

TURING TUMBLE™

Puzzle Book



Curious about the name, "Turing" Tumble?
Check out page 110.

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Illustrated by [Jiaoyang Li](#)

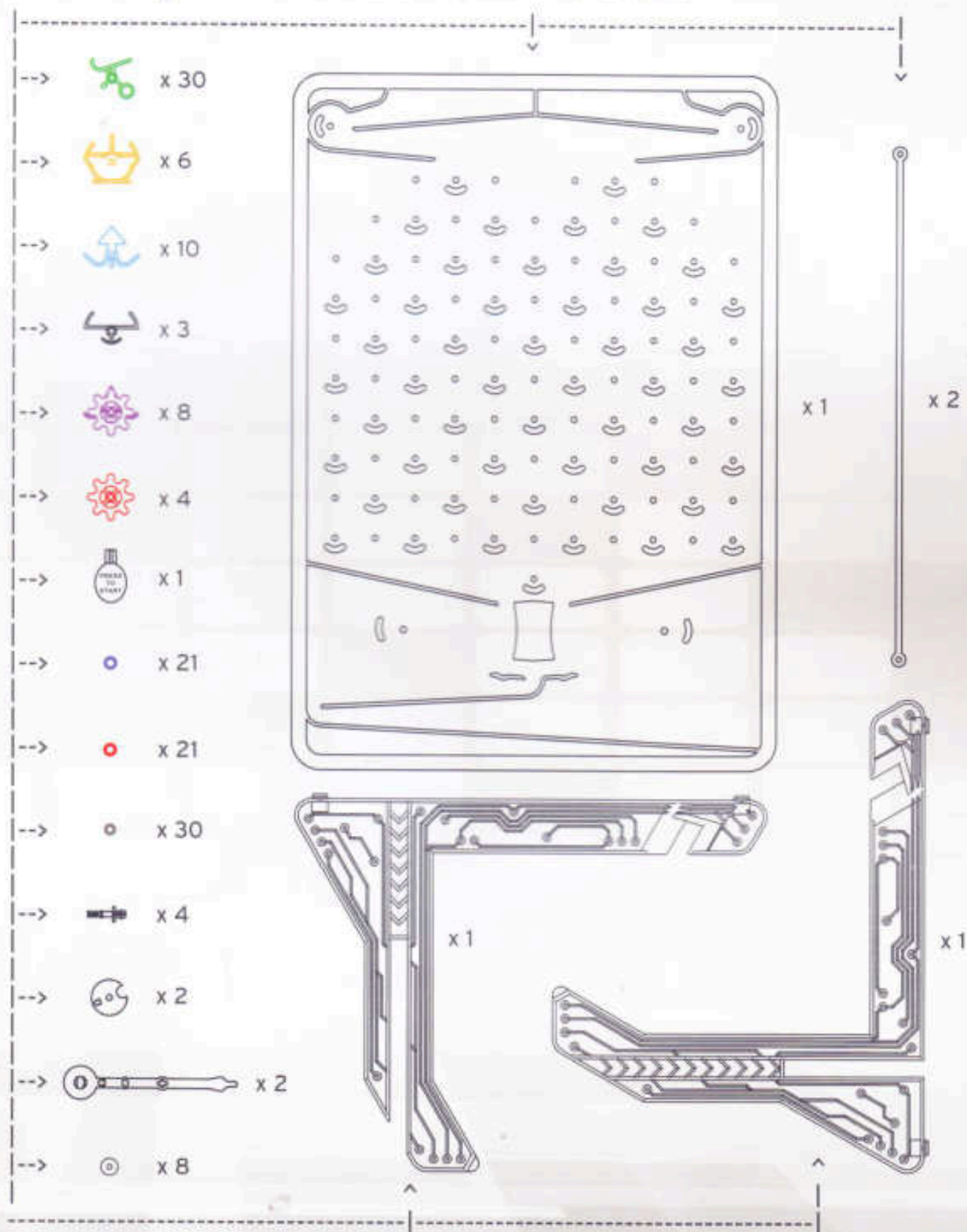
Box art by [Mackey Creative Brand & Strategy \(mackeycreative.com\)](#)



Turing Tumble LLC, 2019

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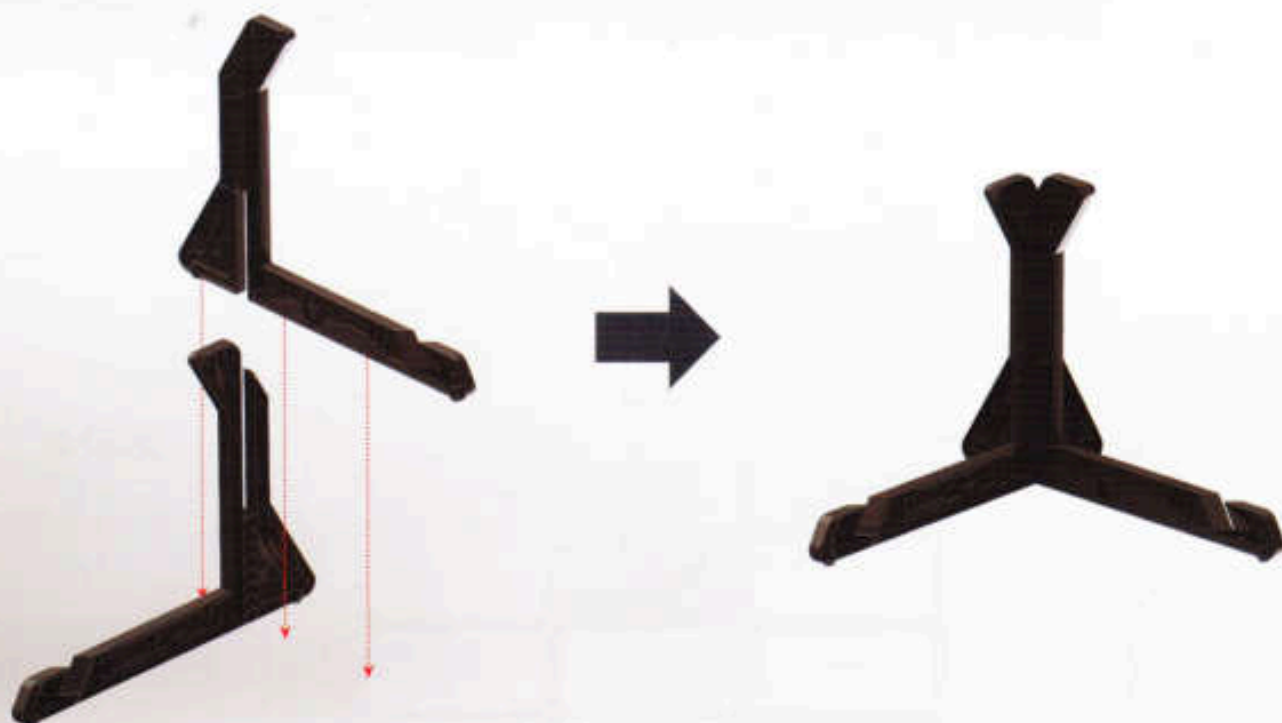
SYSTEM REQUIREMENTS



Is anything missing or damaged? Tell us at hello@turingtumble.com and we'll replace it right away.

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.

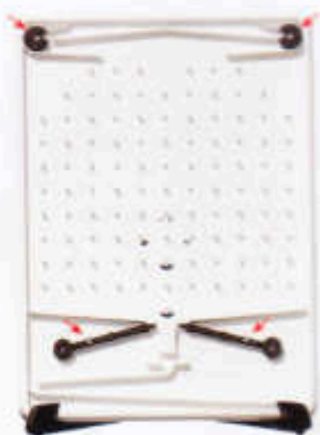


=> **Step 3:** Insert the 4 small pegs into the back side of the 2 levers and the 2 ball releasers. Make sure the peg is facing the correct direction when you snap it in (round side to round side, flat side to flat side).



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

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



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



=> **Step 7:** Snap a small metal ball into each of the 30 green ramps. To save your thumbs, put a ball 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.

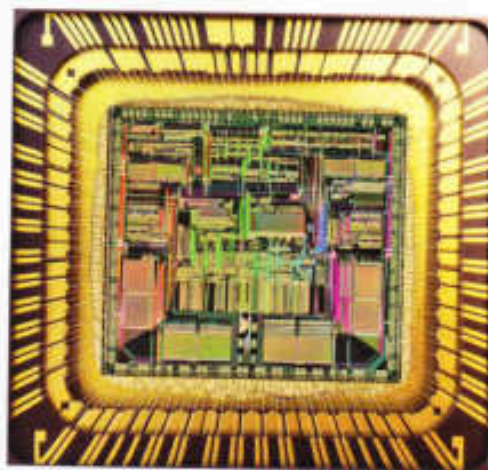
README.1ST

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



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

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.

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

Enjoy your journey!

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

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

THE
ADVENTURE
BEGINS...



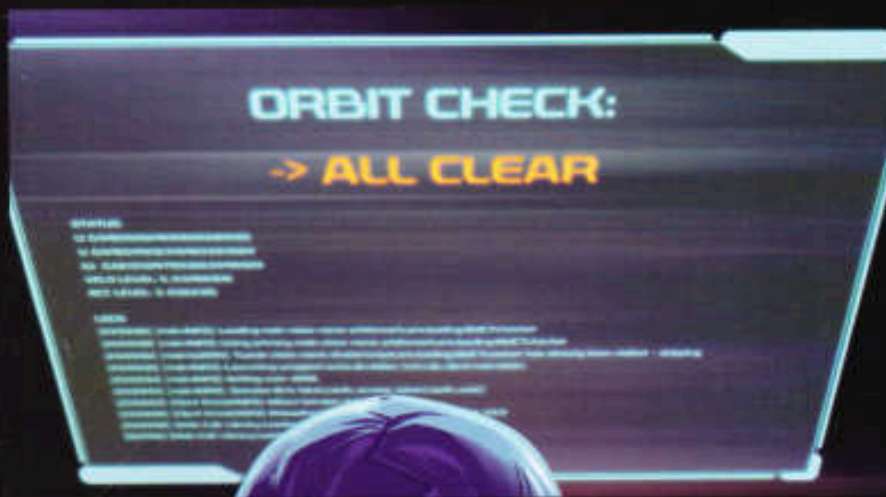
It took Alia three long weeks to reach the Pulsar nebula where she was sent to repair one of Deep Space Industry's communications satellites. The satellite was orbiting a small, barren planet named Eniac. These satellites were incredibly complicated and Alia was the only engineer skilled enough to repair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

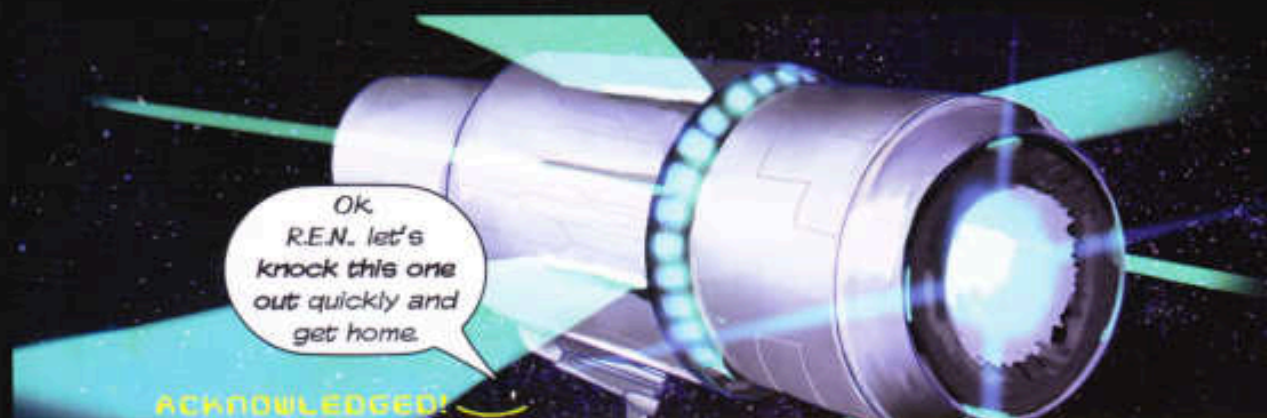


What was missing? Alia spent years searching for the solution. In fact, she pondered this very question as she and R.E.N. prepared to exit their ship and repair the broken satellite.





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--

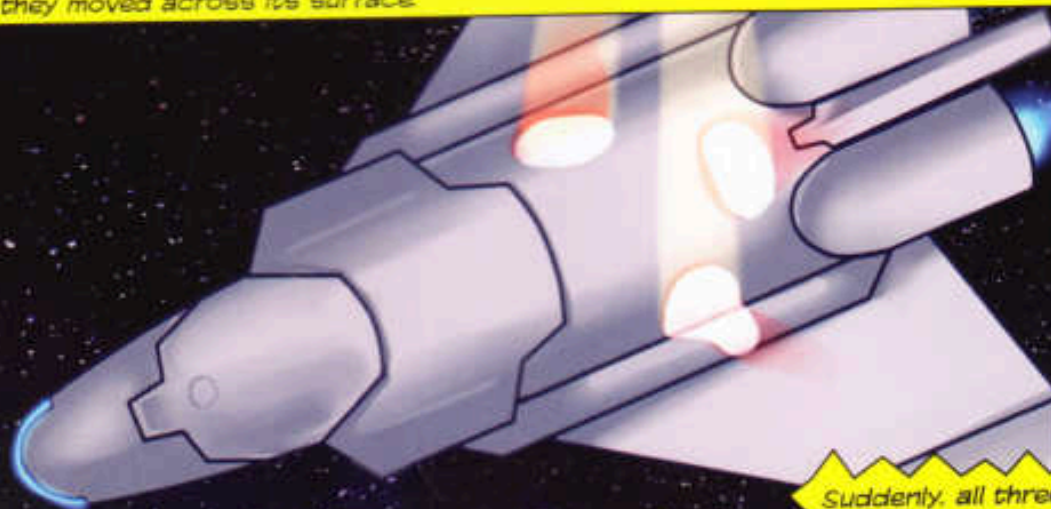
WARNING: SHIP'S
HULL IS
OVERHEATING

OVERHEAT WAR



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.

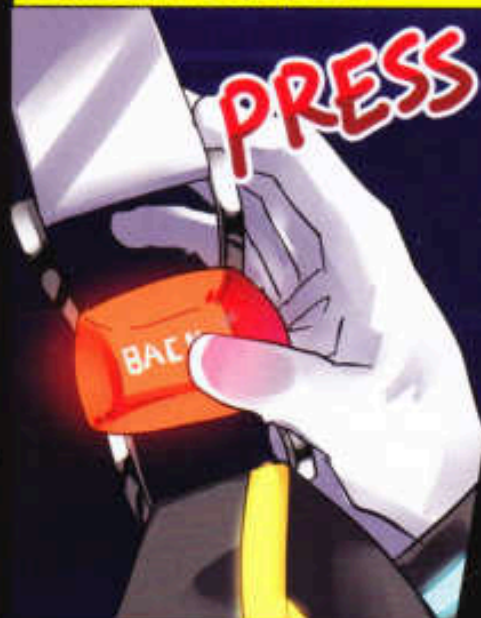


Suddenly, all three lights converged directly over the ship's computers!



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

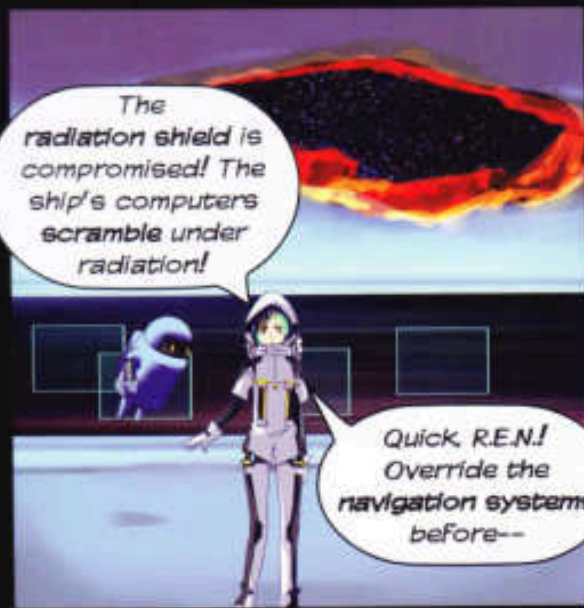
The emergency return winch strained as it yanked Alla back to the ship at top speed.



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

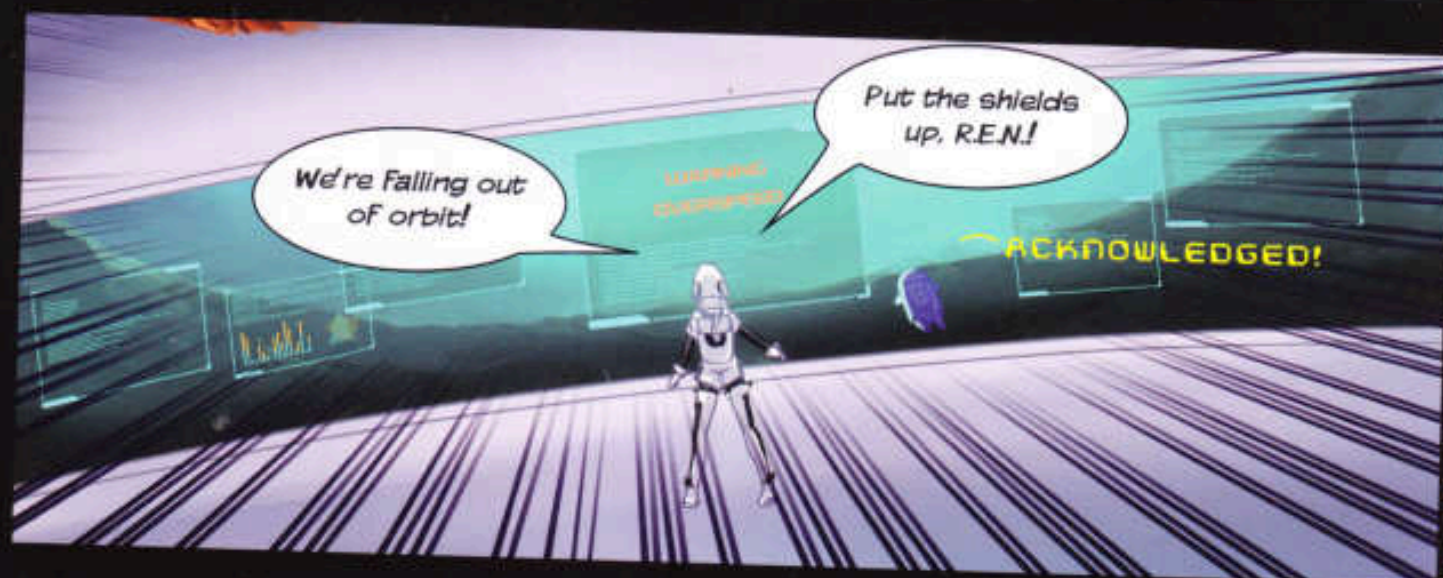


The beam of light melted a hole through the ship's hull and disappeared as quickly as it came.



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.





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



CRASH

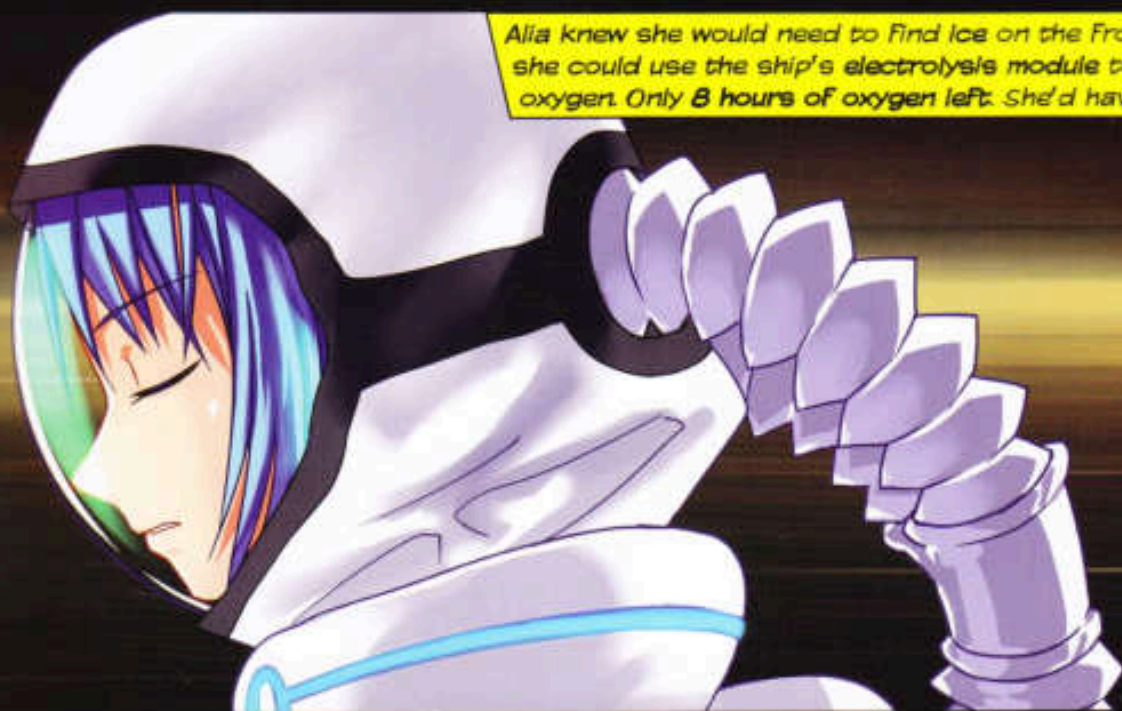
Alia struggled to manually land the crippled ship on the cold, rocky surface of planet Enlac.



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!



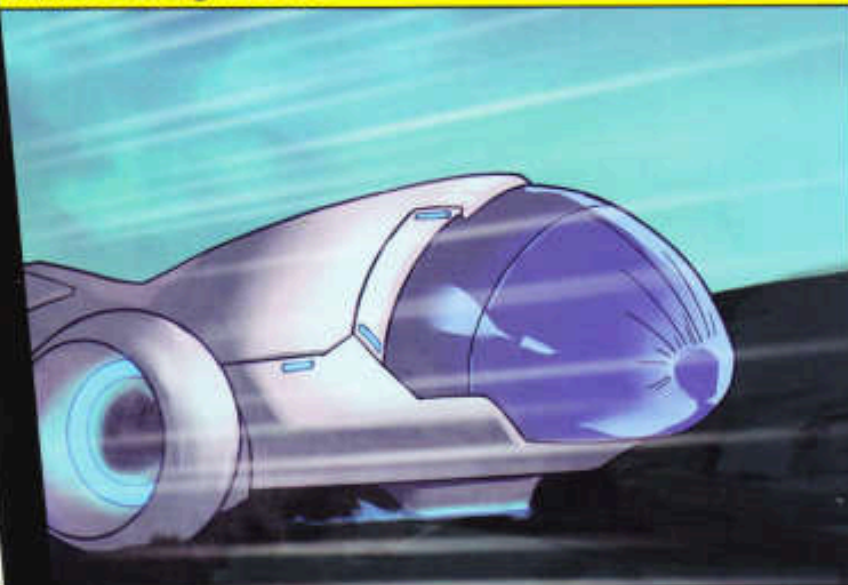
Alia knew she would need to find ice on the Frozen planet. Then she could use the ship's electrolysis module to resupply her oxygen. Only 8 hours of oxygen left. She'd have to move fast.



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



Stay here, R.E.N.! I need to find some 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. _



Only 1
hour of oxygen
left...

...and
still no sign of
ice.

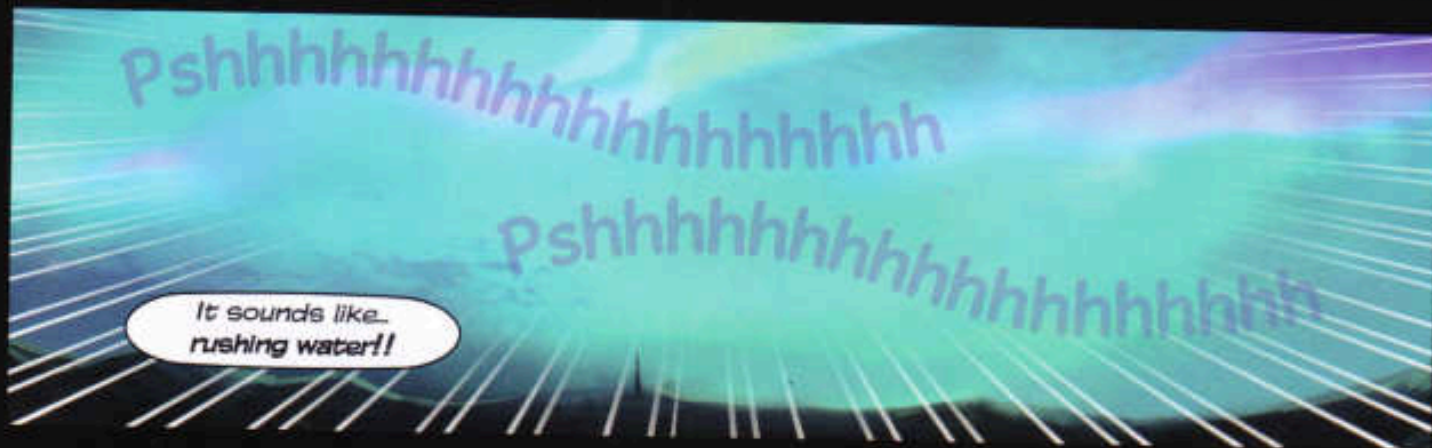


There's
nothing on this
blasted planet but
rock!



Wait...
scanners are
picking up atmospheric
vibrations up
ahead?

Computer—put
the vibrations through so I
can hear them!



It sounds like...
rushing water!!



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.



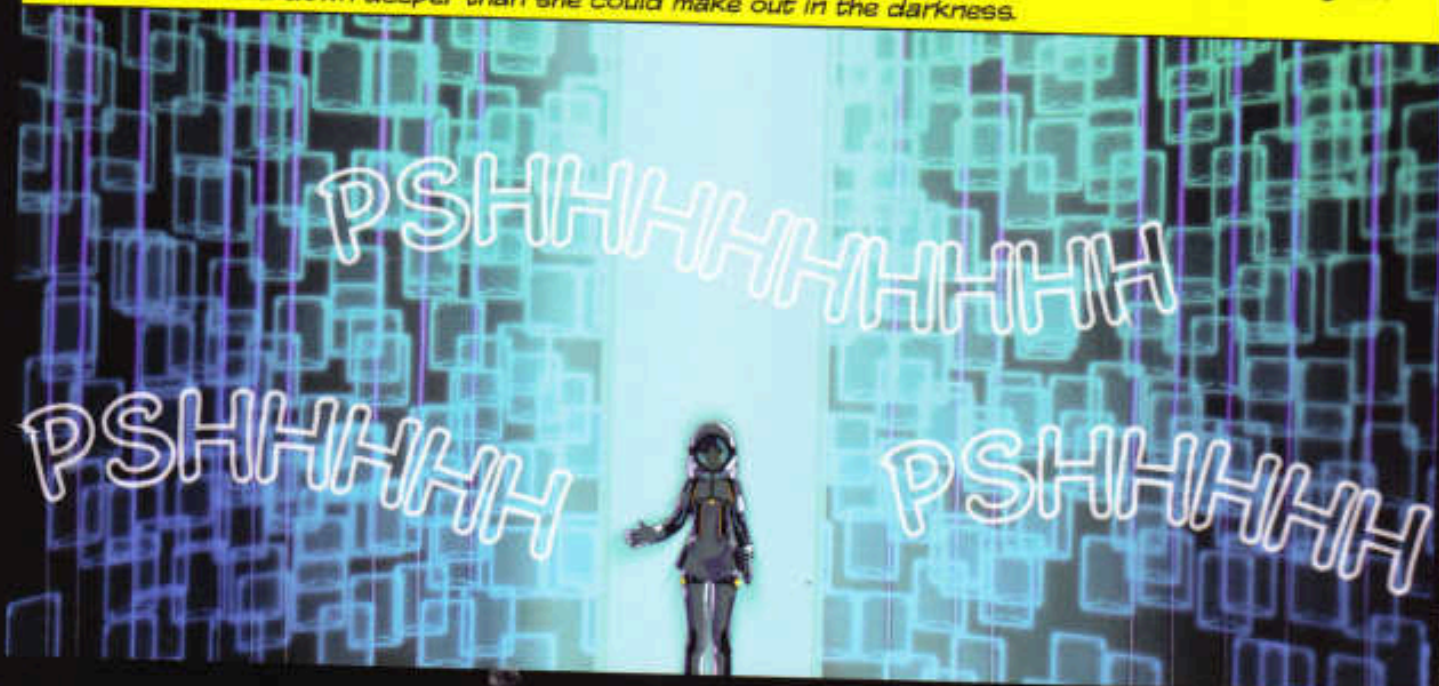
The sound
is coming from inside. I
need to find a way in.



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 balls rolling across the surface of the panels, flipping a myriad of switches as gravity pulled the balls downward.



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



Balls that reached the bottom were pushed to the top by a geothermal pump at the planet's core. Alia picked one up. The ball 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?

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



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



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, balls 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 balls down. Without them, the balls 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:

>

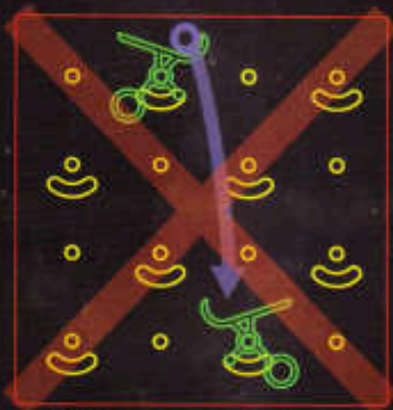


> 3. Once the machine is in motion, you cannot touch the machine or otherwise interfere with its operation.

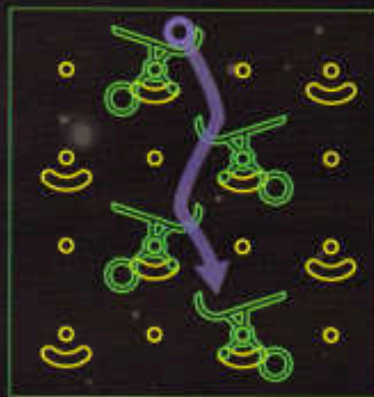
>

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

>



Balls cannot drop freely



Balls 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.

