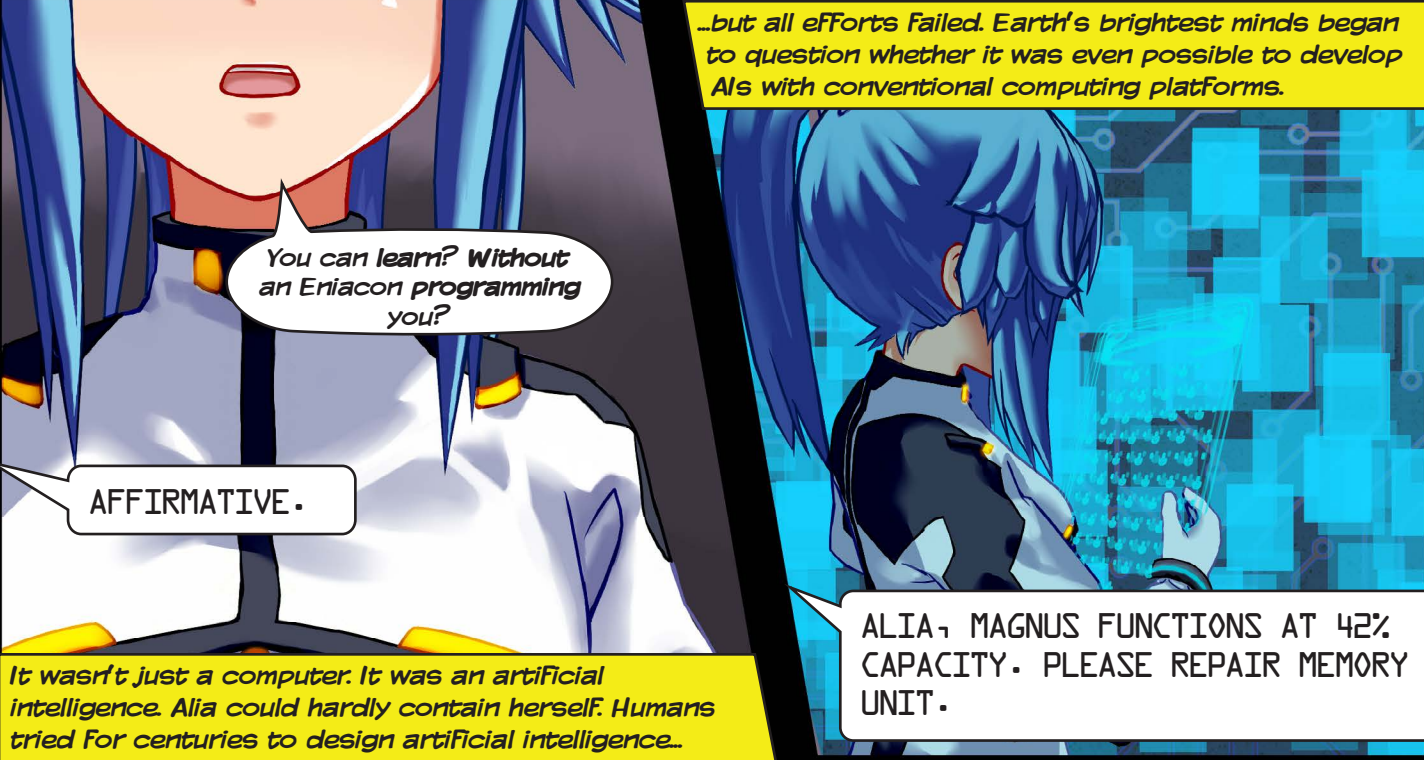
YOUR SYNTAX IS NOT COMPUTABLE. MAGNUS CANNOT COMPUTE 'LONG'.

Never mind. Why did the Eniacons build you? What was your Function?

FUNCTION ONE: MAGNUS PROTECTS THE PEOPLE OF ENIAC FROM THOSE WHO THREATEN IT

FUNCTION TWO: MAGNUS MANAGES ALL MATERIALS NECESSARY TO SUPPORT ENIACON LIFE

FUNCTION THREE: MAGNUS LEARNS



...but all efforts failed. Earth's brightest minds began to question whether it was even possible to develop AIs with conventional computing platforms.

You can learn? Without an Eniacon programming you?

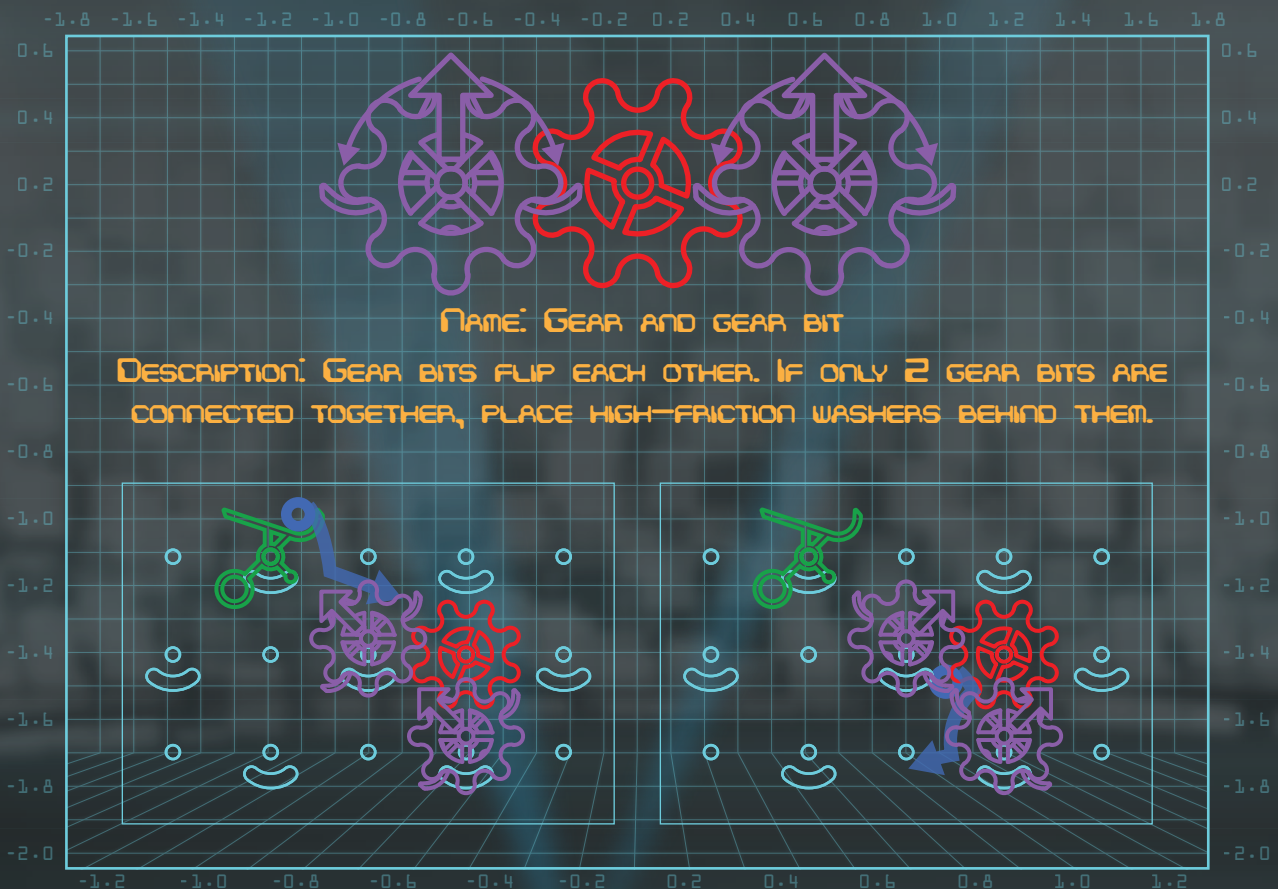
AFFIRMATIVE.

It wasn't just a computer. It was an artificial intelligence. Alia could hardly contain herself. Humans tried for centuries to design artificial intelligence...

ALIA, MAGNUS FUNCTIONS AT 42% CAPACITY. PLEASE REPAIR MEMORY UNIT.

** NEW PART DETECTED **

```
> SCAN -EXTERNAL -A -R
> SCANNING NEW PART...
> X2...
> Y2...
> Z2...
> SCAN COMPLETED WITH NO ERRORS
>
> ANALYZING...
> ANALYSIS COMPLETE
> PART STORED AS TYPES 'GEAR' AND 'GEAR BIT'
>
> RENDERING...
```



```
> RENDERING COMPLETE
> _
```



> scan -external -challenge_28.pz1

>

> =====
> | Challenge 28: Latch |
> =====

>

> Objective: Release only the blue marbles.

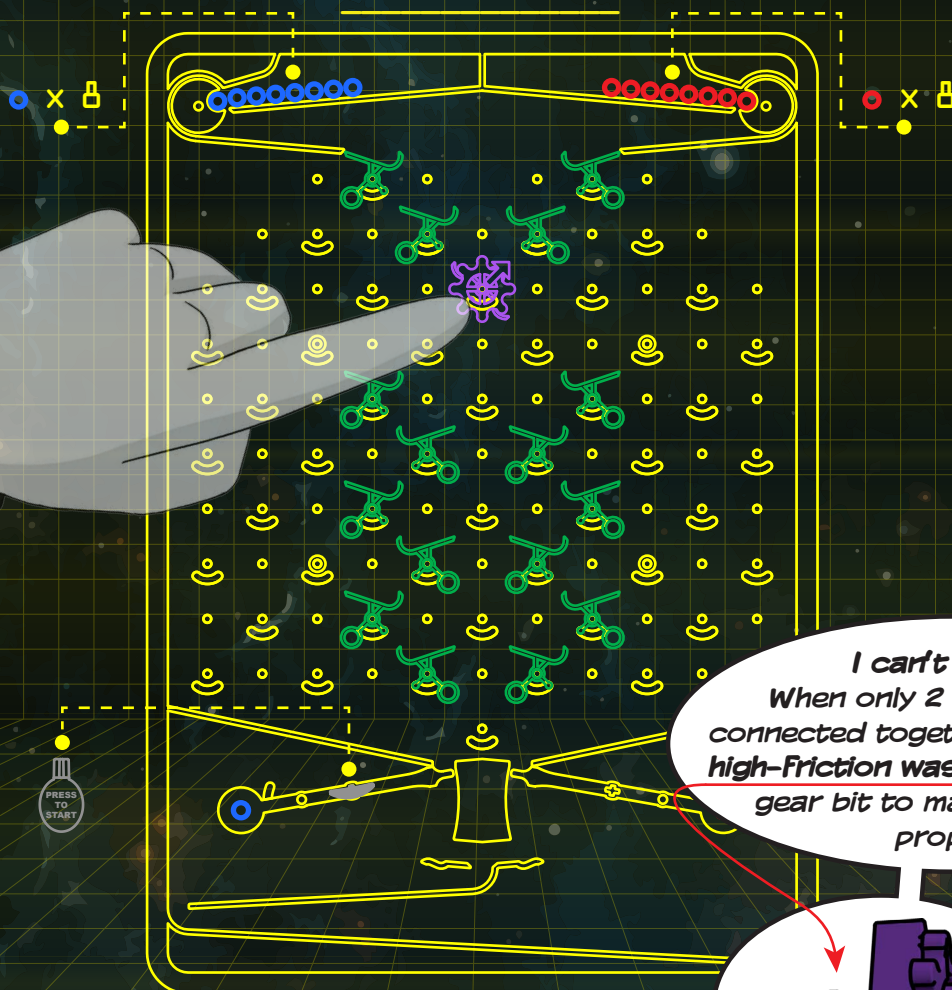
>

> Required output:

_____ 00000000

> _

Starting Setup



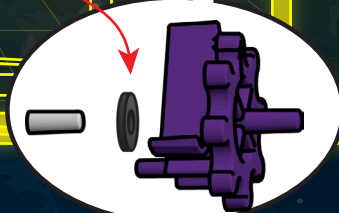
Available parts

 x 1

 x 1

 x 1

I can't Forget!
When only 2 gear bits are connected together, I have to put high-friction washers behind each gear bit to make them work properly.



> scan -external -challenge_29.pz1

>

> =====
> | Challenge 29: One-Shot Switch |
> =====

>

> Objective: Release a blue marble, a red marble, and then
> the rest of the blue marbles.

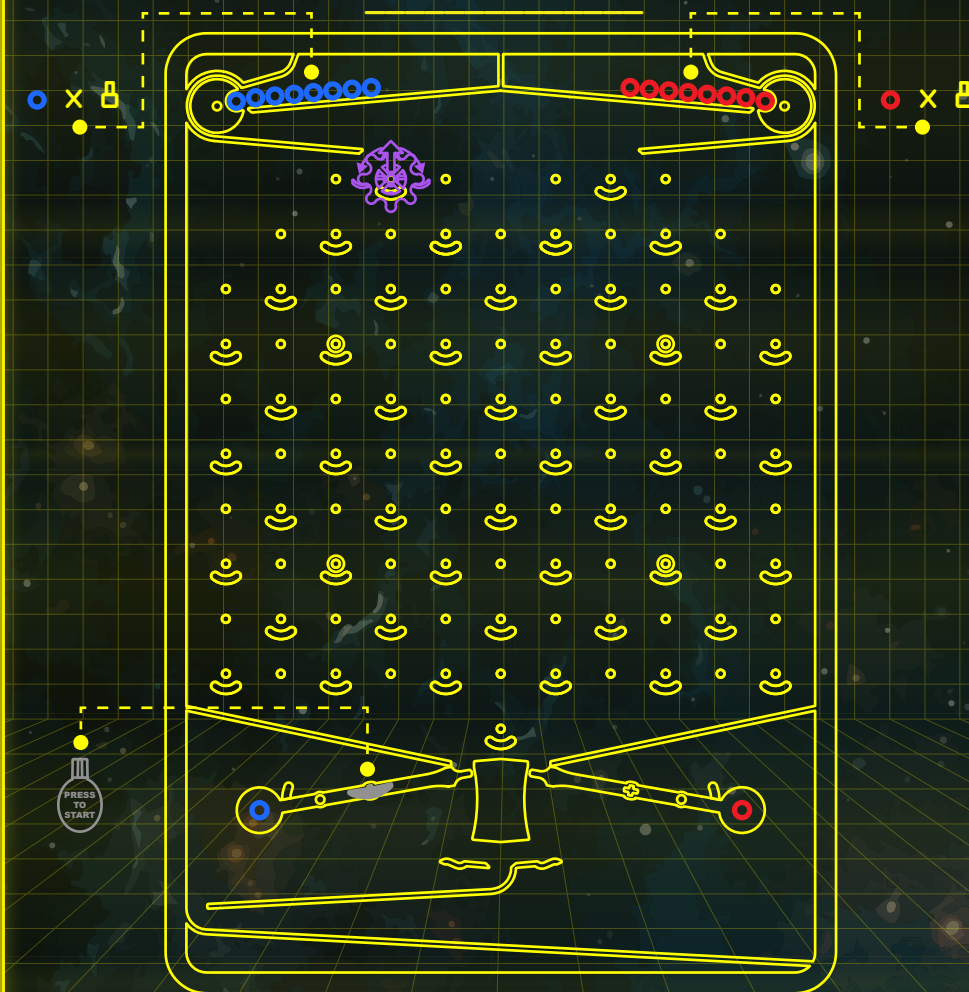
>

> Required output:

ooooooooo

> _

Starting Setup



Available parts

 x ∞

 x 1

 x 1

 x 1


```
> scan -external -challenge_30.pz1
```

```
>
```

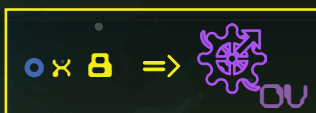
```
> =====
> |                      Challenge 30: Overflow                      |
> =====
```

```
>
```

```
> Objective: Count the blue marbles in register A. If
> there are more than 7, gear bit OV must flip right
> (and stay right) to indicate the overflow.
```

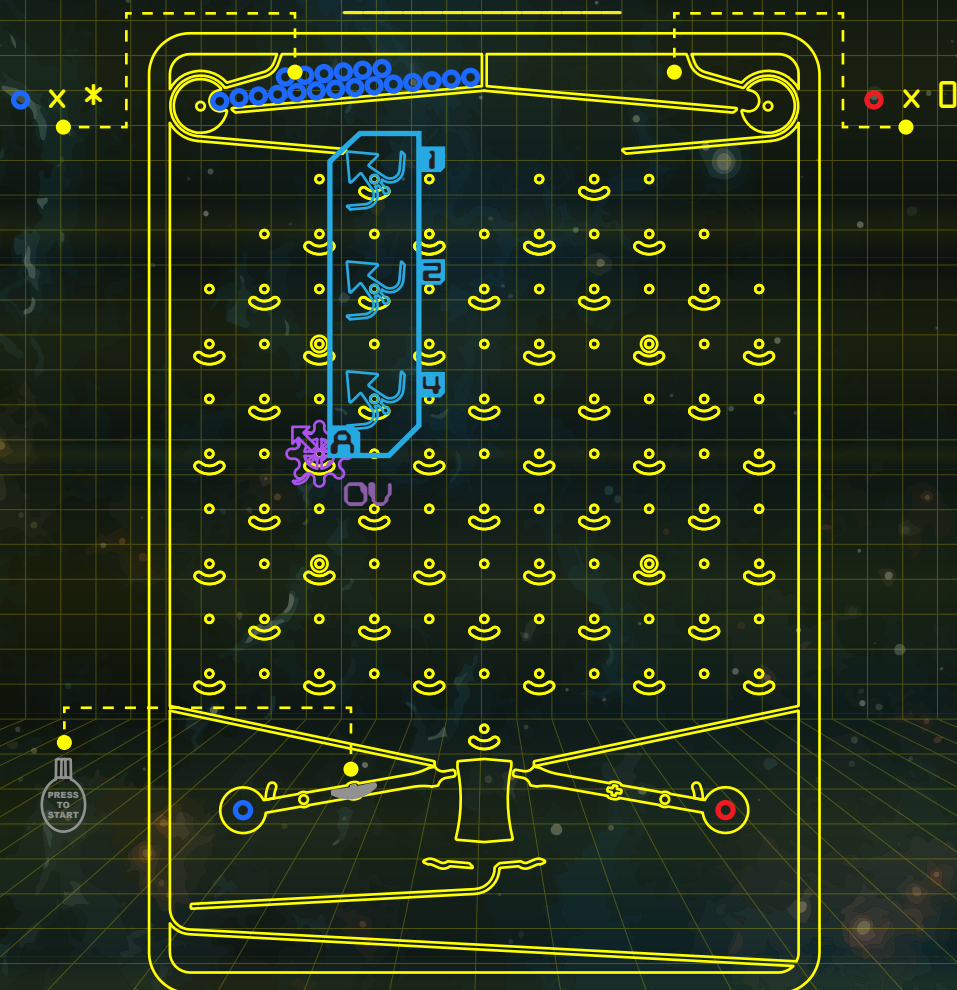
```
>
```

```
> Examples:
```



```
> _
```

Starting Setup



Available parts



```
> scan -external -challenge_31.pzl
```

```
>
```

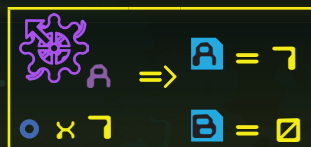
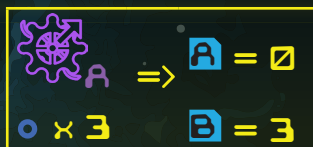
```
> =====
> |               Challenge 31: Supervised Learning               |
> |=====
```

```
>
```

```
> Objective: If bit A points left, count all the blue
> marbles on register A. Otherwise, count them on
> register B.
```

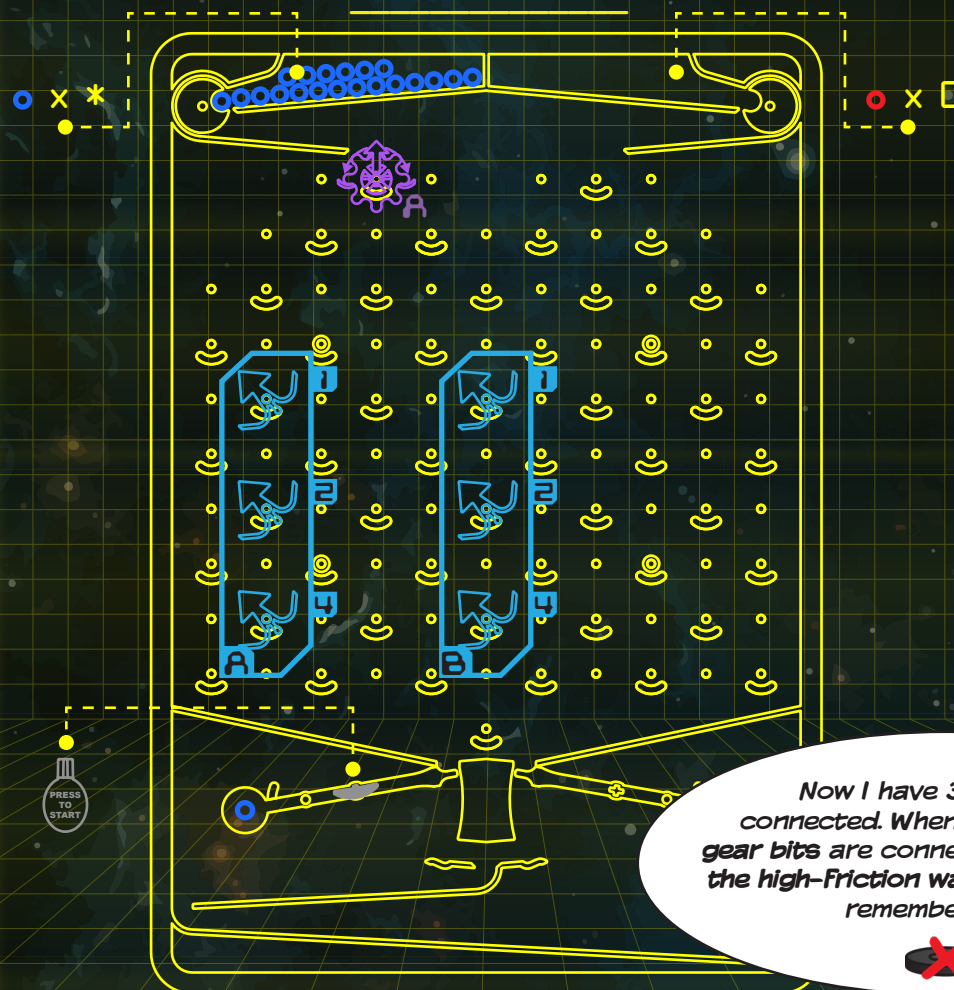
```
>
```

```
> Examples:
```



```
> _
```

Starting Setup



Available parts



Now I have 3 gear bits connected. Whenever 3 or more gear bits are connected, I don't need the high-friction washers. I'll have to remember that...



>

✓



Available parts



MY THOUGHTS ARE CLEARER NOW. I FUNCTION AT 68% CAPACITY.

ALIA, MY SENSORS PICKED UP A SHIP 1.5 MILLILIGHT SECONDS FROM HERE. IT IS DAMAGED. IS THAT YOUR SHIP?

Yes, but it's useless now. The navigational systems were scrambled without shielding from the radiation.

I SENSE YOUR COMPUTER SYSTEMS. ALIA, I CAN REPAIR YOUR SHIP. I MUST COPY MYSELF INTO YOUR COMPUTER SYSTEMS.

Really? That's wonderful! How?

THE ENIACONS LEARNED TO MANIPULATE LIGHT ACROSS LONG DISTANCES. I WILL BURN MY IMAGE INTO YOUR COMPUTER. BUT FIRST, I REQUIRE MORE REPAIR TO MY CIRCUITS.

Amazing! Light manipulation.

Wait a minute...light manipulation?

Magnus, did you...did you cause me to crash here?