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```
> scan -external -challenge_1.pz1
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|                               |
|               Challenge 1: Gravity               |
|                               |
|=====
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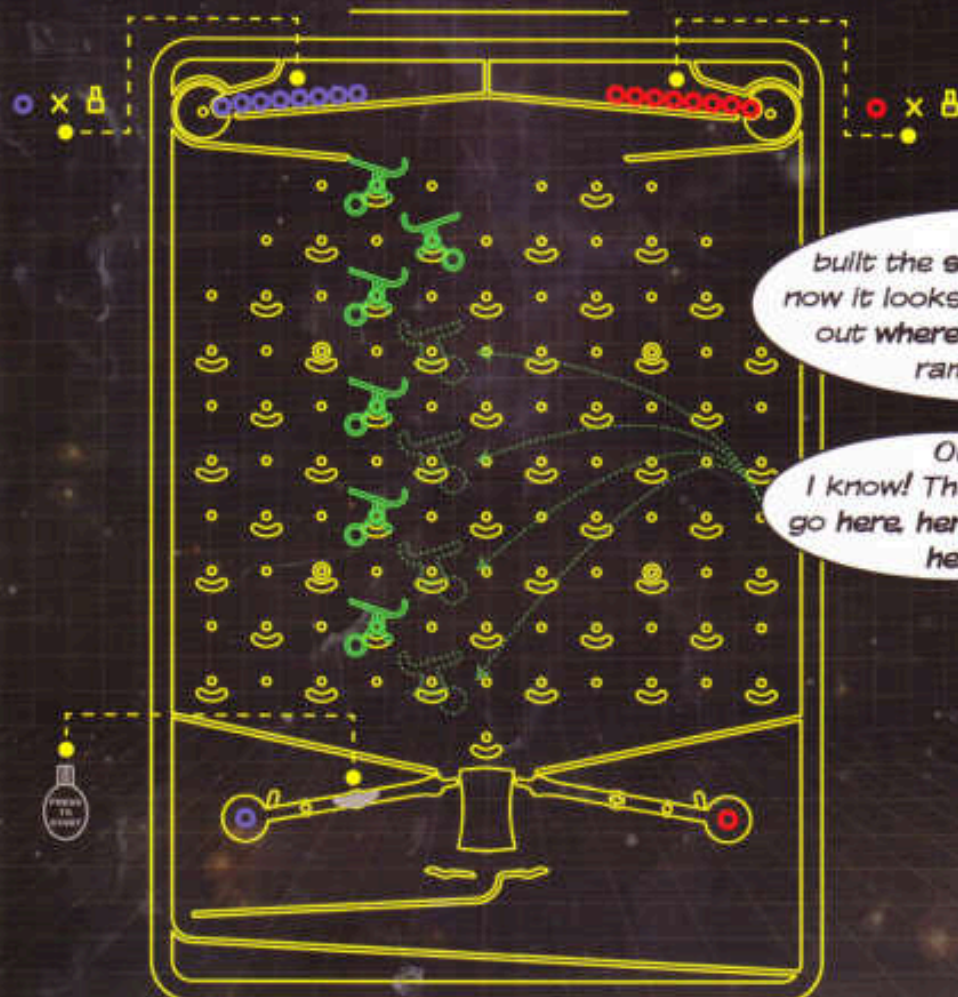
```
Objective: Make all of the blue balls (and only the
blue balls) reach the end.
```

```
Required output:
```

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

```
> _
```

Starting setup



Available parts

 x 4

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

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

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

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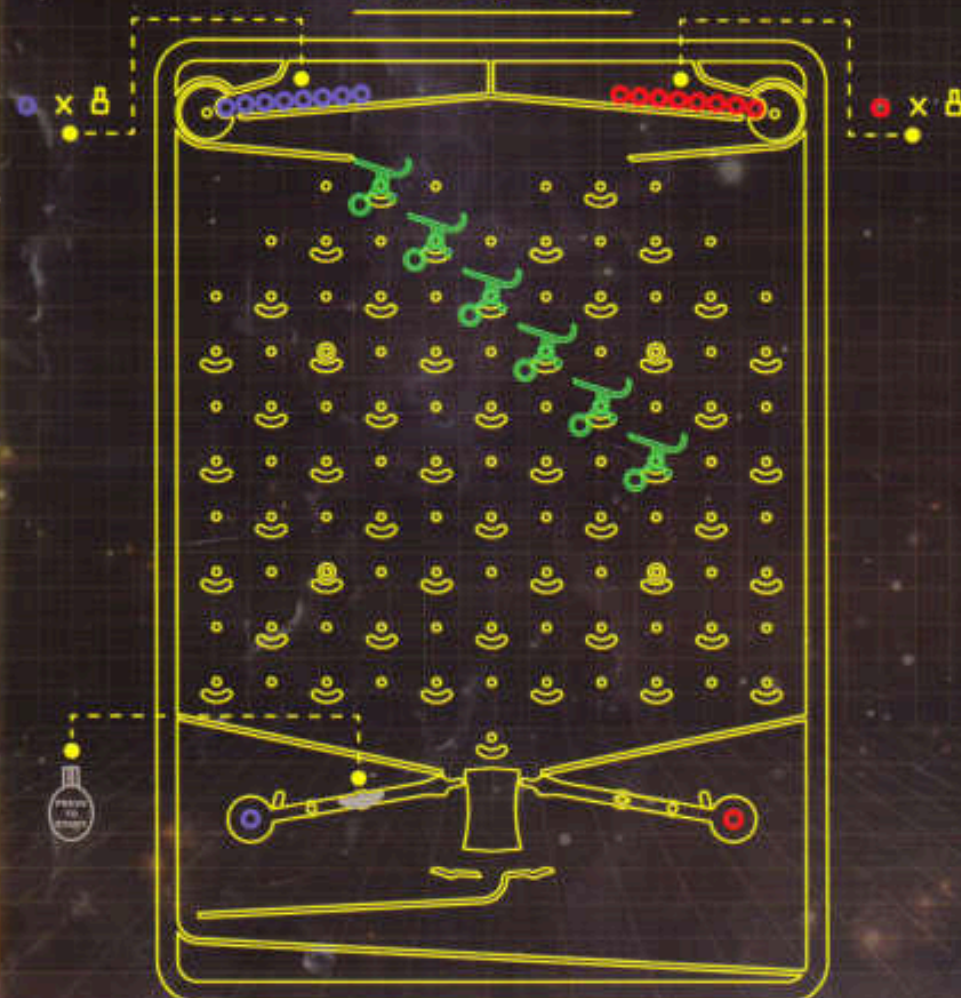
Objective: Make all of the blue balls (and only the blue balls) reach the end.

Required output:



```
> _
```

Starting setup



Available parts





> scan -external -challenge_3.pz1

>

>

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>

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| Challenge 3: Ignition |

=====

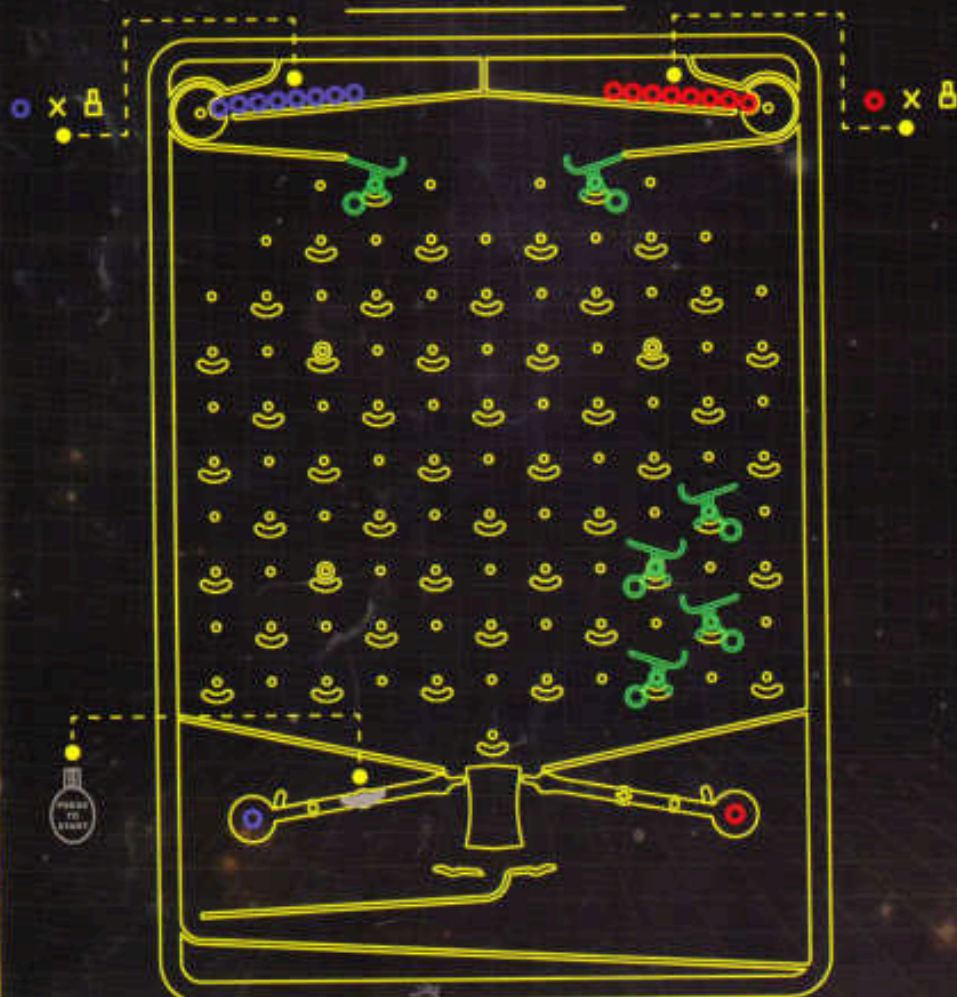
Objective: Release one blue ball and then all of the red balls.

Required output:

ooooooooo

> _

Starting setup



Available parts



Alia Fixed a Few of the panels, making the balls 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.

HSOOW

Unable to hold her breath any longer, Alia Inhaled.

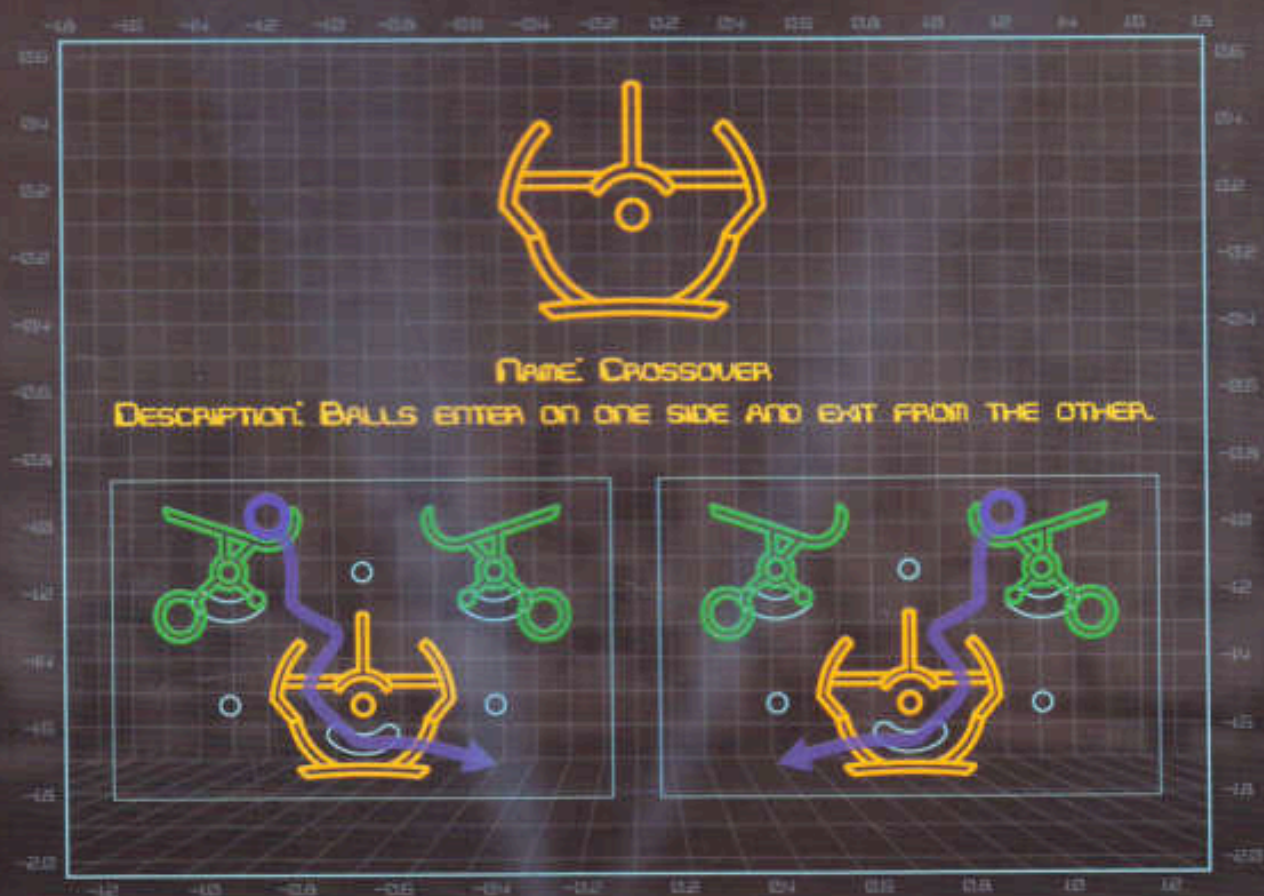


gasp

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
- > _

>

>

3

2

7

>

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>

>

>

Required output:

>

Available parts

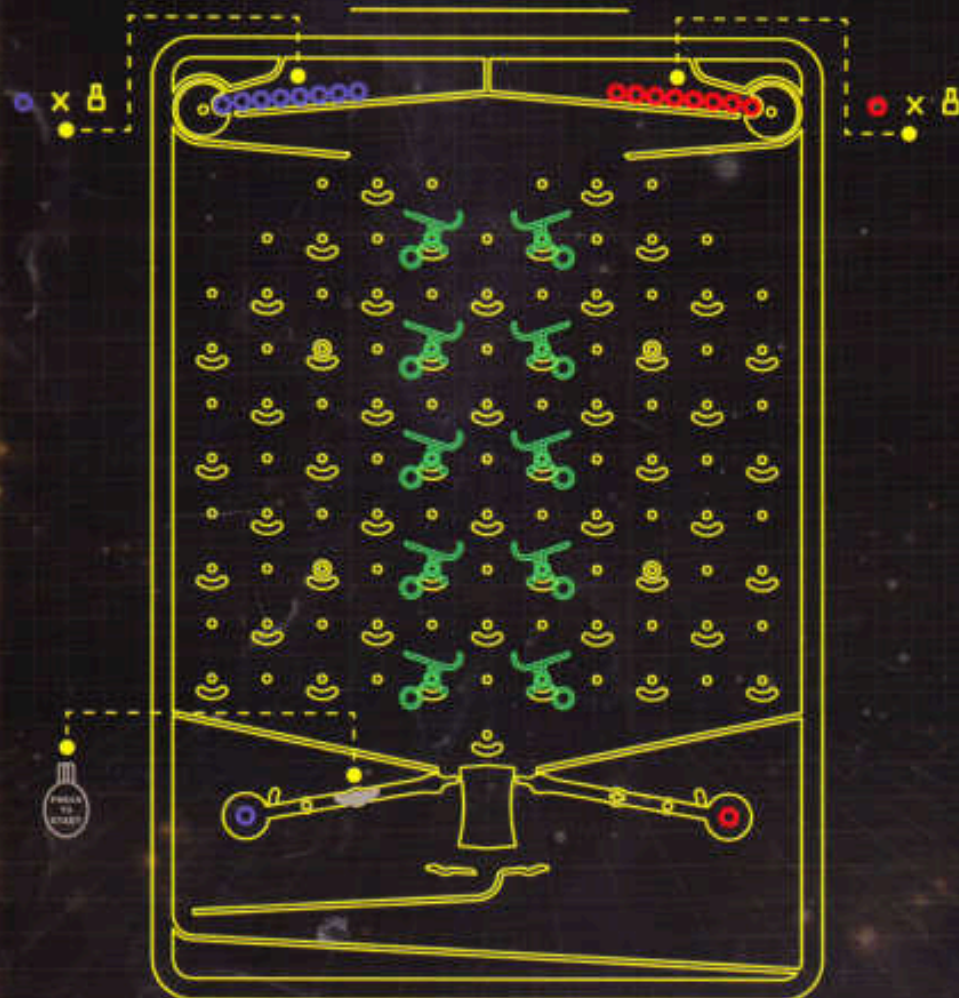


>

Required output:

>

Available
parts

 $\times 2$  x 5

> scan -external -challenge_7.pz1



=====

| Challenge 7: Path of Least Resistance |

=====

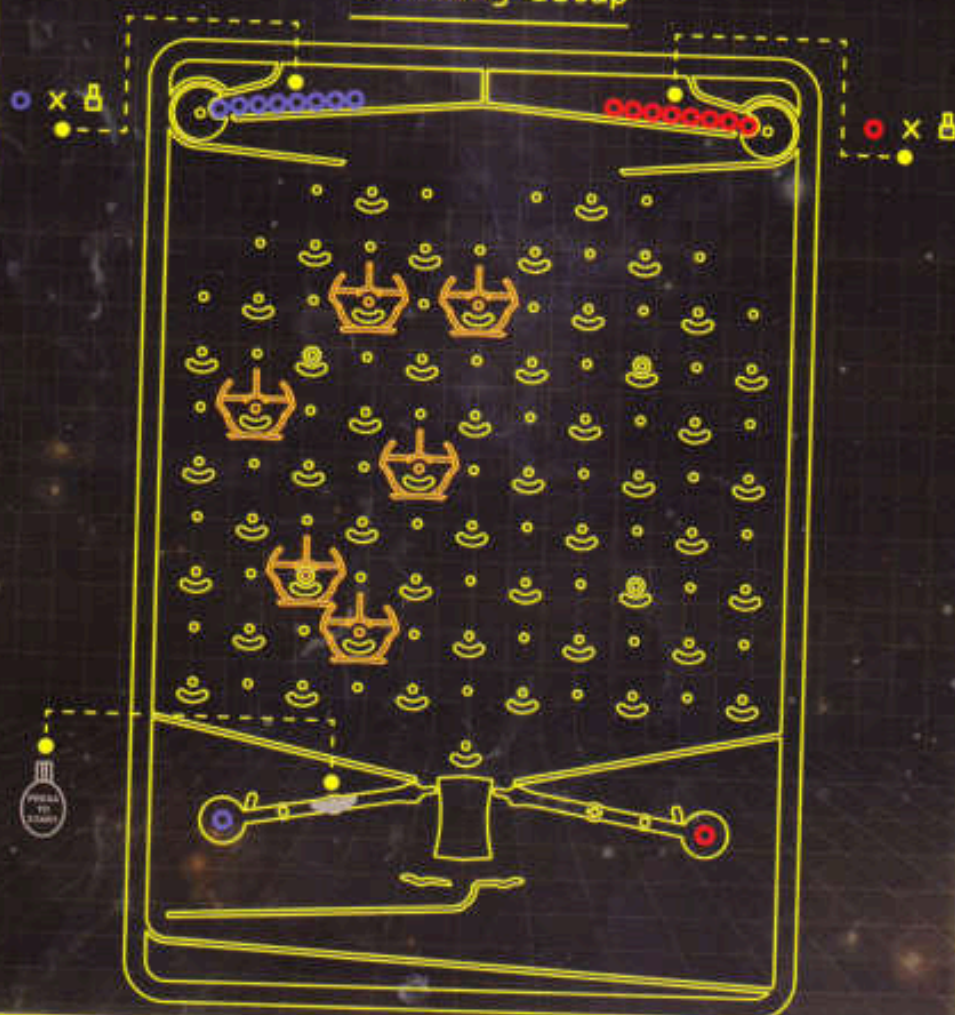
> Objective: Create a path for the blue balls to reach
> the output with only b ramps.

> Required output:



> _

Starting setup



Available
parts





Ha! That
did the trick!

The click-clack of balls 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...



Huh?
Uh...Hello?



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

How
clever! The
computer synthesizes
speech by precisely
timing the taps of balls
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 ball 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...

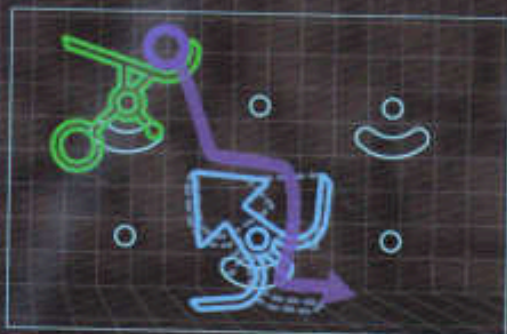
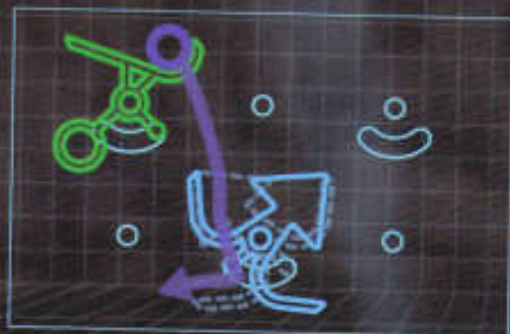
**** NEW PART DETECTED ****

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



NAME: BIT

DESCRIPTION: THE BIT IS A SWITCH. IT STORES INFORMATION BY POINTING LEFT OR RIGHT. THE STARTING POSITION OF A BIT IS *VERY* IMPORTANT.



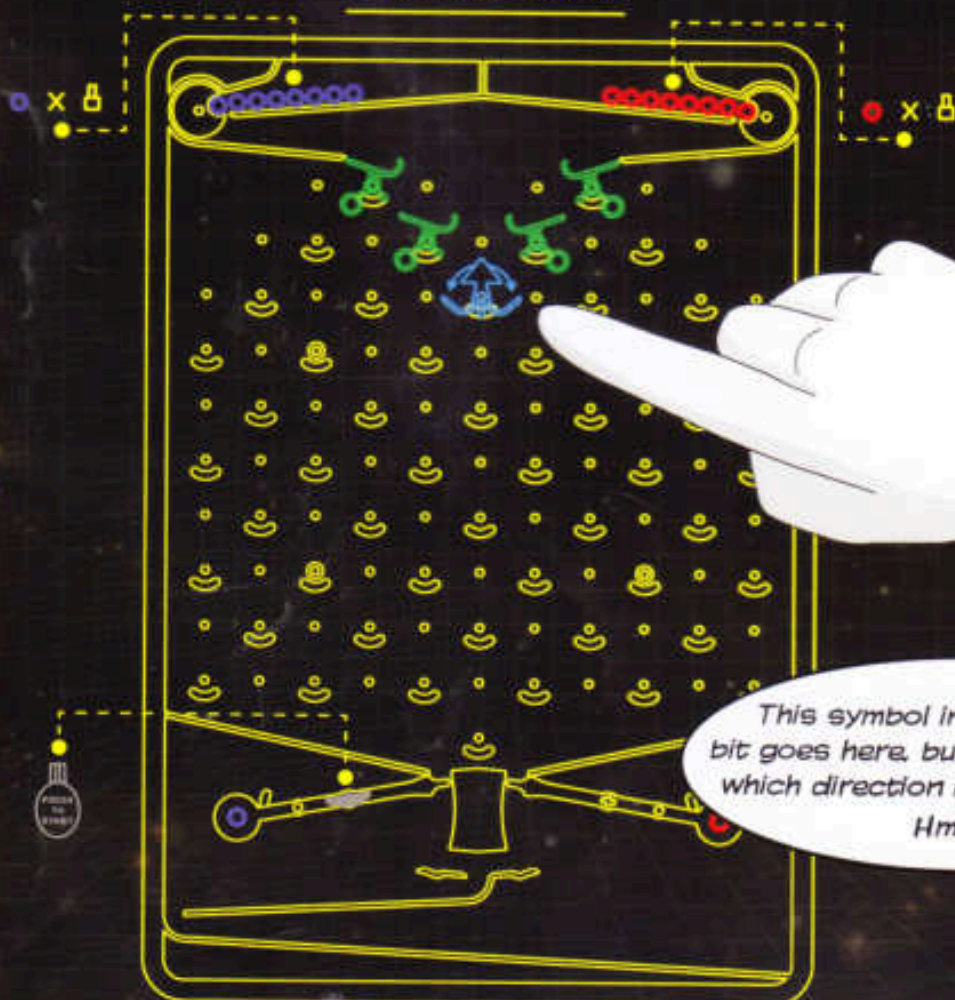
- > RENDERING COMPLETE
- >



Required output:



Available parts



$\times 14$

26

```
> scan -external -challenge_9.pzl
```

```
=====
|                               |
|           Challenge 9: Dimers           |
|                               |
=====
```

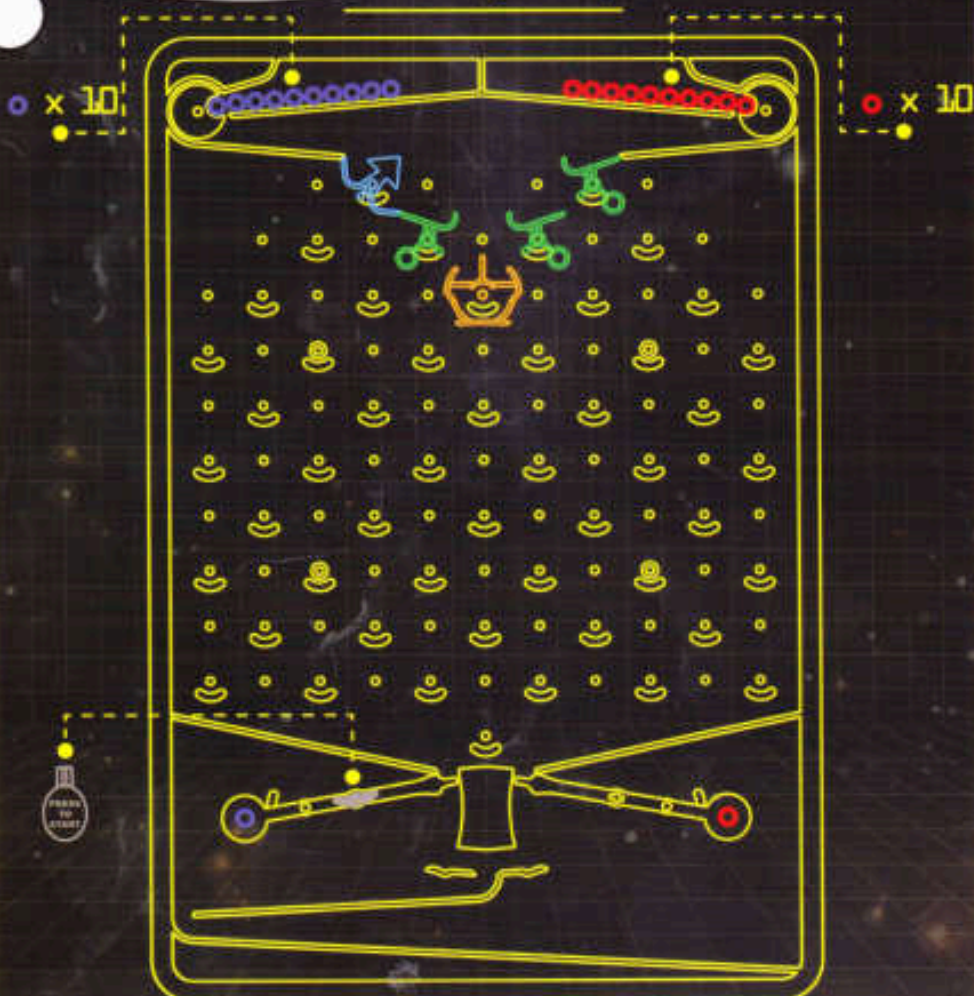
```
> Objective: Make the pattern blue, blue, red, blue,
> blue, red...
```

```
> Required output:
```

```
  o o o o o o o o o o
  o o o o o o o o o o
```

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

Starting setup



Available parts

 x 18

> scan -external -challenge_10.pzl

>

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| Challenge 10: Double Bond |

=====

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

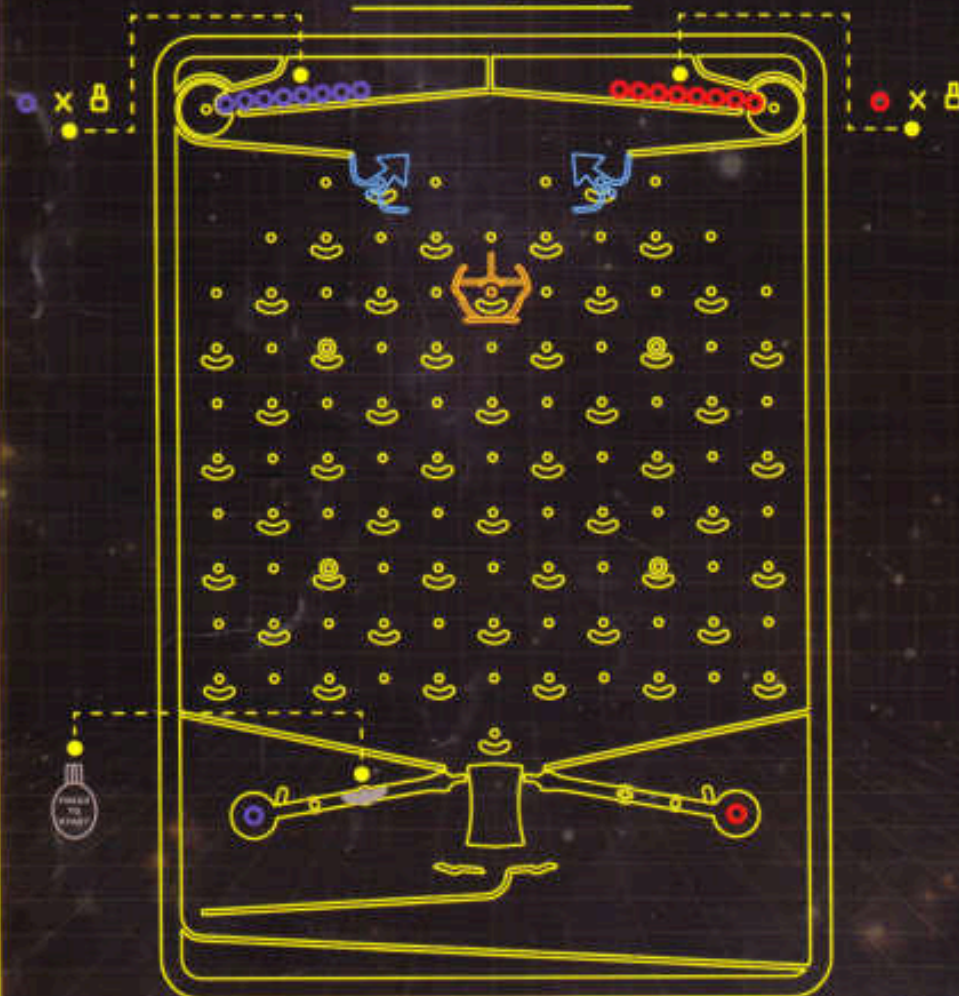
Required output:



>

>

Starting setup



Available parts

 x 22

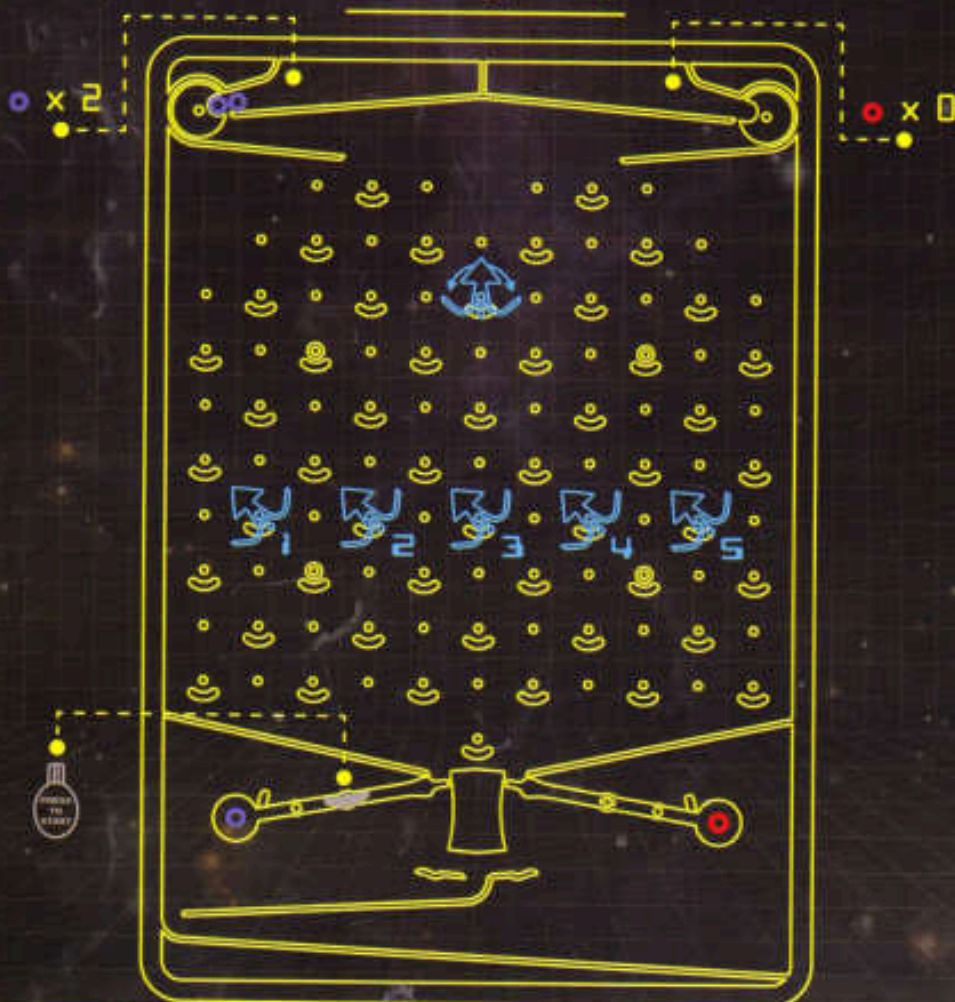
```
> scan -external -challenge_11.pz1
```



```
> =====
> |               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 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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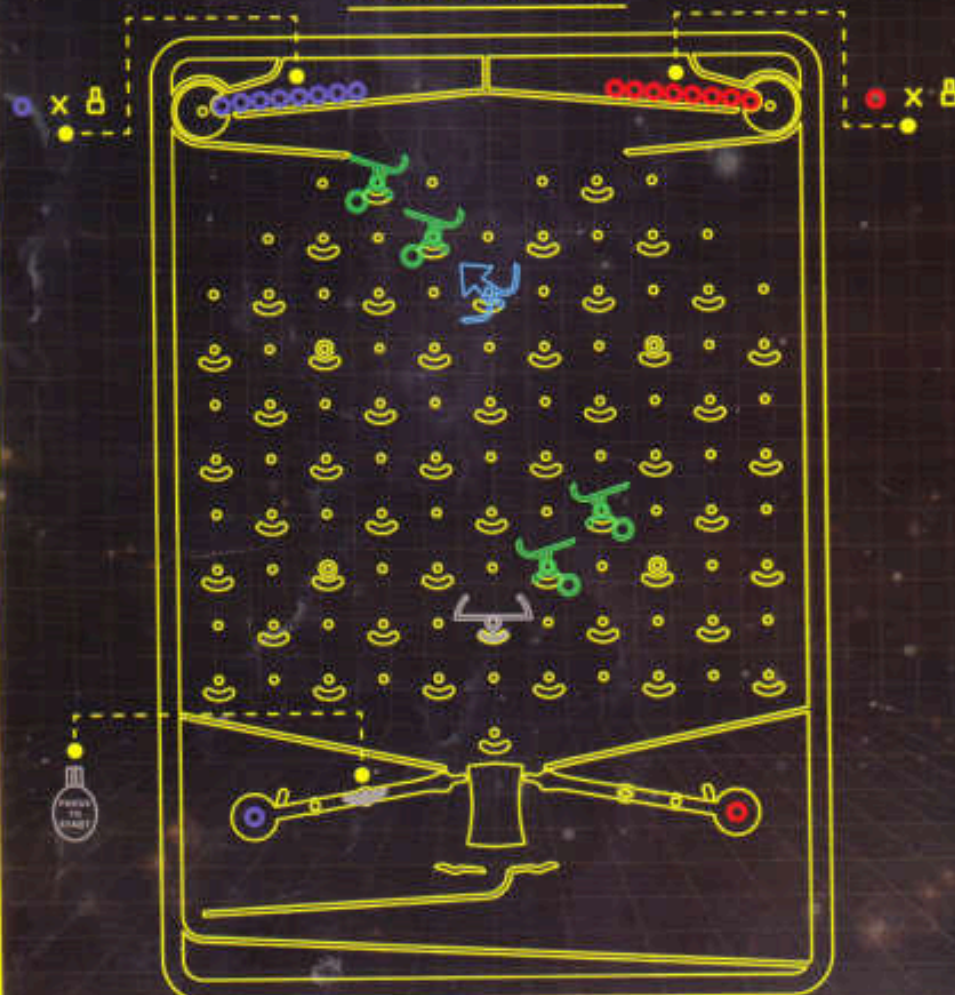
```
>
```

Challenge 12: Duality - Part 1

Objective: Intercept a blue ball.

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

Starting setup



Available parts

 x 3

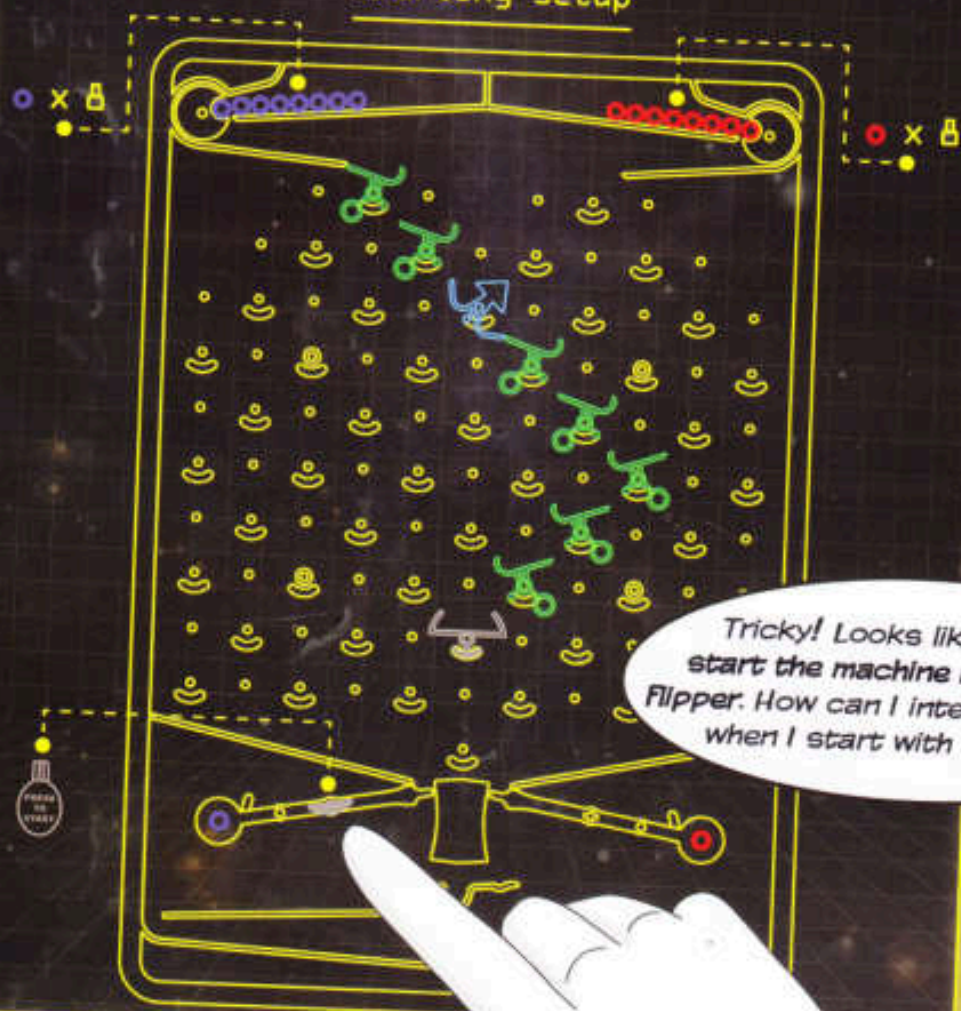
> scan -external -challenge_13.pz1



=====
| Challenge 13: Duality - Part 2 |
=====

> Objective: Intercept a red ball.
> _

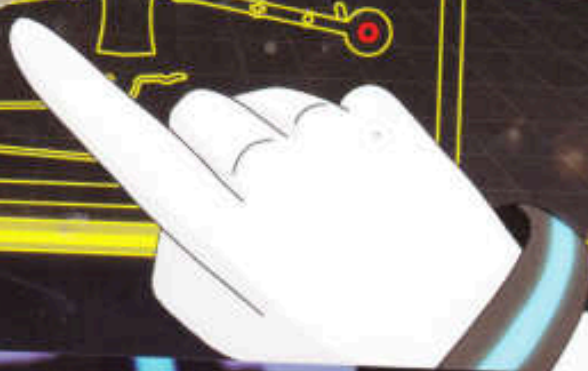
Starting setup



Available parts

 x 12

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



> 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 ball. Otherwise, intercept a red ball.

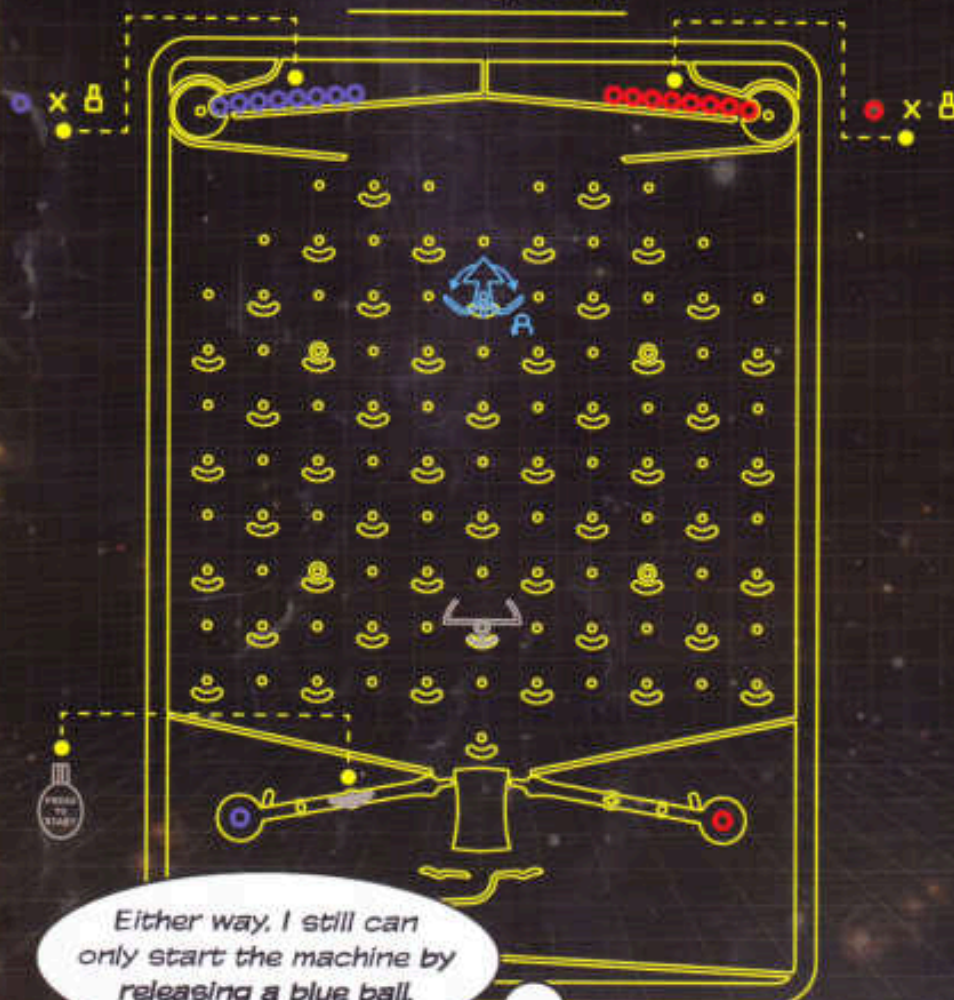
Examples:



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

 x 20

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

```
> scan -external -challenge_15.pzl
```



Challenge 15: Inversion

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

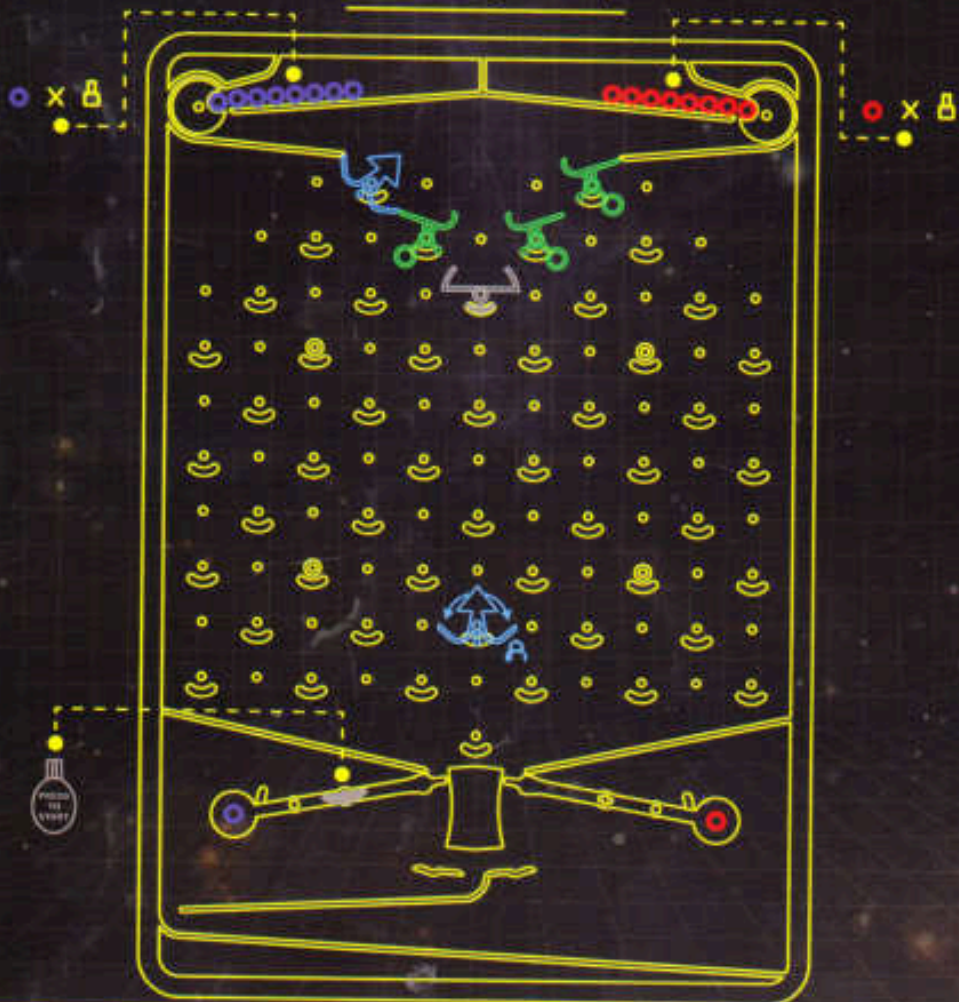
Examples:



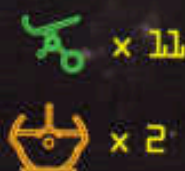
The $\Rightarrow$ symbol means "if" whatever's on the left, "then" whatever's on the right.

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

Starting setup



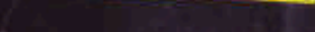
Available parts



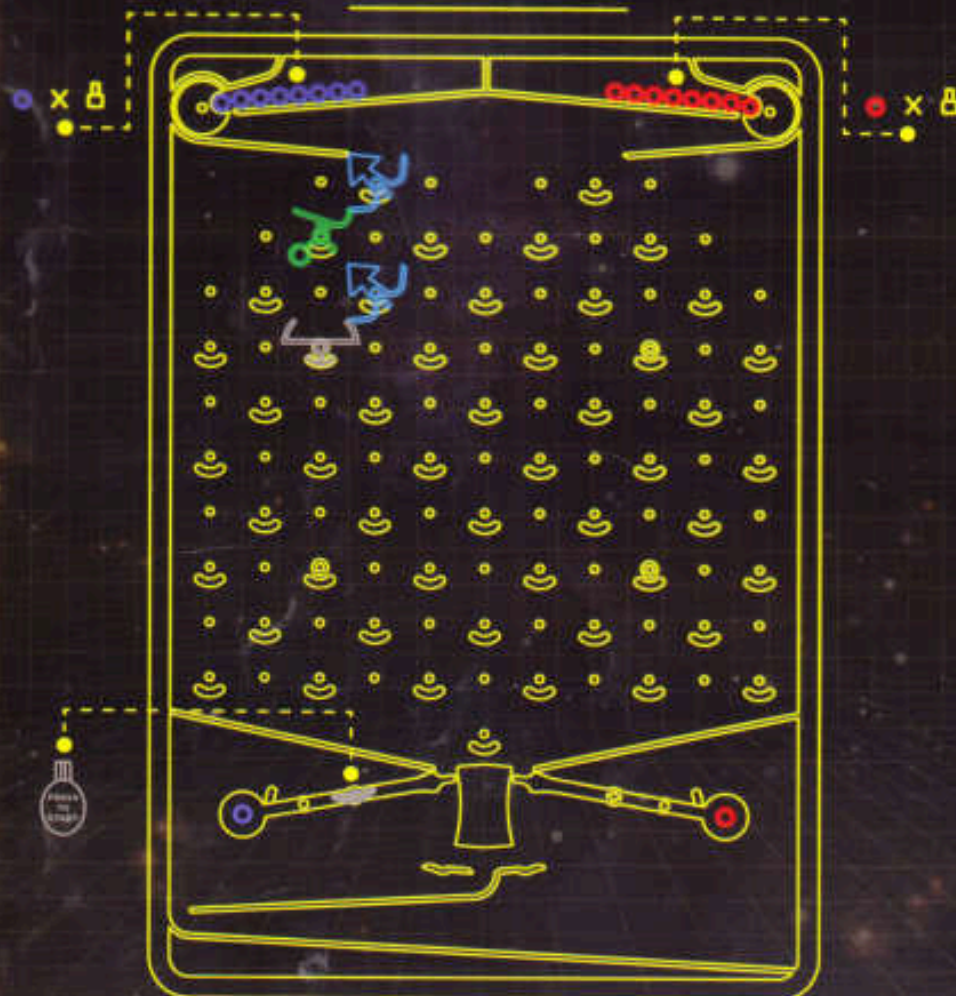
Getting too hard? Check out turingtumble.com/hints for help and extra practice.



>



10



100

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> scan -external -challenge_17.pzl
```

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

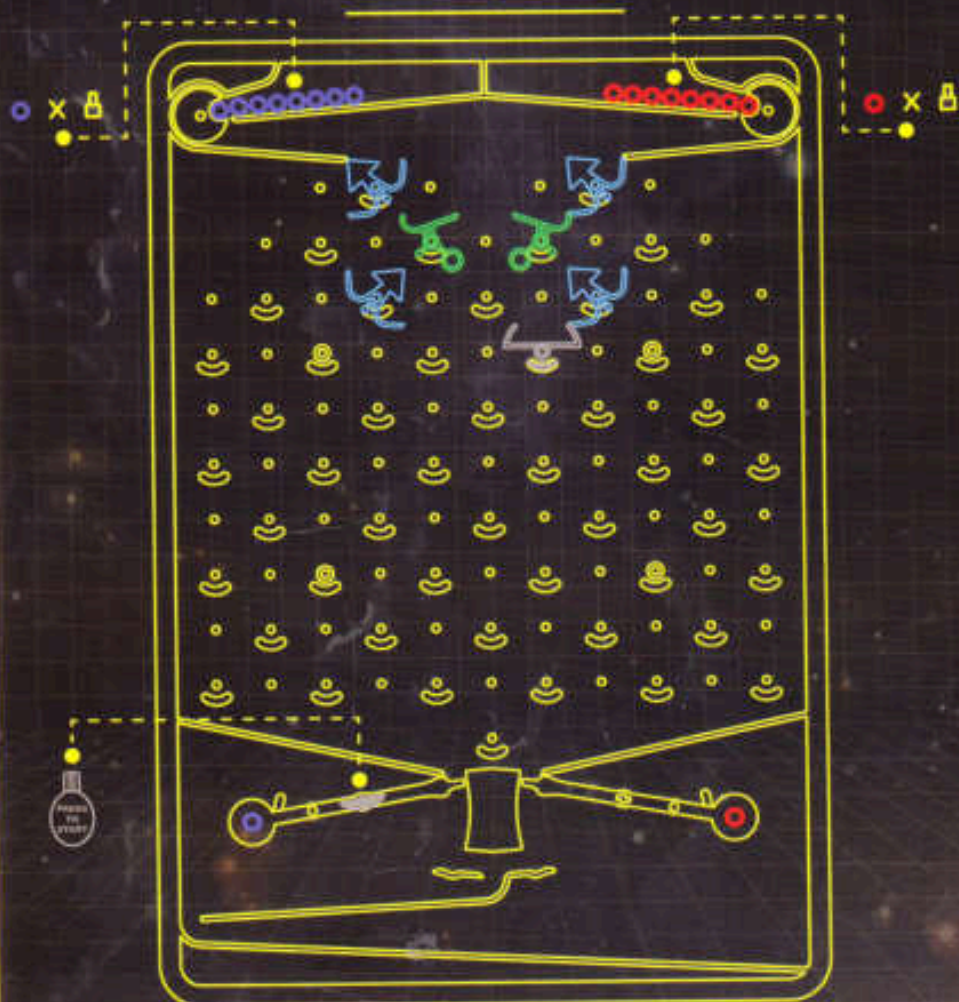
```
> Objective: Make the pattern blue, blue, blue, red,
> red, red.
```

```
> Required output:
```

```
_____ ooo ooo
```

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> _
```

Starting setup



Available parts

 x ∞

> scan -external -challenge_18.pz1

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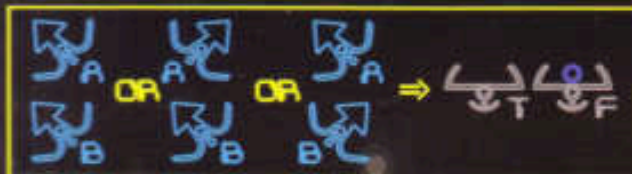
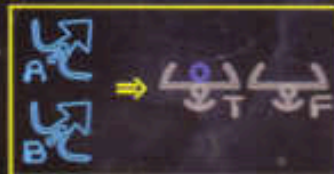
=====

| Challenge 18: Entanglement |

=====

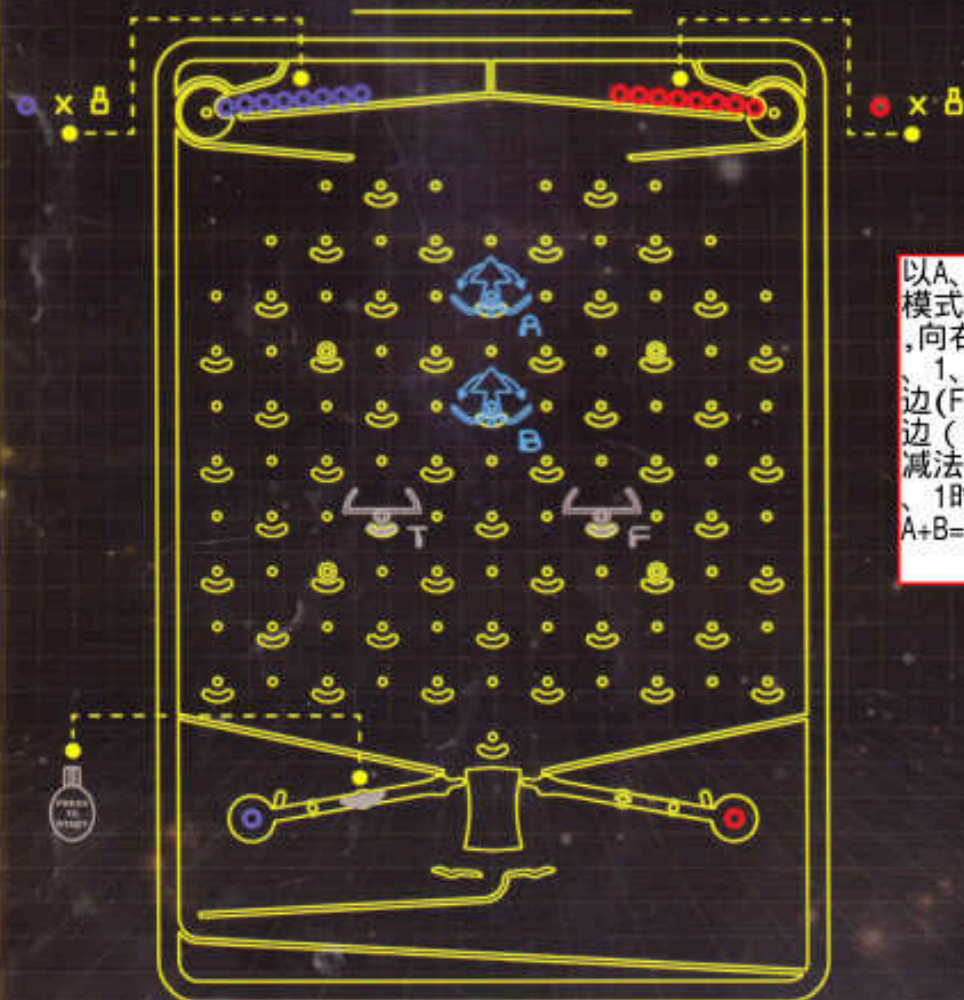
Objective: If the top bit AND the bottom bit start pointed to the right, put a ball in interceptor T. Otherwise put a ball in interceptor F.

Examples:



>

Starting setup



Available parts



以A、B为二进制，加法计数器模式时，A向右为1，向左为0，B向右为2，向左为0，则A+B=0、1、2的时候，蓝球会落在右边(F)，A+B=3时，蓝球落在左边(T)，减法计数器模式时，A+B=3、2、1时，蓝球落在左边(T)，则A+B=0时，蓝球会落在右边(F)

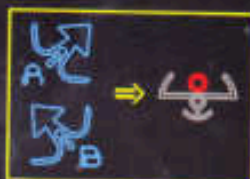
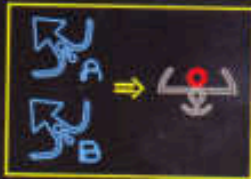
> scan -external -challenge_19.pz1

★★★

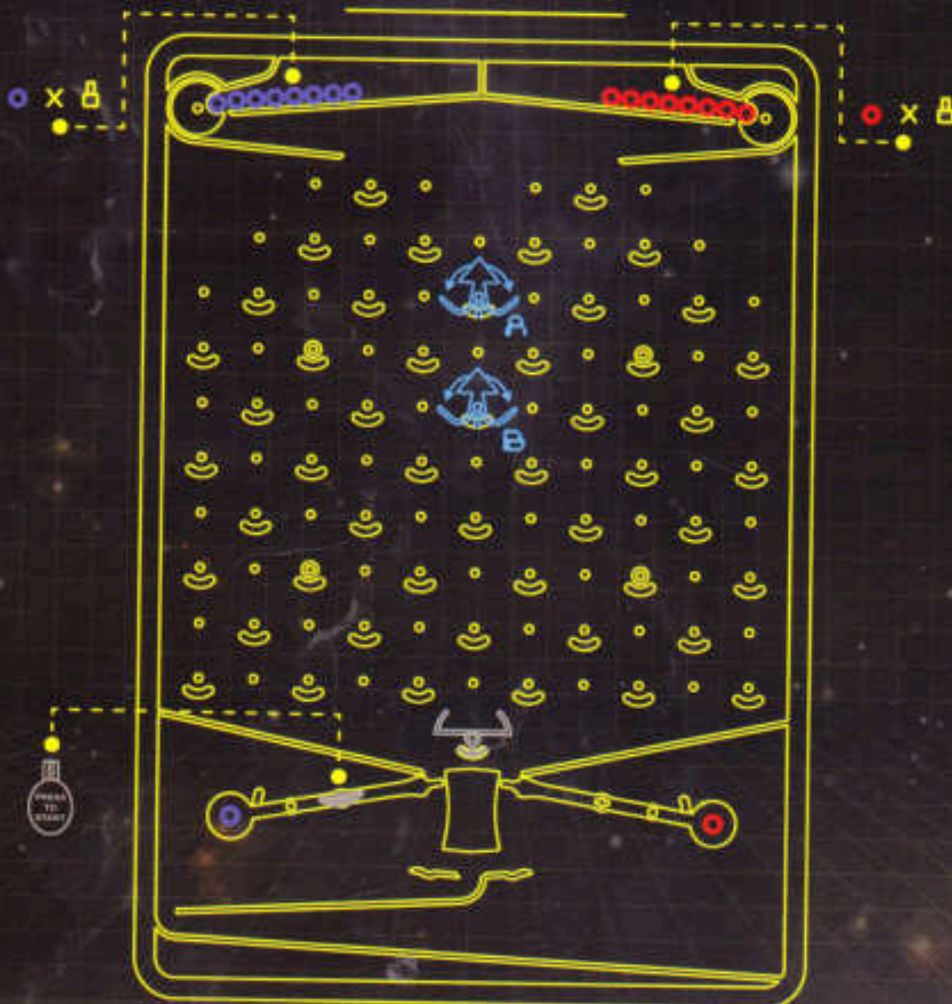
Challenge 19: Entanglement

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

Examples:



Starting setup



Available parts

 x ∞

 x 2

考虑红球经过A+B的情况
或者不经过A+B

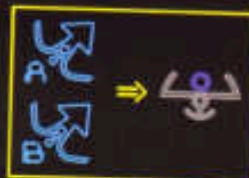
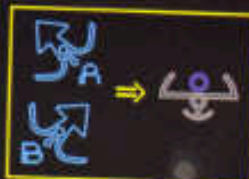
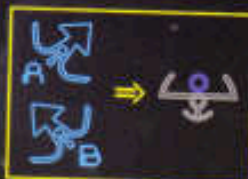
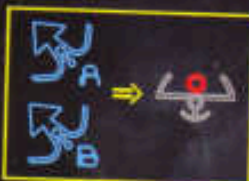
> scan -external -challenge_20.pz1

★★★

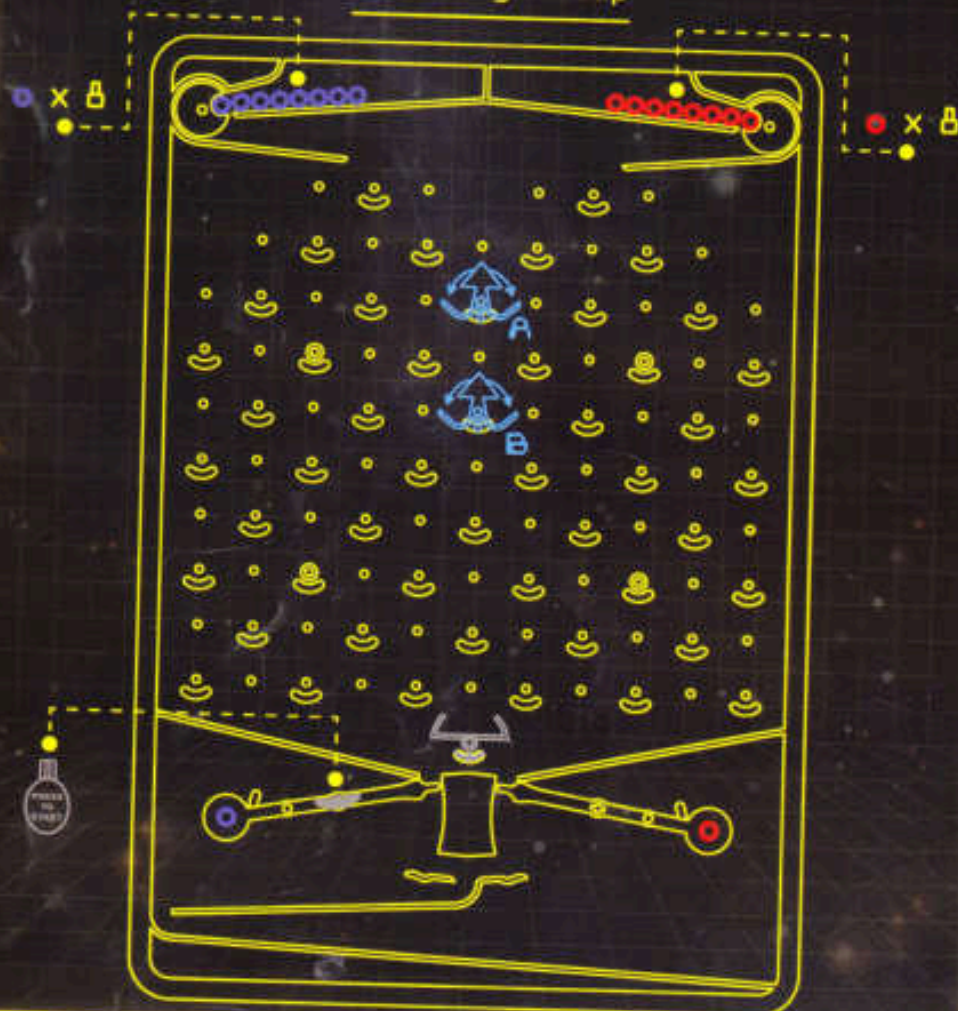
Challenge 20: Symbiosis

Objective: If the top bit 0R the bottom bit start pointed to the right, intercept a blue ball. Otherwise, intercept a red ball.

Examples:



Starting setup



Available parts

 x ∞

 x 2

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...

NAME: REGISTER
DESCRIPTION: A REGISTER IS A GROUP OF BITS THAT MAKE UP A NUMBER. THE NUMBER MAY BE READ BY ADDING THE NUMBERS NEXT TO EACH RIGHT-POINTING BIT.

EXAMPLES:

Register	Bit 1	Bit 2	Bit 4	Bit 8	Sum
1	1	0	0	0	1
2	0	1	0	0	2
3	1	1	0	0	3
4	0	0	1	0	4
5	1	0	1	0	5
6	0	1	1	0	6
7	1	1	1	0	7
8	0	0	0	1	8

- > RENDERING COMPLETE
- >



> scan -external -challenge_21.pz1

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```
=====
|               Challenge 21: Quantum Number               |
=====
```

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

Examples:

$$\text{blue ball} \times 5 \Rightarrow \text{A} = 5$$

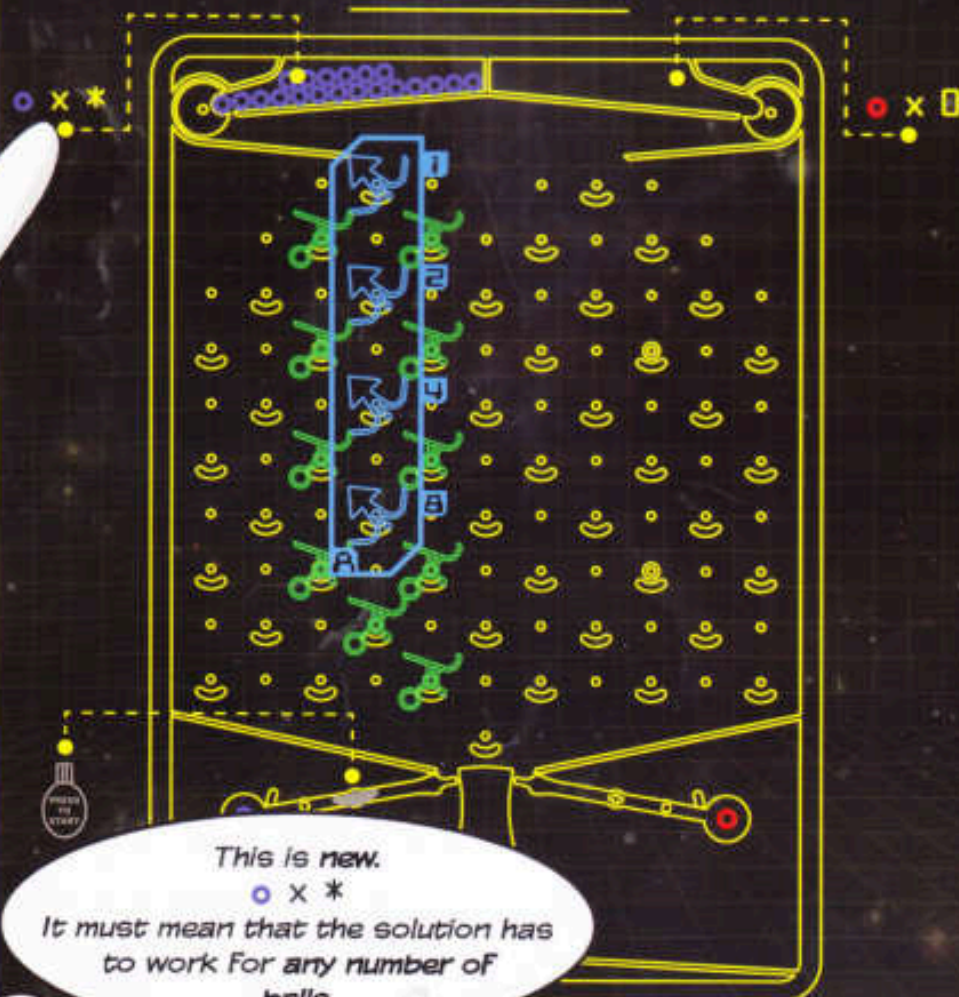
$$\text{blue ball} \times 4 \Rightarrow \text{A} = 4$$

$$\text{blue ball} \times 7 \Rightarrow \text{A} = 7$$

$$\text{blue ball} \times 11 \Rightarrow \text{A} = 11$$

>

Starting setup



Available parts

 x 5

This is new.

 x *

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

> scan -external -challenge_22.pzl

Challenge 22: Depletion

Objective: Register A starts at 15. Subtract the number of blue balls from the register. (Use 15 or fewer balls.)