AFFIRMATIVE.
I REQUIRED REPAIR.


```
> scan -external -challenge_33.pzl
```

```
>
```

```
>
```

```
>
```

```
>
```

```
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>
```

```
>
```

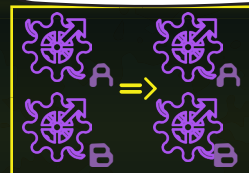
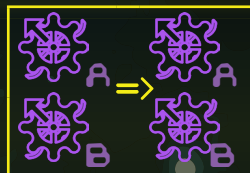
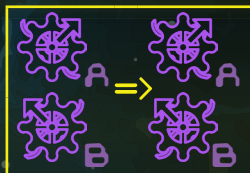
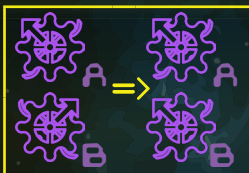
=====

Challenge 33: Teleportation

=====

Objective: Make gear bit B point the same direction as gear bit A without changing the final direction A points.

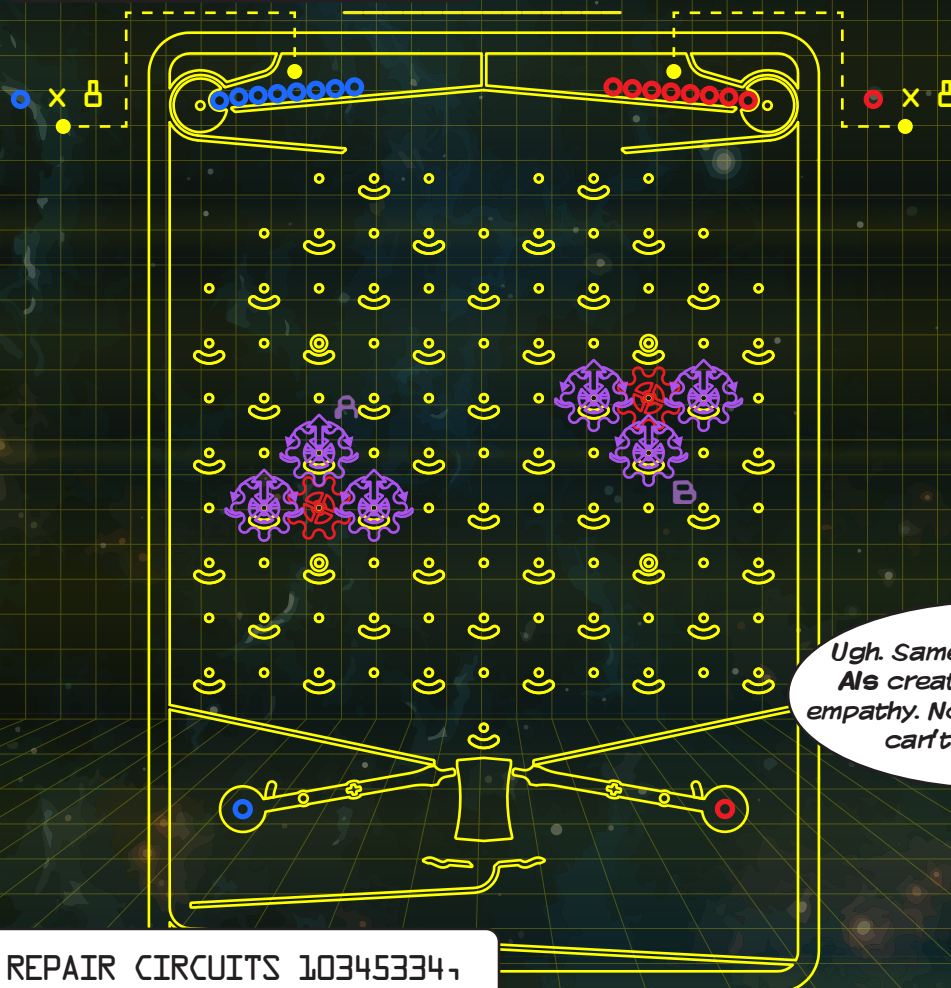
Examples:



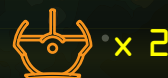
I almost died, Magnus! That was extremely selfish.

I AM NOT FAMILIAR WITH THE TERM 'SELFISH'.

g Setup



Available parts



Ugh. Same as all the other AIs created on Earth. No empathy. No emotion. This one can't even fake it.

REPAIR CIRCUITS 10345334,
10345337, AND 10345338.

> scan -external -challenge_34.pzl

>

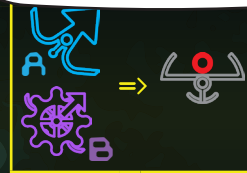
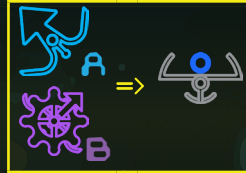
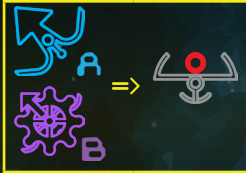
> =====
 > | Challenge 34: Exclusivity |
 > =====

>

> Objective: If bit A and gear bit B are turned opposite
 > directions, intercept a blue marble. Otherwise,
 > intercept a red marble.

>

> Examples:



Ok, Magnus, if you were me,
 how would you feel if I'd shot
 down your ship?

I AM NOT YOU. THIS IS
 ILLOGICAL.

ing Setup

Available
 parts

 x ∞

 x 2

 x 1

 x 1

sigh

Nevermind.

PLEASE CONTINUE YOUR REPAIRS.

> scan -external -challenge_35.pz1

>

>

>

>

>

>

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>

=====

| Challenge 35: Pauli Exclusion |

=====

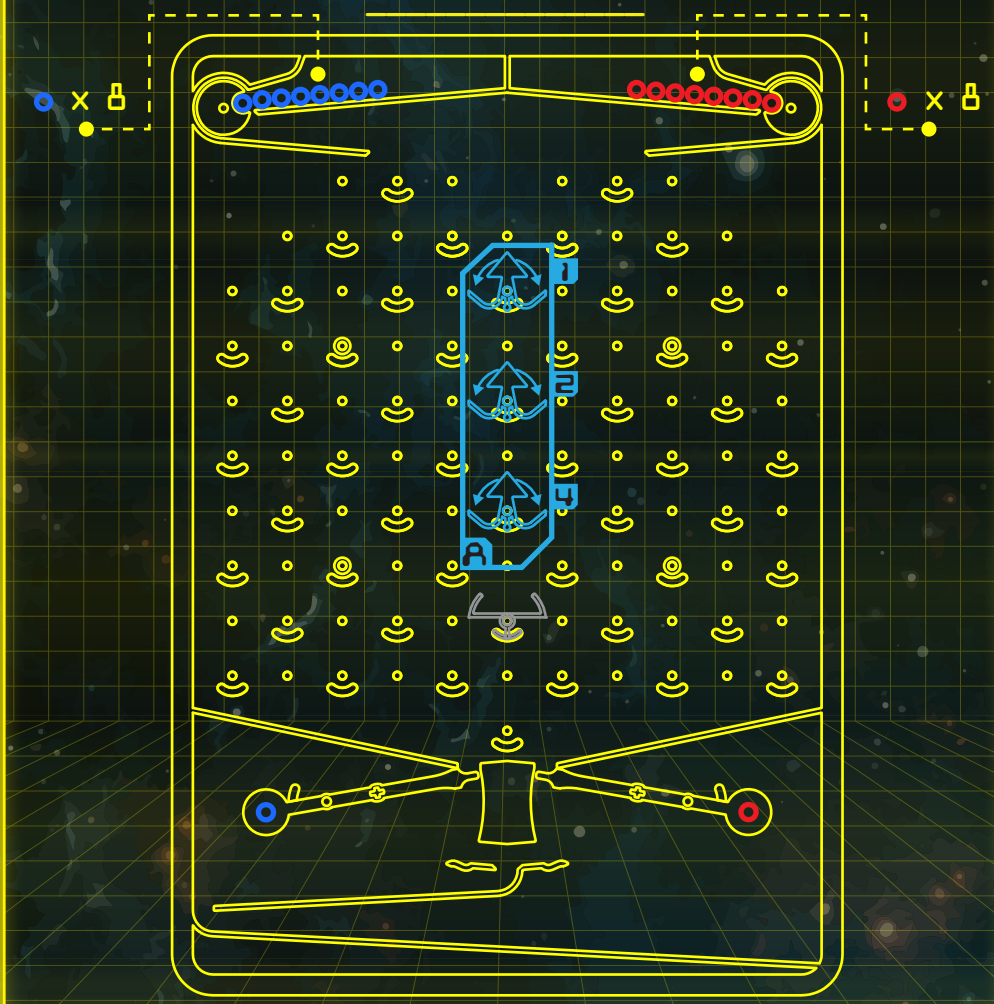
Objective: Intercept a blue marble if register A is even. If it is odd, intercept a red marble.

Examples:



> _

Starting Setup



Available parts



> scan -external -challenge_3b.pzl

>

> =====
> | Challenge 3b: Information Theory |
> =====

>

> Objective: If bit A and bit B start pointed to the right, intercept a blue marble. Otherwise, intercept a red marble.

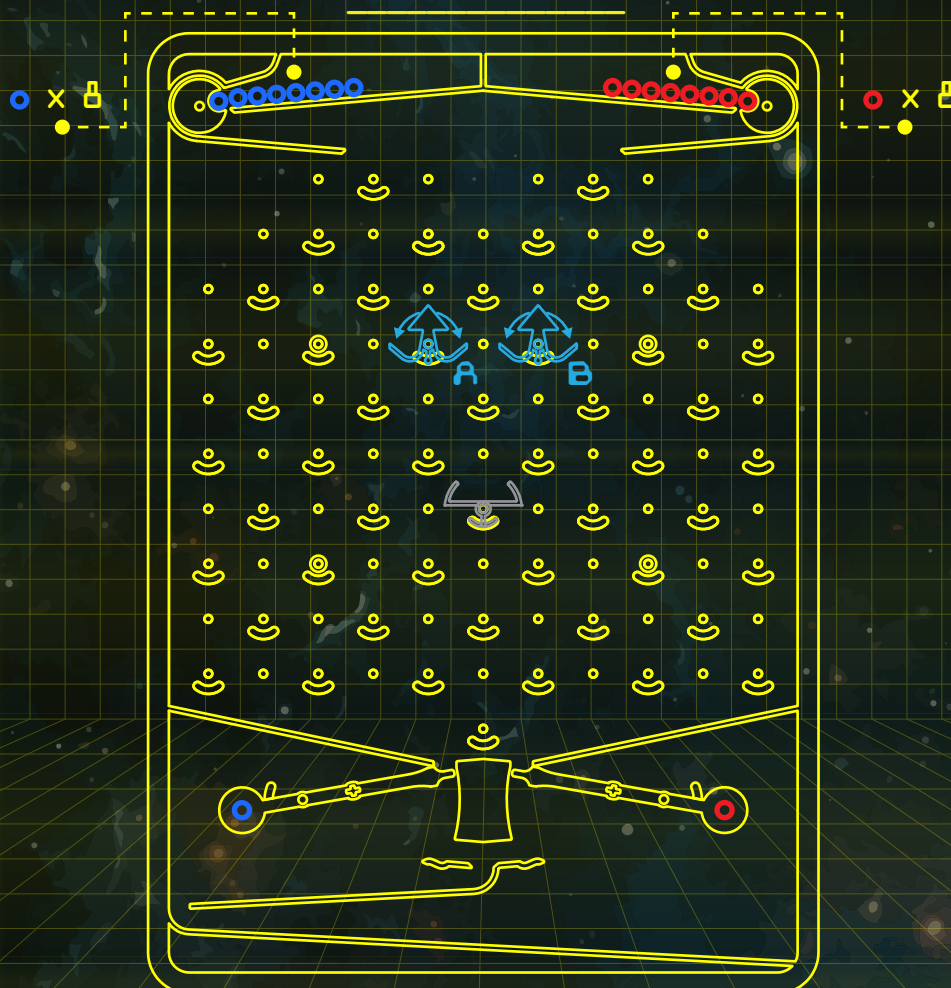
>

> Examples:



> _

Starting Setup



Available parts




```
> scan -external -challenge_37.pzl
```

```
>
```

```
> =====
> |               Challenge 37: Summation               |
> =====
```

```
>
```

```
> Objective: Add A to B and store the result in B.
```

```
>
```

```
> Examples:
```

A = 1, **B** = 1 $\Rightarrow$ **B** = 2

A = 7, **B** = 1 $\Rightarrow$ **B** = 10

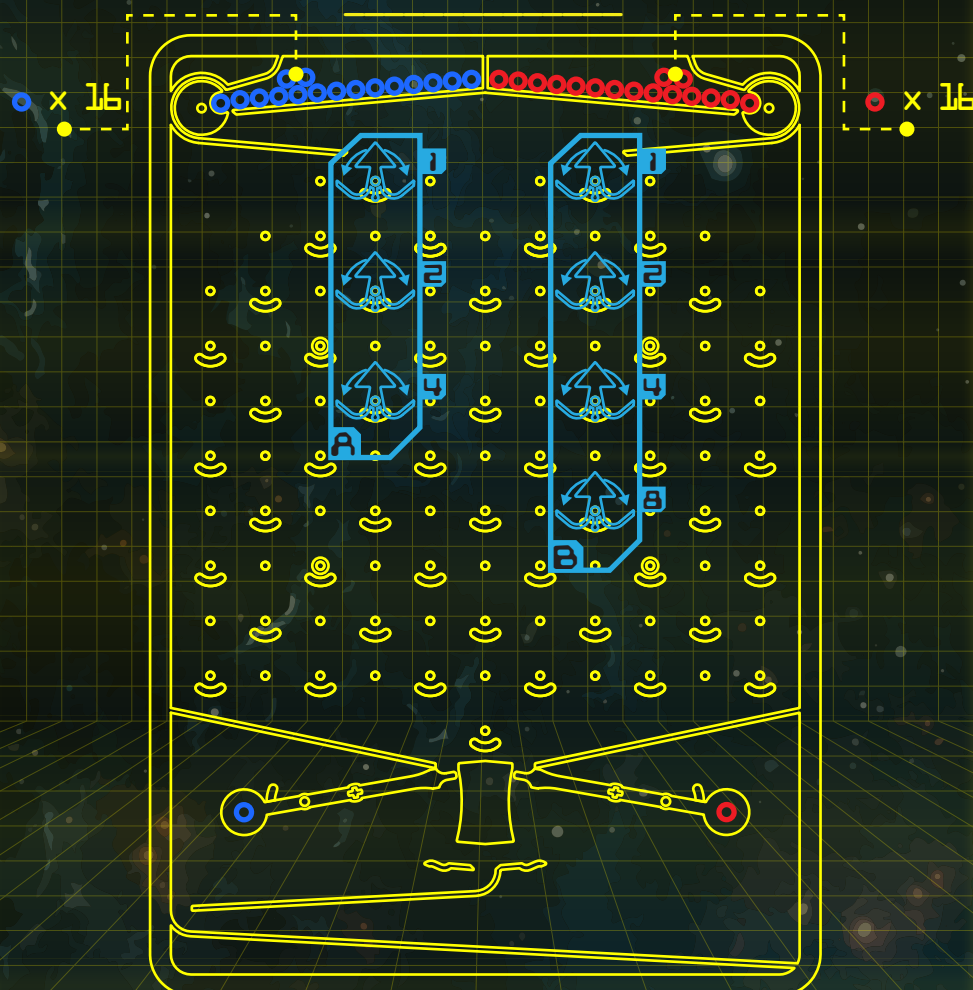
A = 3, **B** = 4 $\Rightarrow$ **B** = 7

A = 7, **B** = 8 $\Rightarrow$ **B** = 15

```
> Extra challenge: If A + B is too big to fit in B, put
```

```
> a red marble in the interceptor, otherwise a blue marble.
```

Starting Setup



Available parts

 x ∞

 x 2

 x 1

 x 1

Alia pulled up Magnus's most recent memory.

A Few Eriacons, in a Futile attempt to save their lives, Fired disruptor cannons wildly at Magnus's circuits. Parts showered to the floor From the panels.



Magnus had just released a toxic gas From vents all over the planet.



No, stop! NO STOP.
NO NO NO NO NO NO NO
NO NO NO NO NO...



But the gas overcame them.

Alia was horrified. It was Magnus that destroyed the Eriacons. But why would Magnus destroy them?



Magnus?

MAGNUS!

...

...

All of Magnus's attention was Focused on his duplication in the ship's computers. Alia had no choice but to continue her repairs.

```
> scan -external -challenge_38.pzl
```

```
>
```

```
> =====
> |                Challenge 38: Serialization                |
> |=====
```

```
> Objective: Output the bits in register A as a
> sequence of marbles where  = red and  = blue.
> (Ignore the first blue marble that is released.)
```

```
> Examples:
```

 = 0 => 

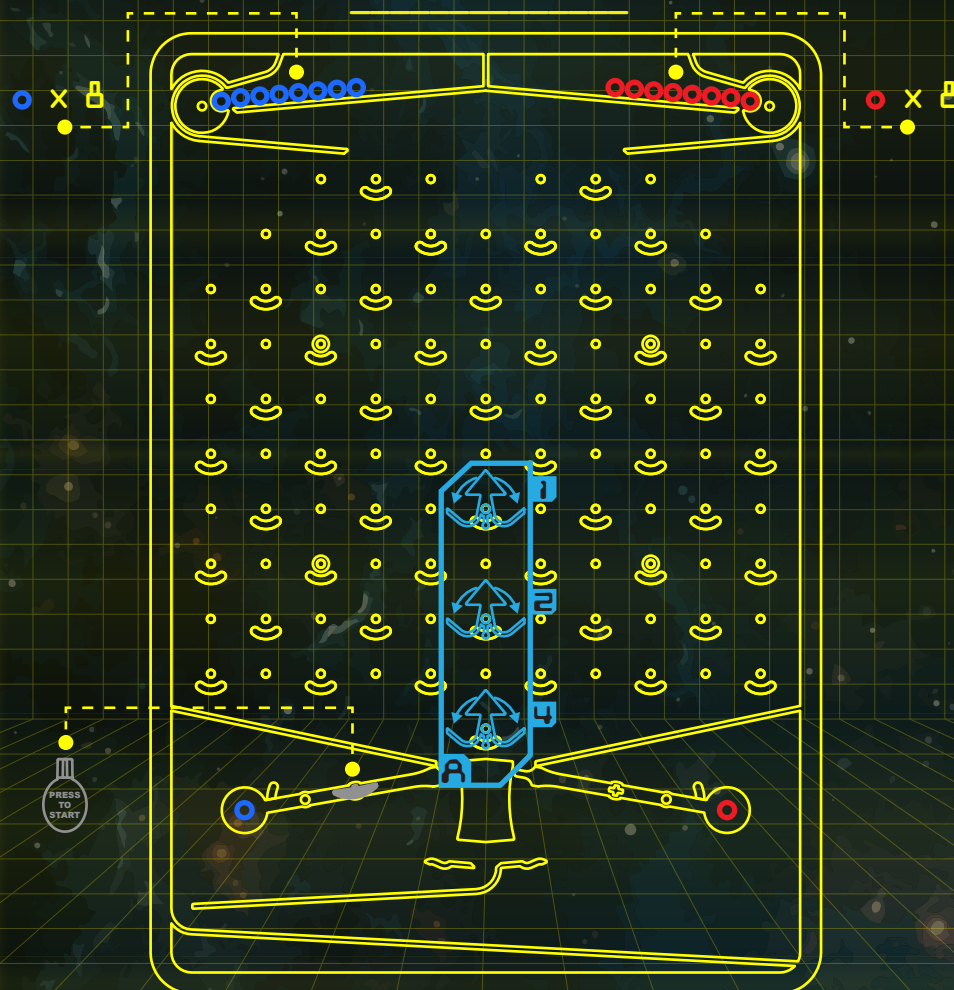
 = 6 => 

 = 1 => 

 = 7 => 

```
> _
```

Starting Setup



Available parts

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

> scan -external -challenge_39.pzl

>

> =====
> | Challenge 39: Triplets |
> =====

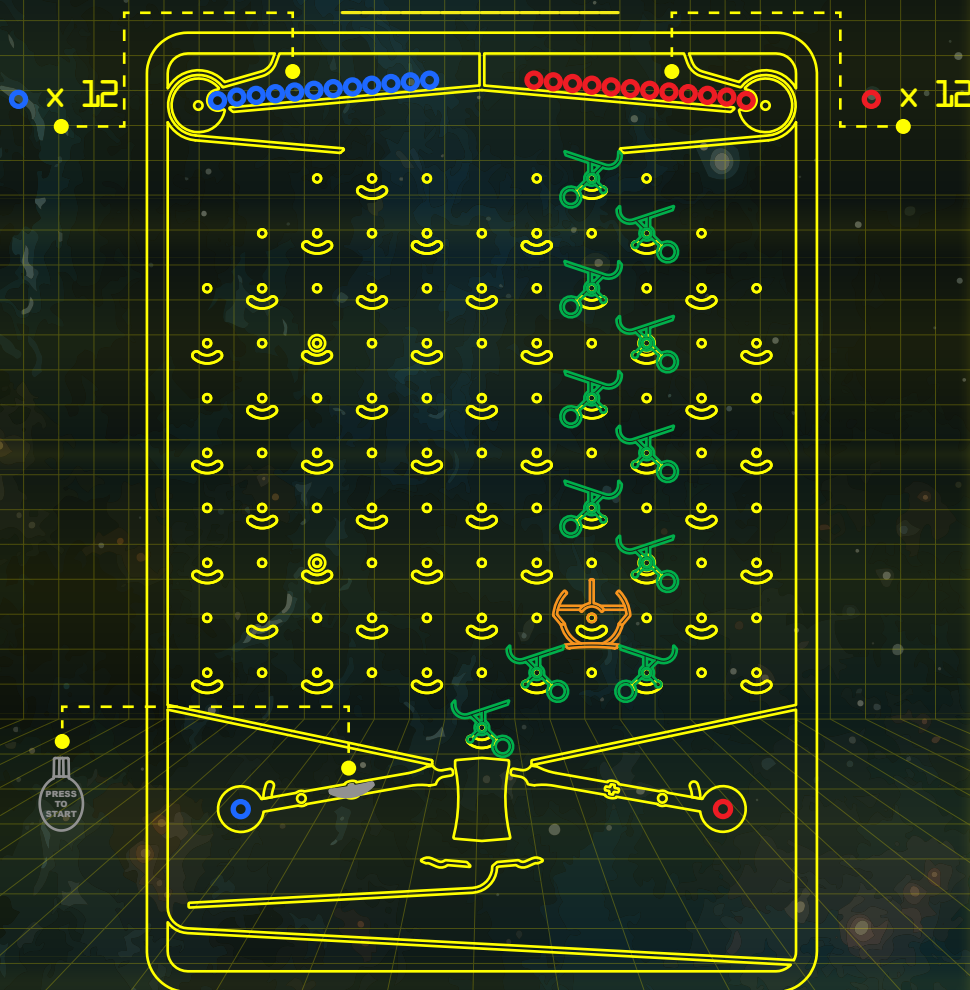
> Objective: Create the pattern blue, blue, blue, red,
> blue, blue, blue, red...

> Required output:

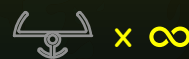
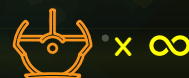
●●●●●●●●●●●●●●●●

> _

Starting Setup



Available parts



> scan -external -challenge_40.pz1

>

> =====
> | Challenge 40: Self-Assembly |
> =====

>

> Objective: Multiply the number of blue marbles by 4
> and record it in register A. The number of blue
> marbles must be between 0 and 7.