Examples:

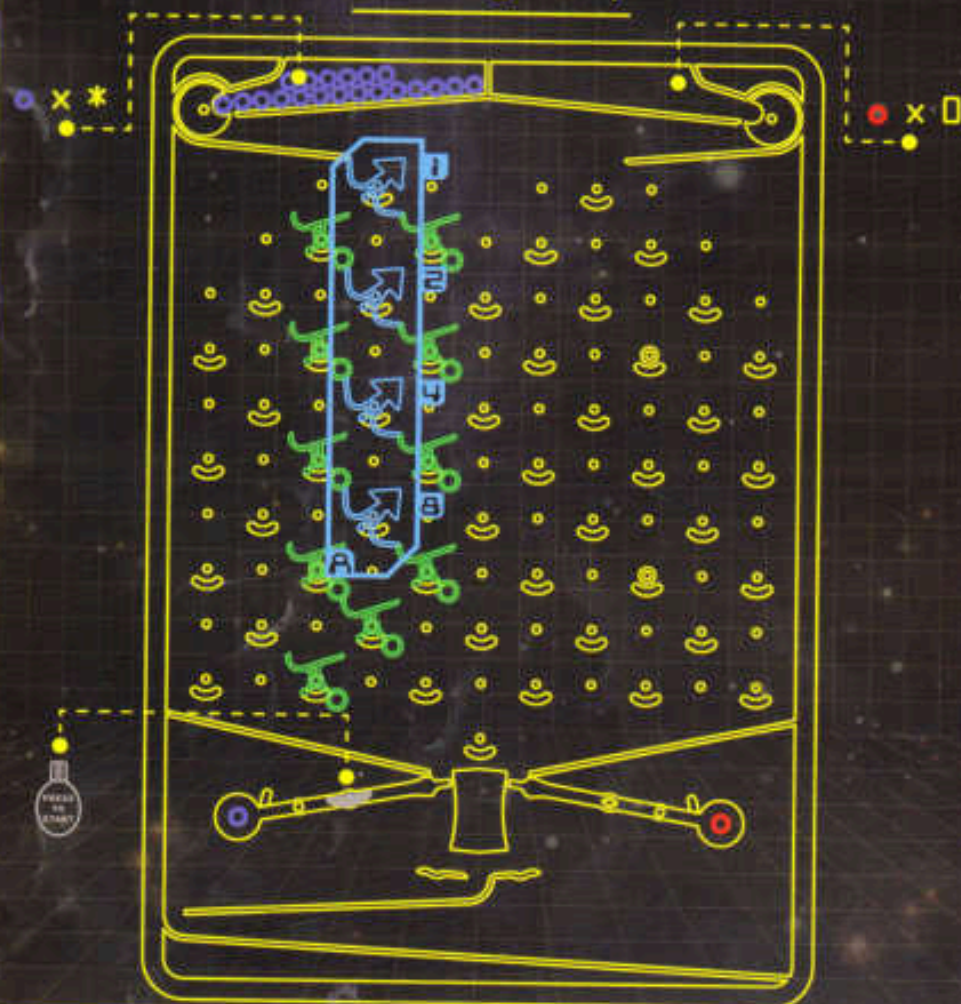
$$\text{blue ball} \times 1 \Rightarrow A = 14$$

$$\text{blue ball} \times 4 \Rightarrow A = 11$$

$$\text{blue ball} \times 10 \Rightarrow A = 5$$

$$\text{blue ball} \times 15 \Rightarrow A = 0$$

Starting setup



Available parts

green scissors x 4

> scan -external -challenge_23.pzl

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

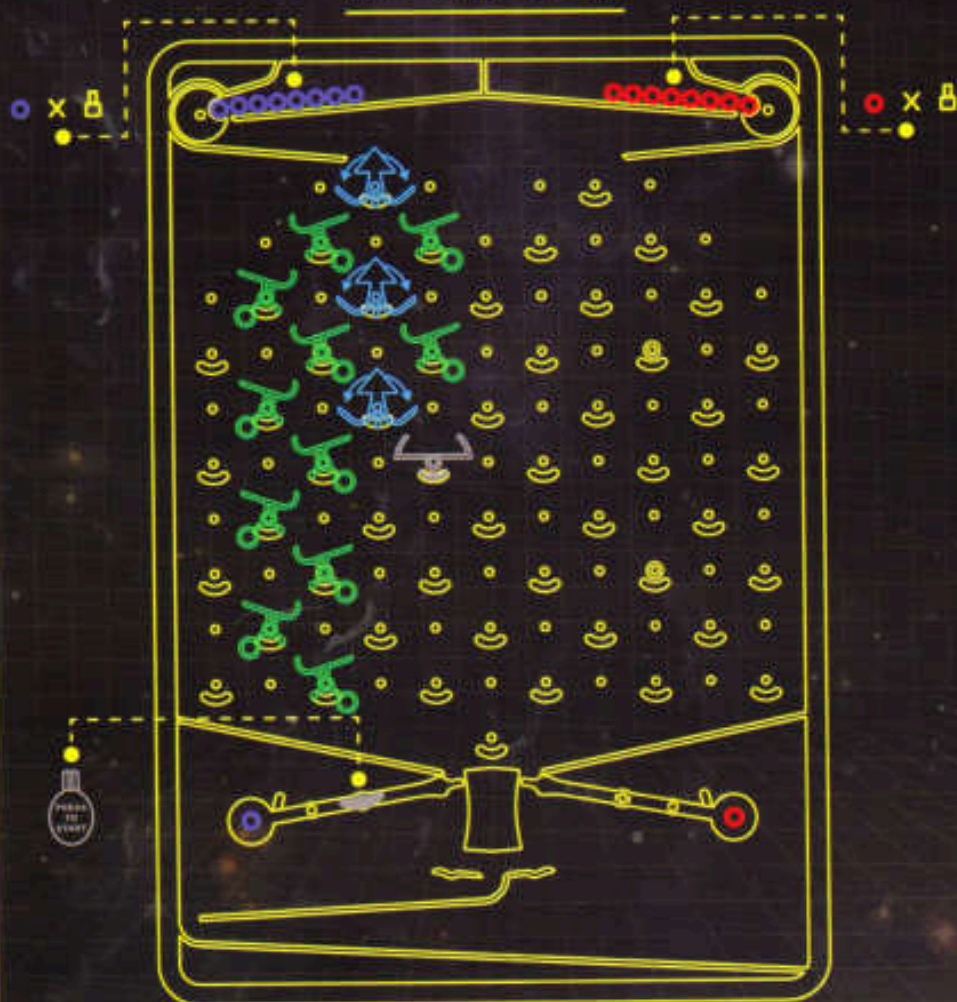
Required output:

_____ 0000

>

>

Starting setup



Available parts

> scan -external -challenge_24.pz1



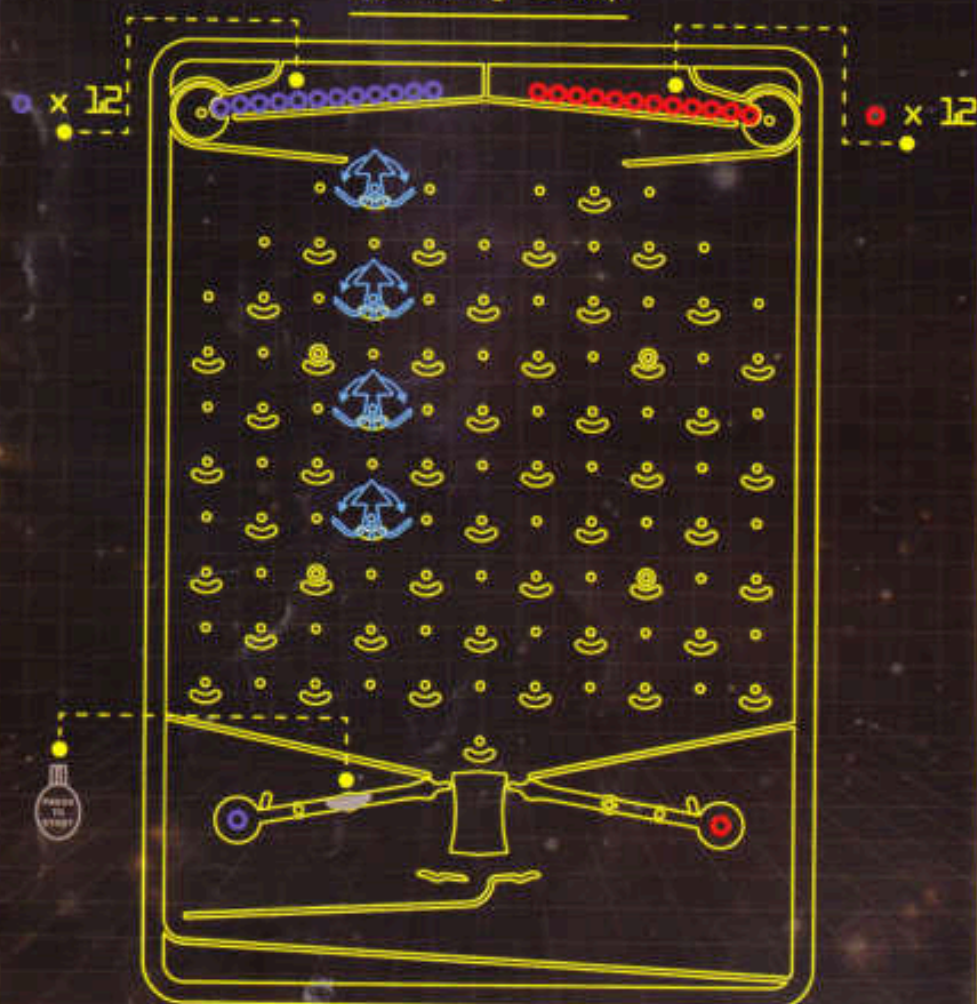
Challenge 24: Ennead

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

Required output:



Starting setup



Available parts



```
> scan -external -challenge_25.pzl
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Challenge 25: Regular Expression

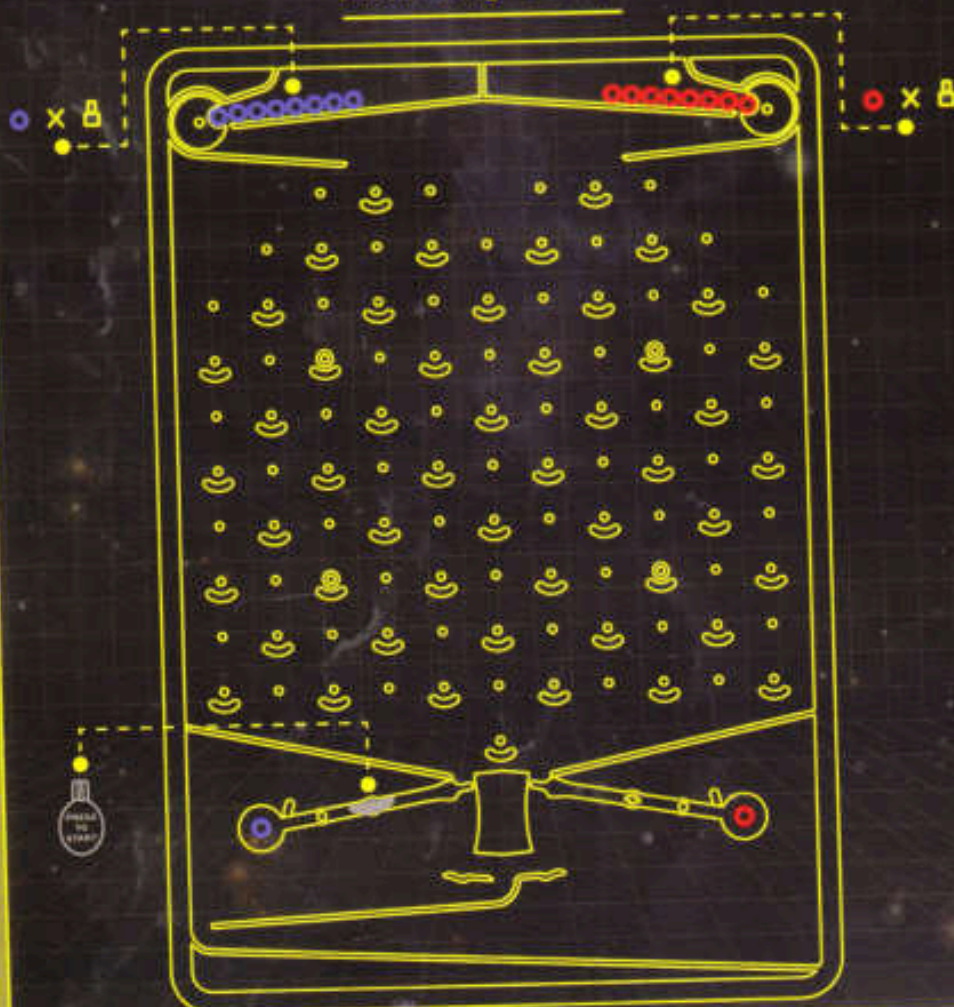
Objective: Generate the required pattern.

Required output:

oooooooo

```
> _
```

Starting setup



Available parts



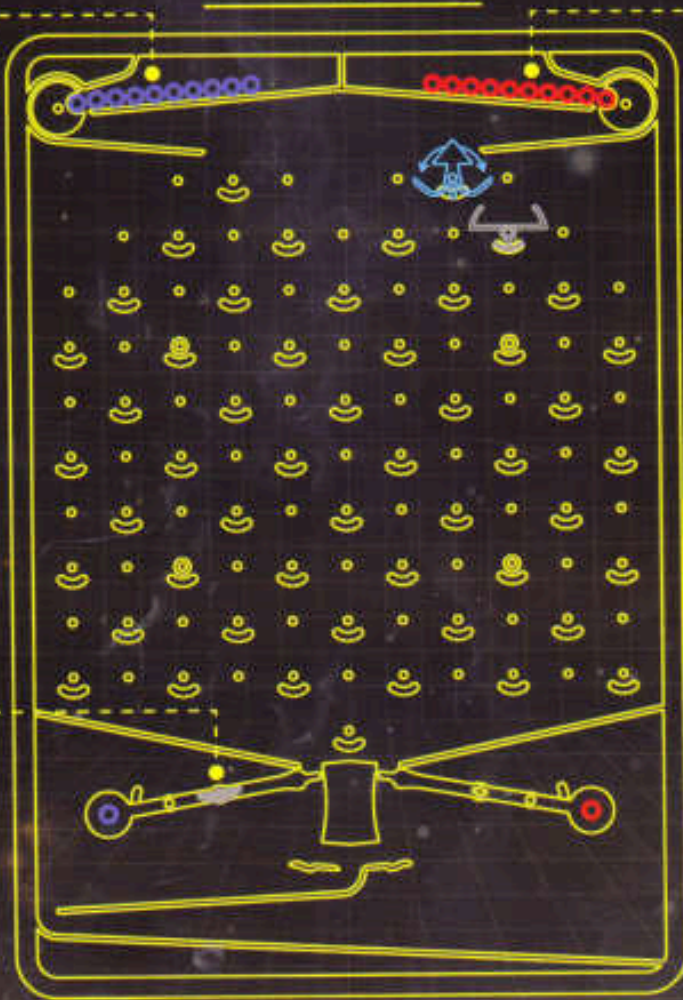
Think of a different solution?
Submit it online at:
community.buringtumble.com

>

Required output:



○ $\times 10^4$

 $\times 10$ $\infty \times \infty$ 

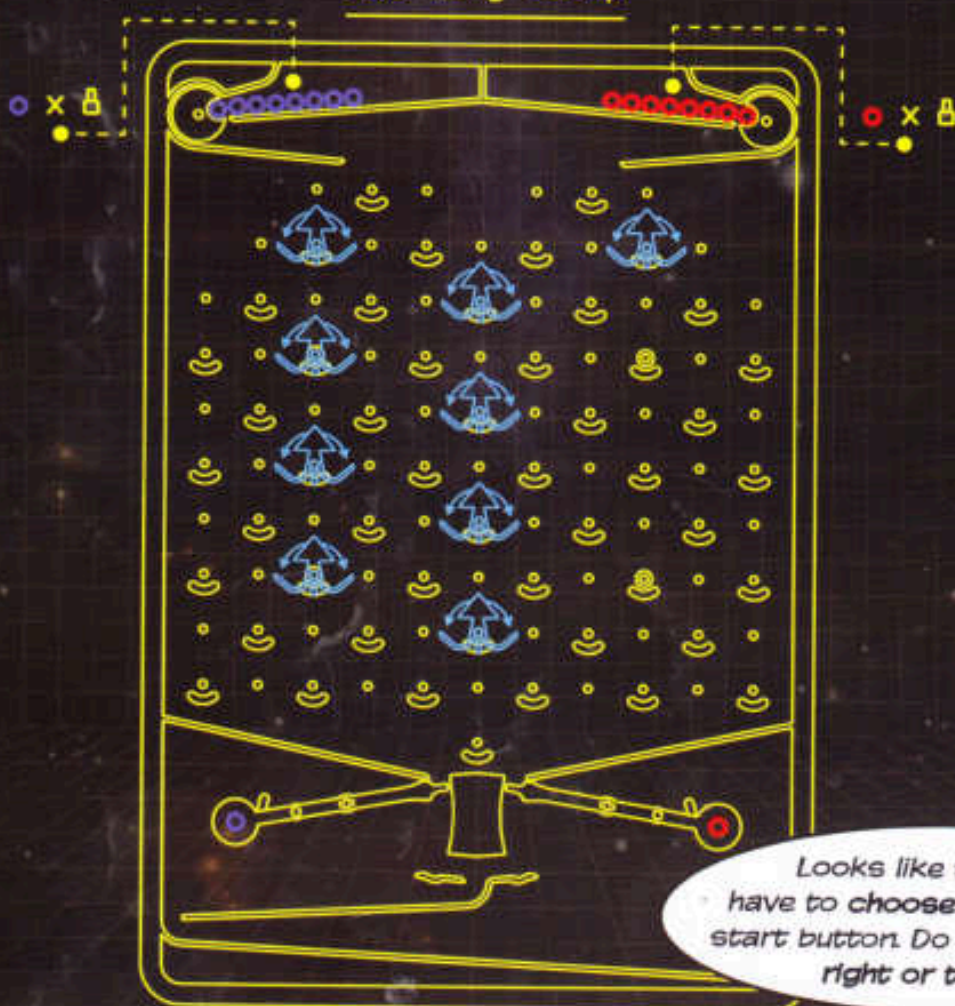
```
> scan -external -challenge_27.pz1
```



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?

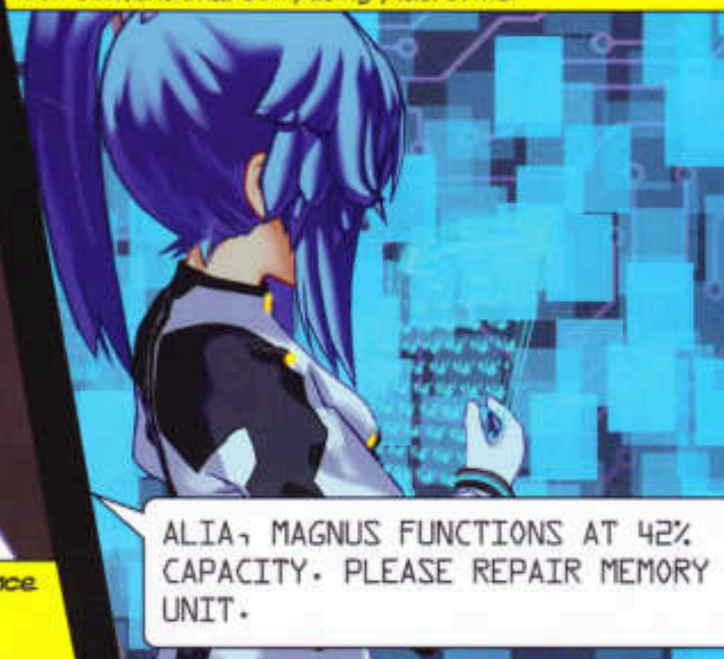
FUNCTION ONE: MAGNUS PROTECTS THE PEOPLE OF ENIAC FROM THOSE WHO THREATEN IT

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

FUNCTION THREE: MAGNUS LEARNS

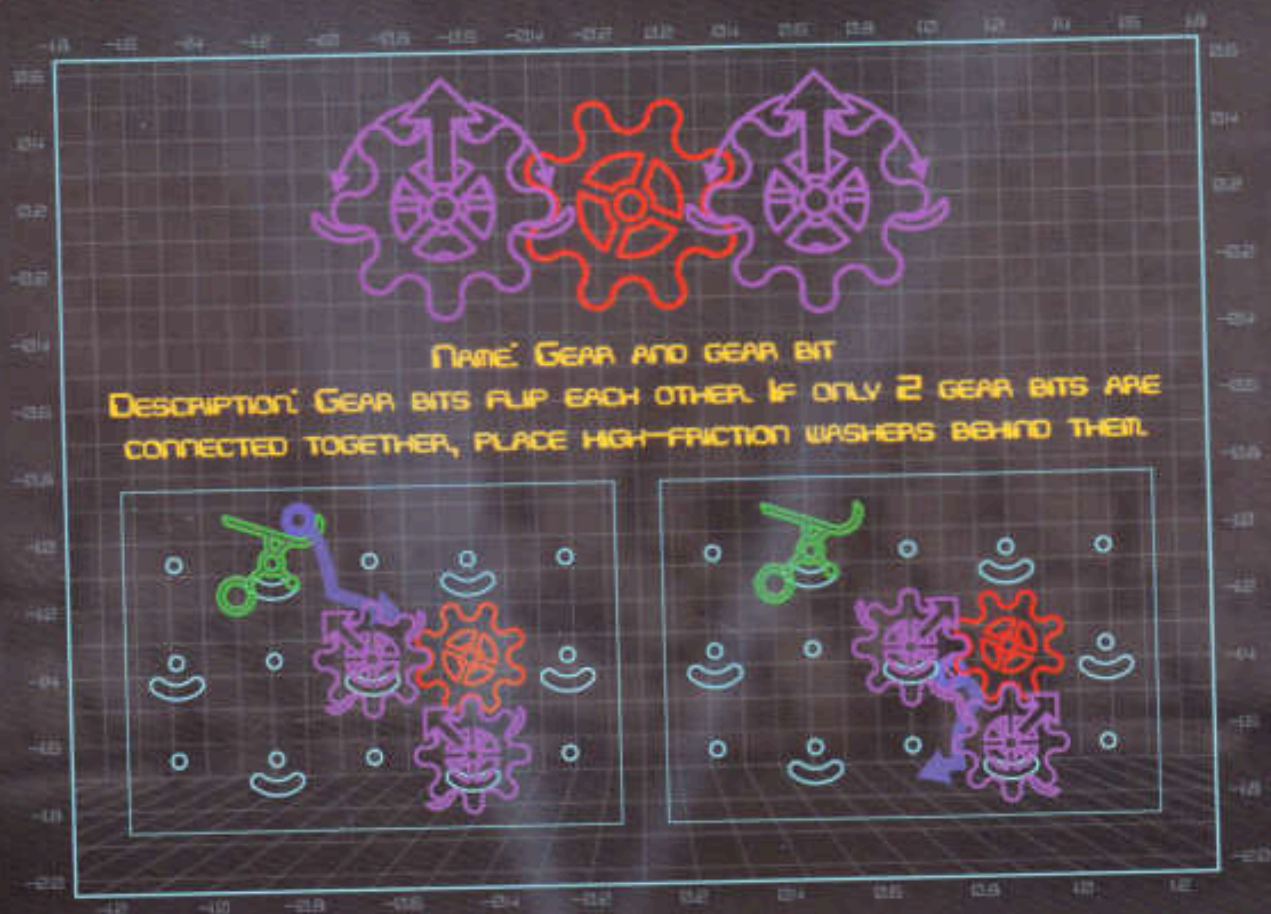


...but all efforts failed. Earth's brightest minds began to question whether it was even possible to develop AI's with conventional computing platforms.



** NEW PART DETECTED **

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



- > RENDERING COMPLETE
- > _

> scan -external -challenge_28.pzl

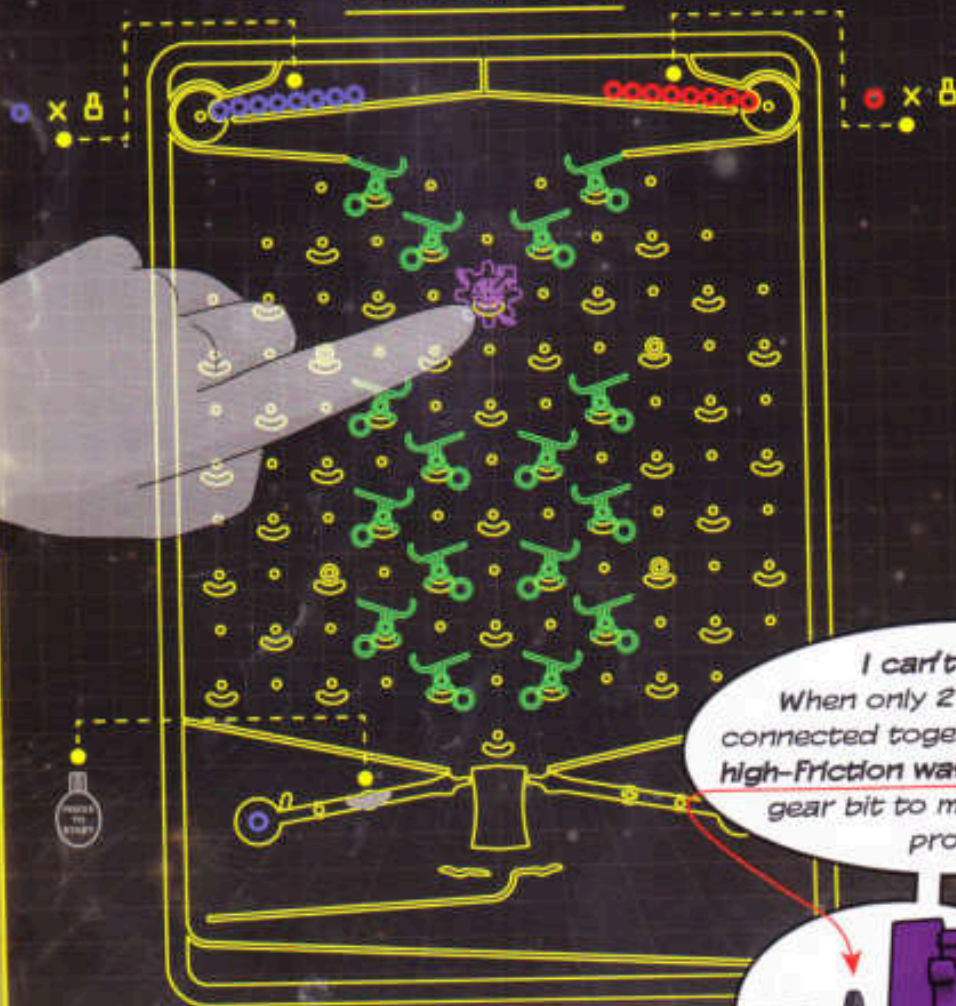
Challenge 28: Latch

Objective: Release only the blue balls.

Required output:



Starting setup



Available parts



x 1



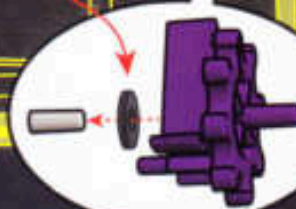
x 1



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
```

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Challenge 29: One-Shot Switch

Objective: Release a blue ball, a red ball, and then the rest of the blue balls.

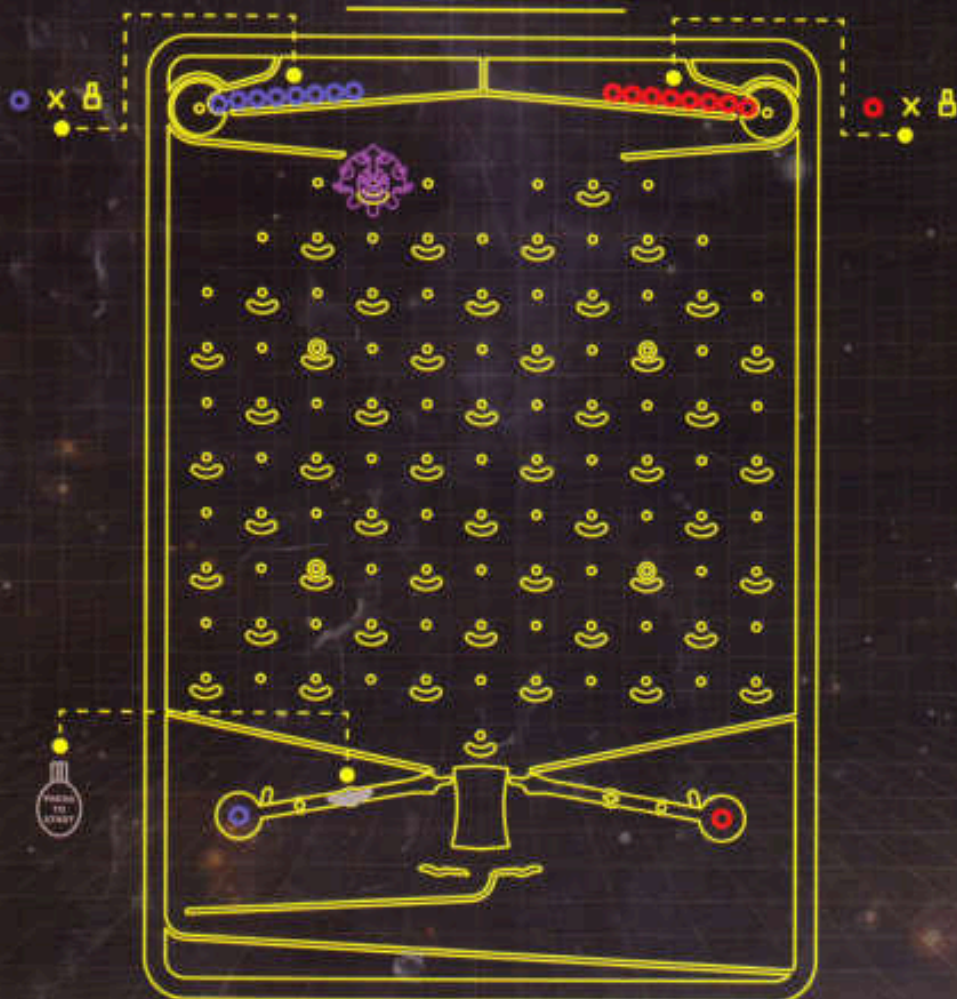
Required output:



>

_

Starting setup



Available parts



> scan -external -challenge_30.pzl

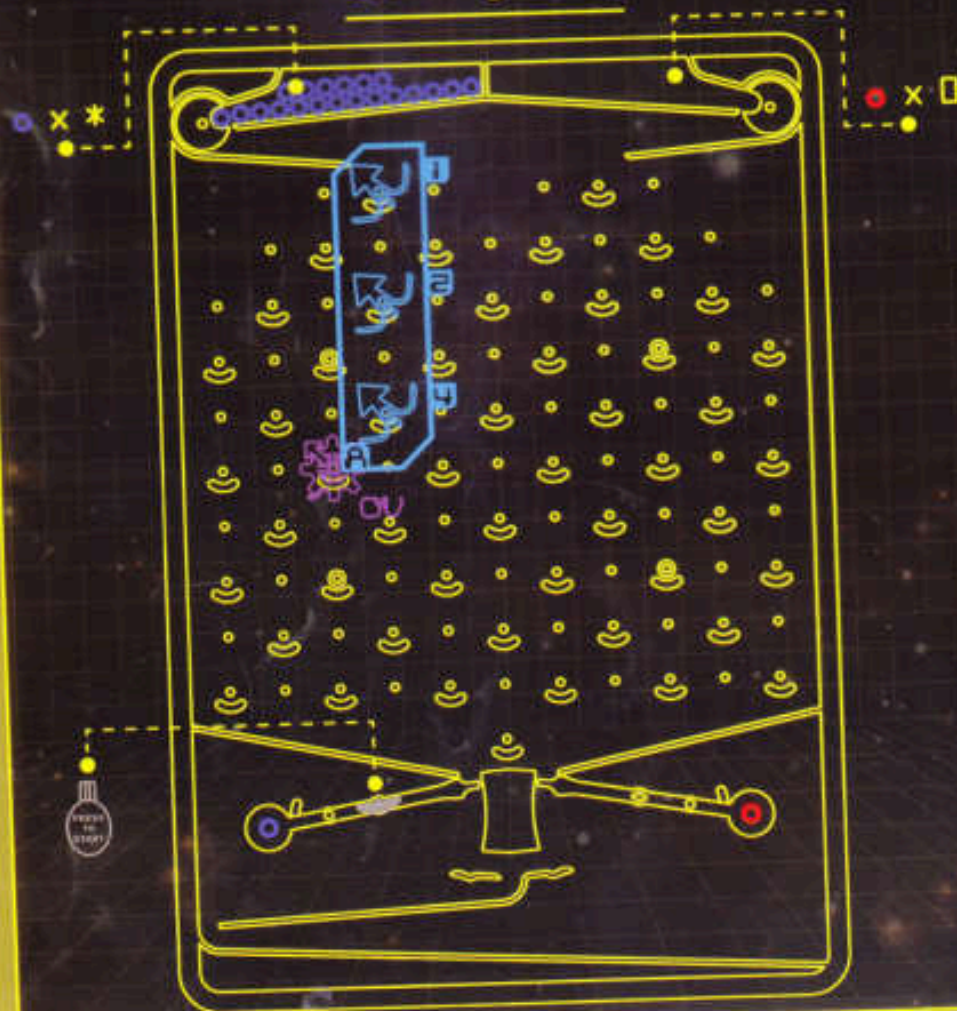
Challenge 30: Overflow

Objective: Count the blue balls in register A. If there are more than 7, gear bit 0V must flip right (and stay right) to indicate the overflow.

Examples:



Starting setup



Available parts

 x 14

 x 1

 x 1

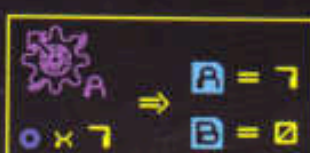
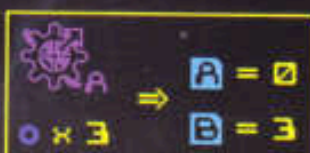
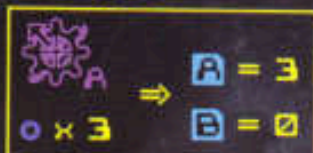
```
> scan -external -challenge_31.pzl
```

★★★

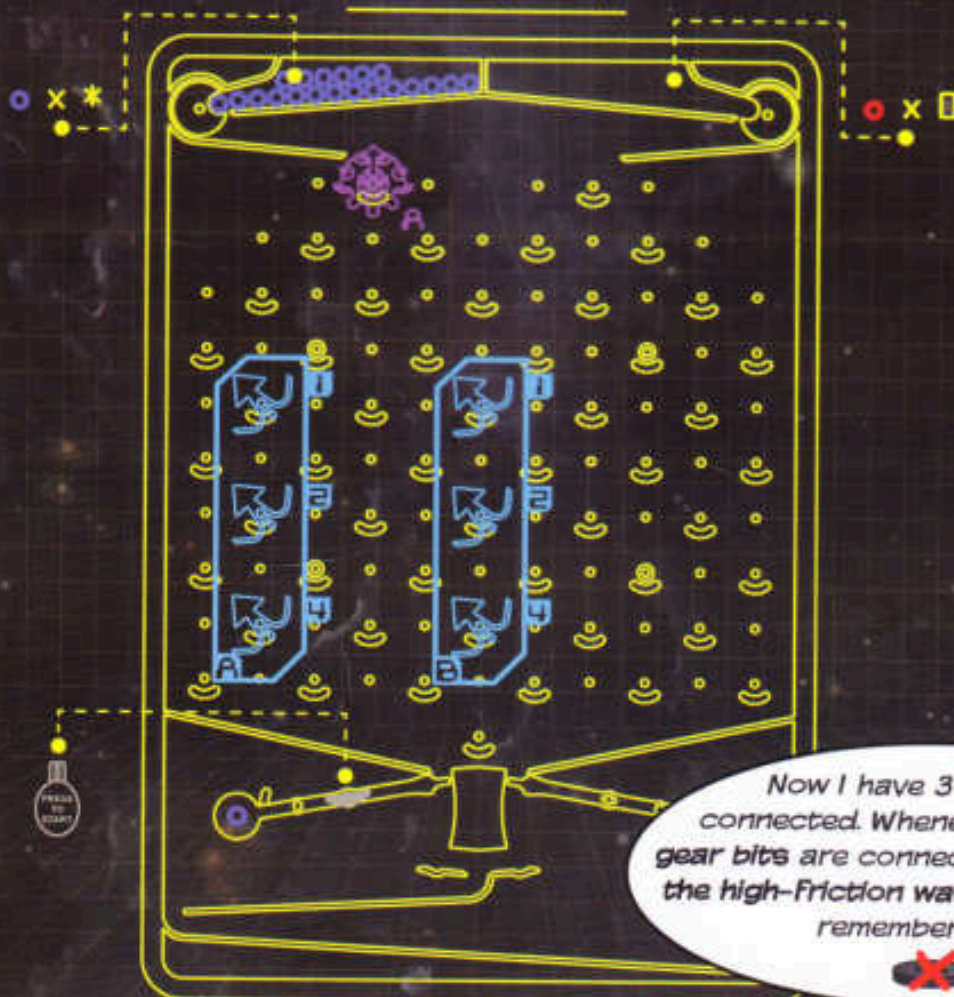
Challenge 31: Supervised Learning

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

Examples:



Starting setup



Available parts

 x ∞

 x 1

 x 2

 x 1

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...



> scan -external -challenge_32.pzl

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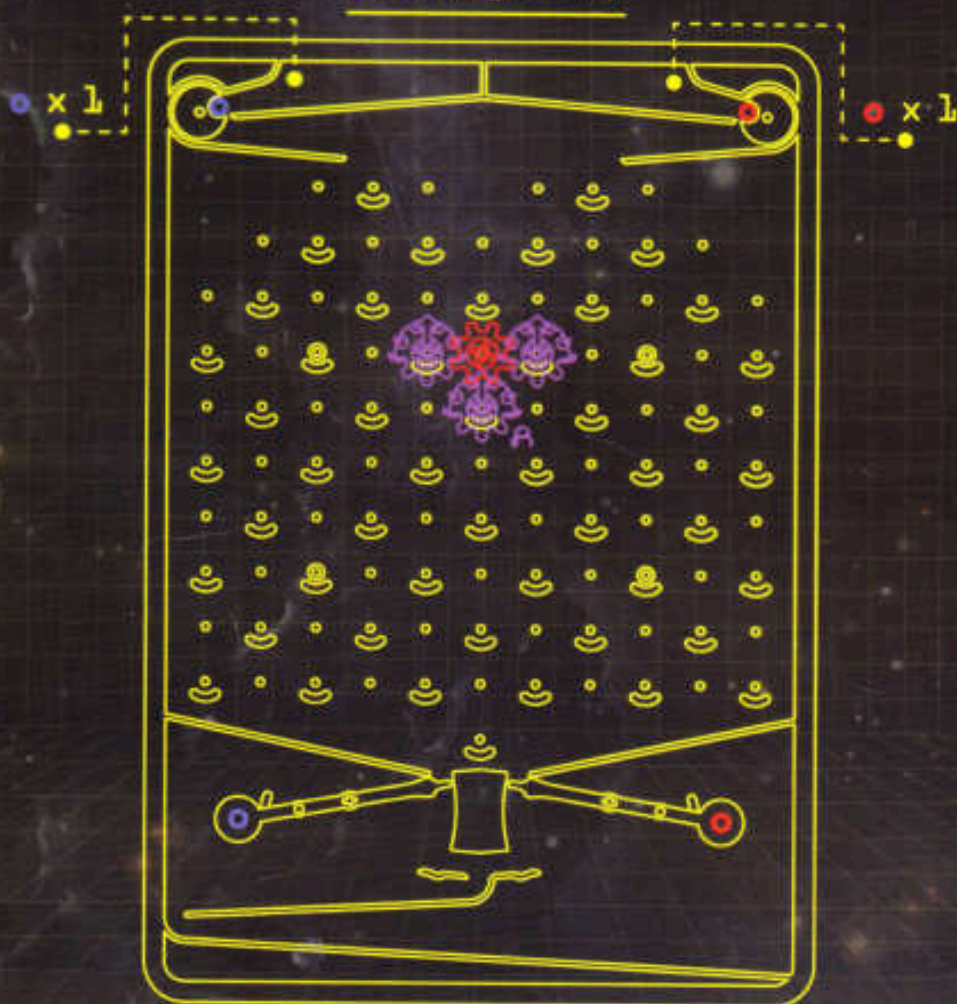
>

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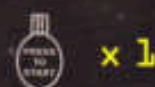
Challenge 32: Set Reset

Objective: For any starting direction of gear bit A, make it point left if the blue ball is released or right if the red ball is released.

Starting setup



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.

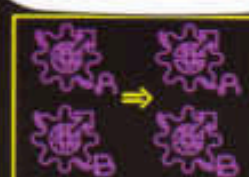
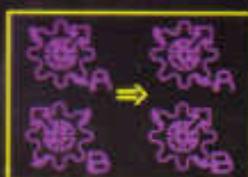
> scan -external -challenge_33.pzl

★★★★

Challenge 33: Teleportation

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

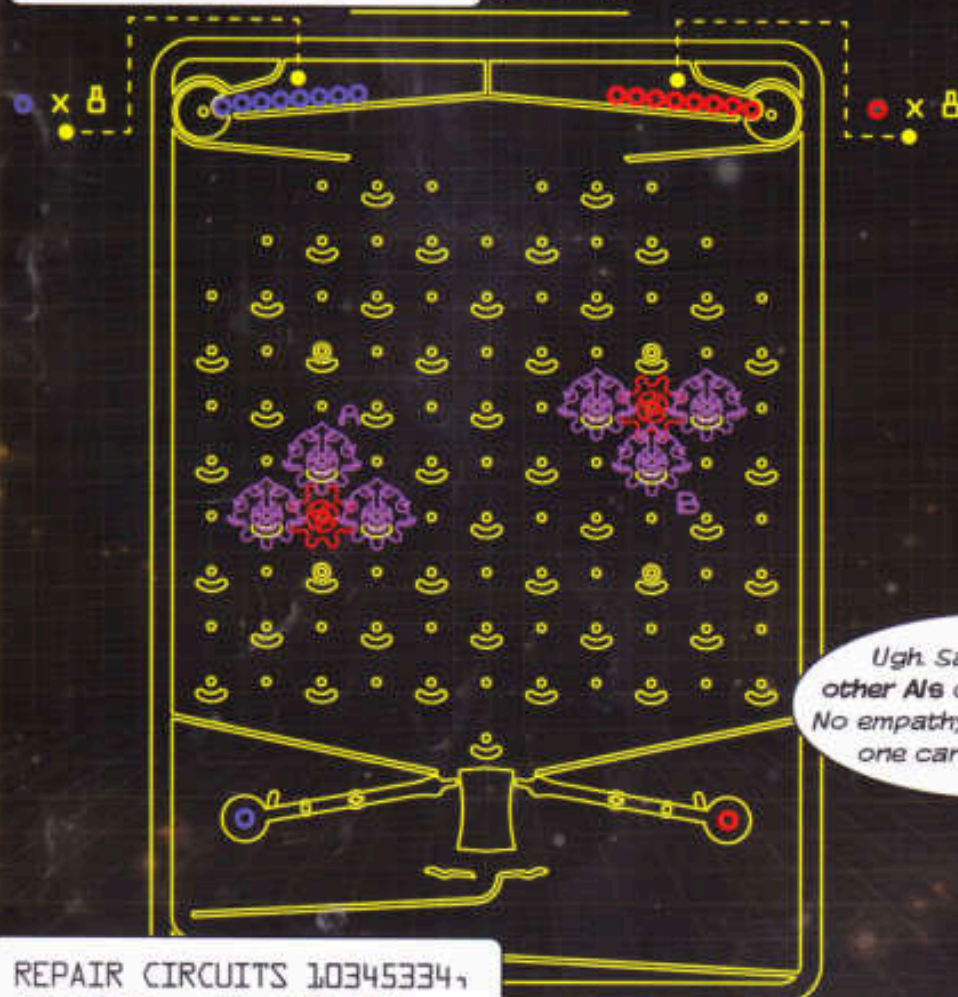
Examples:



I almost died, Magnus! That was extremely selfish.

I AM NOT FAMILIAR WITH THE TERM 'SELFISH'.

ing setup



Available parts



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

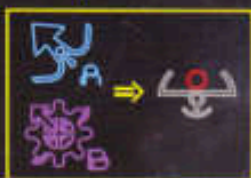
REPAIR CIRCUITS 10345334, 10345337, AND 10345338.

> scan -external -challenge_34.pz1

Challenge 34: Exclusivity

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

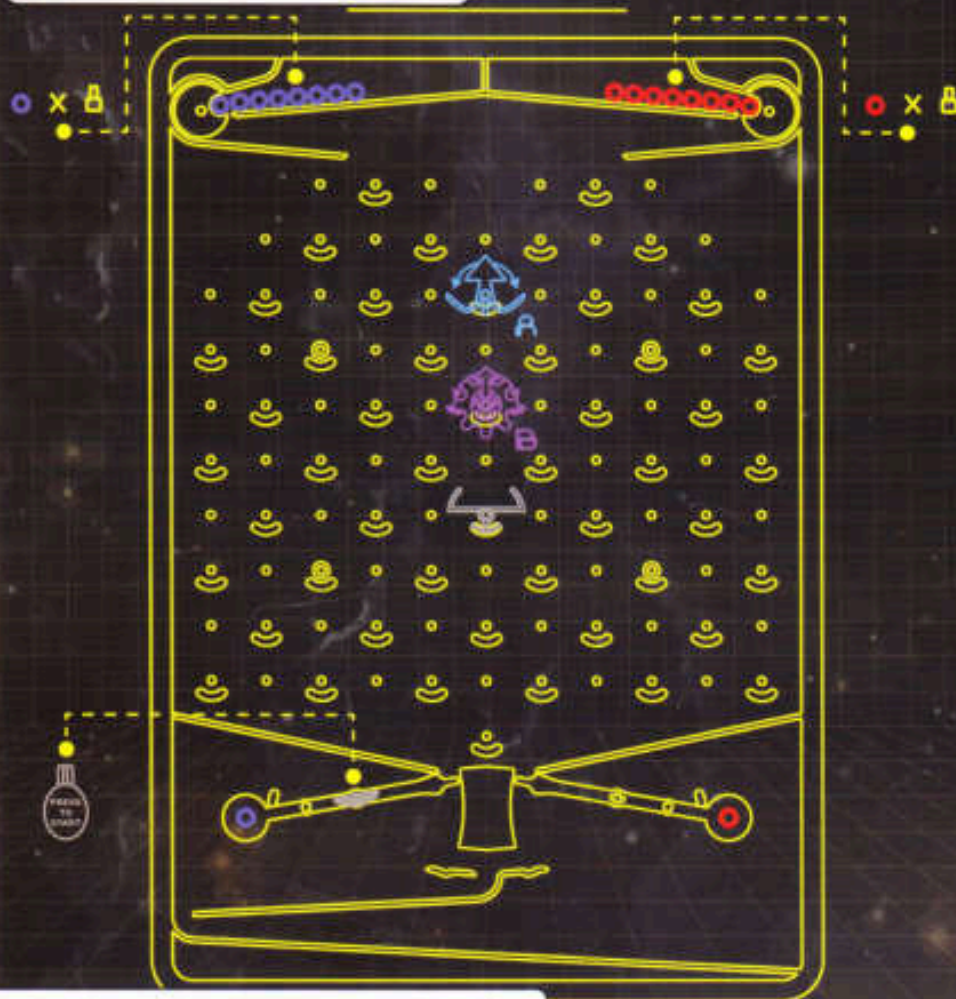
Examples:



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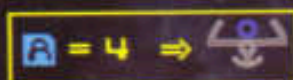
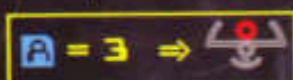
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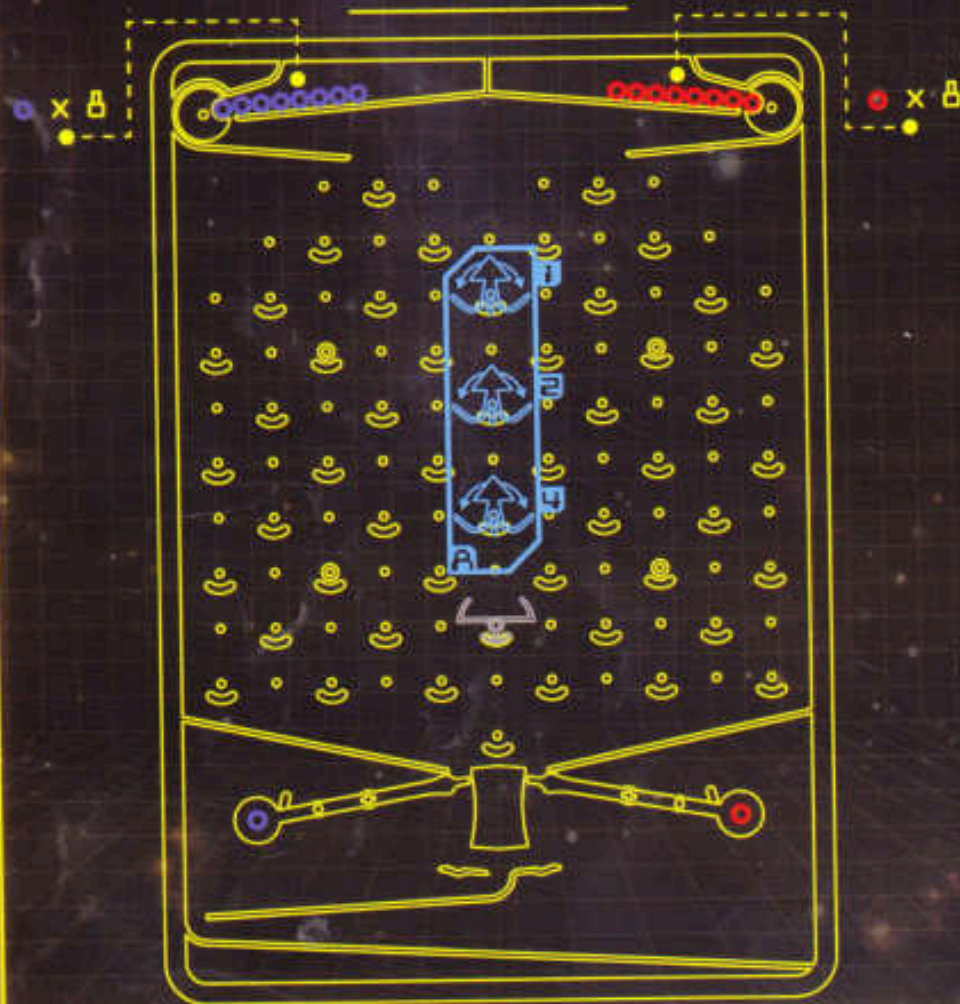
Objective: Intercept a blue ball if register A is even. If it is odd, intercept a red ball.

Examples:



>

Starting setup



Available parts



诀窍是观察“A”
在每个数字时，
“1”的指向



> scan -external -challenge_3b.pz1

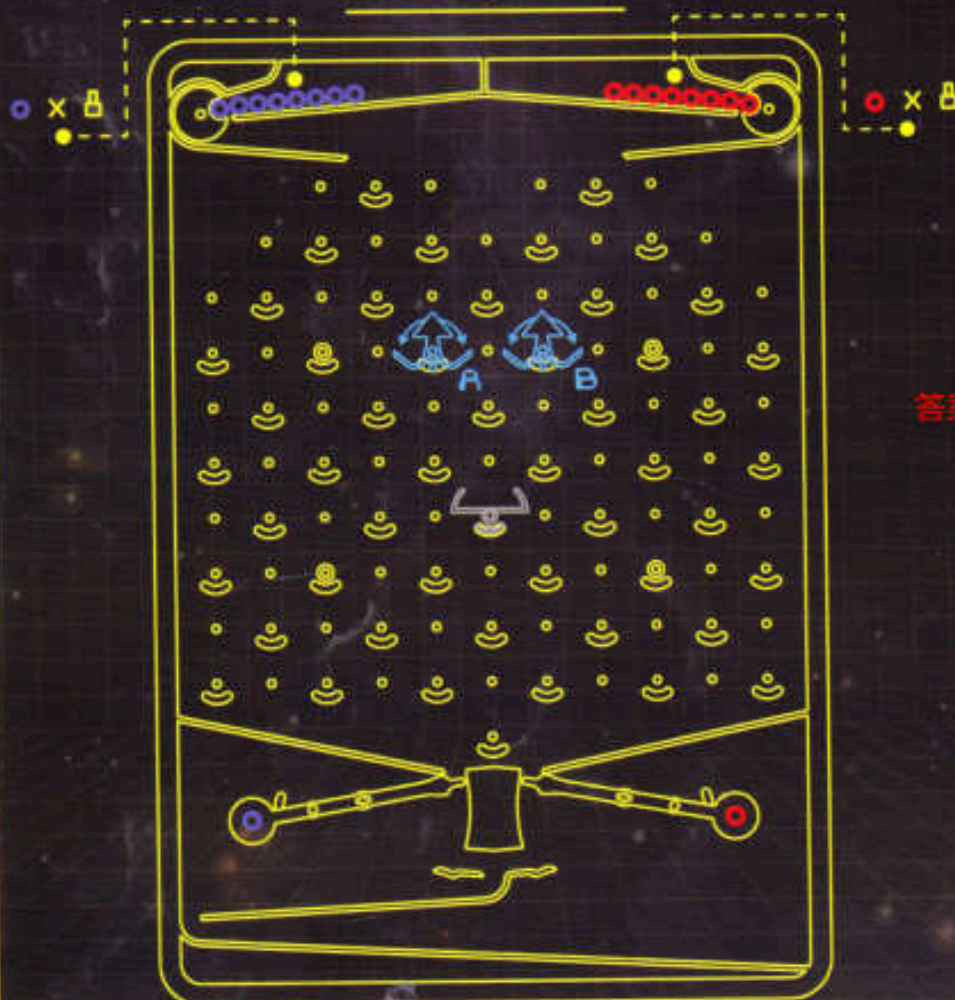
Challenge 3b: Information Theory

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

Examples:



Starting setup



Available parts



答案非常多可以多点尝试

> scan -external -challenge_37.pz1

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Challenge 37: Summation

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

Examples:

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

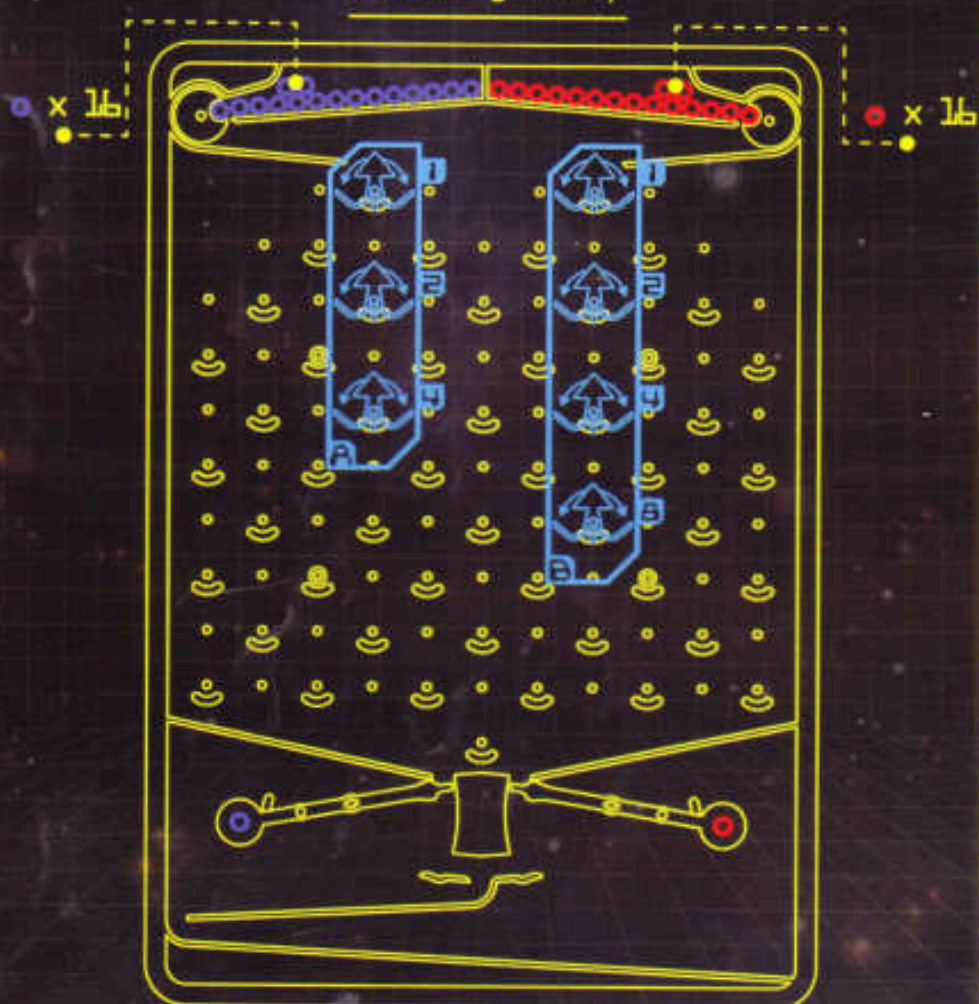
$$A = 7, B = 3 \Rightarrow B = 10$$

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

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

> **Extra challenge:** If $A + B$ is too big to fit in B, put
> a red ball in the interceptor, otherwise a blue ball.

Starting setup



Available parts

 x ∞

 x 2

 x 1

 x 1



Ok, you
should be
good to go
now, Magnus.



INITIATING COPY SEQUENCE.



With unimaginable precision, Magnus used a beam of light to burn himself into the silicon switches of the ship's memory.



You're
doing it.
Magnus! My ship's
computers are
back online.



Hey
Magnus. I see
you in my ship's
files. Mind if I
take a look?

Alia pulled up Magnus's most recent memory.



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

A few Eniacons, in a futile attempt to save their lives, fired disruptor cannons wildly at Magnus's circuits. Parts showered to the floor from the panels.



But the gas overcame them.