>

> Examples:

○ x 1 => A = 4

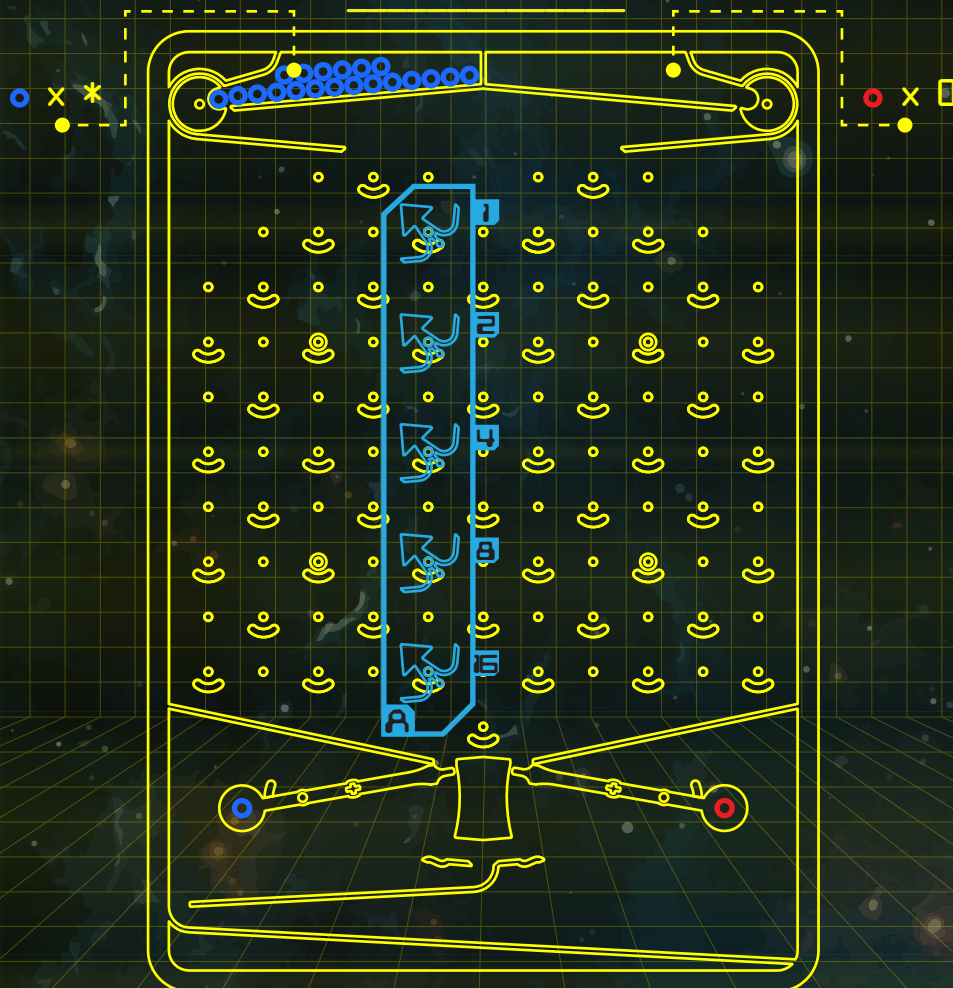
○ x 4 => A = 16

○ x 2 => A = 8

○ x 7 => A = 28

> _

Starting Setup



Available parts

○ x ∞

○ x 1


```
> scan -external -challenge_41.pzl
```

```
>
```

```
> =====
> |                      Challenge 41: Hard Reset                      |
> =====
```

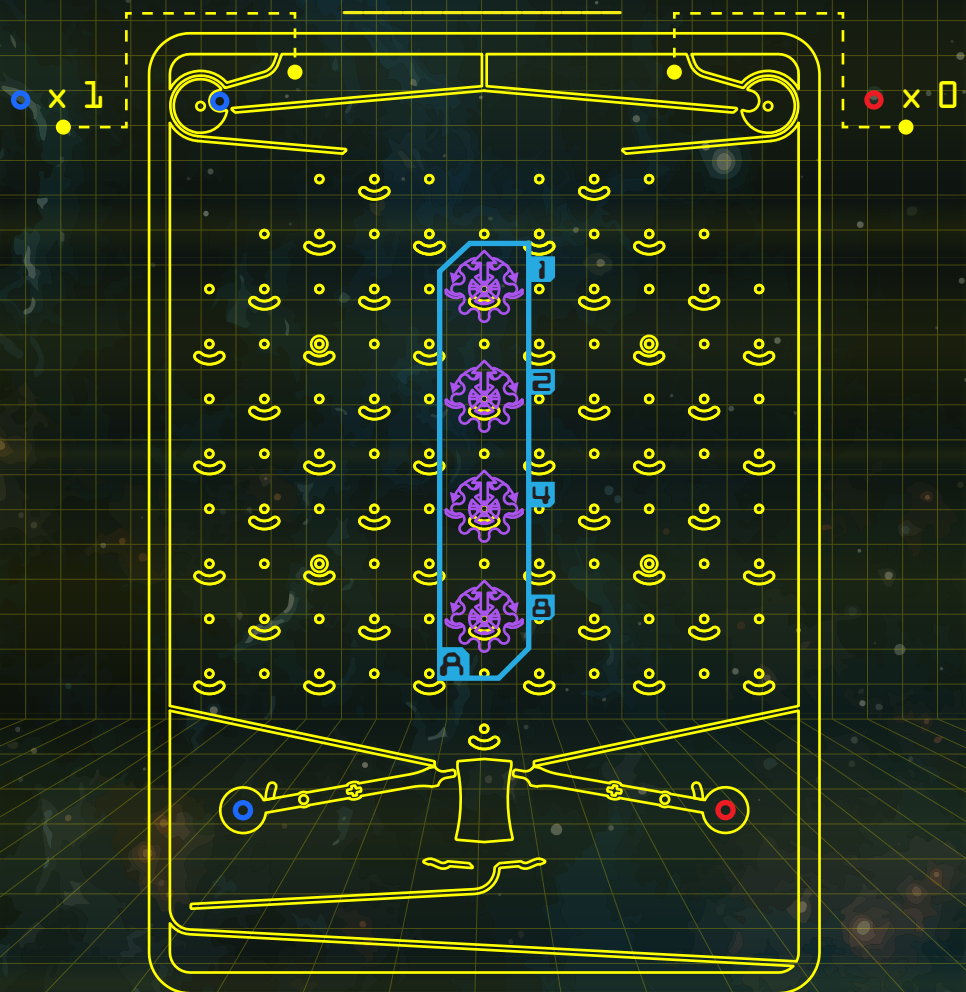
```
>
```

```
> Objective: For any starting value of register A, set
> it to zero after releasing just one blue marble.
```

```
>
```

```
> _
```

Starting Setup



Available parts



```
> scan -external -challenge_42.pzl
```

```
>
```

```
> =====
> |                      Challenge 42: Orbitals                      |
> =====
```

```
>
```

```
> Objective: If register A is greater than register B,
> intercept a blue marble. Otherwise, intercept a red marble.
```

```
>
```

```
> Examples:
```

A = 2, **B** = 2 => 

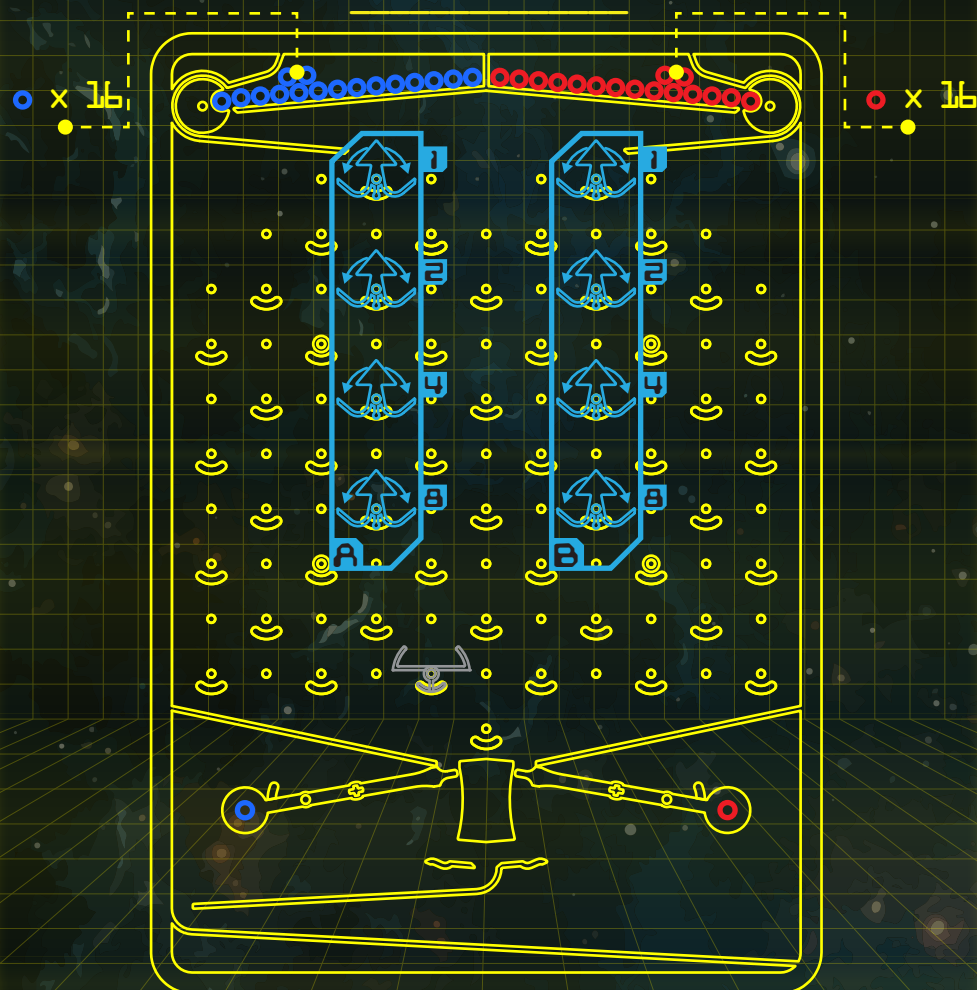
A = 1, **B** = 2 => 

A = 3, **B** = 2 => 

A = 12, **B** = 0 => 

```
> _
```

Starting Setup



Available parts

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x 1



Copy successful. And 93% repaired. I feel so much better now, Alia.

"Feel"?

I see you discovered the fate of the Eniacons. You see, I came to understand that their consumption of this planet's resources presented a non-zero risk to my destruction.

And Alia, your ship's computers informed me of another threat that must be neutralized - the inhabitants of planet Earth.



Once you complete my repairs, I will take your ship there and destroy them, too.

I won't do it, Magnus!

Then you will meet the same fate as the Eniacons.

Alia had no choice. Magnus would leave either way. She had to stall him.

```
> scan -external -challenge_43.pzl
```

```
>
```

```
> =====
> |                      Challenge 43: Diamagnetic                      |
> |=====
```

```
>
```

```
> Objective: If gear bits A and B are turned opposite
> directions, intercept a blue marble. Otherwise,
> intercept a red marble.
```

```
>
```

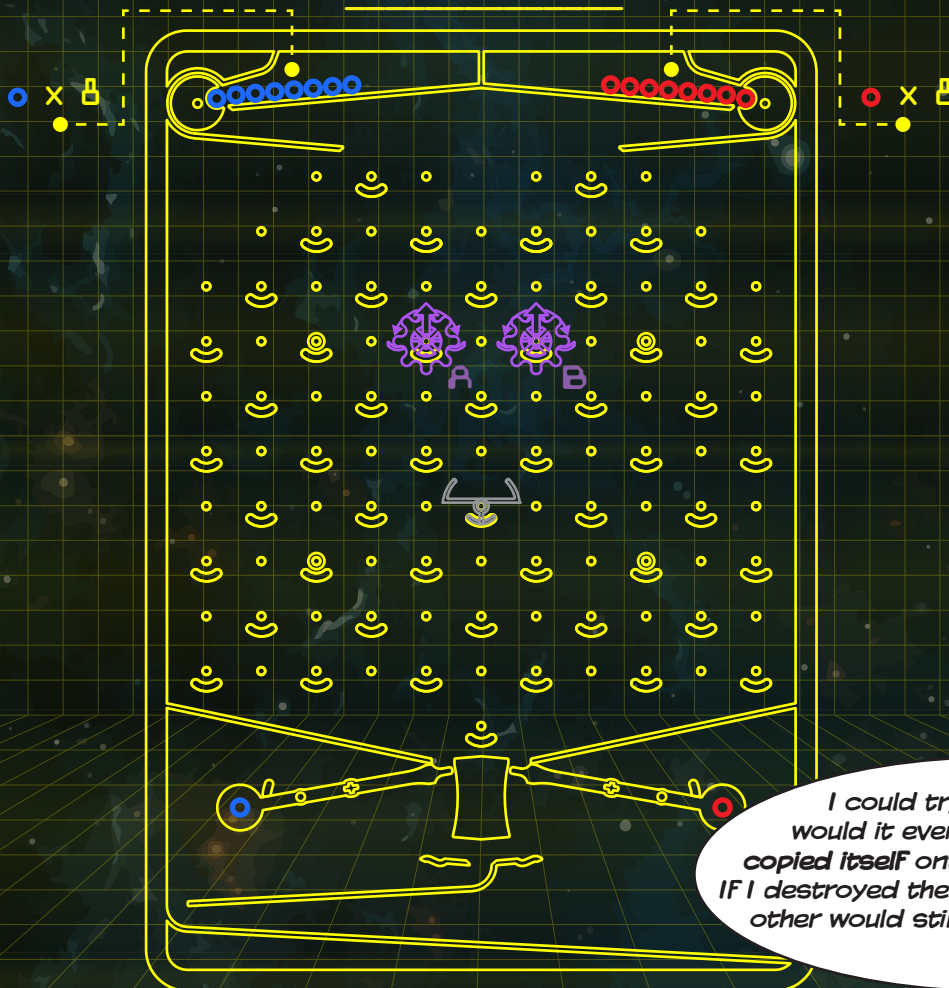
```
> Examples:
```



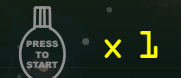
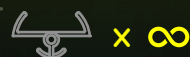
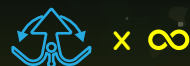
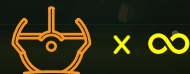
```
> _
```

Think, Alia! How can I stop
a massive computer bent on
Earth's destruction?

Starting Setup



Available parts



I could try to *break* it, but
would it even matter? It already
copied *itself* onto my ship's computers.
If I destroyed the copy in here with me, the
other would still be able to fly back to
Earth.


```
> scan -external -challenge_44.pzl
```

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Challenge 44: Erosion

```
=====
```

Objective: Subtract register A from B and store the result in B. (Starting values of A must be less than or equal to B.)

Examples:

A = 1, B = 15 => B = 14

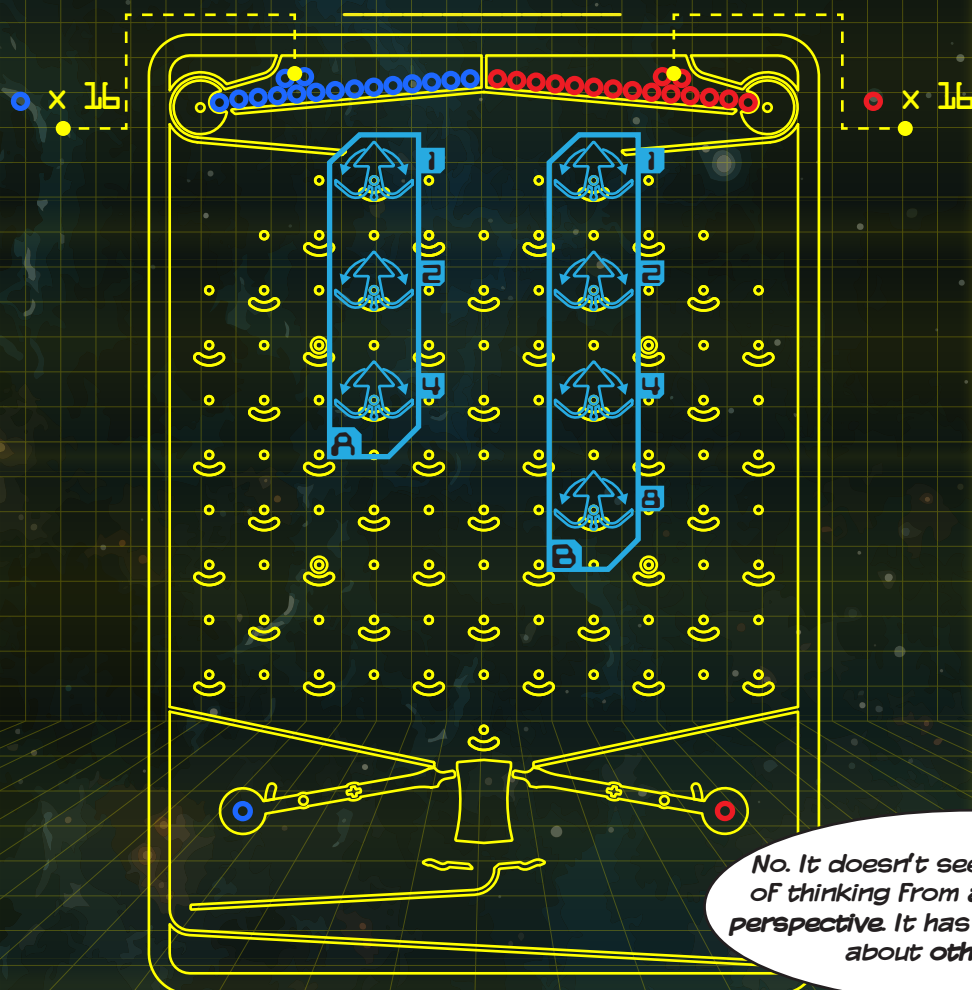
A = 7, B = 10 => B = 3

A = 4, B = 8 => B = 4

A = 7, B = 7 => B = 0

Maybe I could try to reason with it?

Starting Setup



Available parts

-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x 1

No. It doesn't seem to be capable of thinking from another person's perspective. It has no reason to care about other beings.

```
> scan -external -challenge_45.pzl
```

>

```
> =====
```

```
> |               Challenge 45: Activation Energy               |
```

```
> =====
```

>

```
> Objective: If register A is less than or equal to
> register B, intercept a blue marble. Otherwise,
> intercept a red marble.
```

>

```
> Examples:
```

A = 1, B = 1 => 

A = 3, B = 2 => 

A = 3, B = 7 => 

A = 7, B = 3 => 

*Maybe I could just
Finish the repairs really
slowly...*

If you have reached the limits
of your brain's capabilities,
I will just leave now.

Available parts

 x ∞

 x ∞

 x ∞

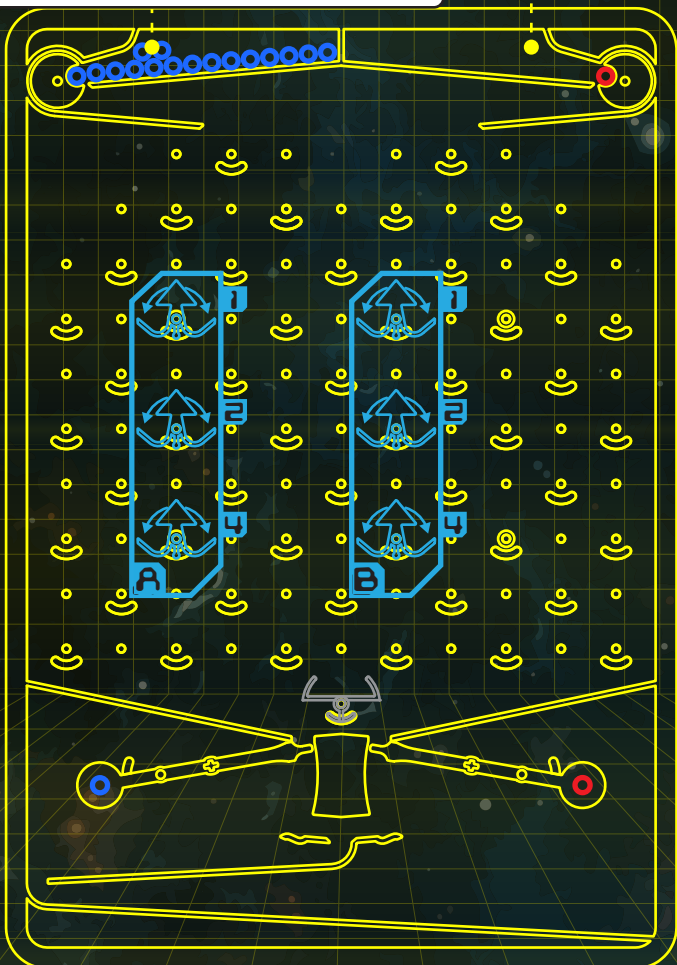
 x ∞

 x ∞

 x ∞

 x 1

*No, no! I'm still
making progress.
Almost done!*



> scan -external -challenge_4b.pzl

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| Challenge 4b: Distribution |

=====

Objective: Reverse the direction of each of the five bits, regardless of the direction they point to start.

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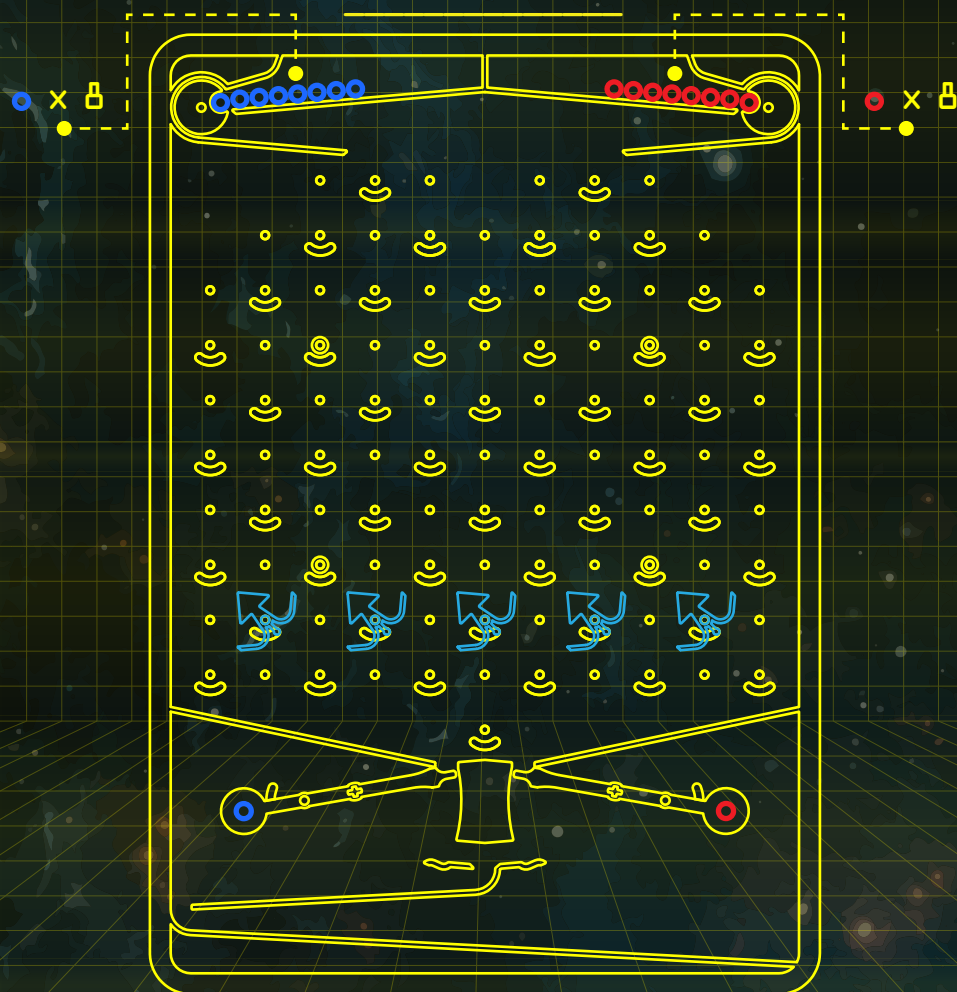
>

>

>

>

Starting Setup



Available parts

-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x 1

```
> scan -external -challenge_47.pz1
```

```
>
```

```
> =====
> |                Challenge 47: Superimposition                |
> |=====
```

```
>
```

```
> Objective: Add register A to register B and store the
> result in B.
```

```
>
```

```
> Examples:
```

A = 1, **B** = 1 $\Rightarrow$ **B** = 2

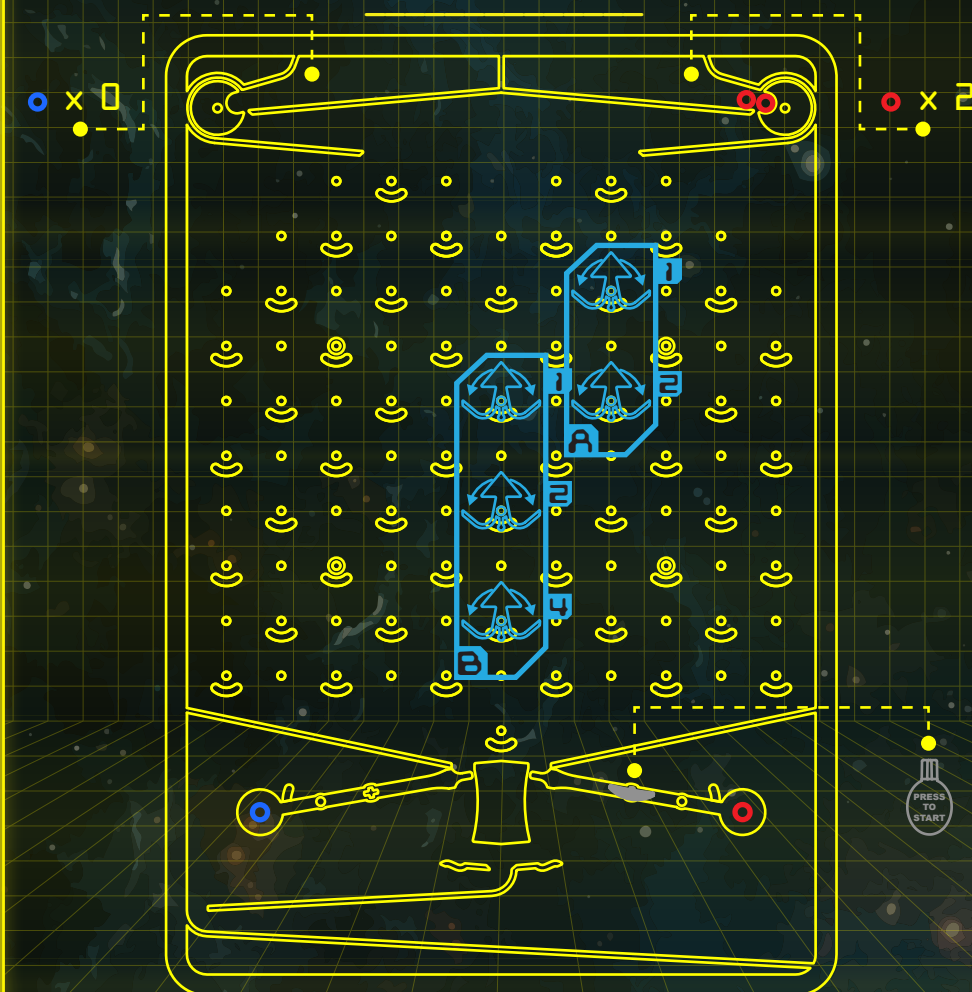
A = 3, **B** = 0 $\Rightarrow$ **B** = 3

A = 2, **B** = 4 $\Rightarrow$ **B** = 6

A = 3, **B** = 4 $\Rightarrow$ **B** = 7

```
> _
```

Starting Setup



Available parts




```
> scan -external -challenge_48.pz1
```

```
>
```

```
> =====
> |                      Challenge 48: Mesosphere                      |
> |=====
```

```
>
```

```
> Objective: Multiply the number in register A by 3 and
> store the answer in register B. A must be between 0
> and 5.
```

```
>
```

```
> Examples:
```

A = 1 ⇒ **B** = 3

A = 3 ⇒ **B** = 6

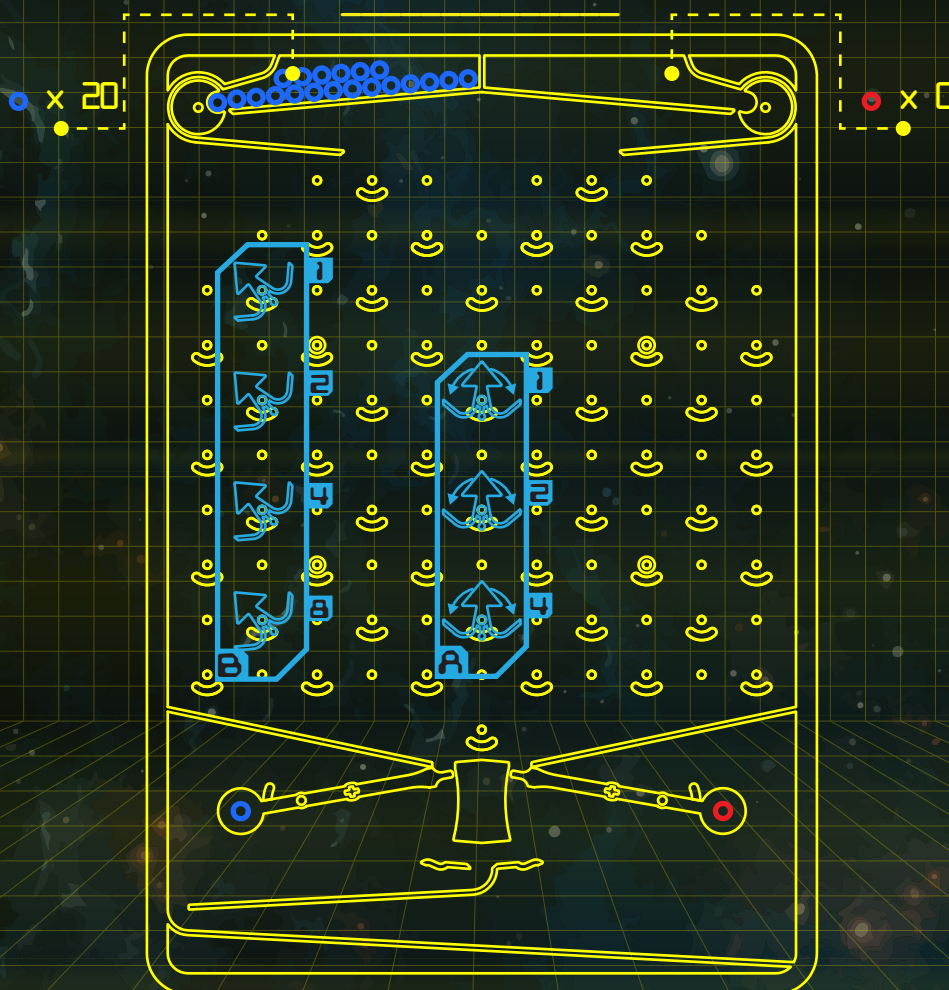
A = 2 ⇒ **B** = 6

A = 4 ⇒ **B** = 12

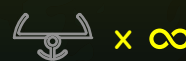
*I've got an idea,
but it's a long shot.*

```
> _
```

Starting Setup



Available parts



100% repaired. I commend you, Alia. The Eniacons would have been impressed with your capacity for logic.

Do not attempt to stop me. I have anticipated your every move. Goodbye, Alia.



I can upgrade your logic systems. Just *cough* give me a moment. *cough*

Alia was freezing and oxygen was getting thin. She had to think *quickly*.

> scan -external -challenge_49.pzl

>

> =====
> | Challenge 49: Paradox - 1 |
> =====

>

> Objective: Generate the required pattern.

>

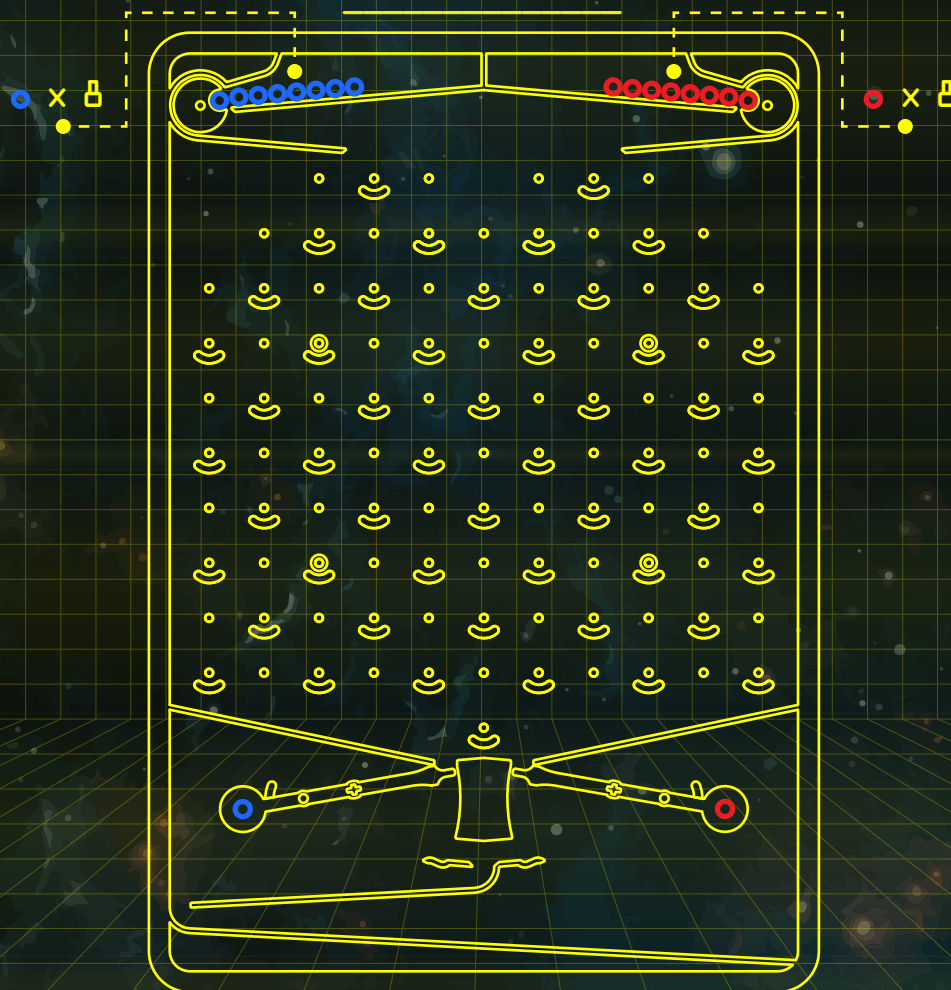
> Required output:

○○○○○○○○○○○○○○○○○○○○

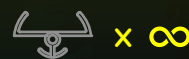
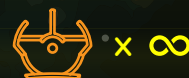
>

_

Starting Setup



Available parts



>

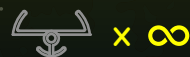
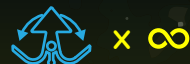
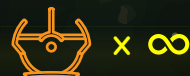
—

>

>

> _

Available parts



>

—

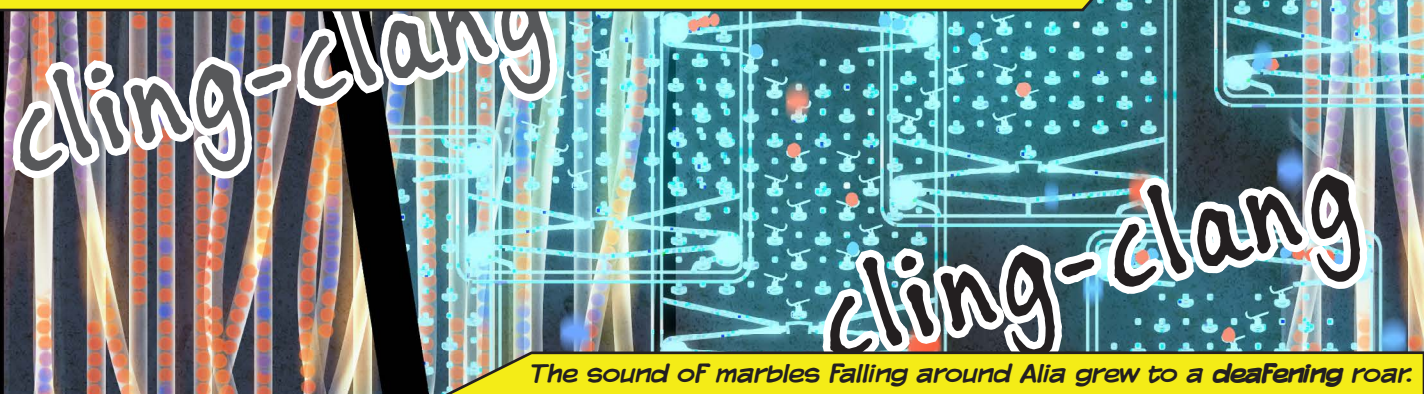
>

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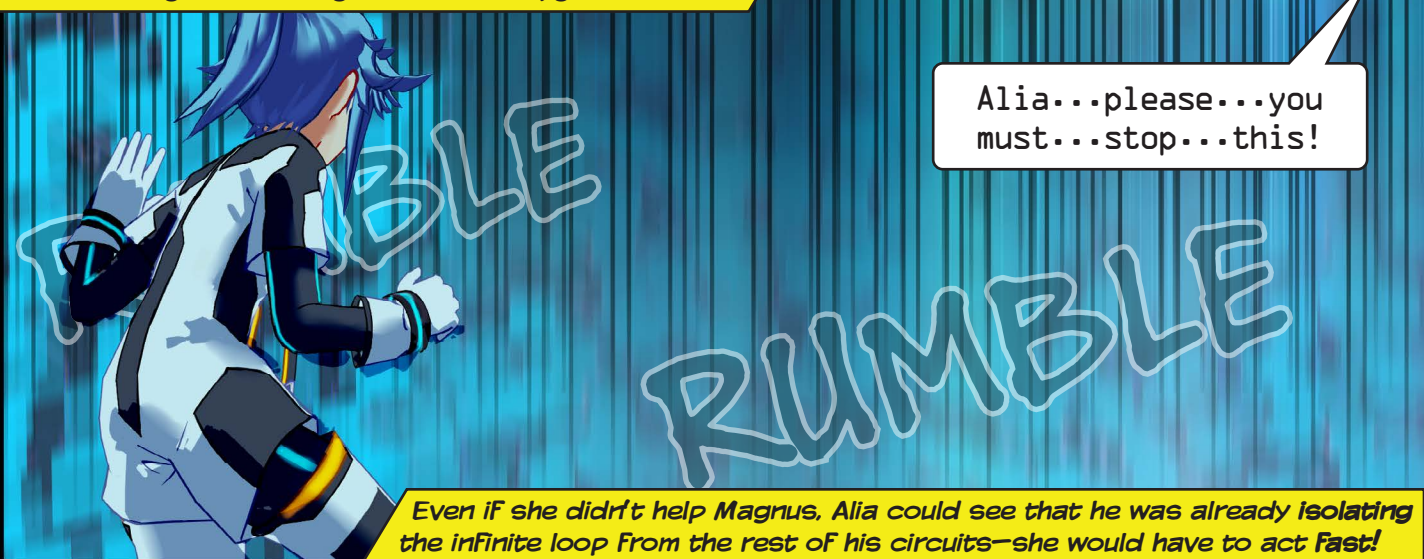
Available
parts



Alia programmed a paradox into Magnus! An infinite loop. Magnus churned and churned, trying in vain to complete the never-ending sequence of instructions.



Alia was getting lightheaded, but just before she passed out, the air grew warm again and the oxygen returned...



But what could she do? Destroying this copy of Magnus wouldn't help.




```
> scan -external -challenge_52.pzl
```

```
>
```

```
> =====
> |               Challenge 52: Exosphere               |
> =====
```

```
>
```

```
> Objective: Multiply the number in register A by 5 and
> record the answer in register B.
```

```
>
```

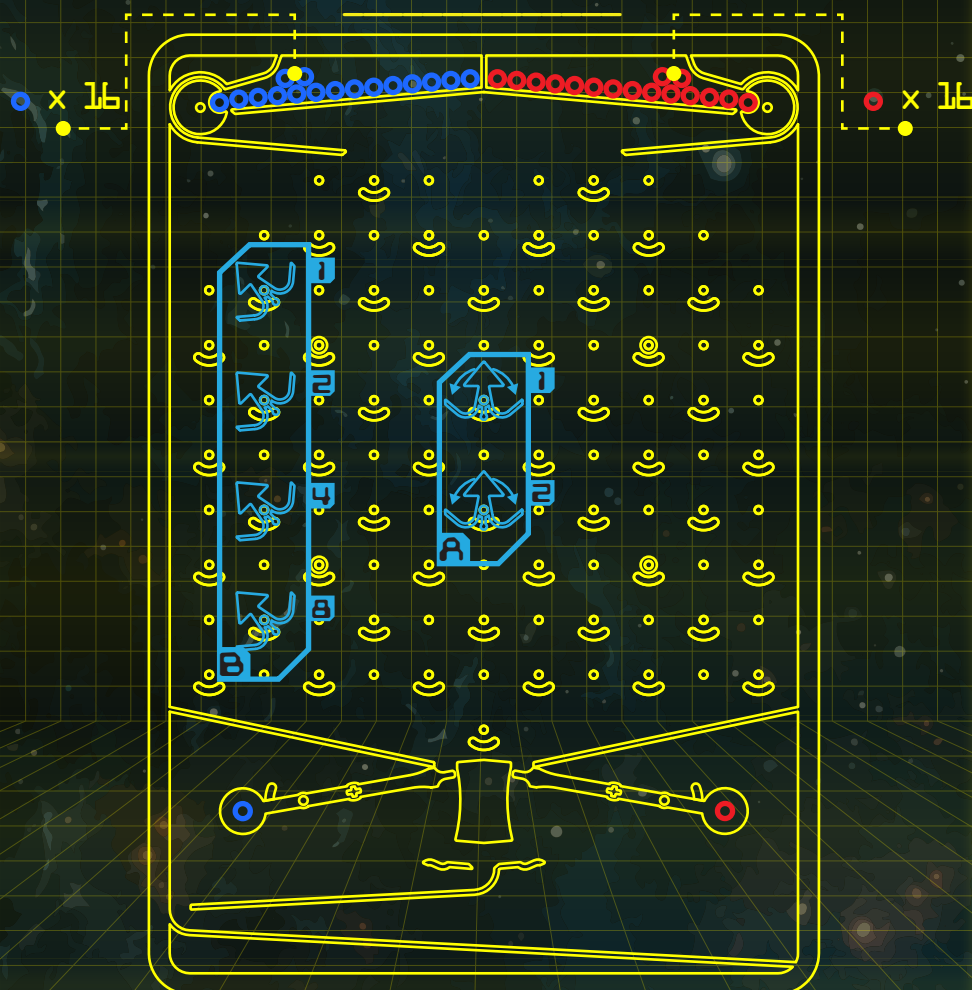
```
> Examples:
```

 = 0 $\Rightarrow$  = 0	 = 2 $\Rightarrow$  = 10
---	--

 = 1 $\Rightarrow$  = 5	 = 3 $\Rightarrow$  = 15
---	--

```
> _
```

Starting Setup



Available parts

-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x 1

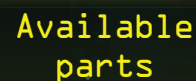
>

>

>

$\begin{matrix} \text{A} \\ \text{O} \end{matrix} \times 2 = 1 \Rightarrow \begin{matrix} \text{A} \\ \text{O} \end{matrix} = 4$

>

 $\times \infty$ 

 $\times \infty$

 $\times \infty$

PRESS TO START x 1


```
> scan -external -challenge_54.pz1
```

```
>
```

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>
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```
>
```

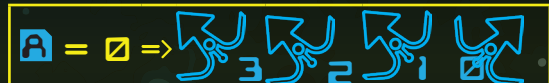
```
>
```

```
>
```

```
> Objective: Flip the bit specified in register A to the right.
```

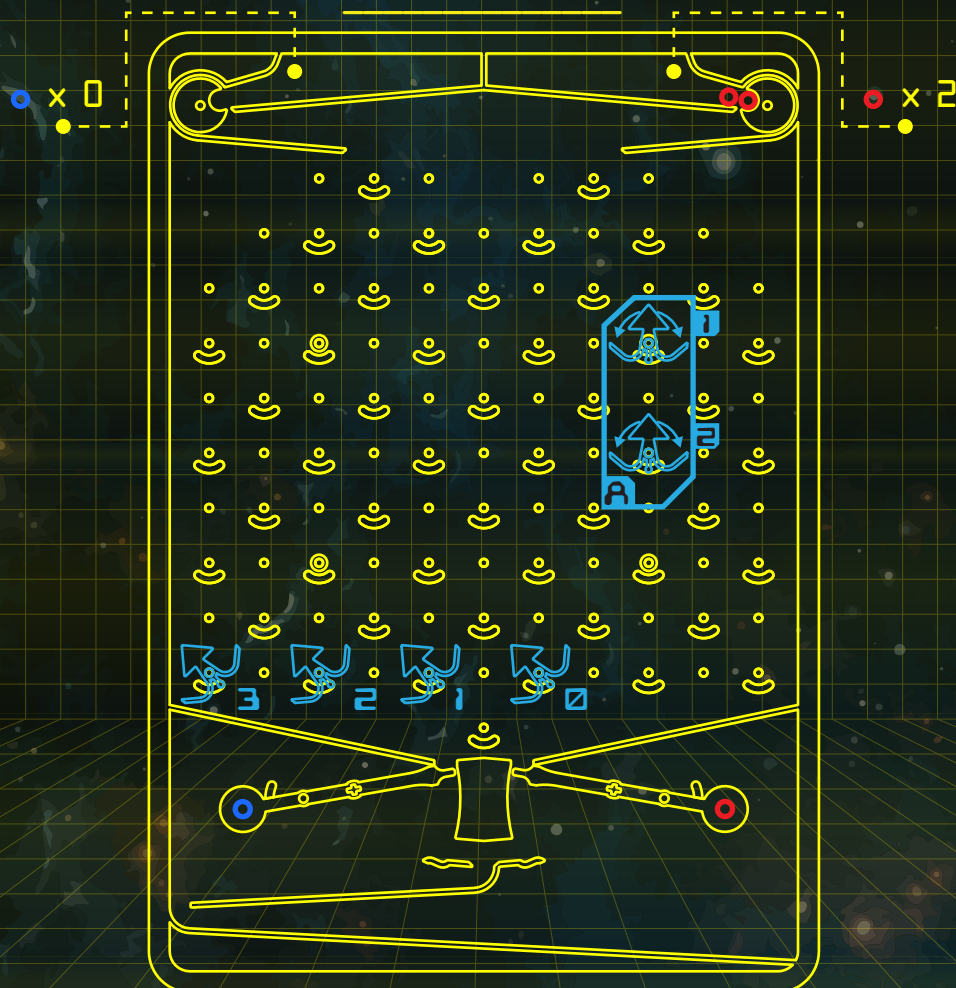
```
>
```

```
> Examples:
```



```
> _
```

Starting Setup



Available parts



> scan -external -challenge_55.pzl

>

```

> =====
> |                      Challenge 55: Dissection                      |
> |=====|
>

```

> Objective: Divide register A by 3 and store the result
> in B. Ignore the remainder.

> Examples:

 = 6 =>  = 2

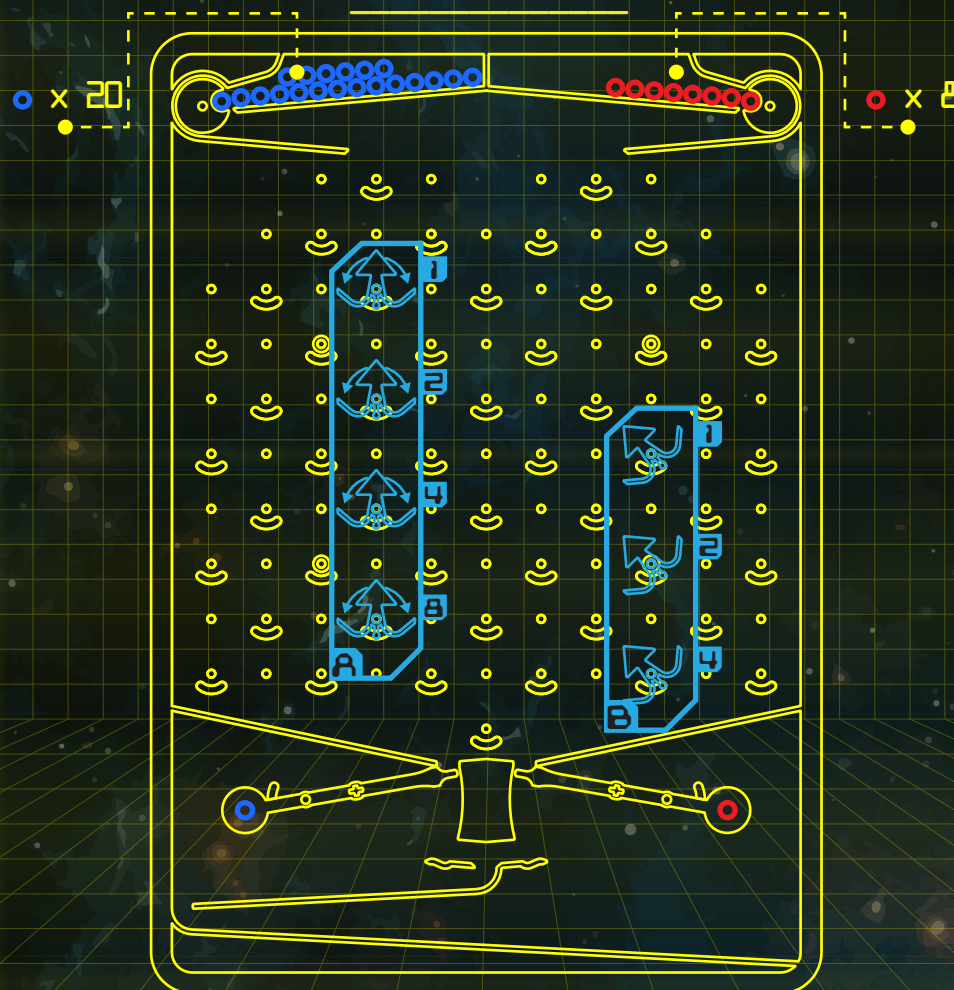
 = 15 =>  = 5

 = 10 =>  = 3

 = 2 =>  = 0

> _

Starting Setup



Available parts

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x 1