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



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

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> scan -external -challenge_38.pz1
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Challenge 38: Serialization

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

Examples:

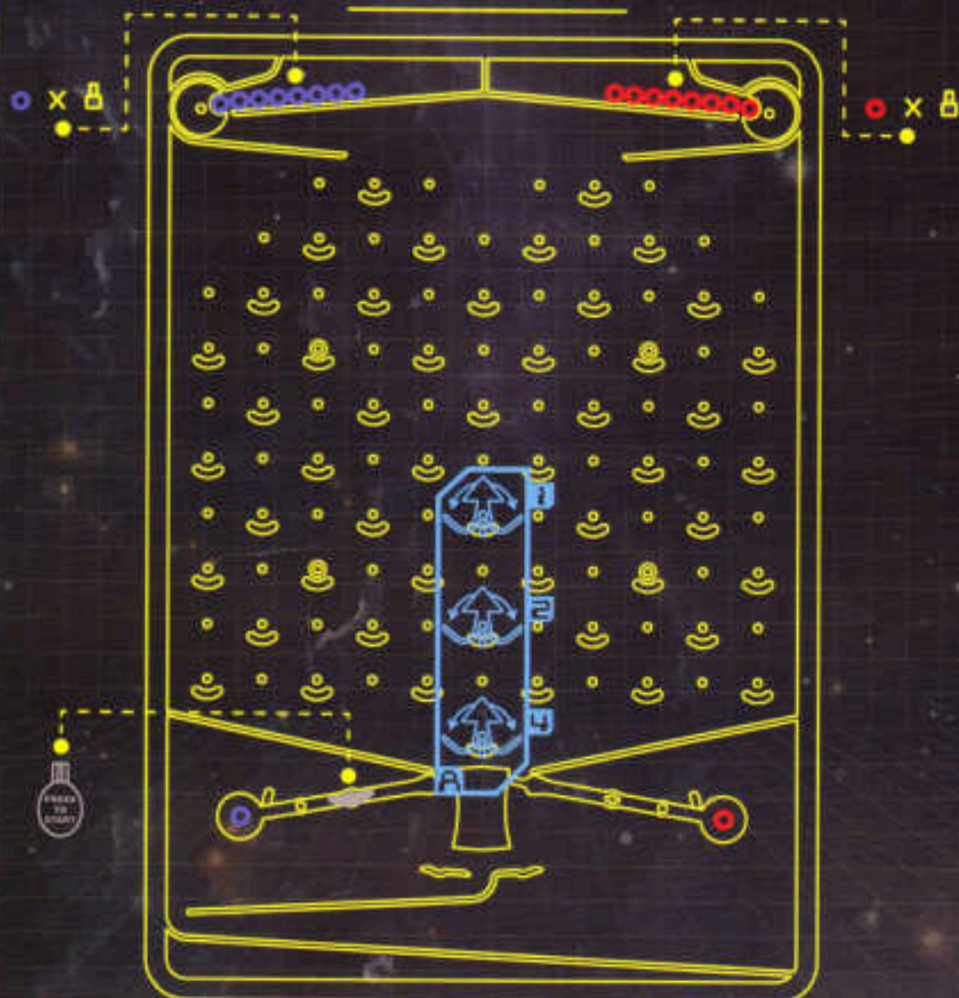
 = 0 $\Rightarrow$     

 = 5 $\Rightarrow$     

 = 1 $\Rightarrow$     

 = 7 $\Rightarrow$       

Starting setup



Available parts

-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞

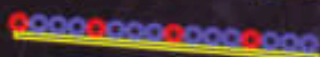
> scan -external -challenge_39.pzl

★★★★★

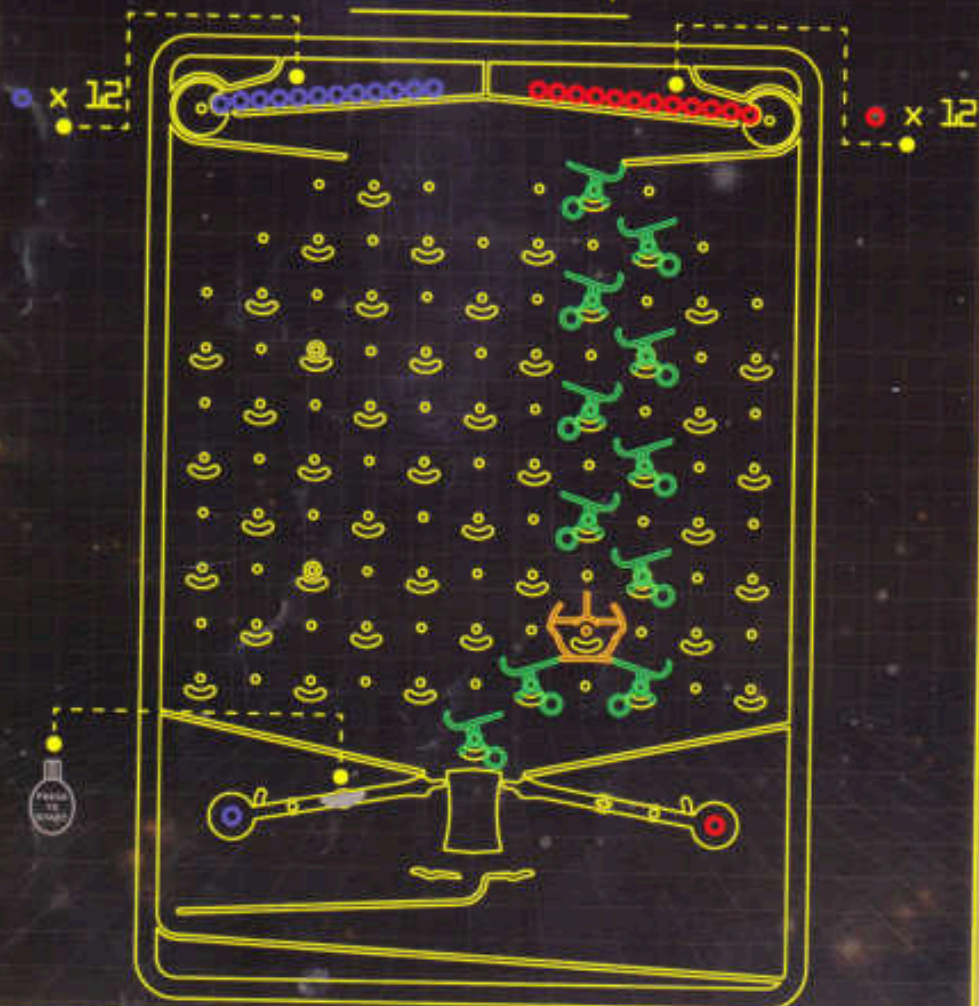
Challenge 39: Triplets

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

Required output:



Starting setup



Available parts

-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞
-  x ∞

```
> scan -external -challenge_40.pz1
```

★★★

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

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

```
> Examples:
```

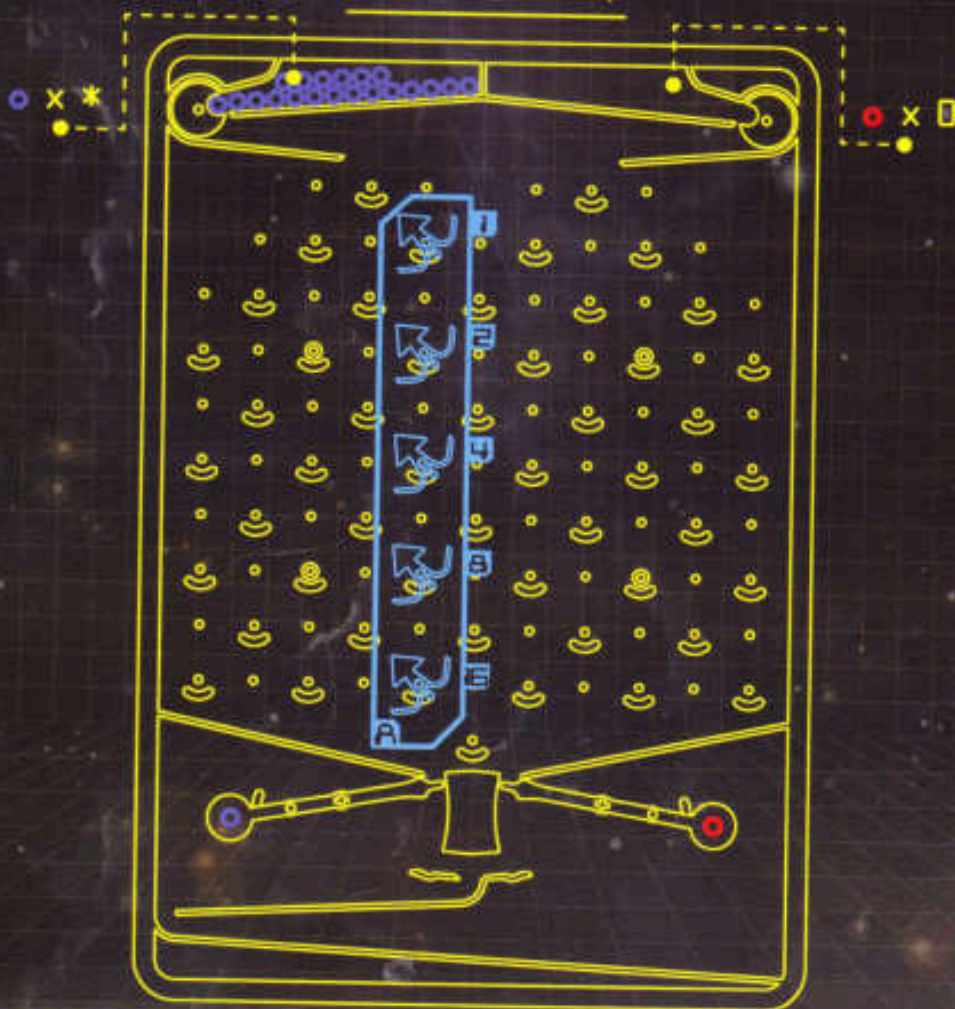
$$\text{blue ball} \times 1 \Rightarrow \text{A} = 4$$

$$\text{blue ball} \times 4 \Rightarrow \text{A} = 16$$

$$\text{blue ball} \times 2 \Rightarrow \text{A} = 8$$

$$\text{blue ball} \times 7 \Rightarrow \text{A} = 28$$

Starting setup



Available parts

 $\times \infty$
 $\times 1$

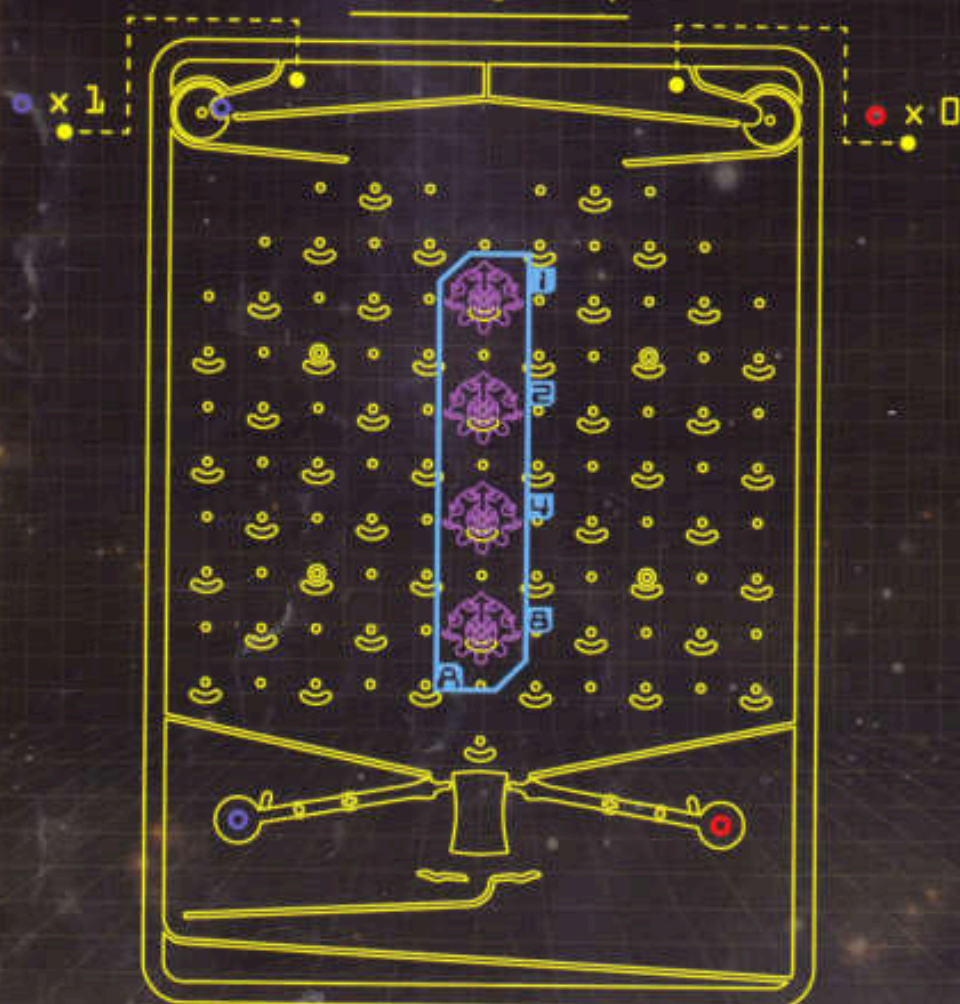
> scan -external -challenge_41.pz1



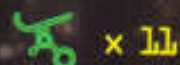
Challenge 41: Hard Reset

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

Starting setup



Available parts



```
> scan -external -challenge_42.pz1
```

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

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

```
> Examples:
```

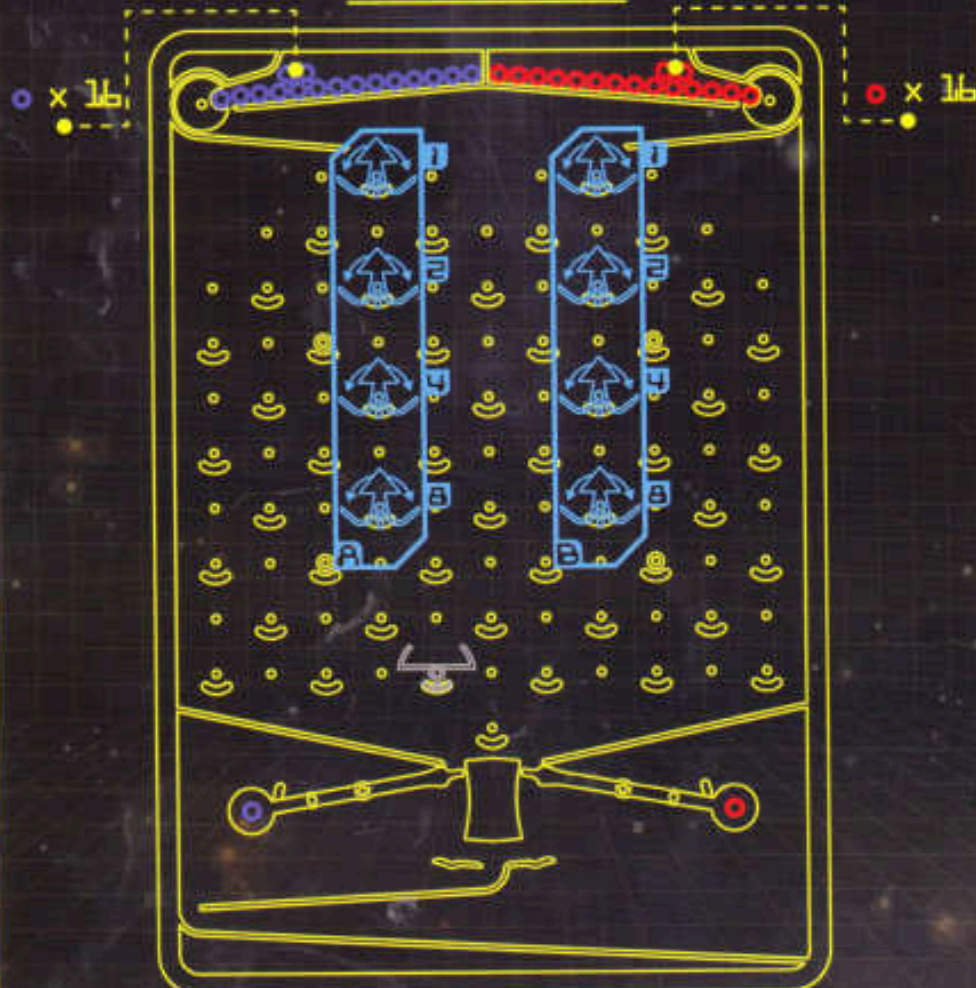
```
A = 2, B = 2 ⇒ 
```

```
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.pz1
```

★★★★★

Challenge 43: Diamagnetic

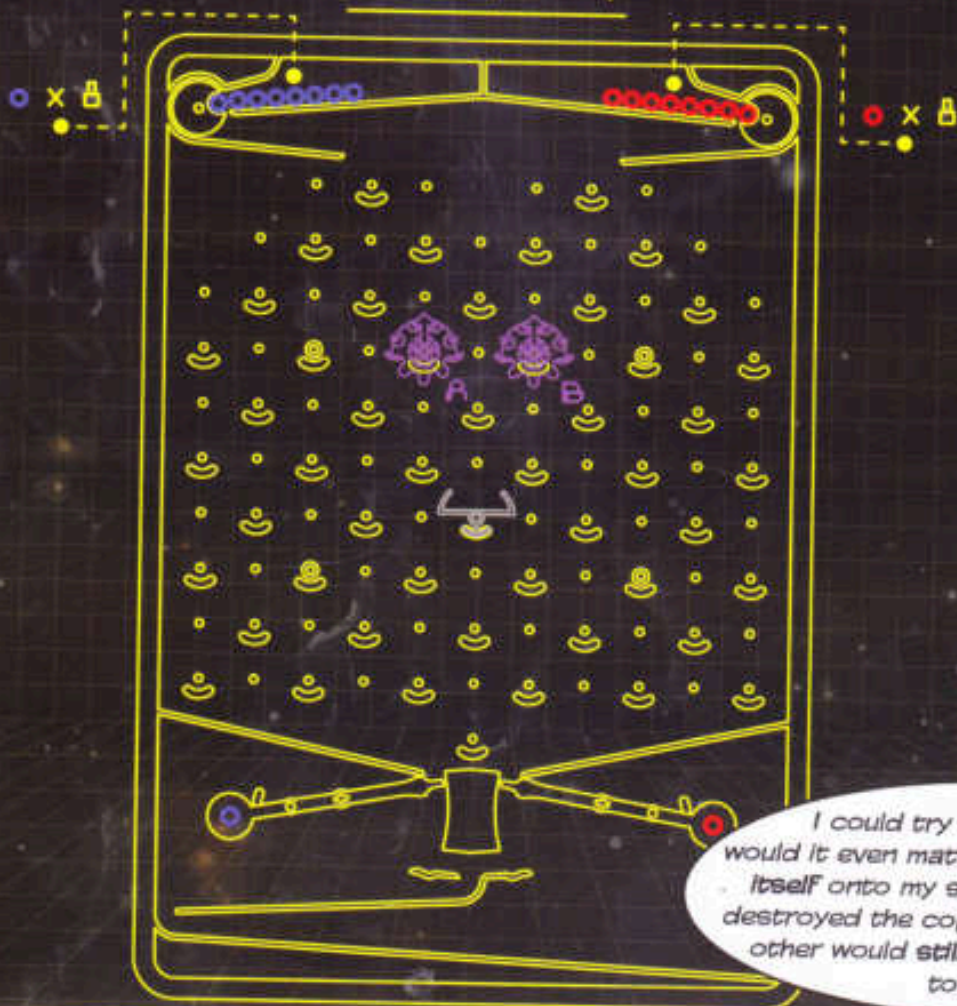
Objective: If gear bits A and B are turned opposite directions, intercept a blue ball. Otherwise, intercept a red ball.

Examples:

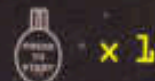


Think, Alla! How can I stop a massive computer bent on Earth's destruction?

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.pz1
```

★★★★

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:

$$A = 1, B = 5 \Rightarrow B = 4$$

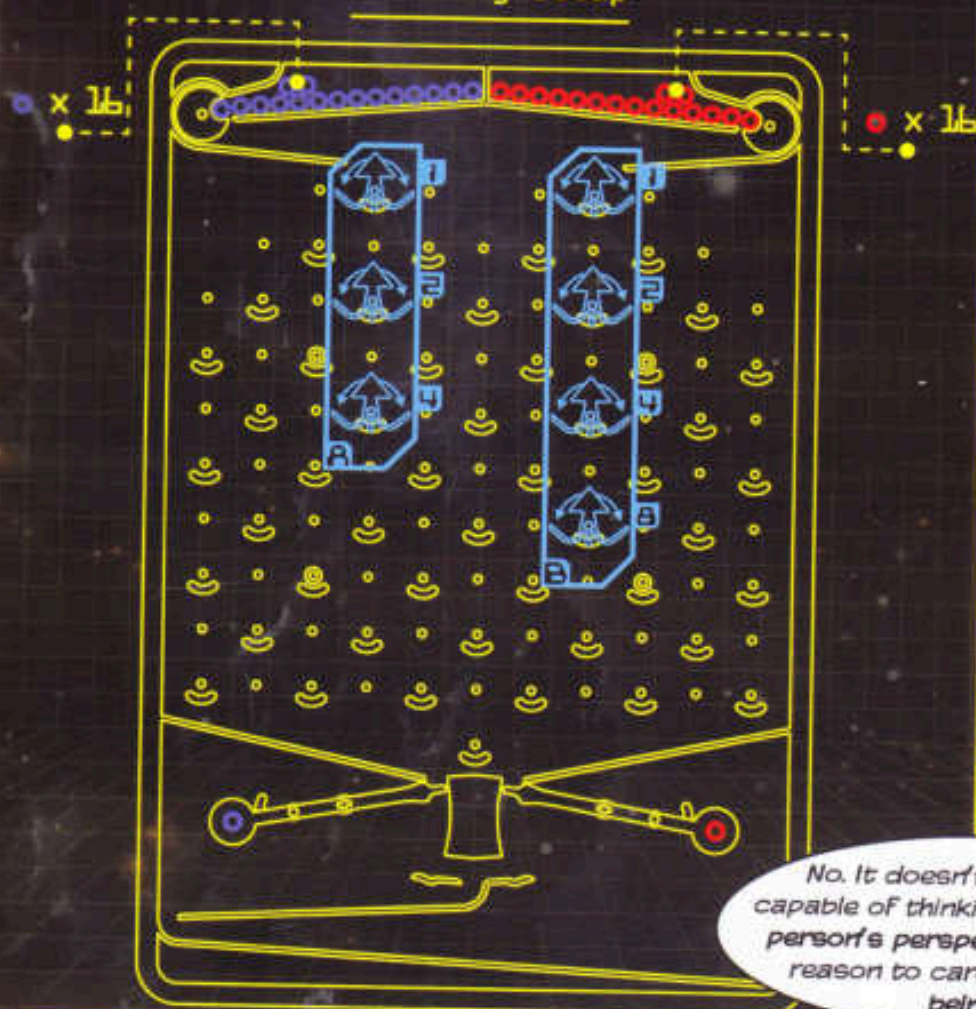
$$A = 7, B = 10 \Rightarrow B = 3$$

$$A = 4, B = 8 \Rightarrow B = 4$$

$$A = 7, B = 7 \Rightarrow B = 0$$

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.pz1
```

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Challenge 45: Activation Energy

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

Examples:

$$A = 1, B = 1 \Rightarrow \text{blue ball}$$

$$A = 3, B = 2 \Rightarrow \text{red ball}$$

$$A = 3, B = 7 \Rightarrow \text{blue ball}$$

$$A = 7, B = 3 \Rightarrow \text{red ball}$$

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.

up

○ x 16

○ x 1

Available parts

○ x ∞

○ x ∞

○ x ∞

○ x ∞

○ x ∞

○ x ∞

○ x 1

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

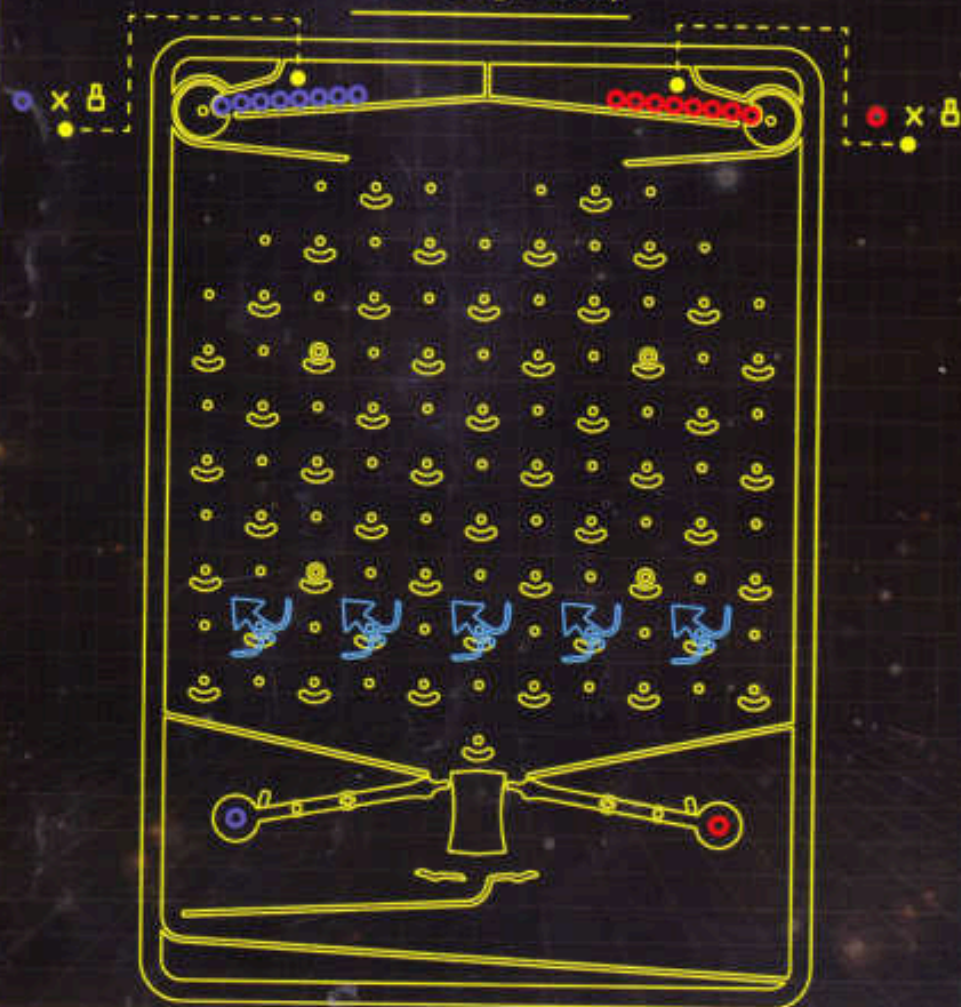
```
> scan -external -challenge_4b.pz1
```

★★★★★

```
=====
|               Challenge 4b: Distribution               |
=====
```

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

Starting setup



Available parts

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x 1

```
> scan -external -challenge_47.pzl
```

```
>
```

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

```
>
```

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

```
>
```

```
> Examples:
```

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

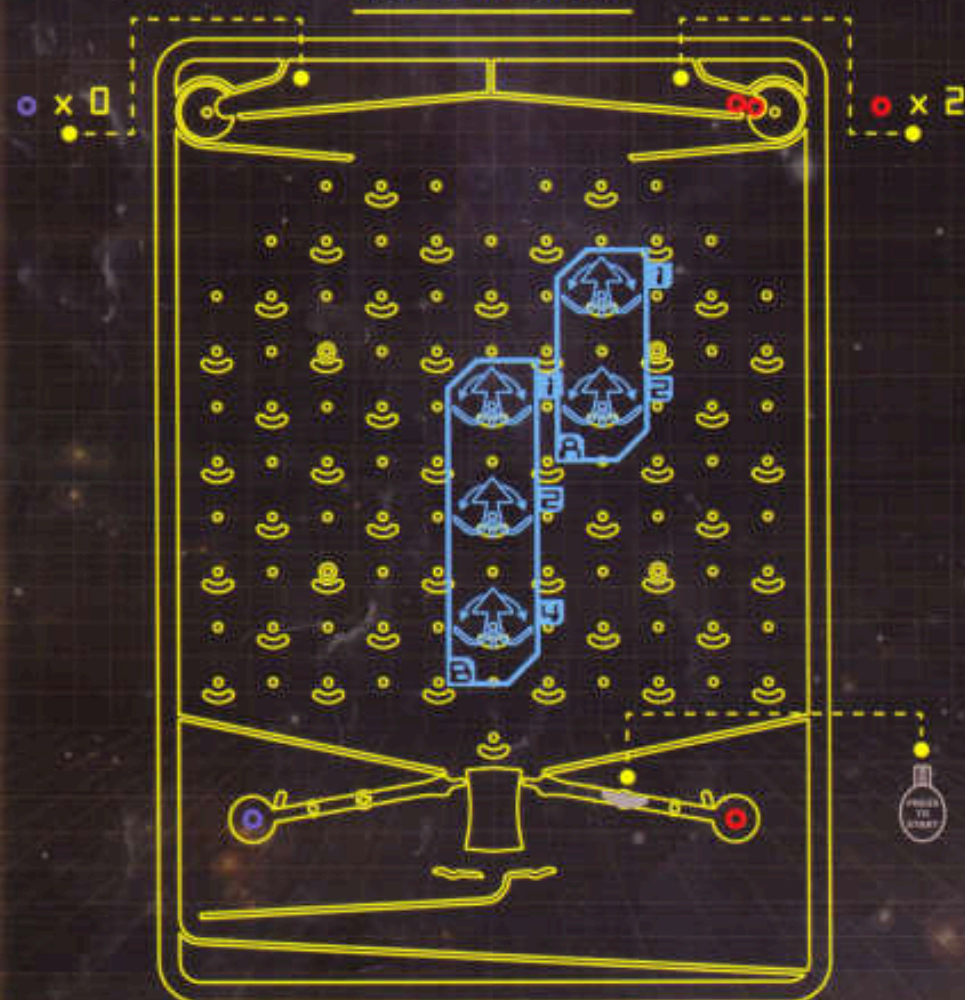
$$A = 3, B = 0 \Rightarrow B = 3$$

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

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

```
> _
```

Starting setup



Available parts

x 16

x 2

x 1

```
> 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:

$$A = 1 \Rightarrow B = 3$$

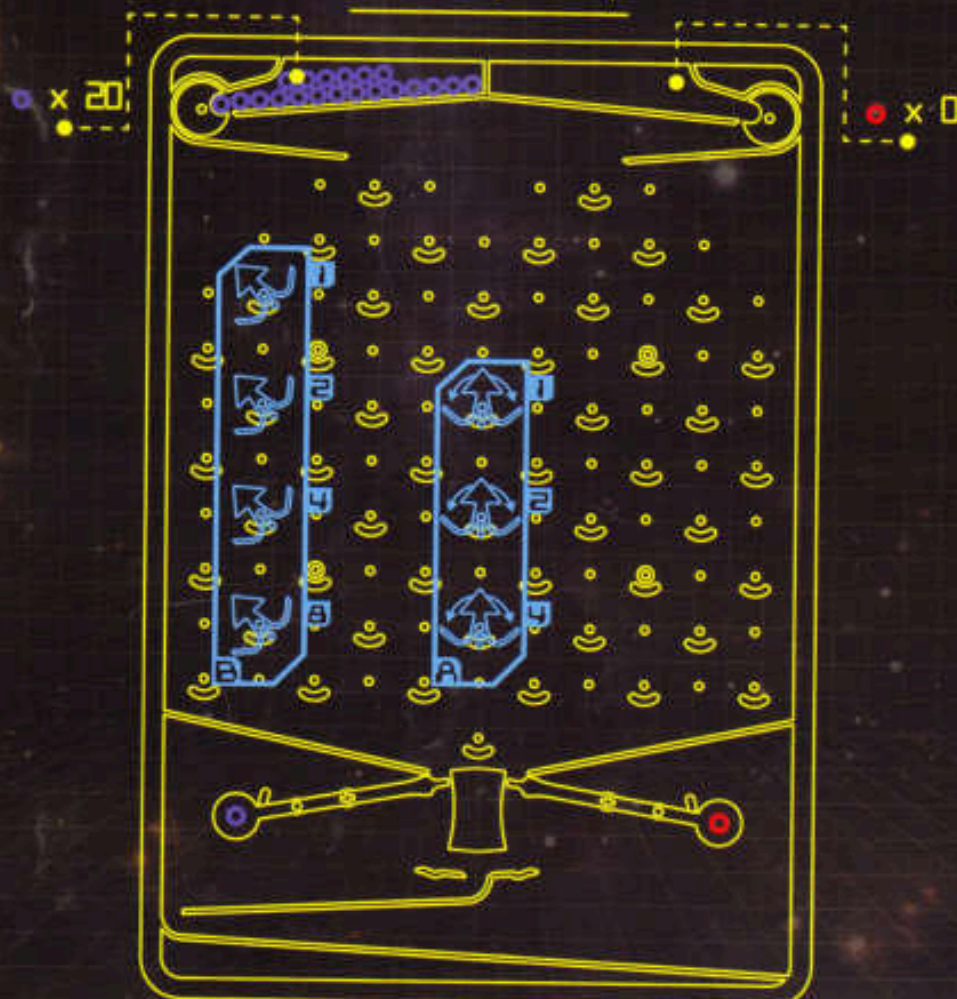
$$A = 3 \Rightarrow B = 9$$

$$A = 2 \Rightarrow B = 6$$

$$A = 4 \Rightarrow B = 12$$

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

Starting setup



Available parts

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

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.



The temperature in the room dropped as the air outside was
vented into the room. It burned Alia's lungs.



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
```



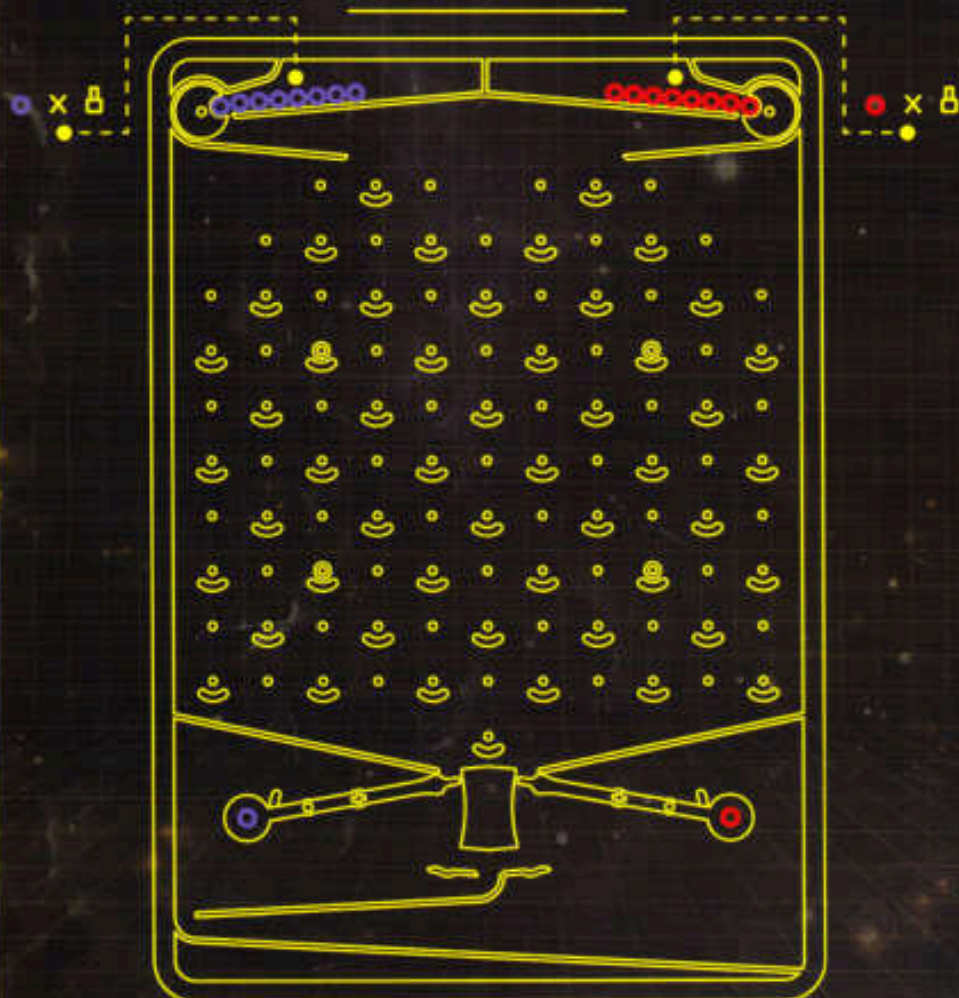
```
> =====
> |           Challenge 49: Paradox - 1           |
> =====
```

> Objective: Generate the required pattern.