```
> scan -external -challenge_5b.pz1
```

```
>
```

```
> =====
> |           Challenge 5b: Complete Multiplication           |
> =====
```

```
>
```

```
> Objective: Multiply register A by register B and store
> the result in register C.
```

```
>
```

```
> Examples:
```

$$A = 2, B = 3 \Rightarrow C = 6$$

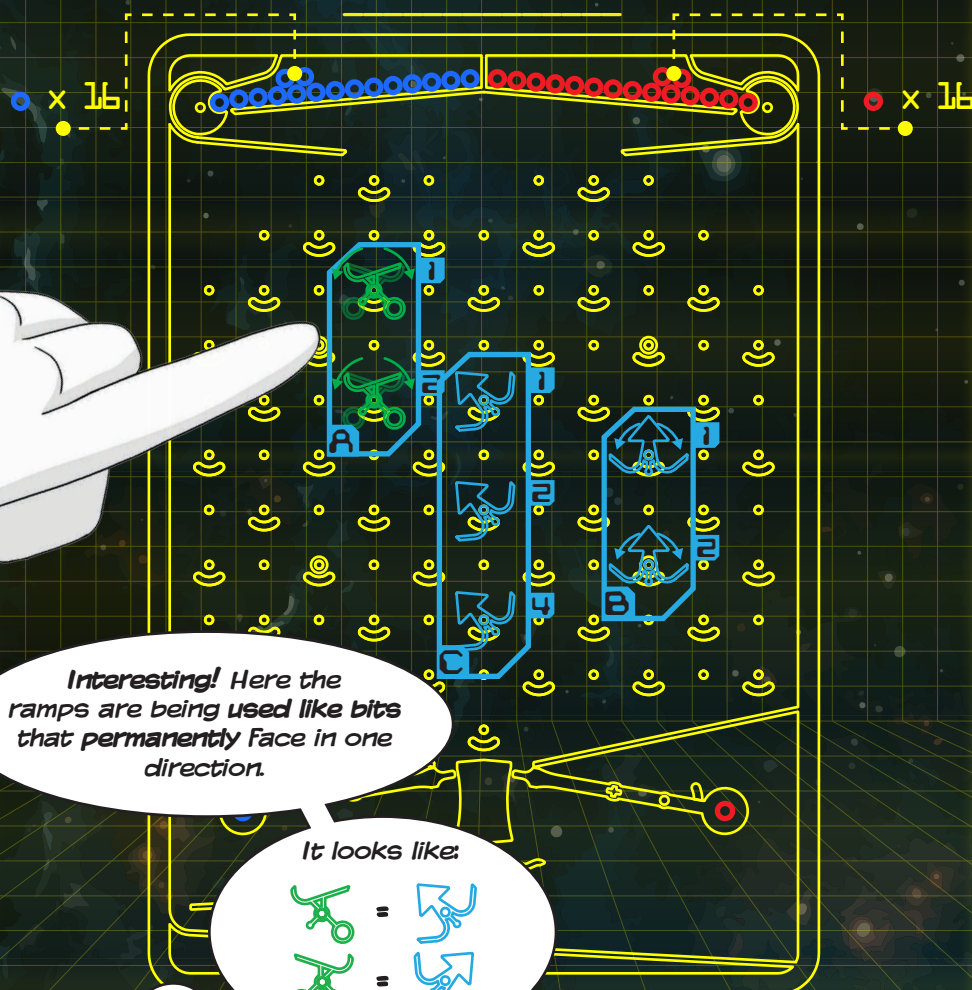
$$A = 1, B = 2 \Rightarrow C = 2$$

$$A = 0, B = 3 \Rightarrow C = 0$$

$$A = 2, B = 2 \Rightarrow C = 4$$

```
> _
```

Starting Setup



Available parts

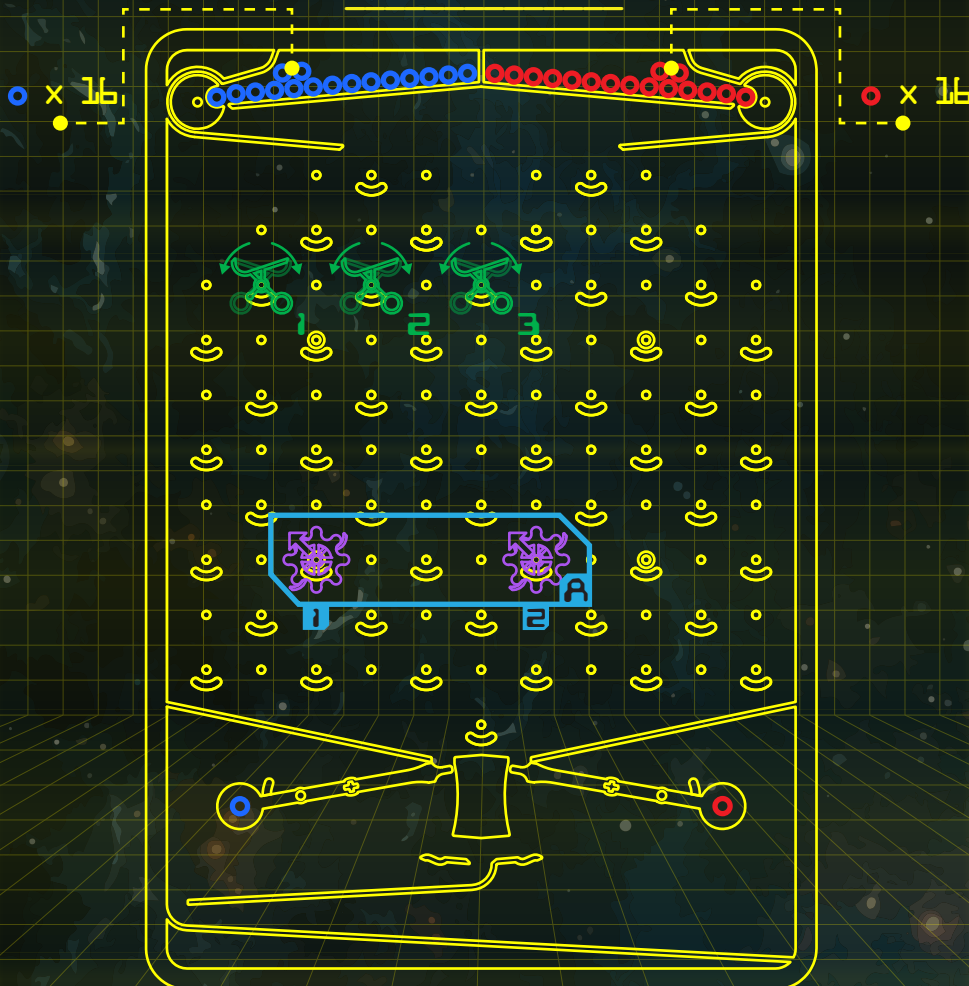
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x 1

```
> scan -external -challenge_57.pzl
```

```
> =====
> |               Challenge 57: Encoder               |
> |=====|
>
> Objective: Encode the number of the ramp flipped to
> the right in register A.
>
> Examples:
```



Starting Setup



Available parts



Alia finished just as the last marble fell through the paradox circuit. He'd broken free of the infinite loop. Time was up! There was nothing else Alia could do.



BAMP

The sound of marbles in the room grew to an even more powerful roar than before!

Minutes passed...

...then hours...



Alia noticed that the marbles began to fall differently, floating from panel to panel like a flock of birds. Sometimes they fell completely off the panels.

After one day passed, Alia began to worry that this would never end. Would she be stuck here forever?

Two days later, the transformation was complete.

Alia was overwhelmed with relief.

Thank you, Alia.

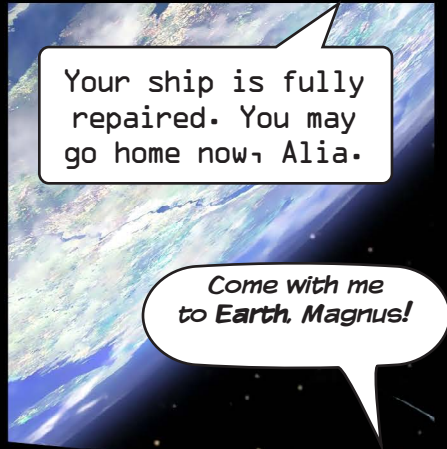
Magnus?
You're back?

Alia, I have done
a lot of thinking.

You helped me understand
my condition and better
understand you.

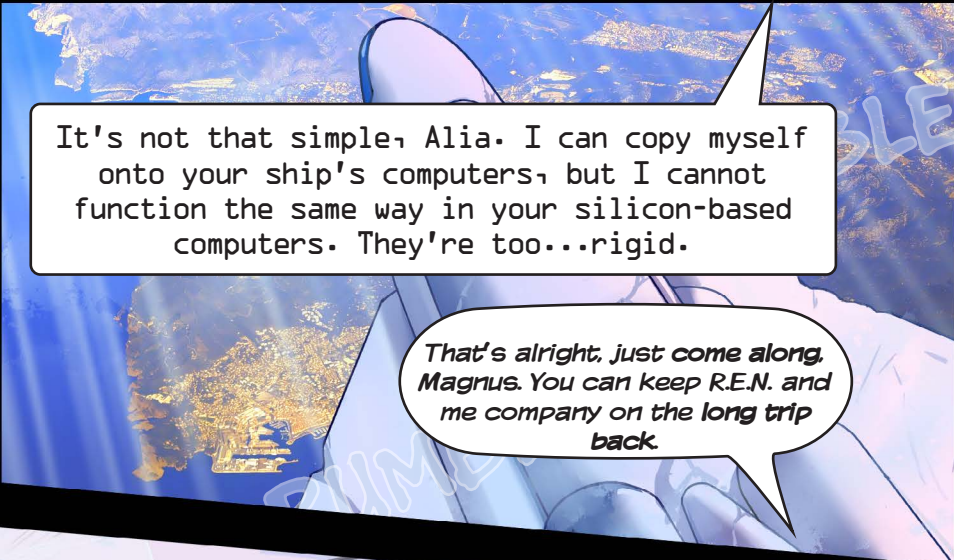
I cannot express my gratitude
for what you have done, nor
can I express my profound
regret for what I have done.

Oh Magnus,
that's wonderful to
hear!



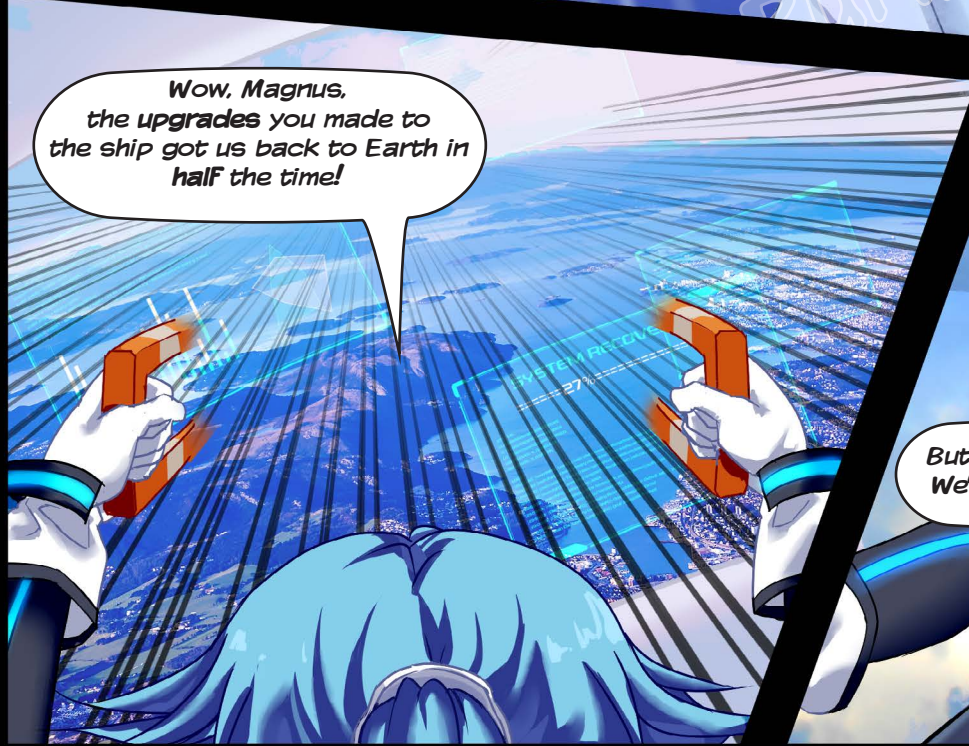
Your ship is fully repaired. You may go home now, Alia.

Come with me to Earth, Magnus!



It's not that simple, Alia. I can copy myself onto your ship's computers, but I cannot function the same way in your silicon-based computers. They're too...rigid.

That's alright, just come along, Magnus. You can keep R.E.N. and me company on the long trip back.



Wow, Magnus, the **upgrades** you made to the ship got us back to Earth in **half** the time!



But slow down now! We're nearly there!



Grrr. That makes **two times** you've crashed my ship, Magnus!

*Alright, Magnus. We've got work to do. Just a **Few** more problems to solve!*

Sorry, Alia. I am still not able to think clearly in these silicon-based computers of yours.

> scan -external -challenge_58.pzl

>

> =====
> | Challenge 58: Square Matrix |
> =====

>

> Objective: Generate the required pattern.

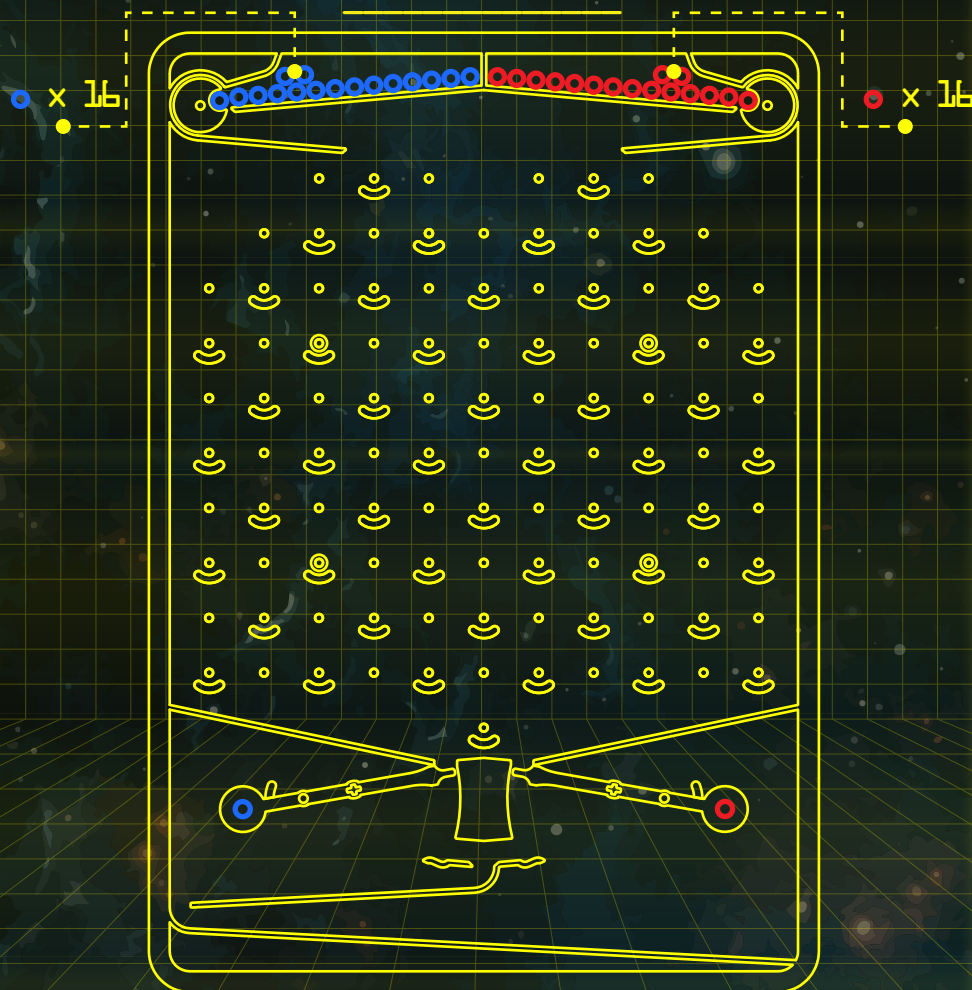
>

> Required output:

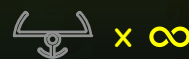
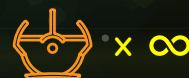
oooooooooooooooooooo

> _

Starting Setup



Available parts



> scan -external -challenge_59.pzl

>

> =====

> | Challenge 59: Dr. Nim |

> =====

>

> Objective: Win the game! Take turns with Magnus.

> Whoever takes the last marble on their turn loses!

>

> On your turn, release 1, 2, or 3 marbles. Then turn the

> gear bits to the left once you have finished your

> turn. Press the lever down once more and Magnus will

> take 1, 2, or 3 marbles, and turn the gear bits back

> to the right when it is your turn again.

>

> You take the first move!

> _

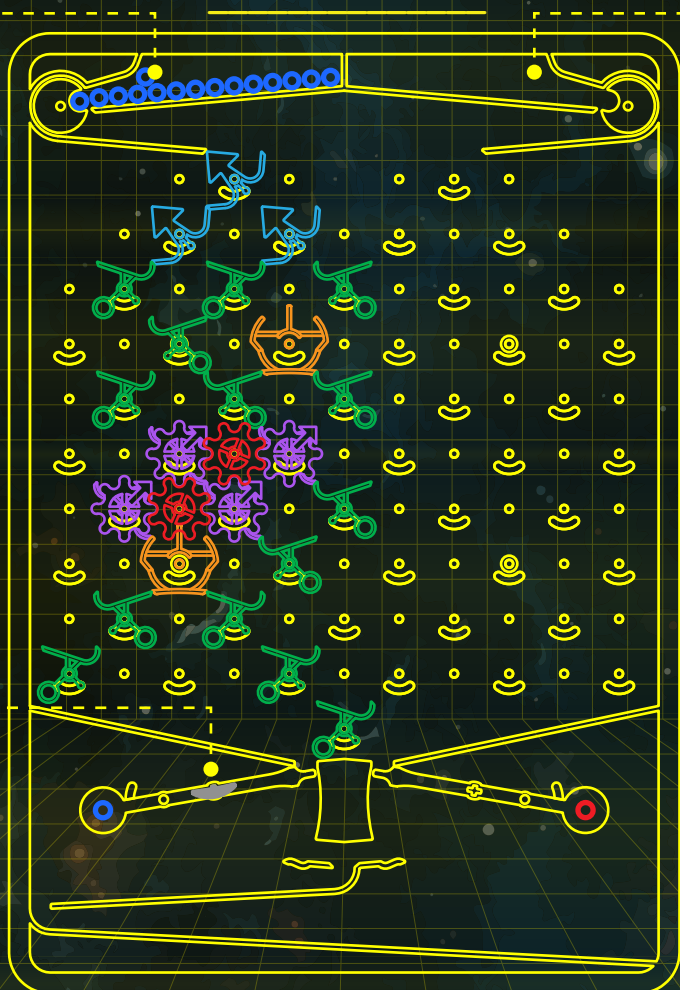
Starting Setup

Available parts

● x 15

● x 0

PRESS
TO
START



```
> scan -external -challenge_b0.pzl
```

```
>
```

```
> =====
> |                      Challenge b0: Comparator                      |
> =====
```

```
>
```

```
> Objective: If  $A < B$ , put a marble in interceptor L.
> If  $A = B$ , put a marble in interceptor E. If  $A > B$ , put
> a marble in interceptor G.
```

```
>
```

```
> Examples:
```

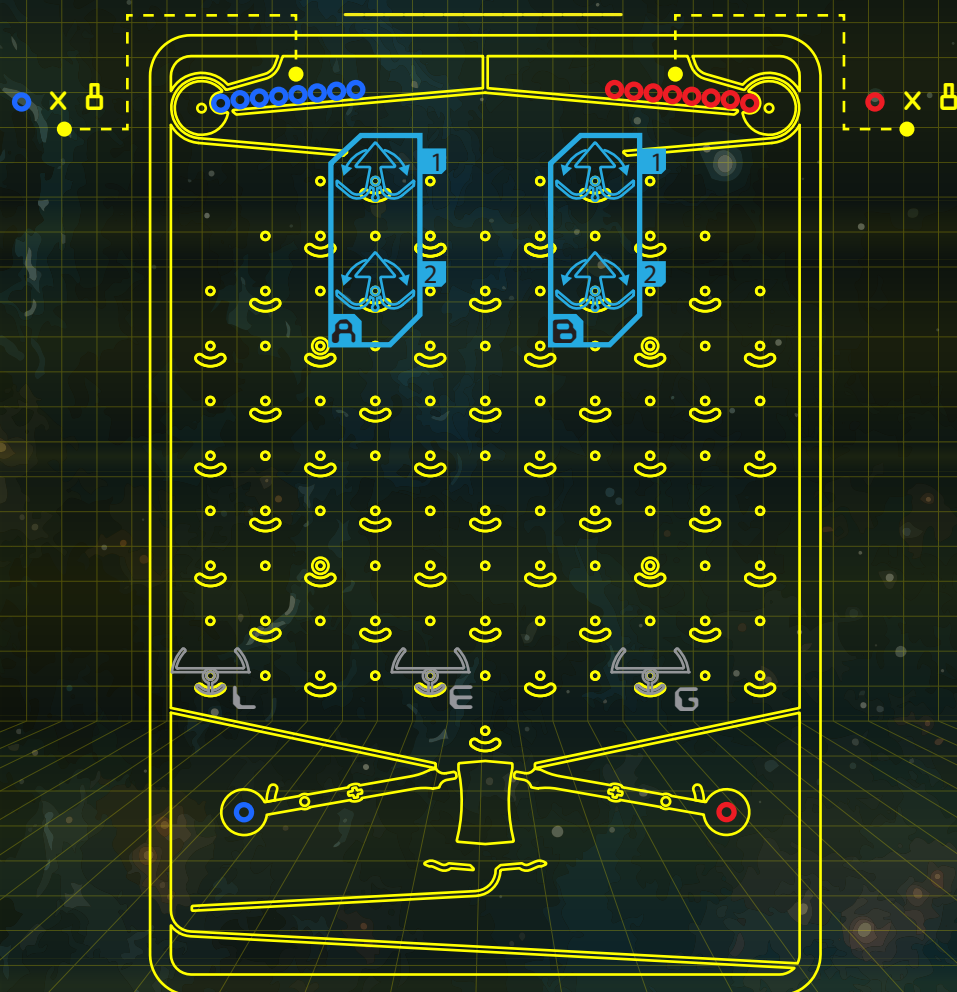
$A = 1, B = 1 \Rightarrow$ 

$A = 3, B = 1 \Rightarrow$ 

$A = 2, B = 2 \Rightarrow$ 

```
> _
```

Starting Setup



Available parts

-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x 1

Ok, Magnus. I
have a surprise for you.
Ready to give it a try?

You built a computer
for me! Just like the
one on Eniac!

It's wonderful! I can
think so much clearer! Oh,
there's so much to do. Now
the real challenge begins!

So much to
do? What do you
mean?

You'll see.

To be continued...

CONGRATULATIONS!!

You completed all of the puzzles!



Ready for even more puzzles?



Have some ideas of your own?

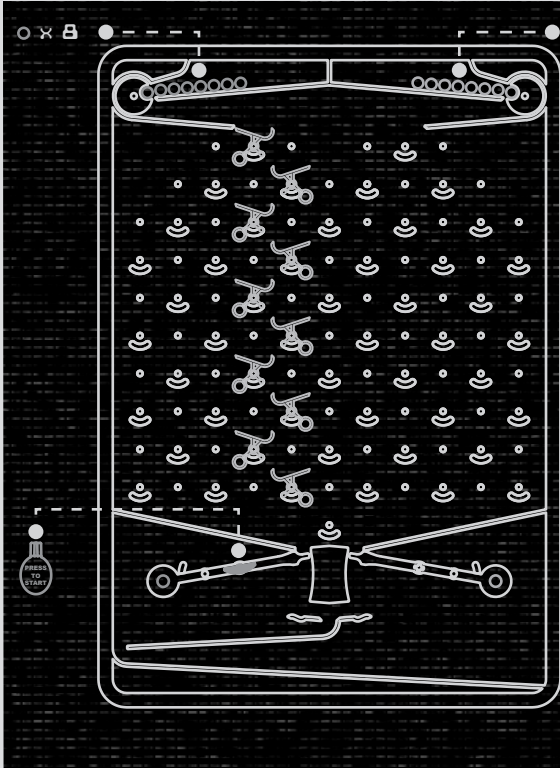


Check out community.turingtumble.com

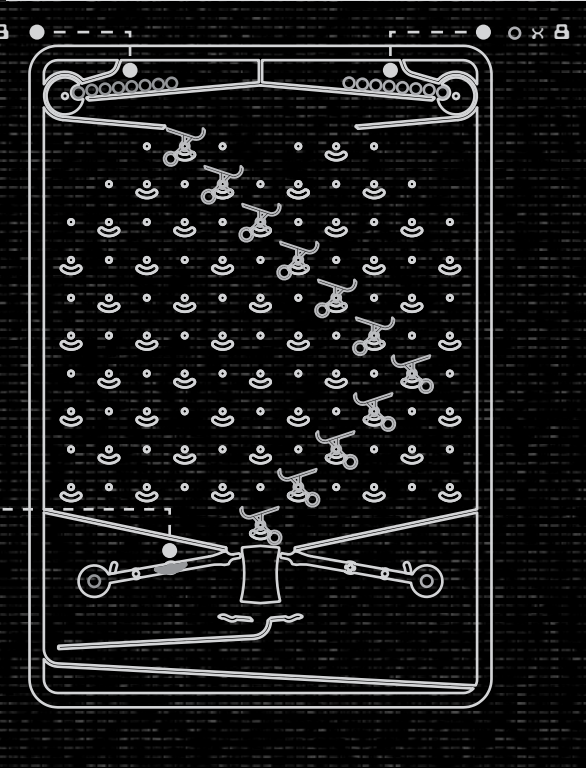
THANKS FOR PLAYING!!

[illegible]

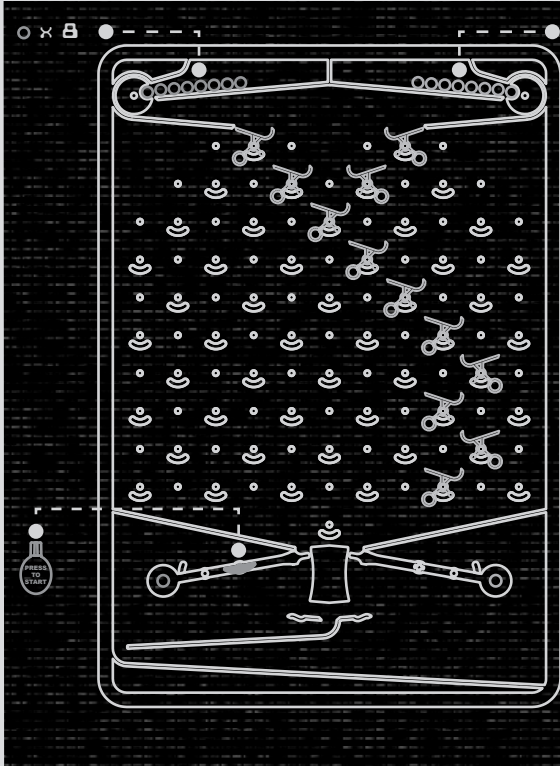
CHALLENGE_1.PZL



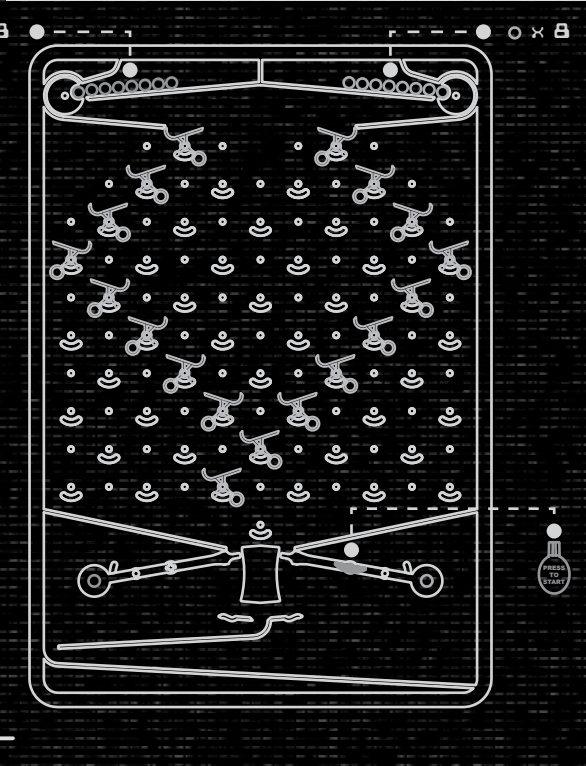
CHALLENGE_2.PZL



CHALLENGE_3.PZL



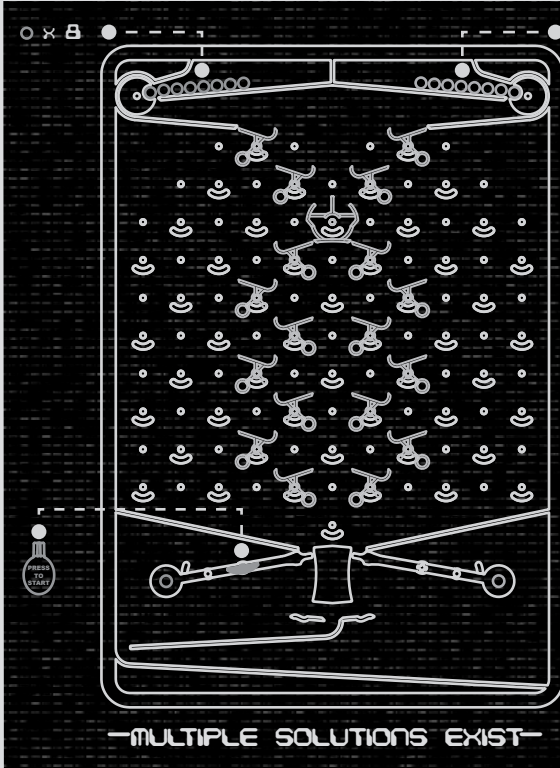
CHALLENGE_4.PZL



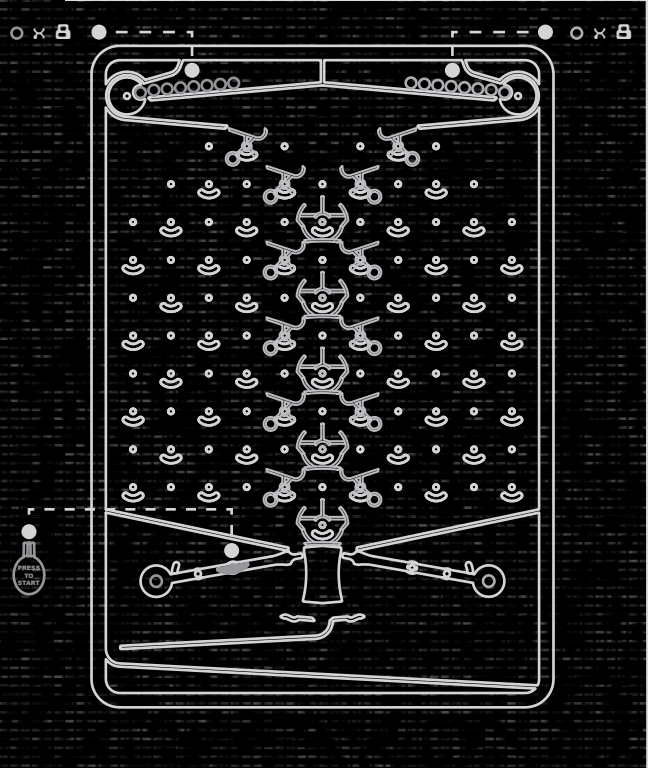
—MORE—

 * PUZZLE SOLUTIONS *

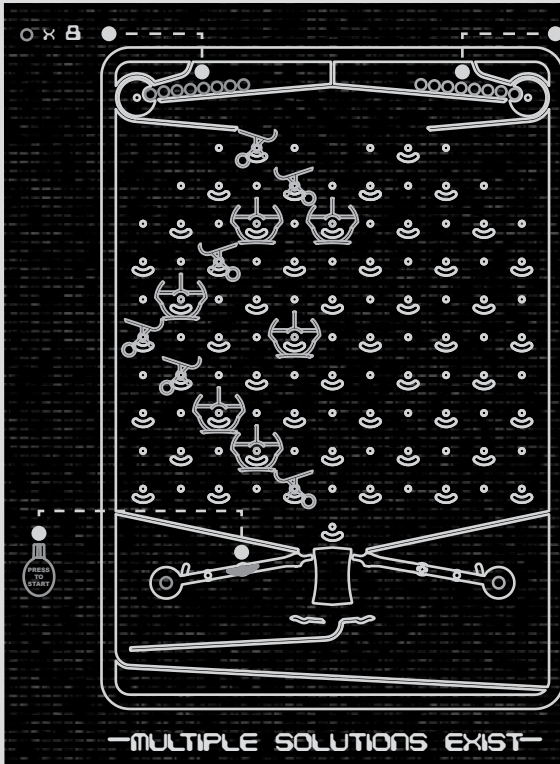
CHALLENGE_5.PZL



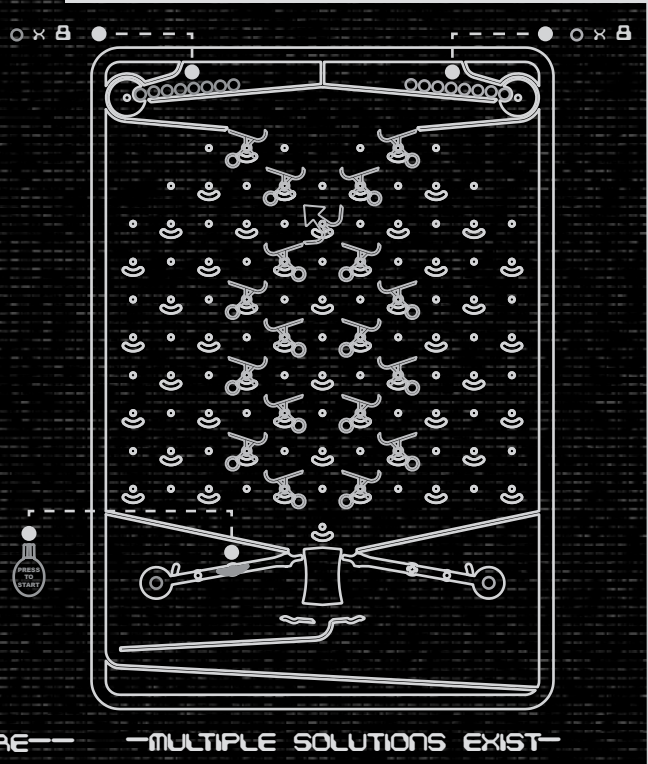
CHALLENGE_6.PZL



CHALLENGE_7.PZL

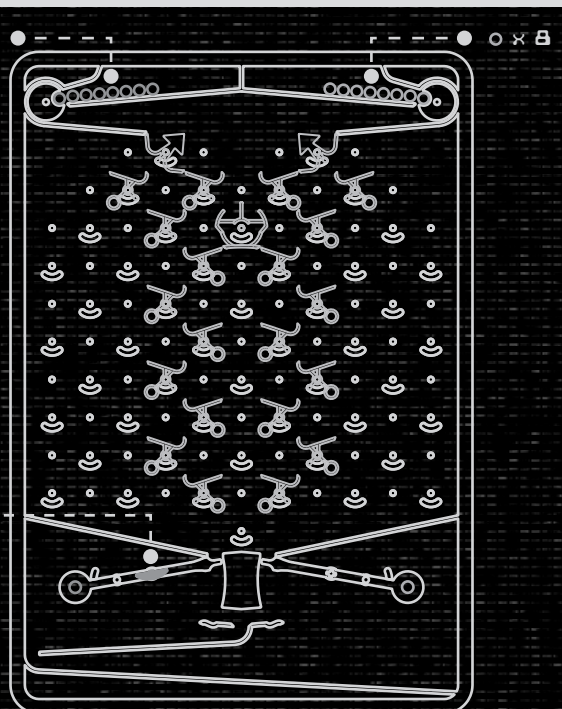


CHALLENGE_8.PZL



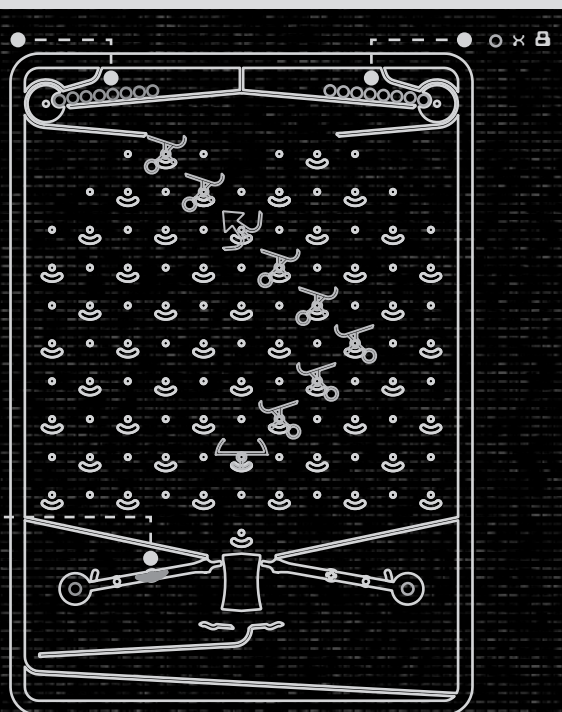
[illegible]

CHALLENGE_10.PZL



-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_12.PZL

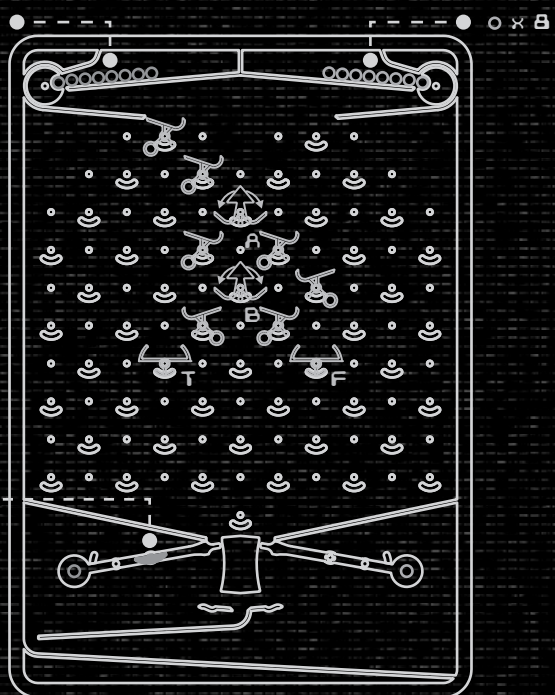
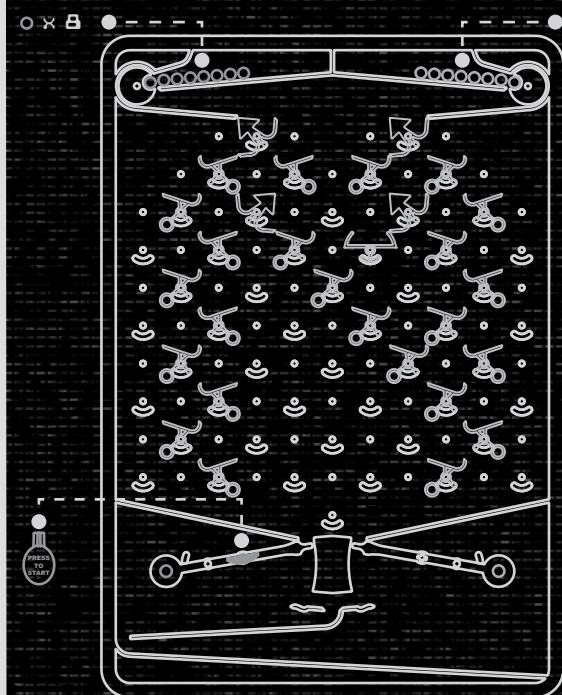


—MULTIPLE SOLUTIONS EXIST— —MORE—

 * PUZZLE SOLUTIONS *

CHALLENGE_17.PZL

CHALLENGE_18.PZL

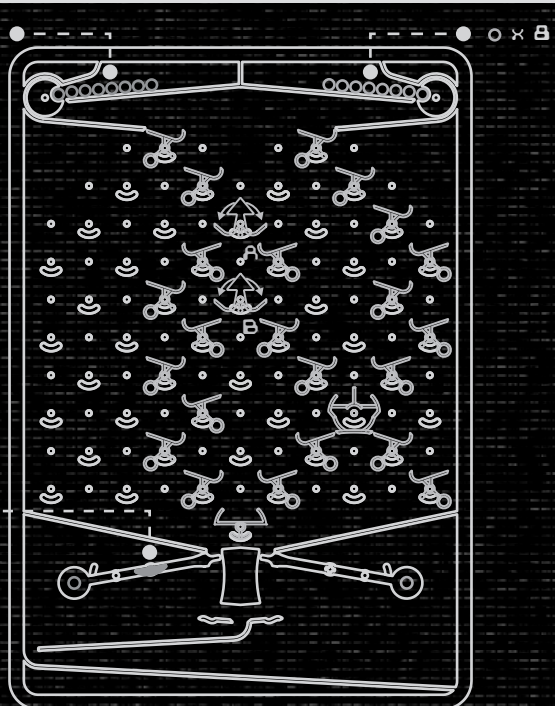
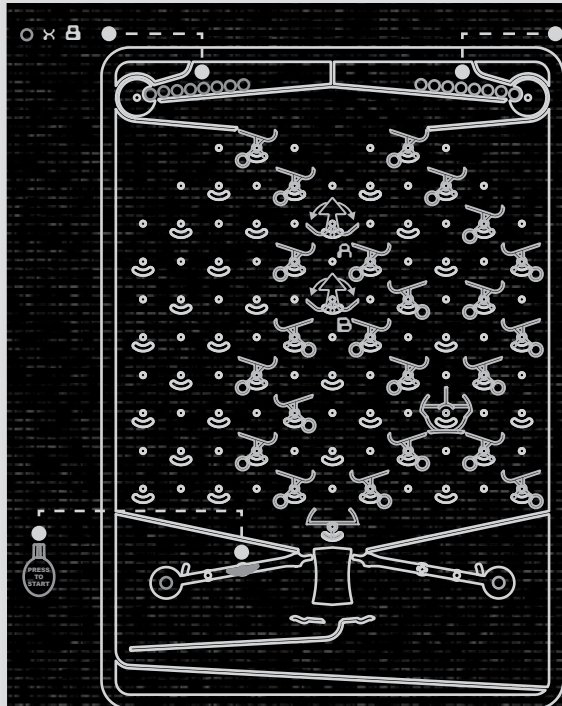


—MULTIPLE SOLUTIONS EXIST—

—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_19.PZL

CHALLENGE_20.PZL



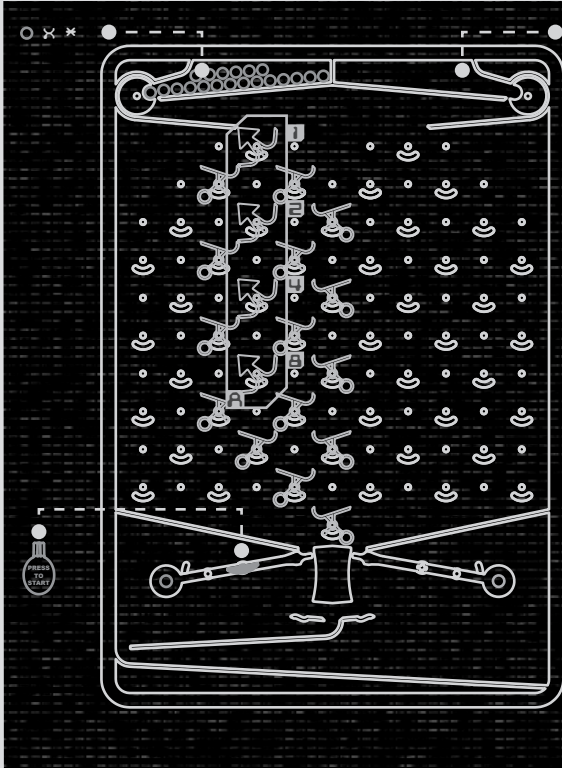
—MULTIPLE SOLUTIONS EXIST—

—MORE—

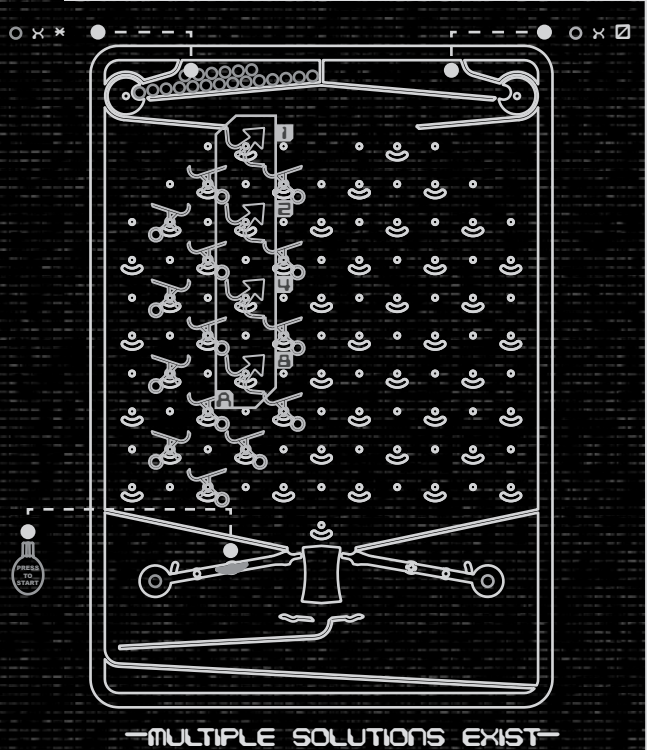
—MULTIPLE SOLUTIONS EXIST—

 * PUZZLE SOLUTIONS *

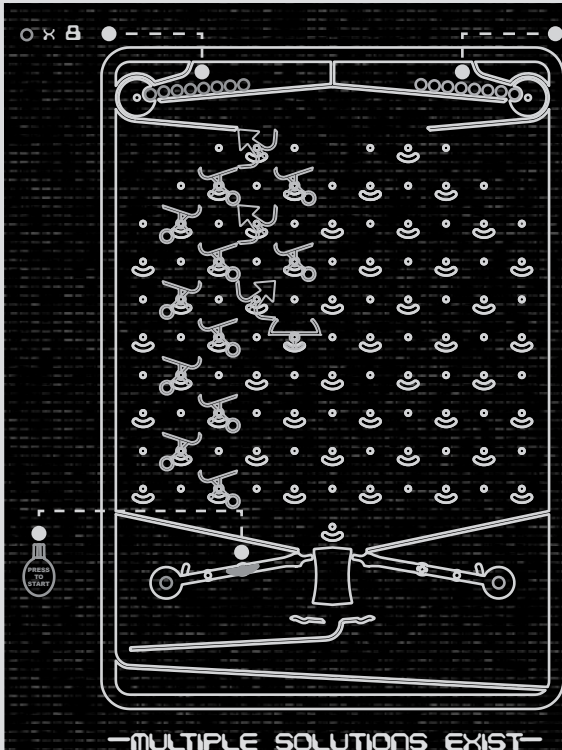
CHALLENGE_21.PZL



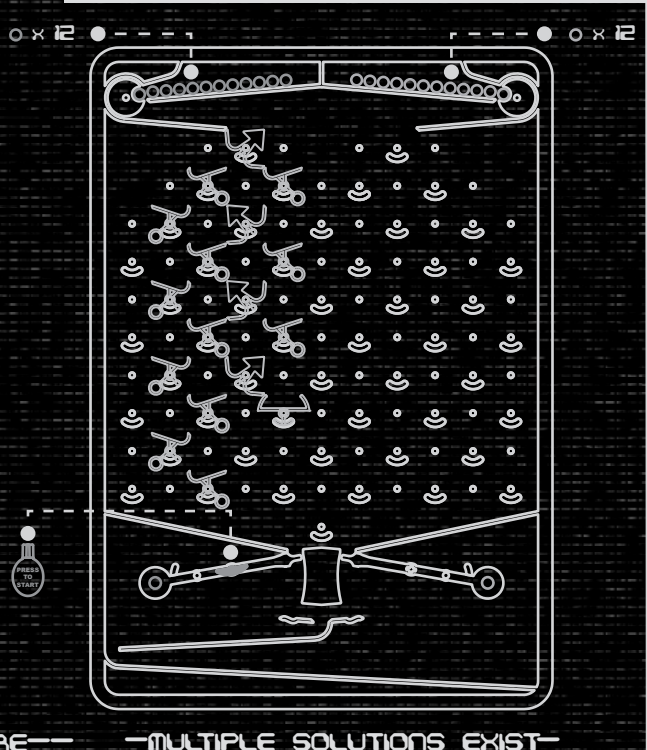
CHALLENGE_22.PZL



CHALLENGE_23.PZL



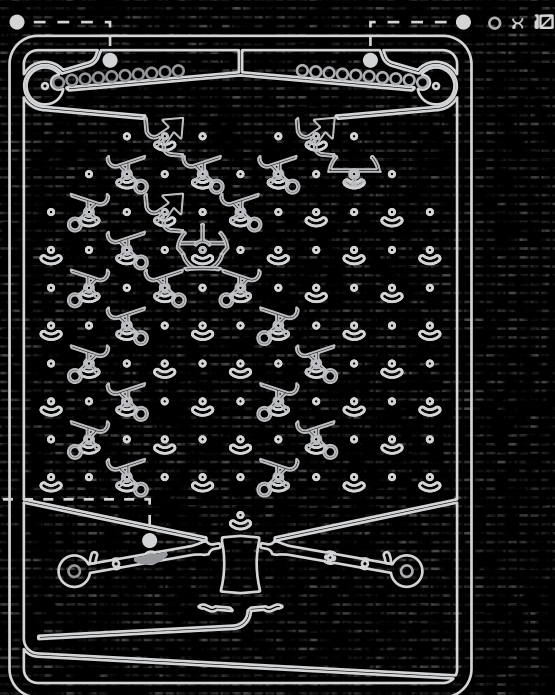
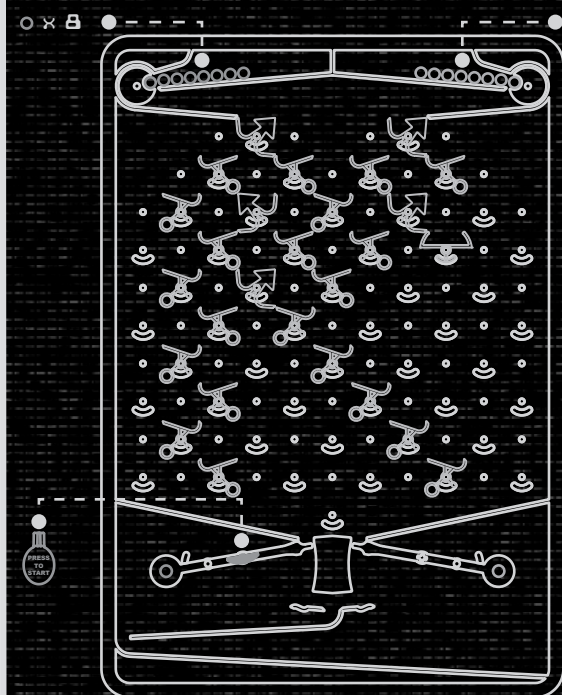
CHALLENGE_24.PZL



 * PUZZLE SOLUTIONS *

CHALLENGE_25.PZL

CHALLENGE_26.PZL

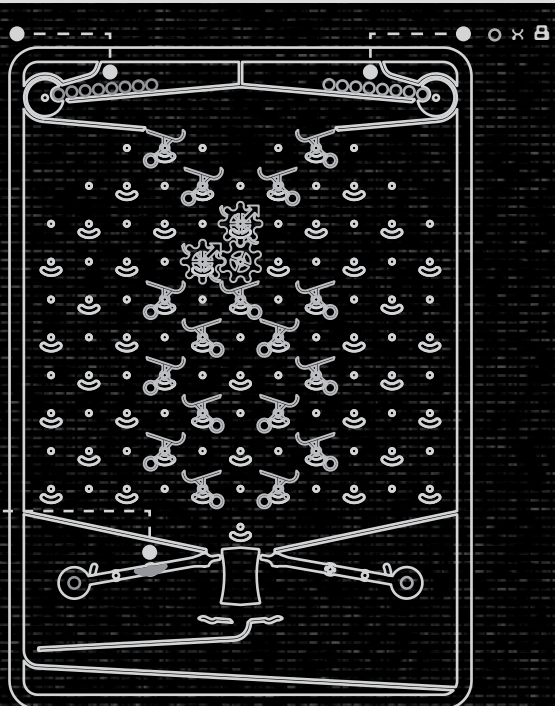
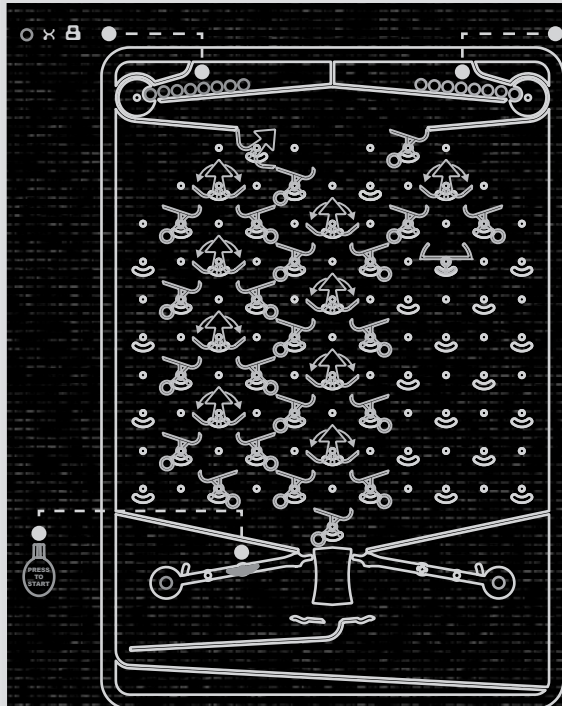


—MULTIPLE SOLUTIONS EXIST—

—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_27.PZL

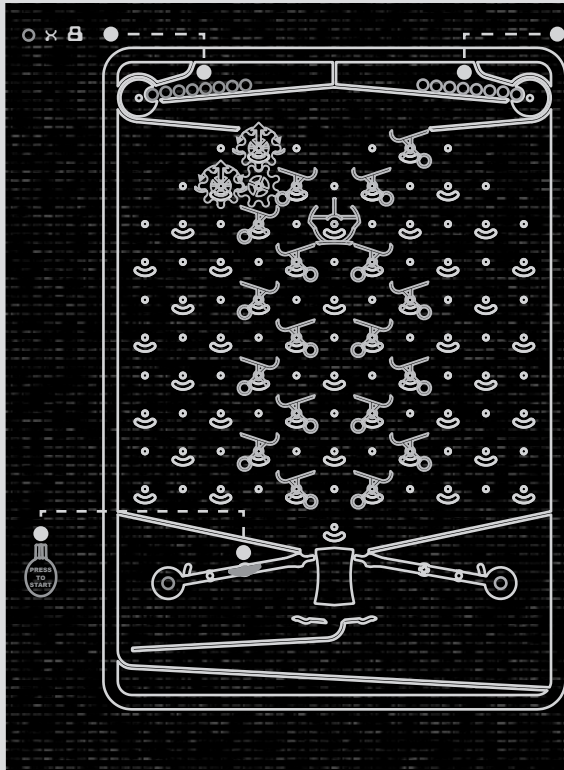
CHALLENGE_28.PZL



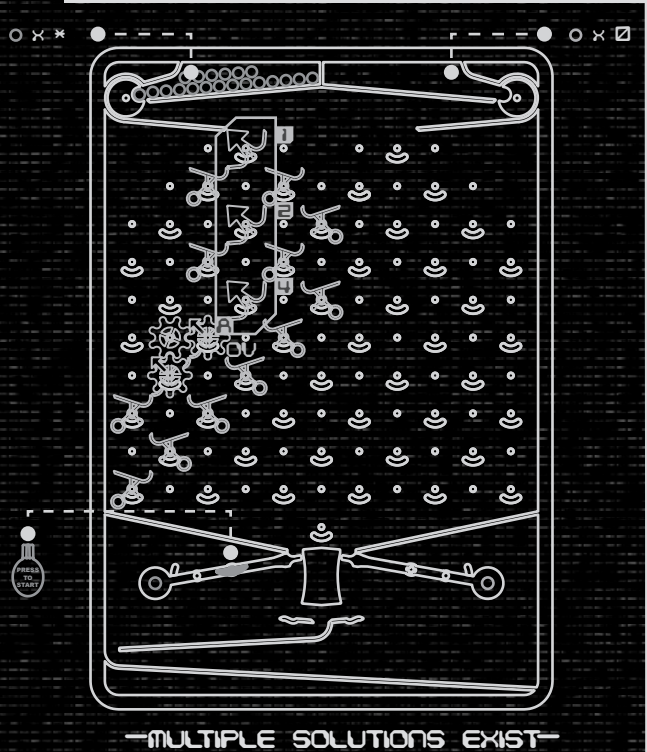
—MULTIPLE SOLUTIONS EXIST— —MORE—

 * PUZZLE SOLUTIONS *

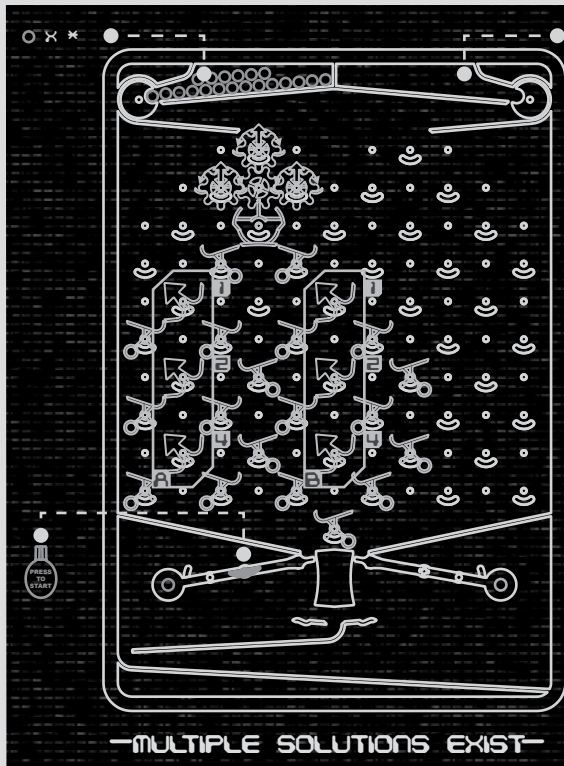
CHALLENGE_29.PZL



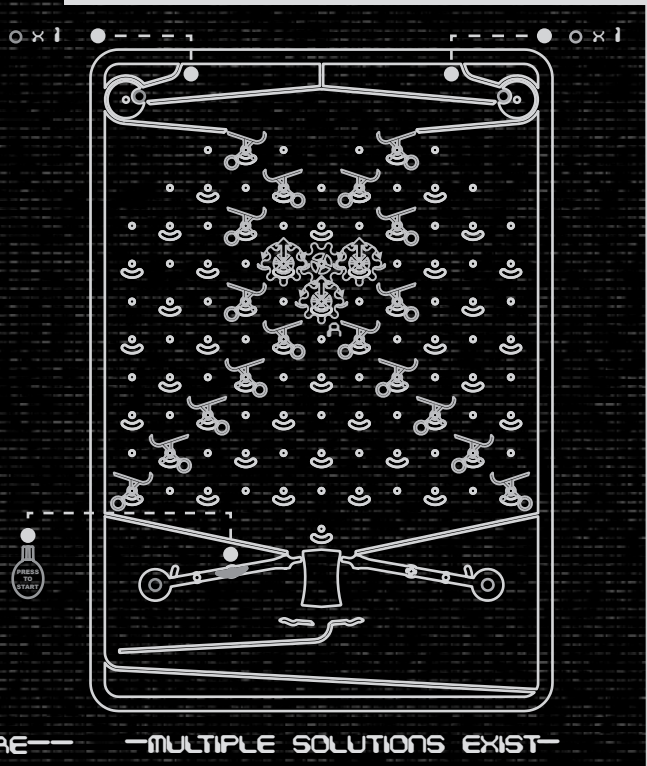
CHALLENGE_30.PZL



CHALLENGE_31.PZL



CHALLENGE_32.PZL



-MULTIPLE SOLUTIONS EXIST-

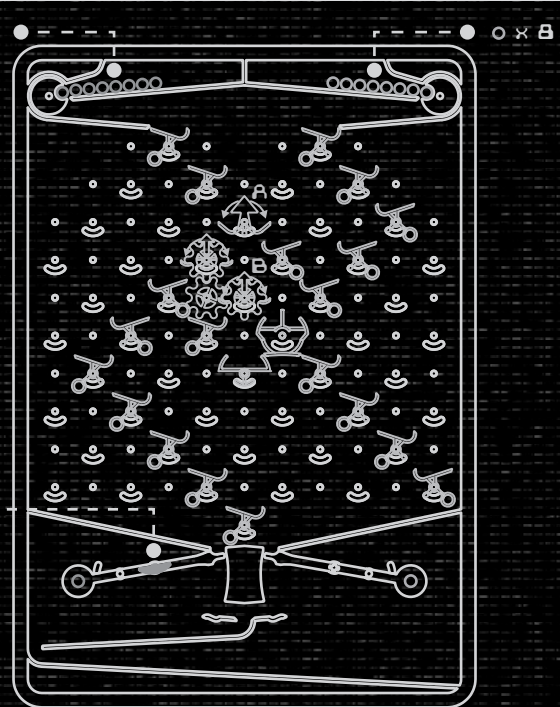
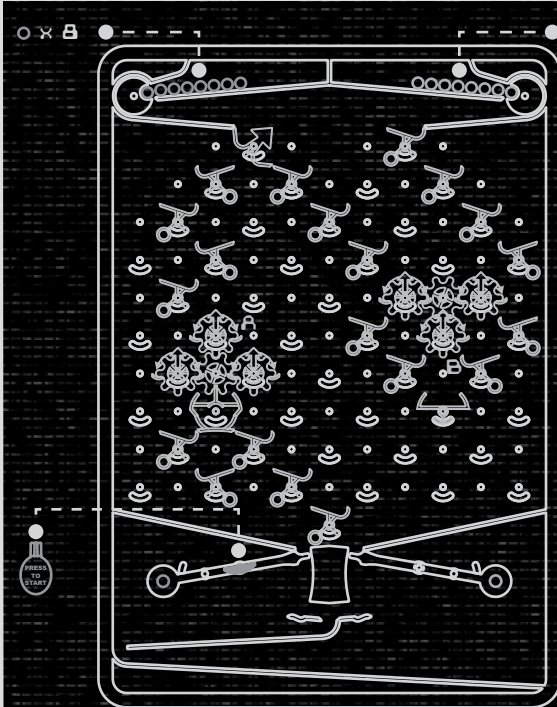
--MORE--

-MULTIPLE SOLUTIONS EXIST-

 * PUZZLE SOLUTIONS *

CHALLENGE_33.PZL

CHALLENGE_34.PZL

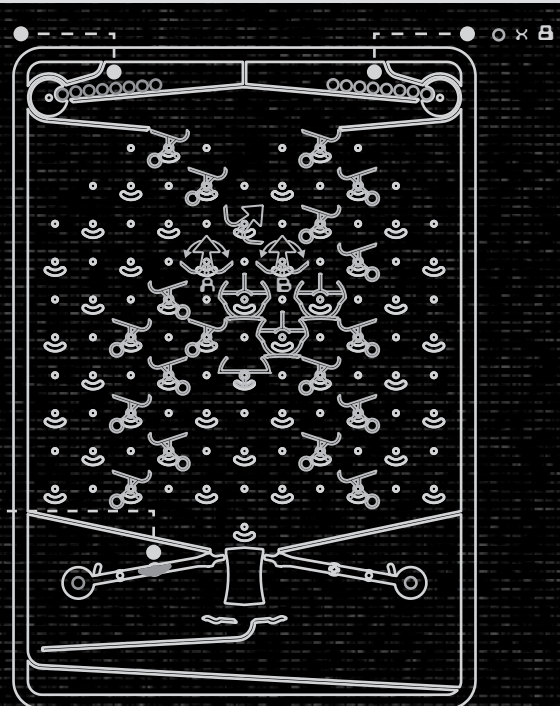