> Required output:

 γ

Starting setup



Available
parts



> scan -external -challenge_50.pz1

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```
=====
|               Challenge 50: Paradox - 2               |
=====
```

Objective: Generate the next required pattern. (Notice the balls start in the same order as the output of the last puzzle.)

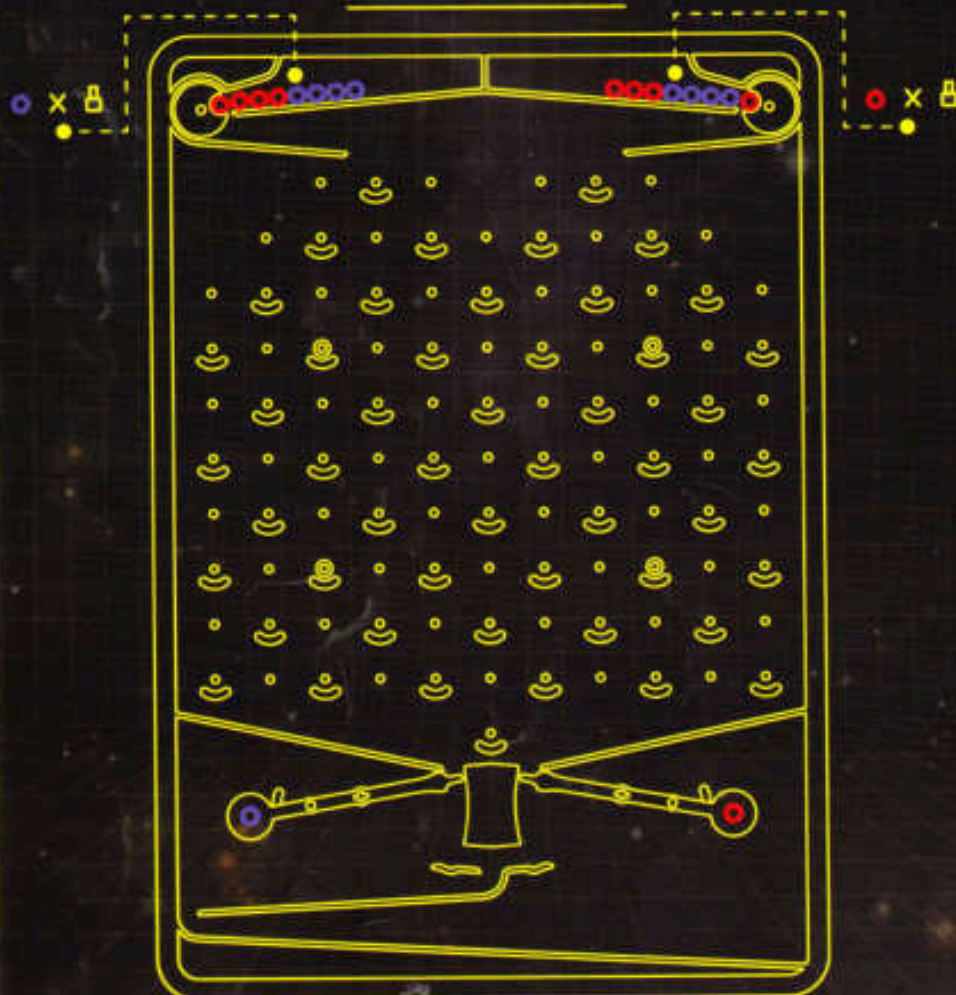
Required output:

○○○○○○○○○○○○○○○○○○○○

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Starting setup



Available parts



> scan -external -challenge_51.pzl

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Challenge 51: Paradox - 3

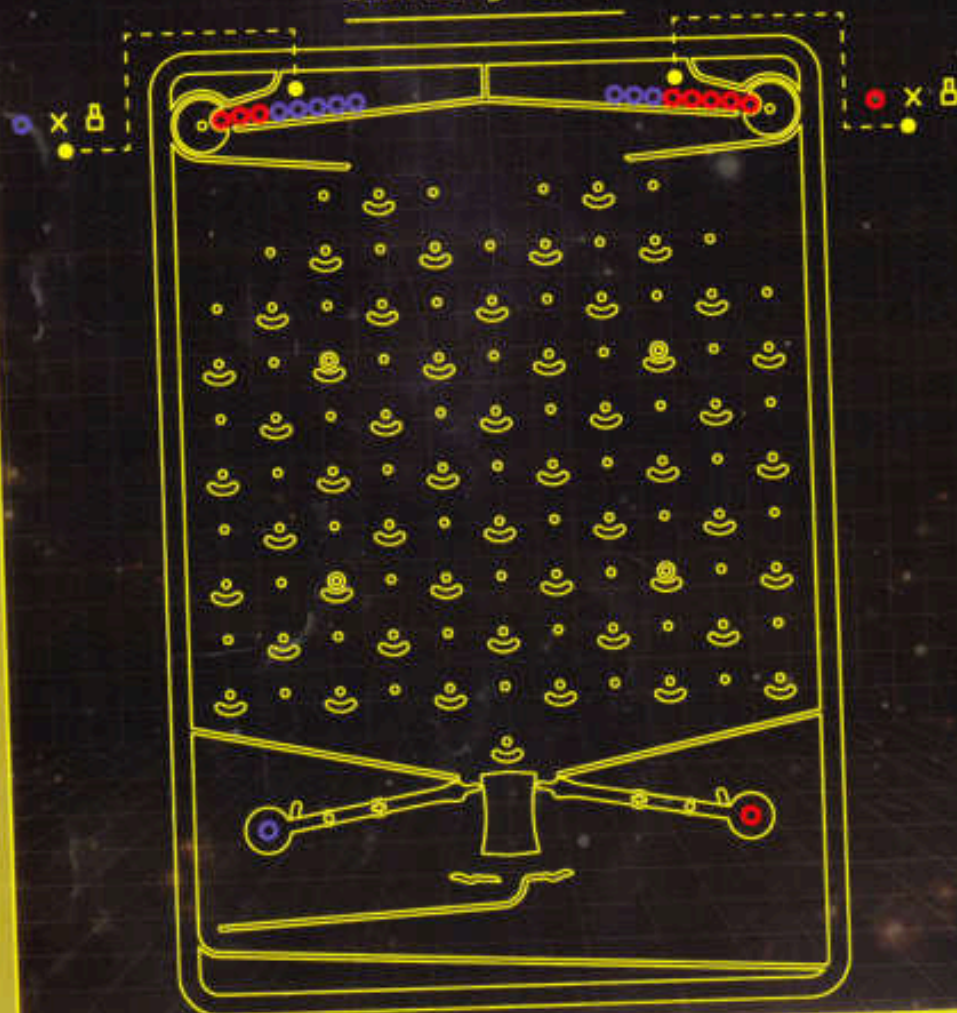
Objective: Generate the next required pattern. (Notice the balls start in the same order as the output of the last puzzle.)

Required output:

○○○○○○○○○○○○○○○○○○○○

And now, back to where we started.

Starting setup



Available parts

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

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



The sound of balls falling around Alia grew to a deafening roar.

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



Alia...please...you must...stop...this!

RUMBLE

Even if she didn't help Magnus, Alia could see that he was already isolating the infinite loop from the rest of his circuits—she would have to act fast!

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



No.



I will make Magnus...
smarter!

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

★★★★★

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Challenge 52: Exosphere

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

Examples:

$$A = 0 \Rightarrow B = 0$$

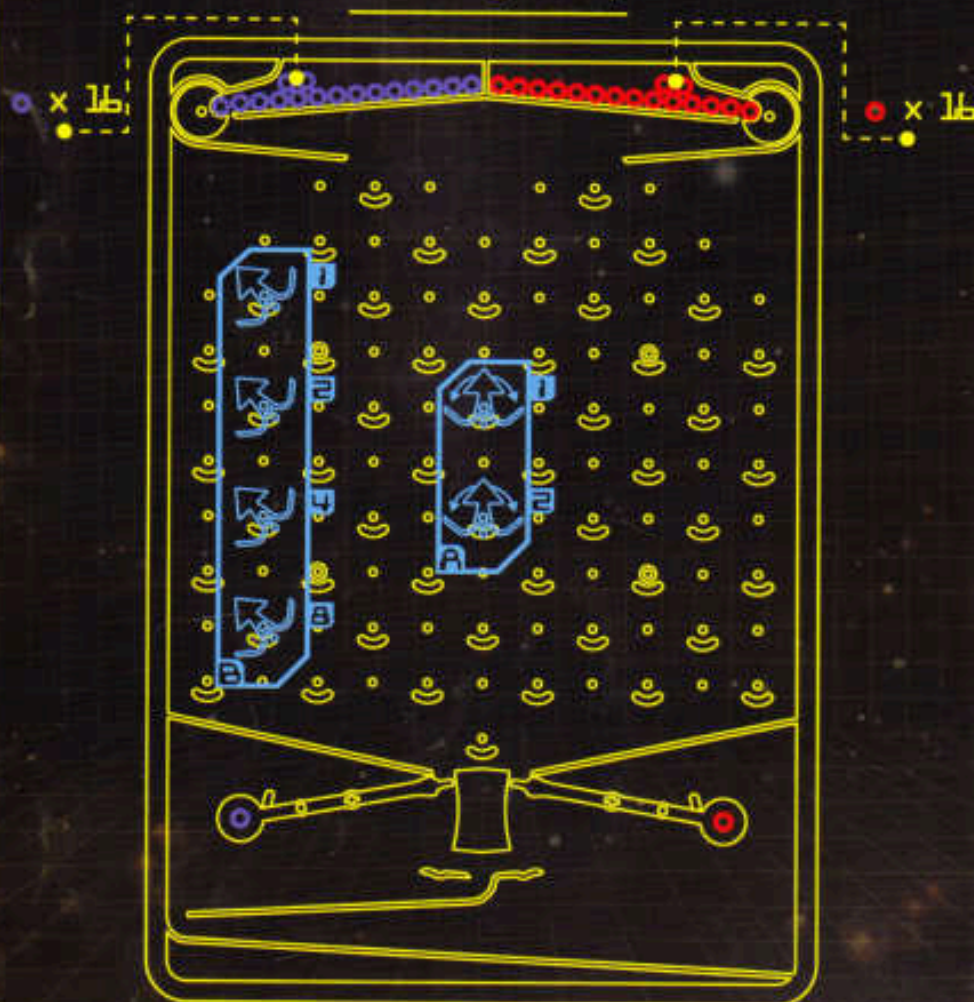
$$A = 2 \Rightarrow B = 10$$

$$A = 1 \Rightarrow B = 5$$

$$A = 3 \Rightarrow B = 15$$

>

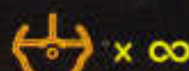
Starting setup



Available parts



x ∞



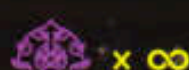
x ∞



x ∞



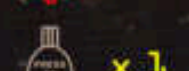
x ∞



x ∞



x ∞



x 1

```
> scan -external -challenge_53.pz1
```

```
> =====
> |               Challenge 53: Exponential Growth               |
> =====
```

```
> Objective: Each blue ball released must double the
> value of register A. (If the number is too large to
> fit, the upper bits may be trimmed.)
```

```
> Examples:
```

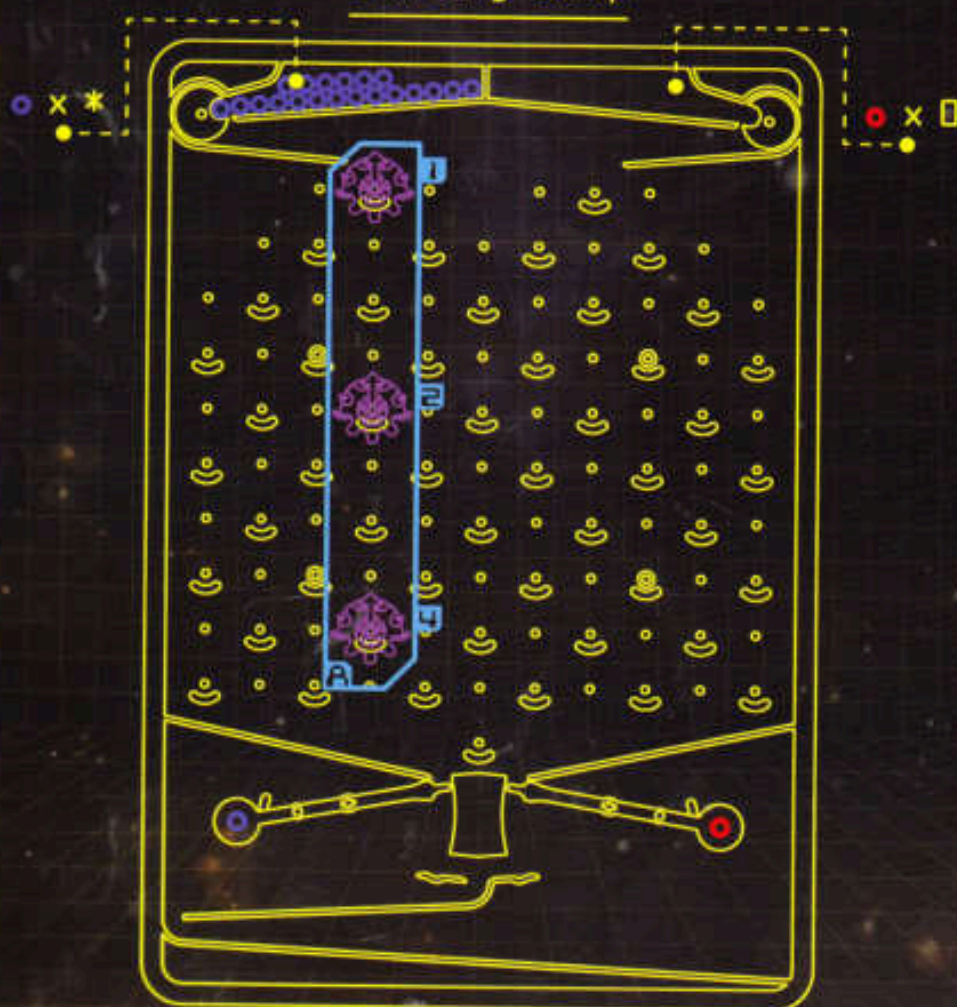
$$\begin{array}{c} \text{A} = 1 \\ \circ \times 1 \end{array} \Rightarrow \text{A} = 2$$

$$\begin{array}{c} \text{A} = 3 \\ \circ \times 1 \end{array} \Rightarrow \text{A} = 6$$

$$\begin{array}{c} \text{A} = 1 \\ \circ \times 2 \end{array} \Rightarrow \text{A} = 4$$

$$\begin{array}{c} \text{A} = 0 \\ \circ \times 5 \end{array} \Rightarrow \text{A} = 0$$

Starting setup



Available parts

-  $\times \infty$
-  $\times \infty$
-  $\times \infty$
-  $\times \infty$
-  $\times \infty$
-  $\times \infty$
-  $\times 1$

> scan -external -challenge_54.pz1

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Challenge 54: Decoder

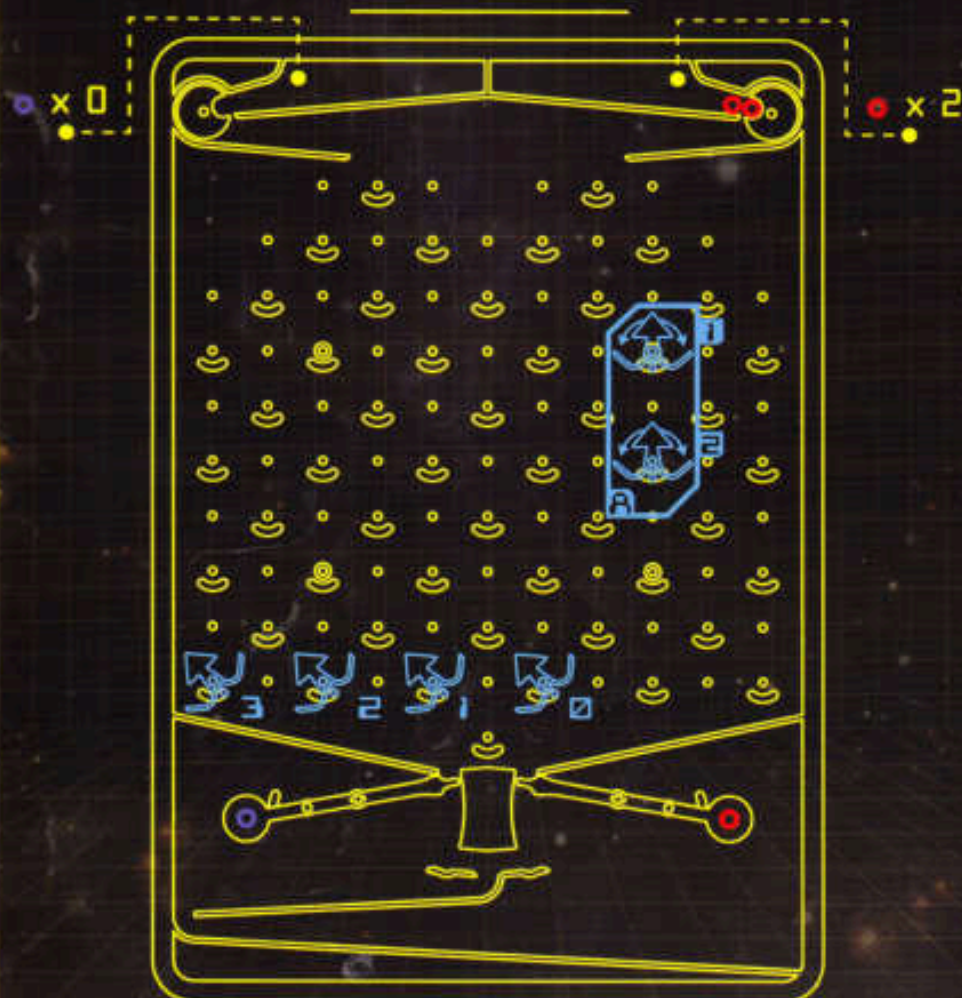
Objective: Flip the bit specified in register A to the right.

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:
```

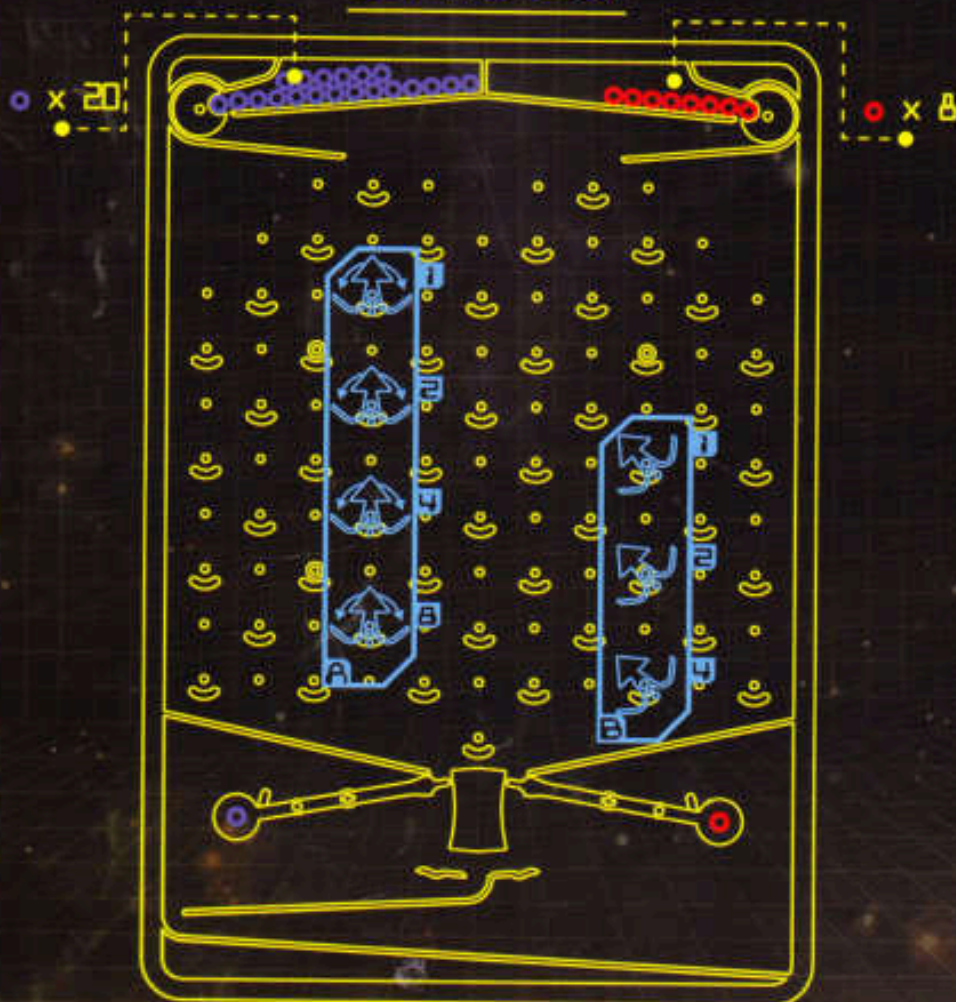
```
A = 6  =>  B = 2
```

```
A = 15 =>  B = 5
```

```
A = 10 =>  B = 3
```

```
A = 2  =>  B = 0
```

Starting setup



Available parts

x ∞

x ∞

x ∞

x ∞

x ∞

x ∞

x 1

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

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

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

Examples:

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

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

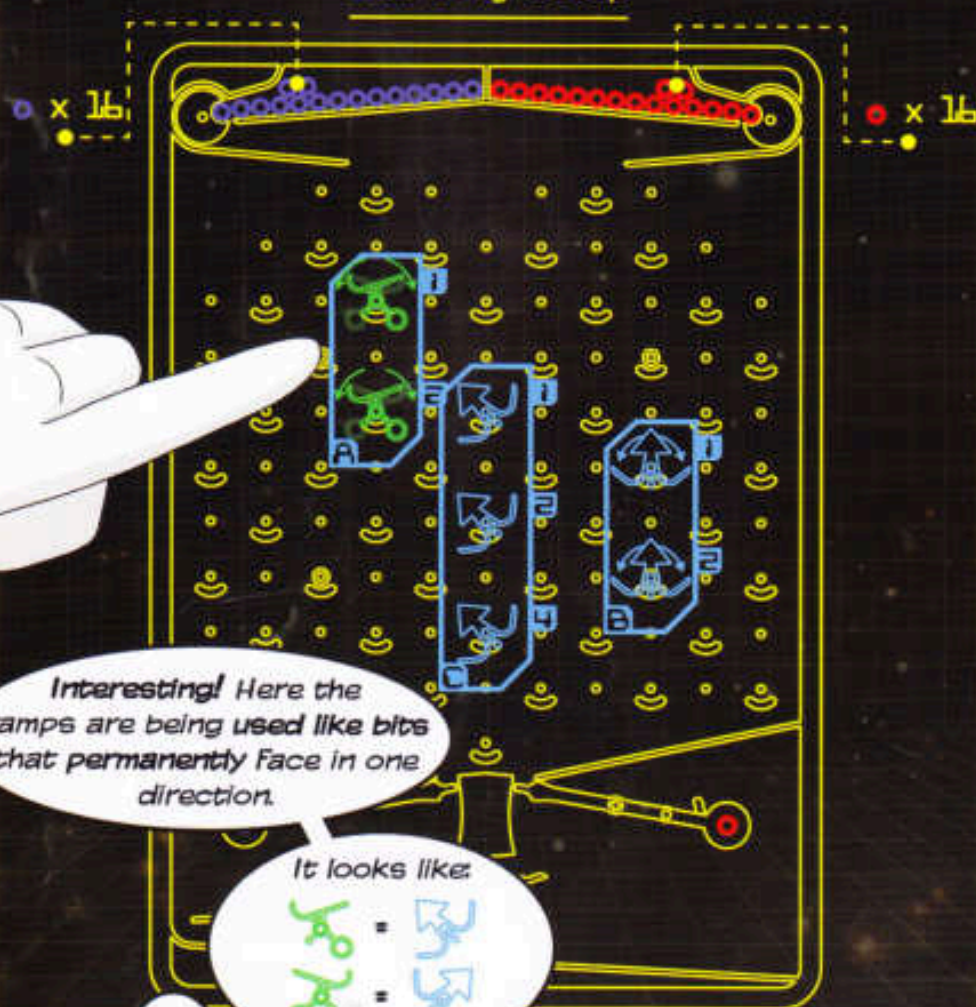
$$A = 0, B = 3 \Rightarrow C = 0$$

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

>

>

Starting setup



Available parts

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x ∞

 x 1

Interesting! Here the ramps are being used like bits that permanently face in one direction.

It looks like

$$\begin{matrix} \text{Green Ramp} & = & \text{Blue Ramp} \\ \text{Green Ramp} & = & \text{Blue Ramp} \end{matrix}$$

> scan -external -challenge_57.pzl

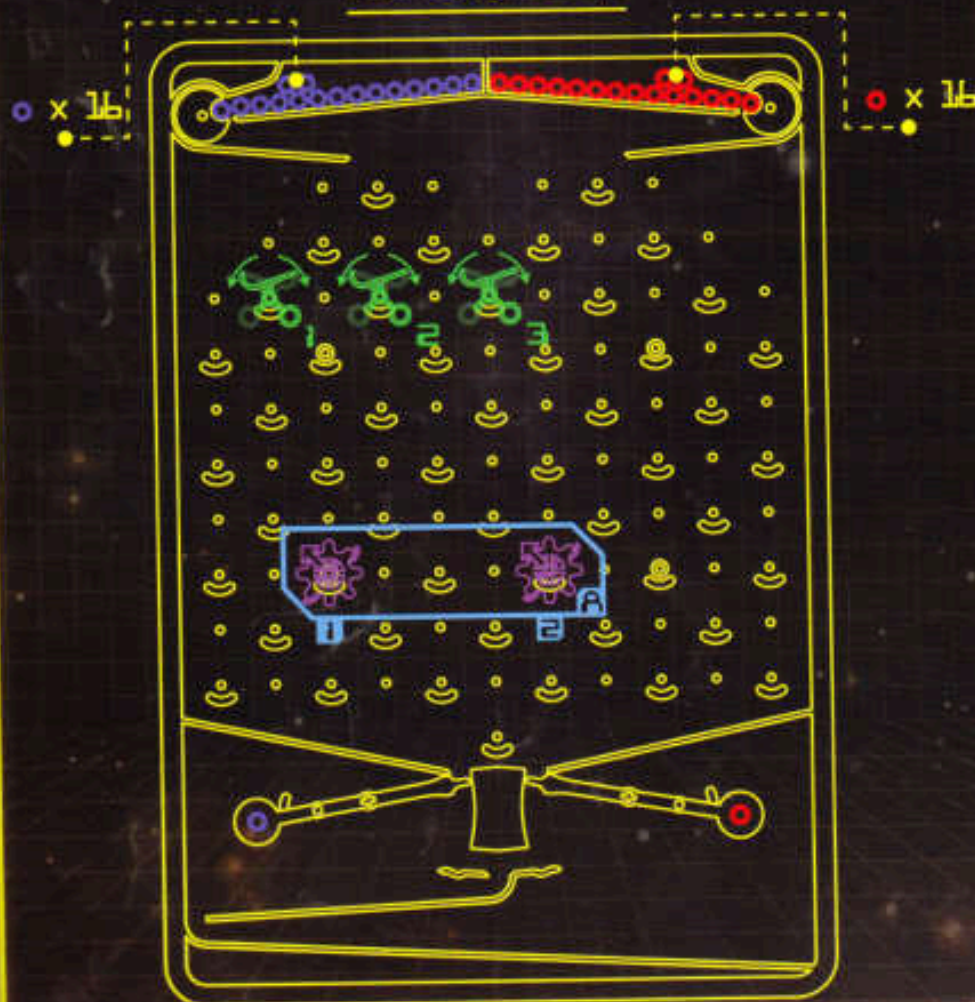
Challenge 57: Encoder

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



Magnus?

BAMP

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

Minutes passed...

...then hours...



Alia noticed that the balls 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.

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.

Alia was overwhelmed with relief.

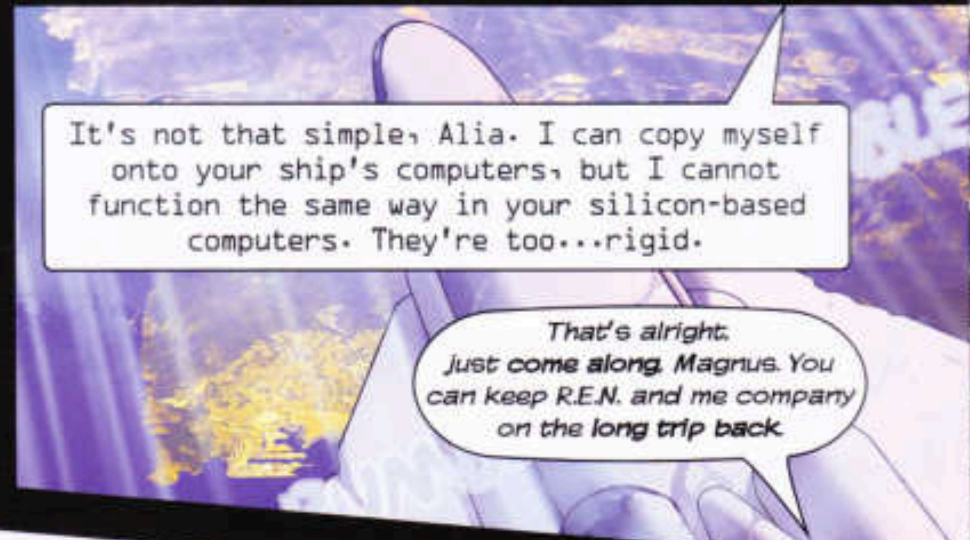


Oh Magnus,
that's wonderful to
hear!



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.

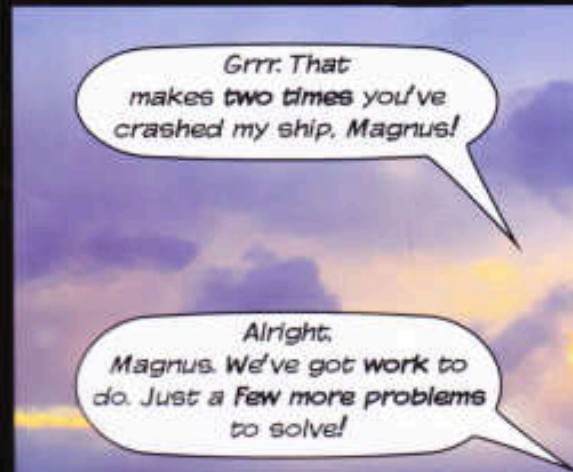
That's alright. Just come along, Magnus. You can keep R.E.N. and me company on the long trip back.



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

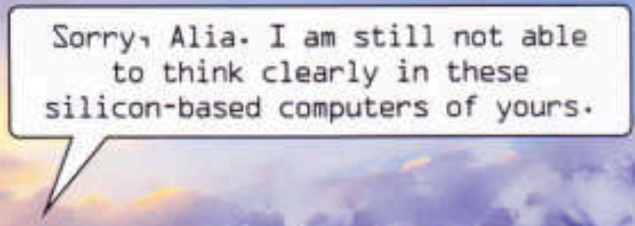


But slow down now! We're nearly there!



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
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Challenge 58: Square Matrix

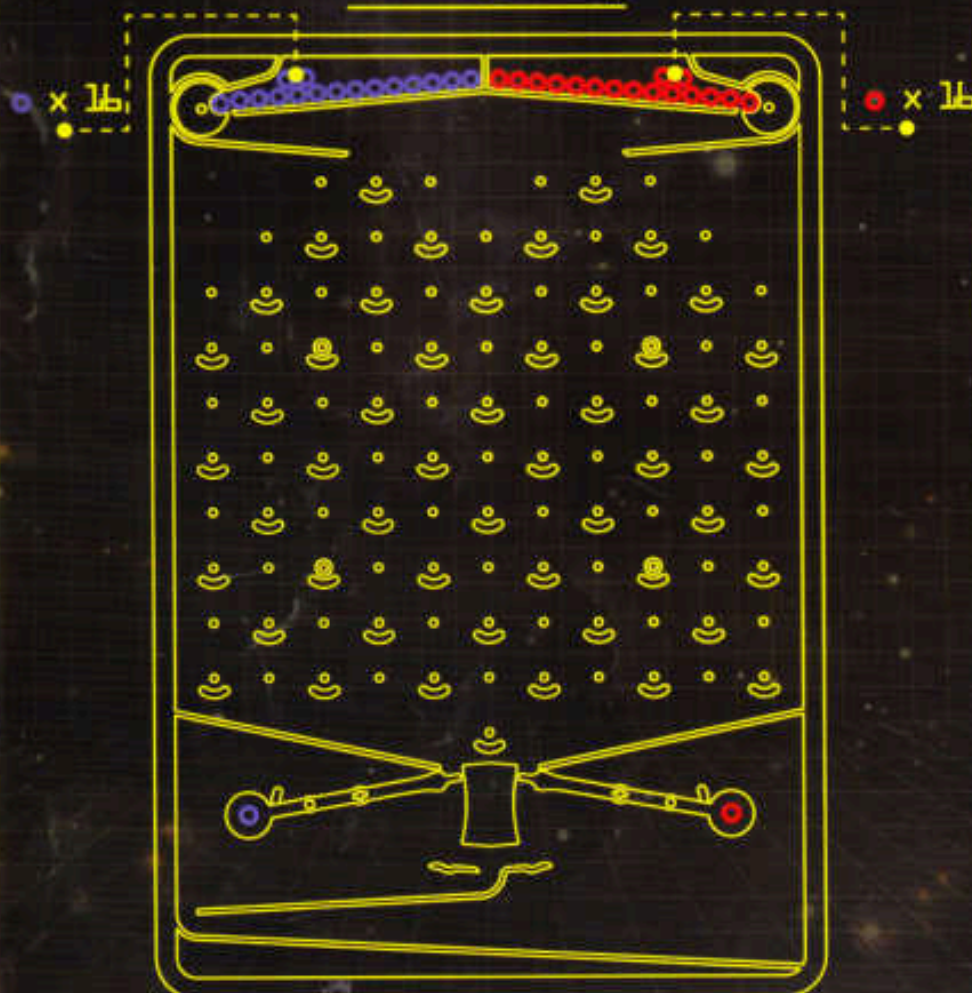
Objective: Generate the required pattern.