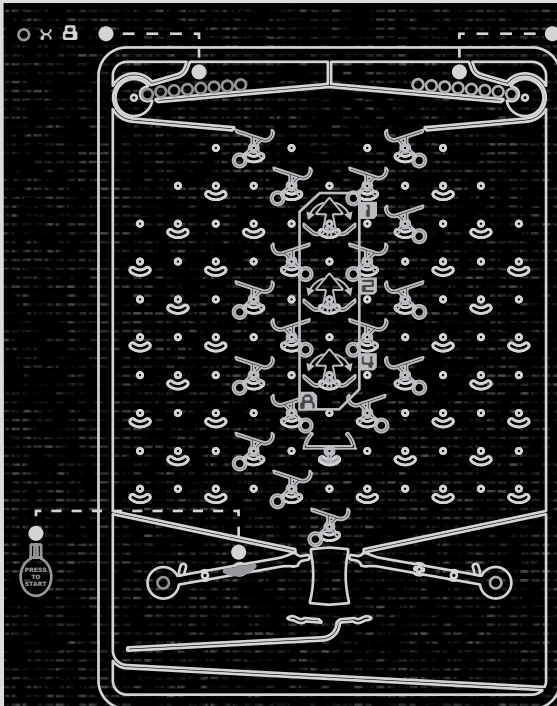


—MULTIPLE SOLUTIONS EXIST—

—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_35.PZL

CHALLENGE_36.PZL

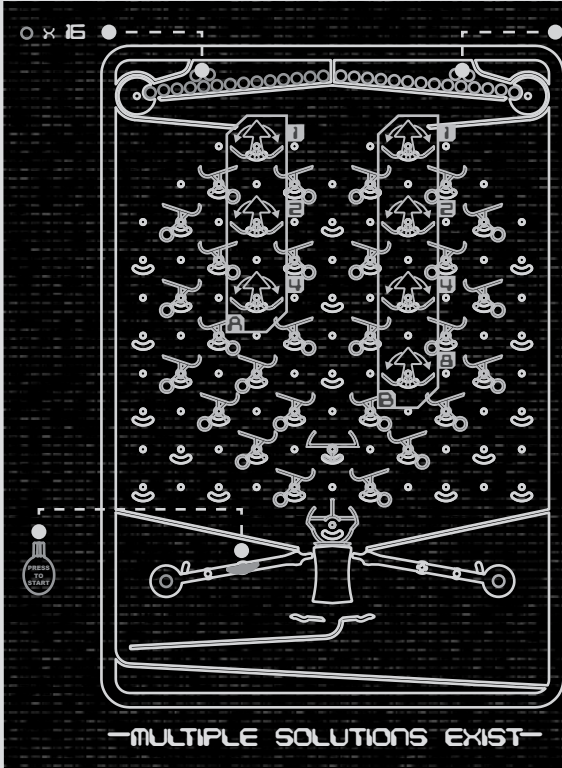


—MULTIPLE SOLUTIONS EXIST— —MORE—

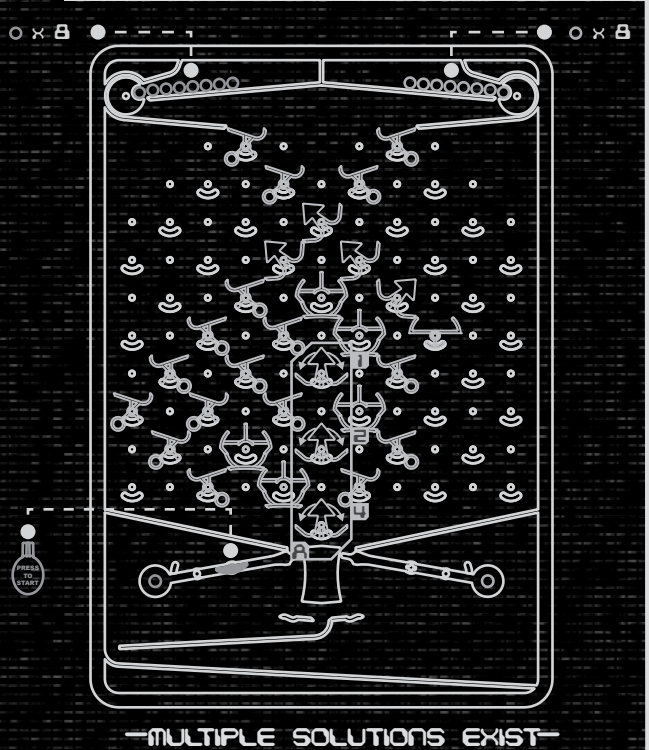
—MULTIPLE SOLUTIONS EXIST—

 * PUZZLE SOLUTIONS *

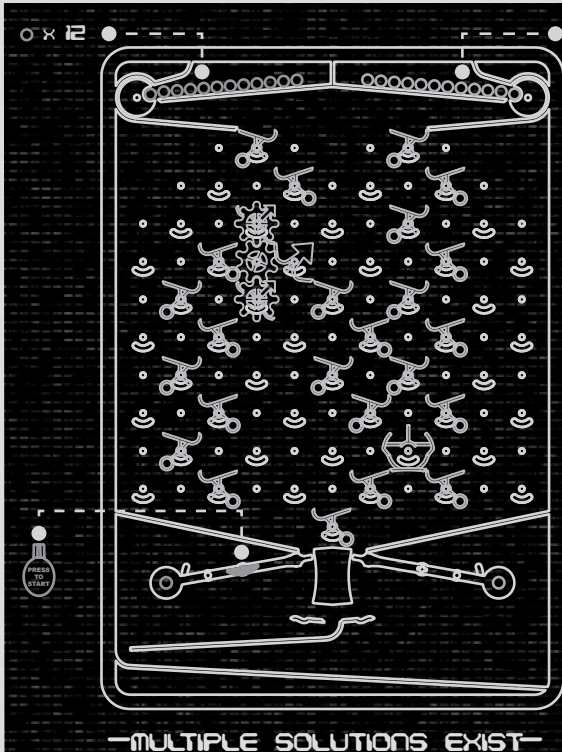
CHALLENGE_37.PZL



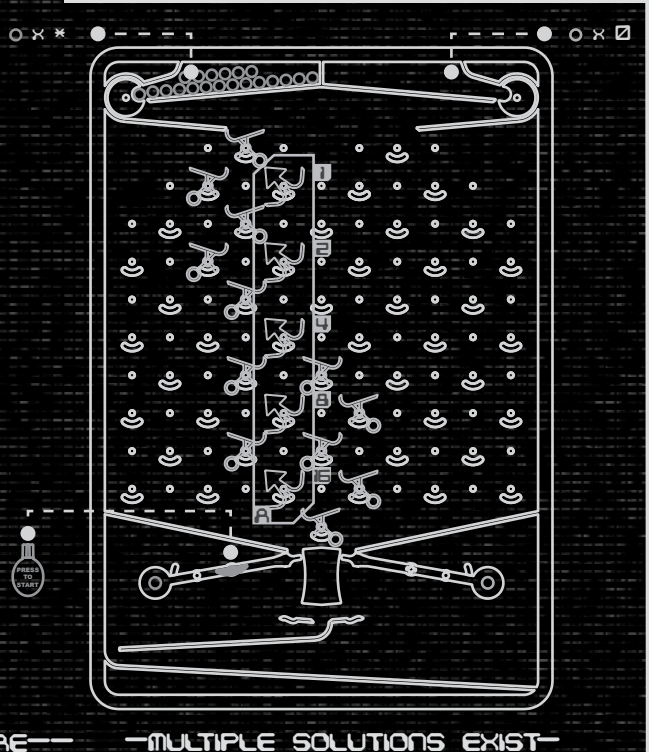
CHALLENGE_38.PZL



CHALLENGE_39.PZL

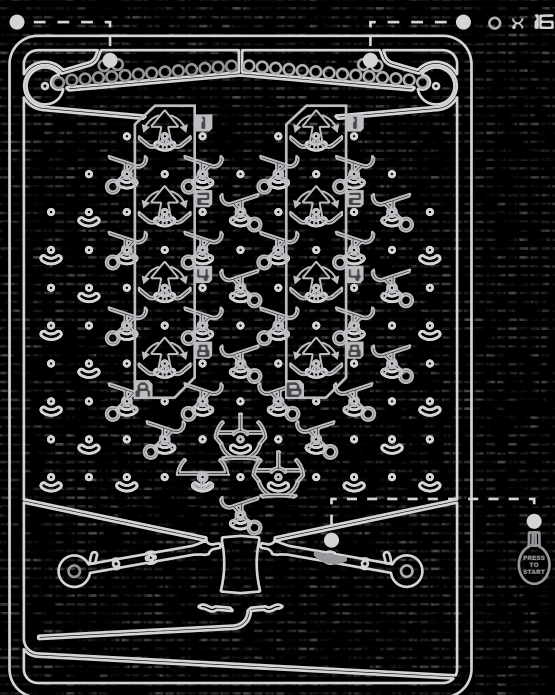


CHALLENGE_40.PZL



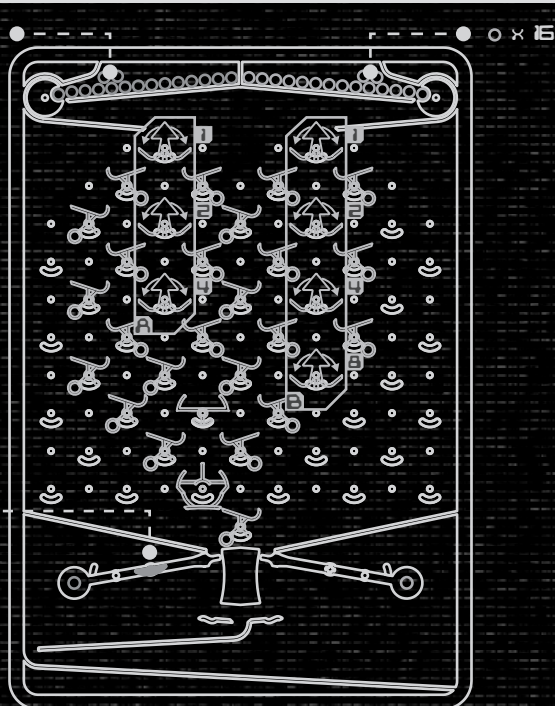
[illegible]

CHALLENGE_42.PZL



-MULTIPLE SOLUTIONS EXIST-

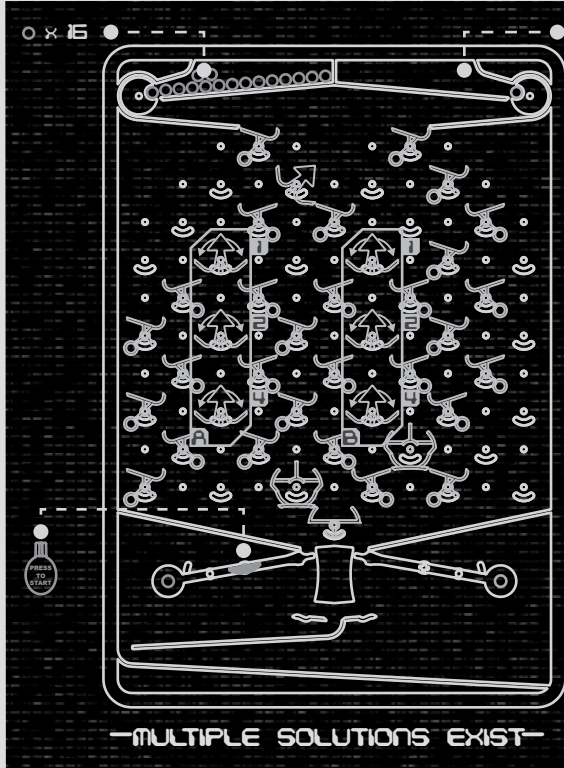
CHALLENGE_44.PZL



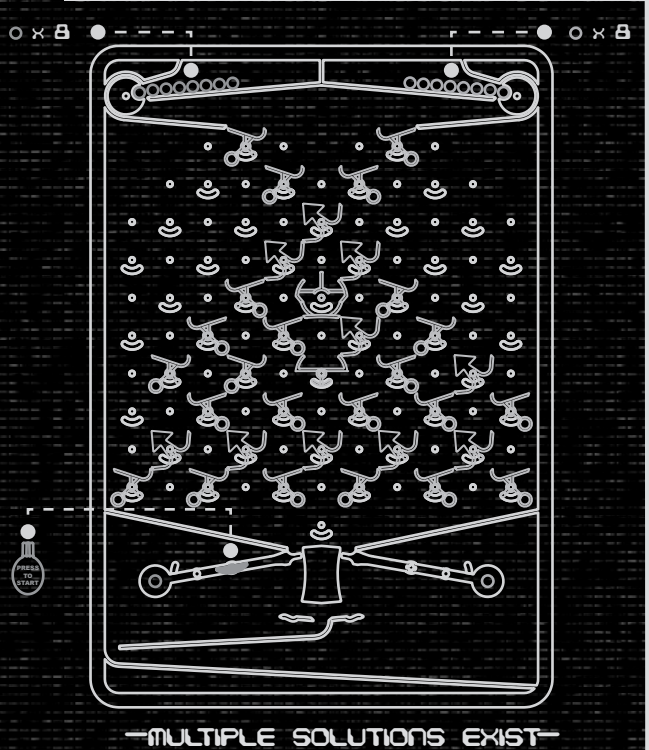
-MULTIPLE SOLUTIONS EXIST-

 * PUZZLE SOLUTIONS *

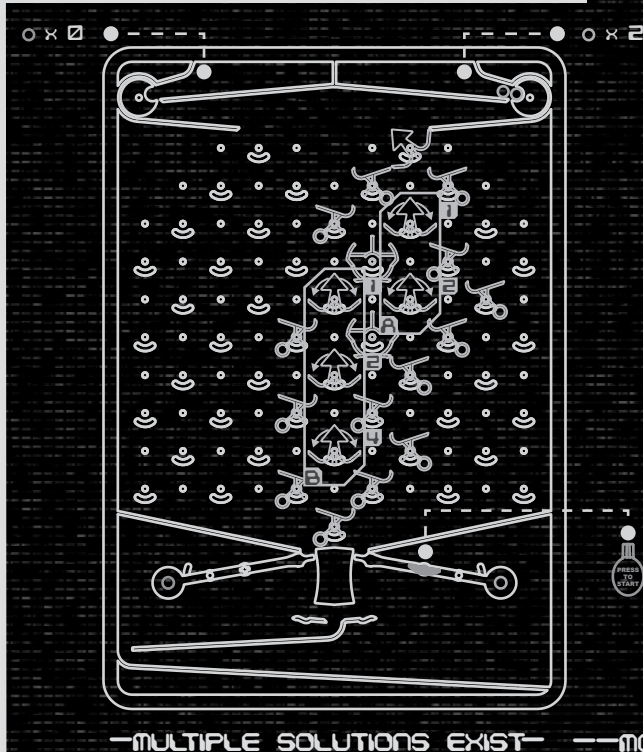
CHALLENGE_45.PZL



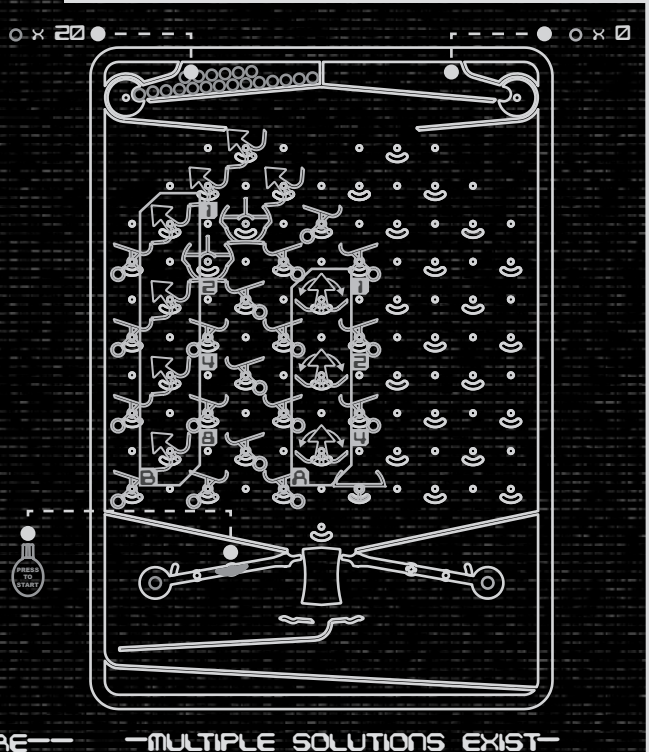
CHALLENGE_46.PZL



CHALLENGE_47.PZL



CHALLENGE_48.PZL



[illegible]

CHALLENGE_50.PZL



-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_52.PZL

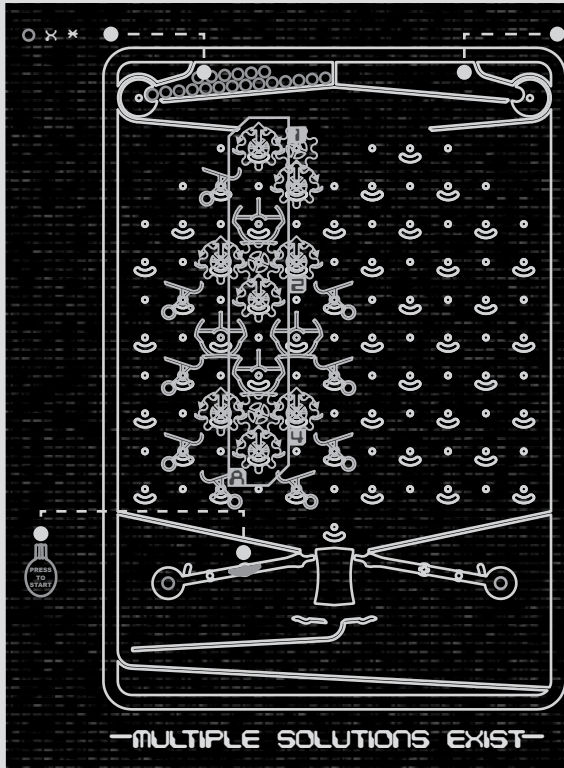


A detailed line drawing of a rectangular board game, likely a Go board. The board is enclosed in a rectangular frame with rounded corners. At the top, there are two circular pieces, one on the left and one on the right, connected by a horizontal line. Below this, the board is filled with a grid of small circles, representing intersections. A complex arrangement of pieces, including various shapes like triangles, squares, and circles, is placed on the board. A central structure, resembling a small house or a fort, is built in the middle. At the bottom, there is a large, central rectangular piece, flanked by two circular pieces, one on the left and one on the right, connected by a horizontal line. The entire drawing is in black and white, with a clean, minimalist style.

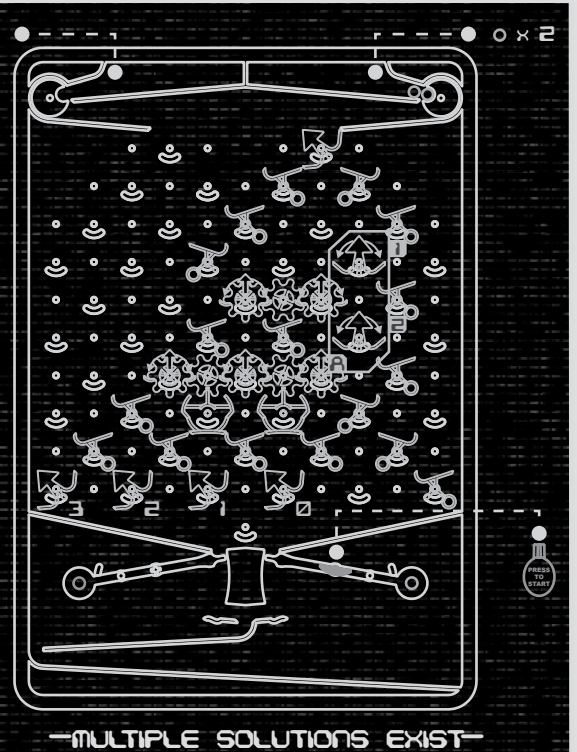
-MULTIPLE SOLUTIONS EXIST-

 * PUZZLE SOLUTIONS *

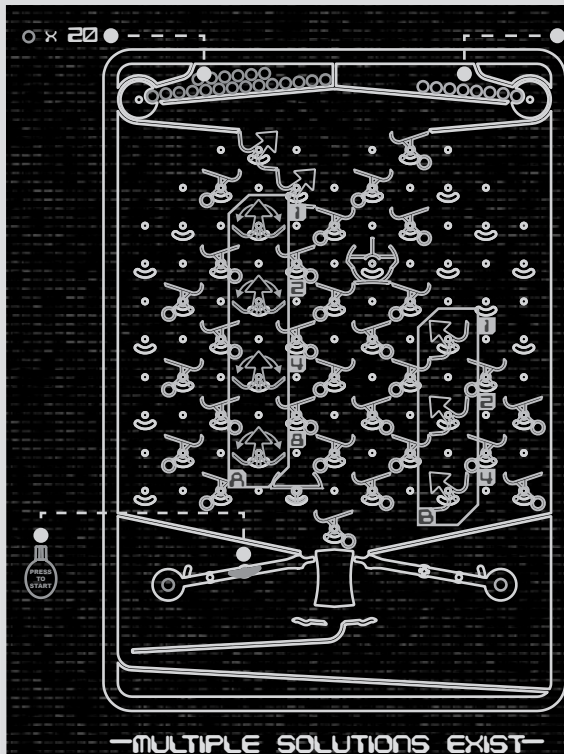
CHALLENGE_53.PZL



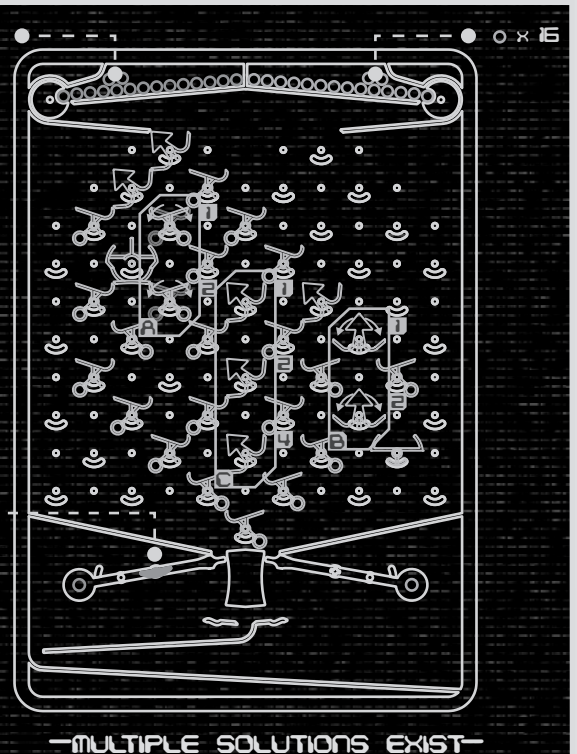
CHALLENGE_54.PZL



CHALLENGE_55.PZL



CHALLENGE_56.PZL

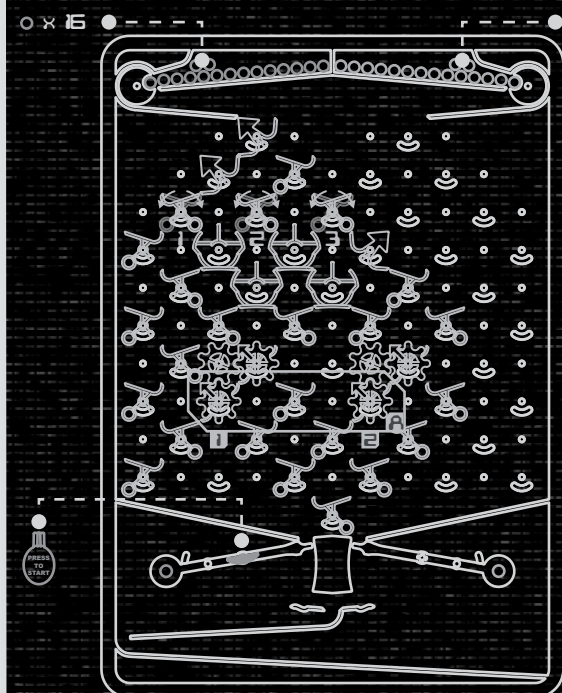


—MORE—

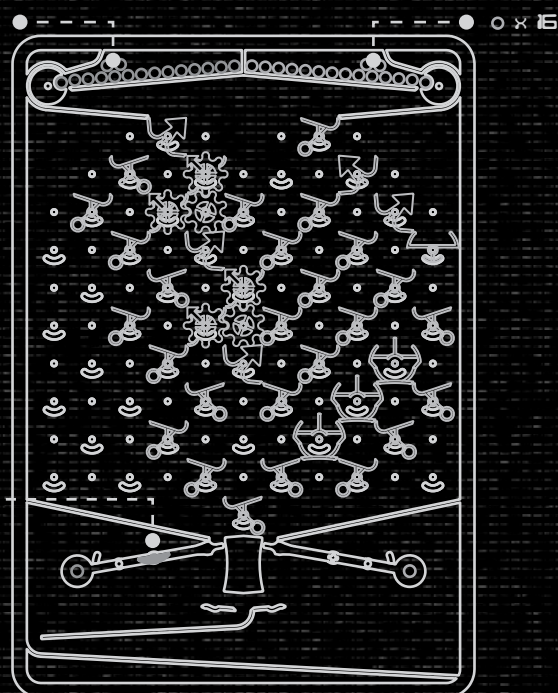
 * PUZZLE SOLUTIONS *

CHALLENGE_57.PZL

CHALLENGE_58.PZL



-MULTIPLE SOLUTIONS EXIST-

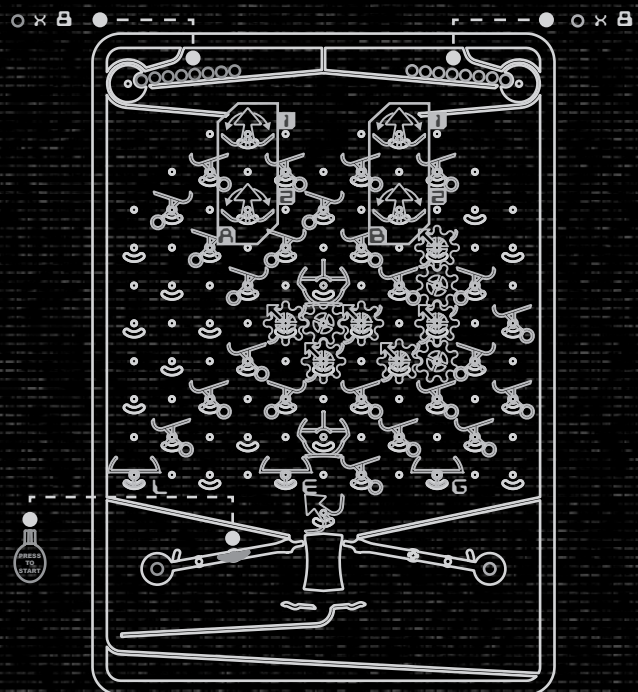


-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_59.PZL

CHALLENGE_60.PZL

TURN 1: TAKE 2 MARBLES
 (MAGNUS TAKES 1 MARBLE)
 TURN 2: TAKE 3 MARBLES
 (MAGNUS TAKES 1 MARBLE)
 TURN 3: TAKE 3 MARBLES
 (MAGNUS TAKES 1 MARBLE)
 TURN 4: TAKE 3 MARBLES
 (MAGNUS TAKES THE LAST MARBLE)
 YOU WIN!



-MULTIPLE SOLUTIONS EXIST-

Who was Turing?

Alan Turing was born in 1912 in England. From a young age, Alan was intensely interested in math and science, even when it wasn't always encouraged by his teachers. He ran chemical reactions, charted the paths of the stars, and derived equations to describe them.

When Alan graduated from school, he chose to become a researcher of mathematics. He spent a lot of time thinking about a big question: **Could there exist a set of instructions that could be followed to tell whether any mathematical statement is true?** At the time, most mathematicians assumed that the answer was 'yes', but no one had actually **proven** it.



Alan Turing (unknown date)¹

Now you might think proving mathematical statements is a rather boring, straightforward task. Not at all. It requires tremendous creativity, a fact which Alan proved with a famously creative proof of his own. To do it, he first outlined a new type of theoretical machine that could perform any computation without human intervention – **what we now call a “Turing machine”**. He showed that even though a Turing machine would be capable of following any set of instructions, it could never calculate certain things exactly. Therefore, there could **never** be a set of instructions to automatically test whether any mathematical statement is true.

At a time when the study of math was considered high status, not to be troubled by practical issues like engineering, **Alan began building machines to help work out mathematical solutions**. He blazed a trail, developing tools to solve problems that mathematicians were only beginning to realize could not be solved by traditional mathematical solutions. **Instead, he developed machines that could solve them by force.**

When World War II began, Alan joined the British codebreakers, leading a team of mathematicians and chess masters. His task was to improve machines built to solve one such problem that required the use of force. The German military used a device called the Enigma to encrypt messages passed between ships. **Through a series of brilliant insights, Alan's team built machines called “bombes” that could automatically find encryption keys to decode the German messages.** Their work was a deciding factor in the war. It's estimated that it shortened the war by two years.

After the war, Alan went on to lay the foundations of modern computing, designing and developing a complete electronic computer – a practical realization of his Turing machine. Later, he went on to make great contributions not just in computer science, but in biology, where he described how cells in organisms can tell how and where they should grow, in chemistry, where he developed a mathematical explanation for a puzzling chemical reaction, and in cognitive science, where he theorized how the brain works and how it could be modeled by a computer.

Alan's contributions have had ripples that long surpassed his tragically short life. This game is but one of them.

¹Colorized by Mads Madsen of colorized-history.com

Special Thanks

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