Required output:



```
> _
```

Starting setup



Available parts



> scan -external -challenge_59.pz1

★★★★★

=====

| Challenge 59: Dr. Nim |

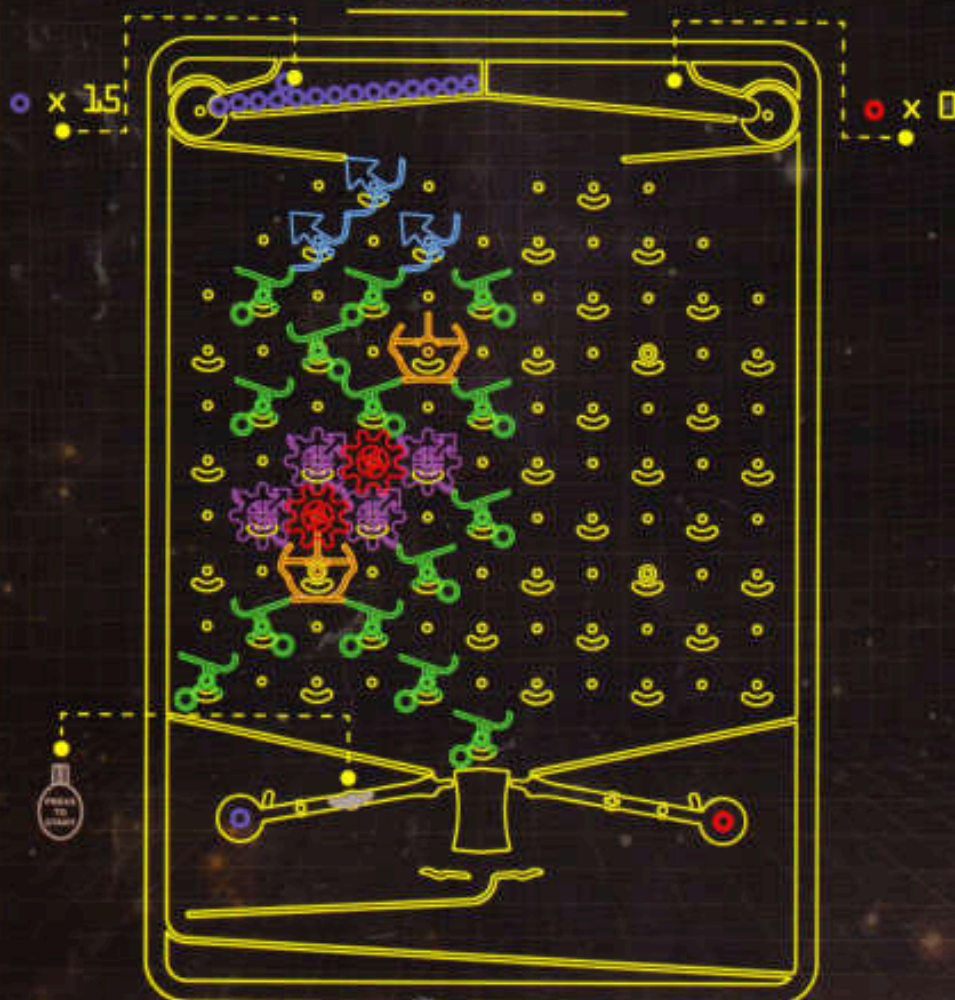
=====

> Objective: Win the game! Take turns with Magnus.
> Whoever takes the last ball on their turn loses!

> On your turn, release 1, 2, or 3 balls. 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 balls, and turn the gear bits back
> to the right when it is your turn again.

> You take the first move!

Starting setup



Available parts

```
> scan -external -challenge_b0.pz1
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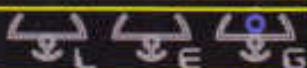
```
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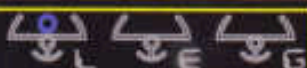
```
=====
|                               |
|           Challenge b0: Comparator           |
|                               |
|=====
```

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

Examples:

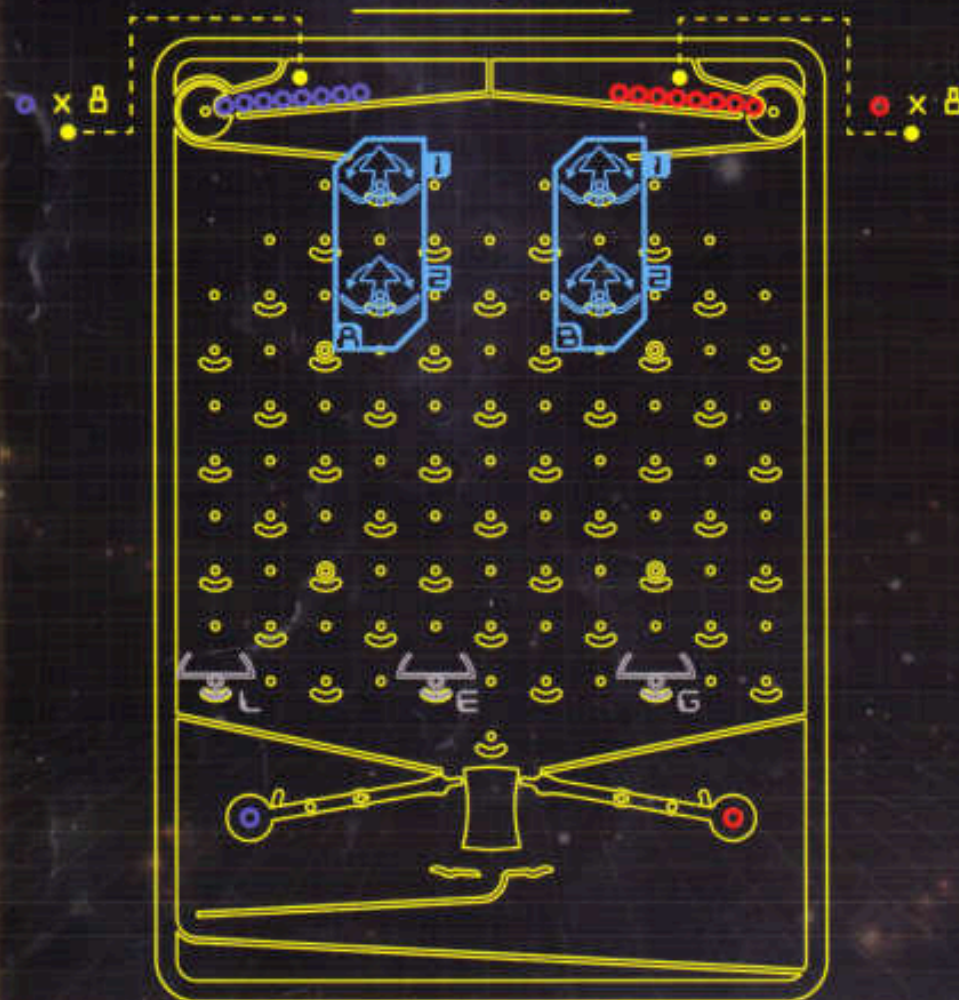
$A = 1, B = 1 \Rightarrow$ 

$A = 3, B = 1 \Rightarrow$ 

$A = 0, B = 2 \Rightarrow$ 

```
> _
```

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?

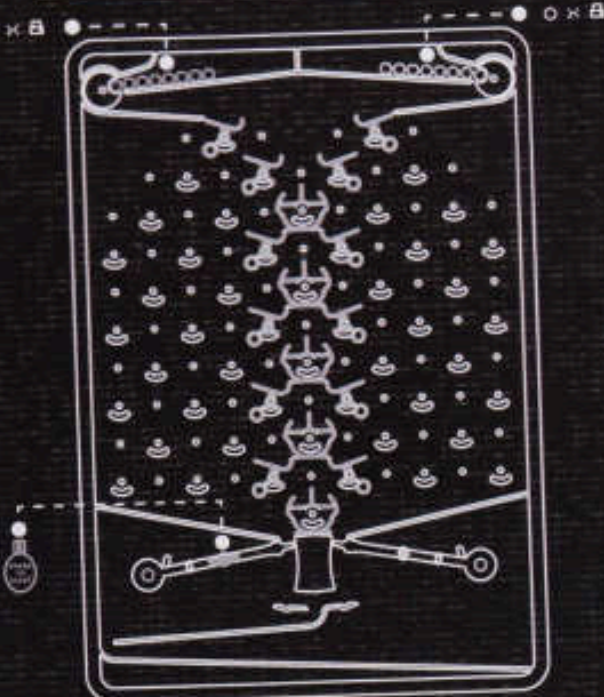


Check out community.turingtumble.com

THANKS FOR PLAYING!!

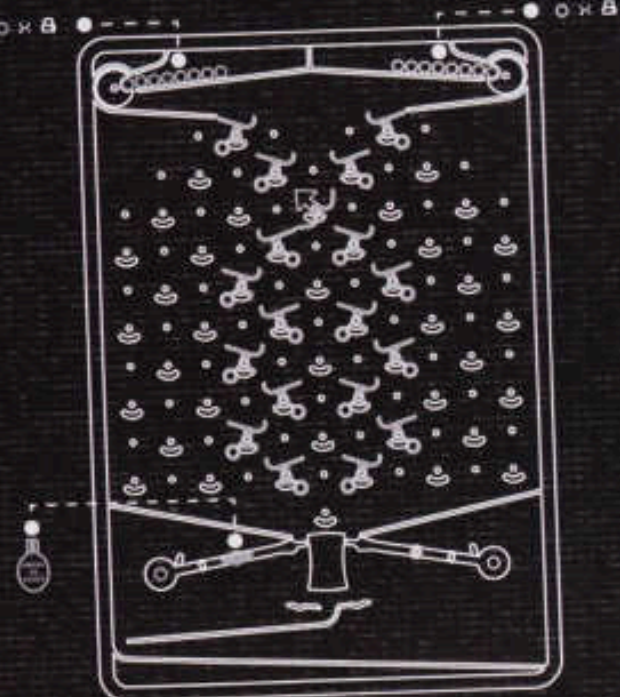
PUZZLE SOLUTIONS

CHALLENGE_6.P2L



CHALLENGE_8.P2L

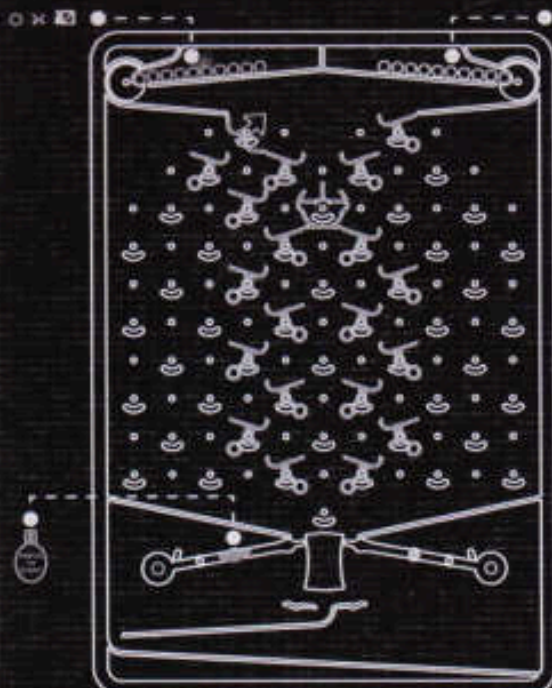
CHALLENGE_A.P2L



-MULTIPLE SOLUTIONS EXIST-

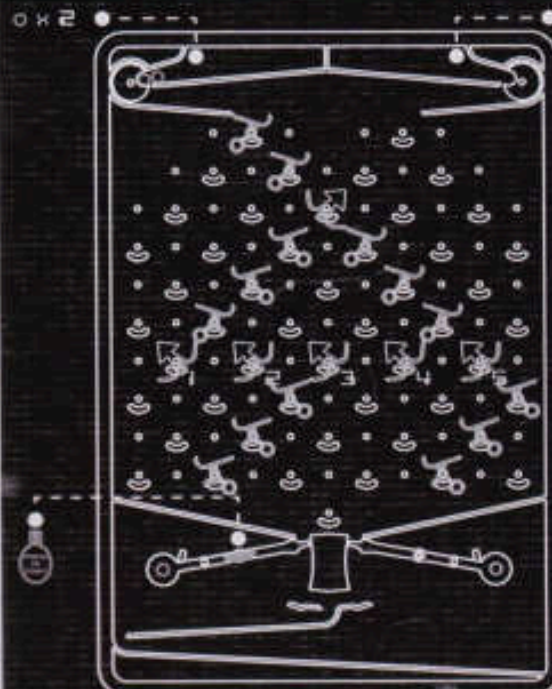
[illegible]

CHALLENGE 9.PZL



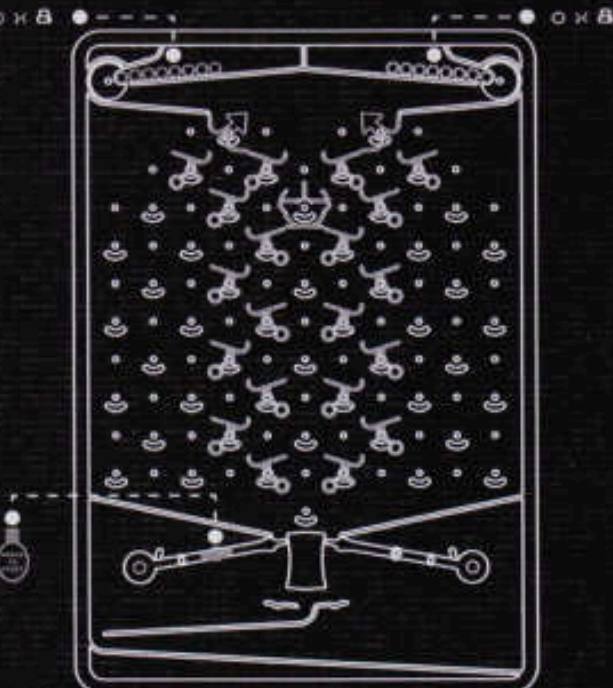
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE 11PZL



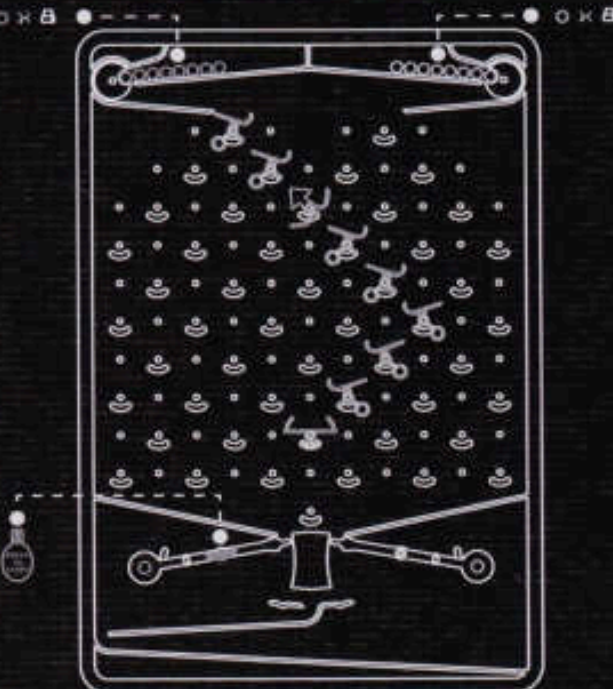
~~MULTIPLE SOLUTIONS EXIST~~ ~~MORE~~

CHALLENGE 10.P2L



-MULTIPLE SOLUTIONS EXIST-

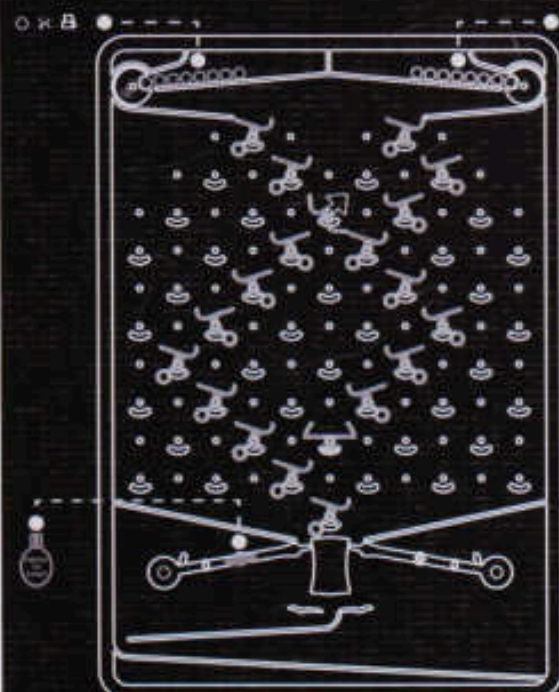
CHALLENGE_12.PZA



~~MULTIPLE SOLUTIONS EXIST~~ ~~MORE~~

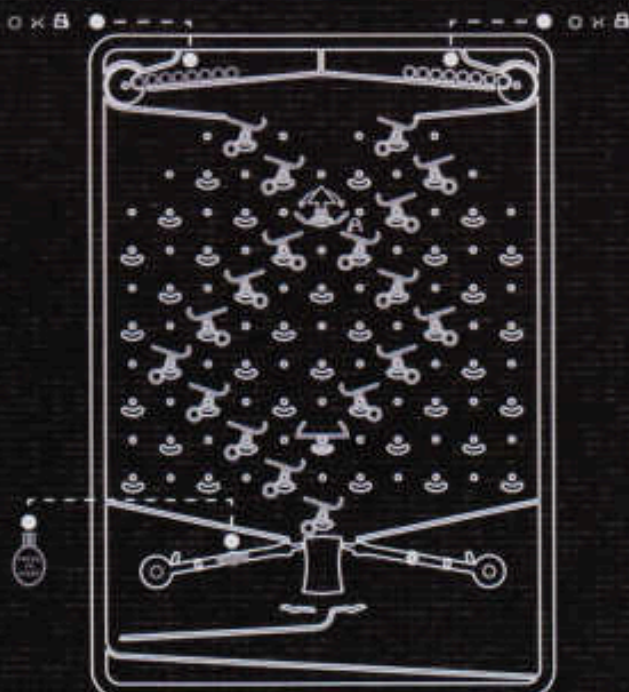
 * PUZZLE SOLUTIONS *

CHALLENGE_13.PZL



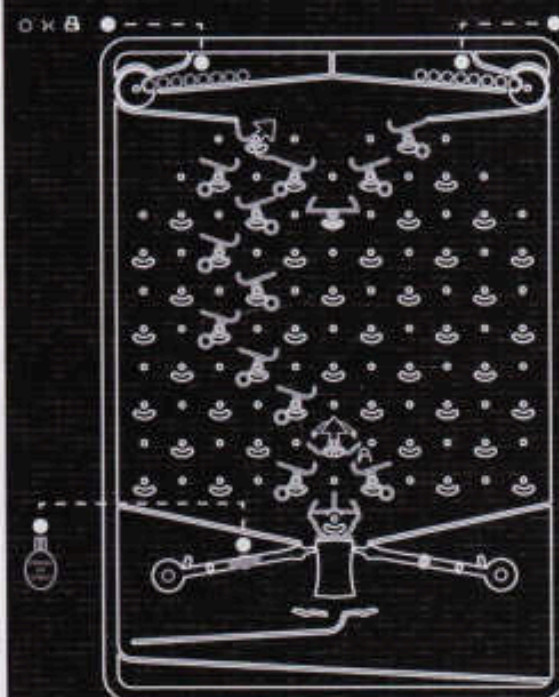
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_14.PZL



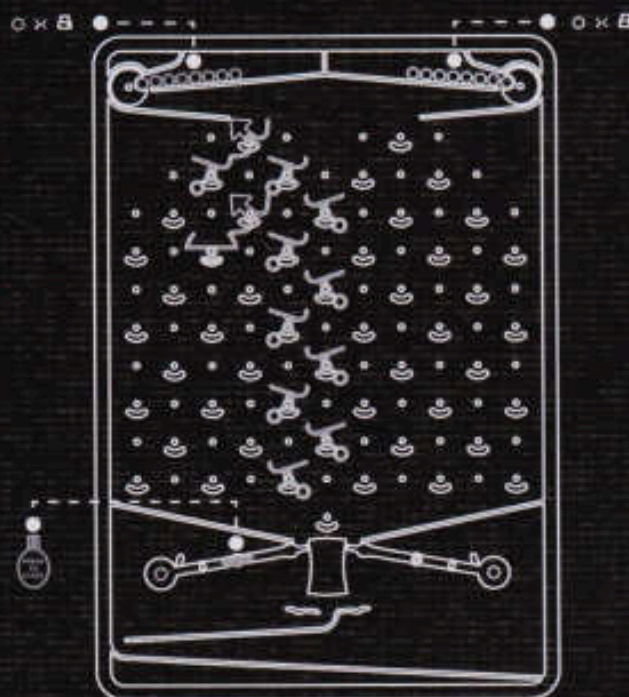
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_15.PZL



-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_16.PZL

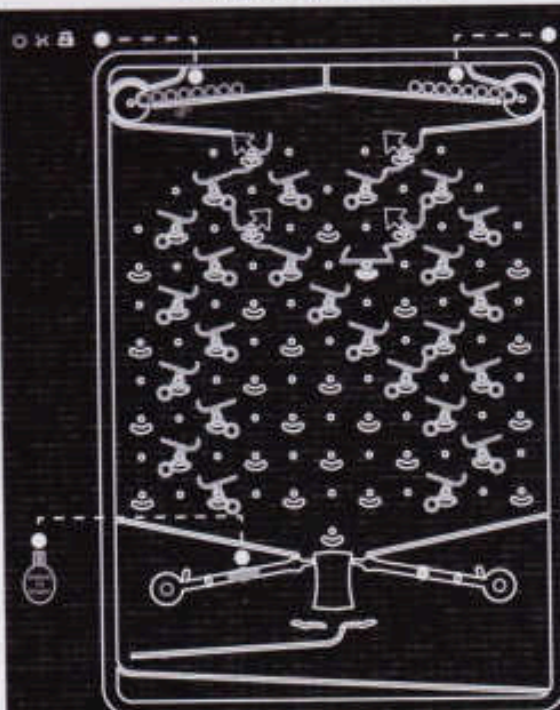


-MULTIPLE SOLUTIONS EXIST-

-MORE-

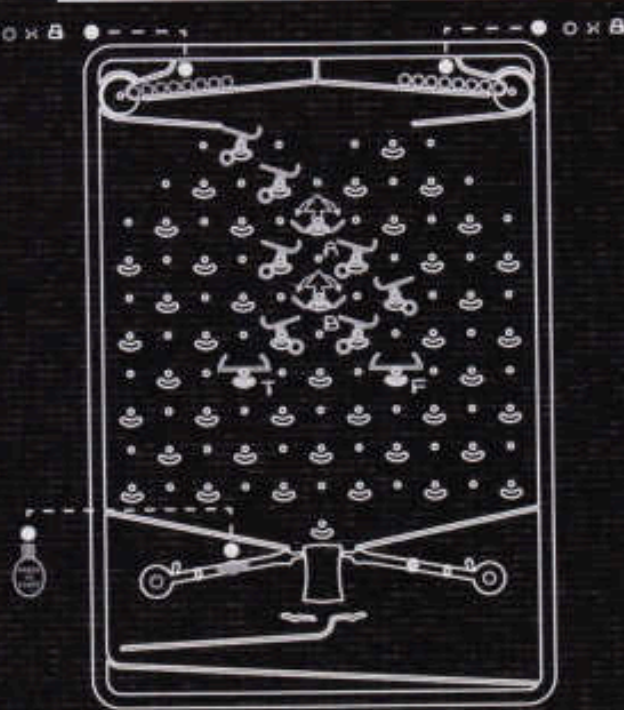
PUZZLE SOLUTIONS

CHALLENGE_17.PZL



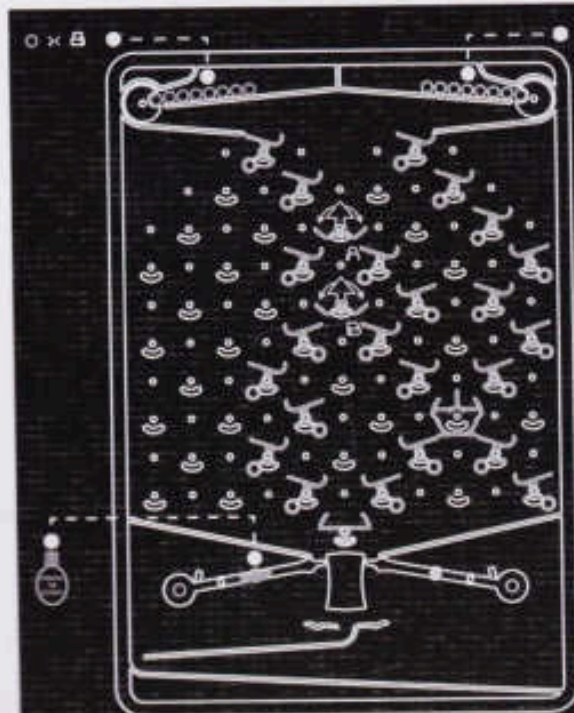
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_18.PZL



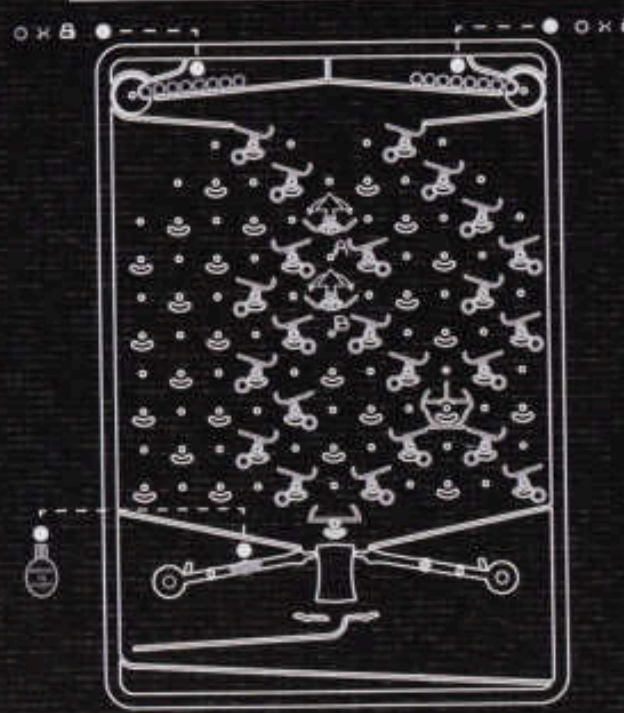
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_19.PZL



-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_20.PZL

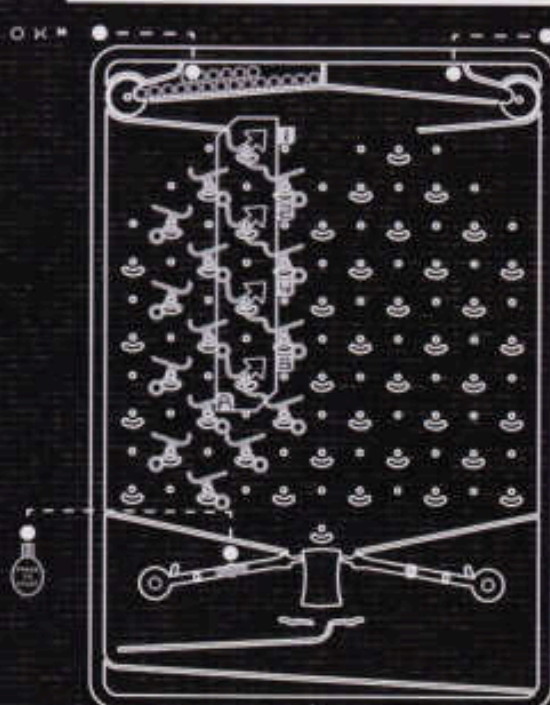


-MULTIPLE SOLUTIONS EXIST-

---MORE---

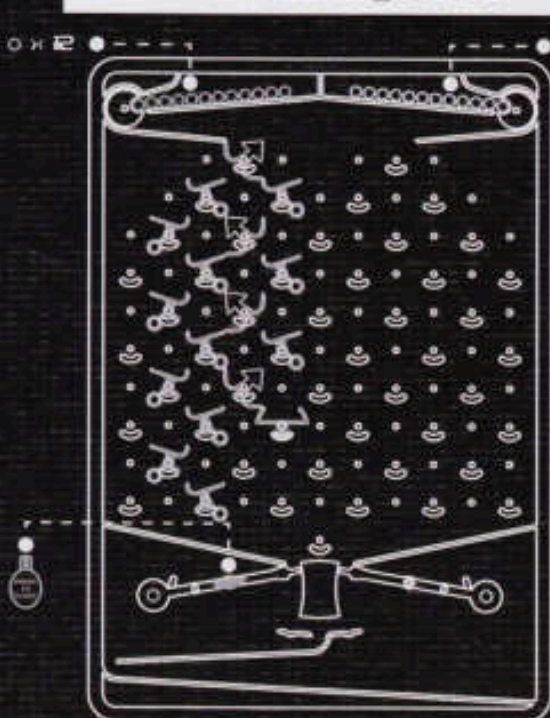
[illegible]

CHALLENGE_22.PZL



—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_24.P2L



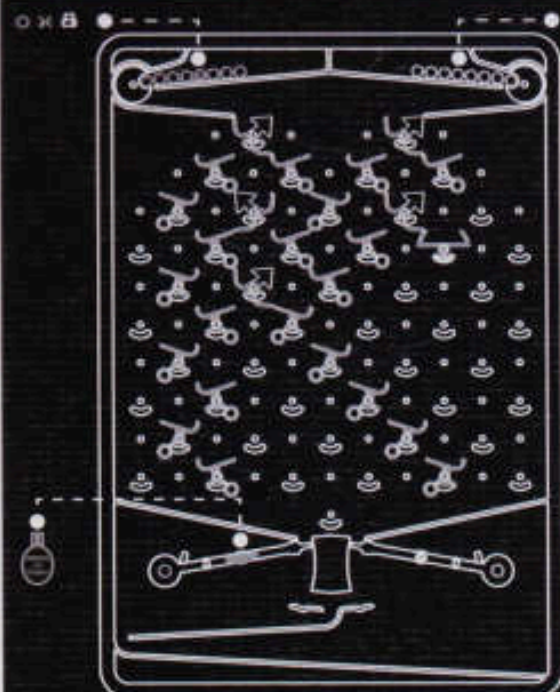
-MULTIPLE SOLUTIONS EXIST-

-MORE-

~~—MULTIPLE SOLUTIONS EXIST—~~

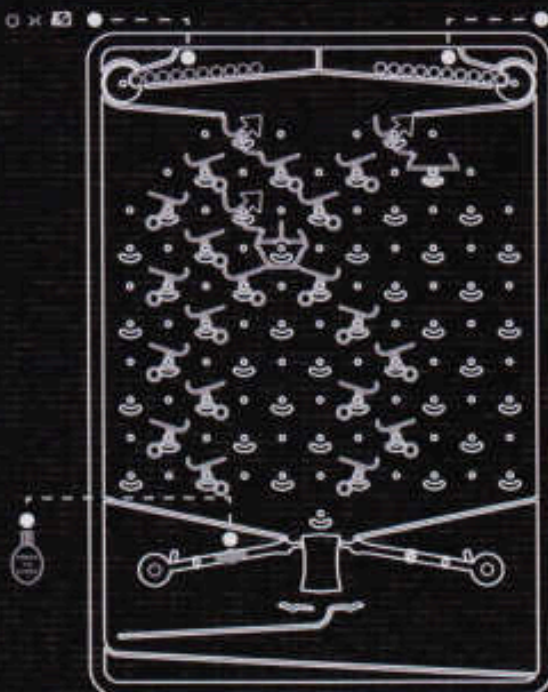
PUZZLE SOLUTIONS

CHALLENGE_25.P2L



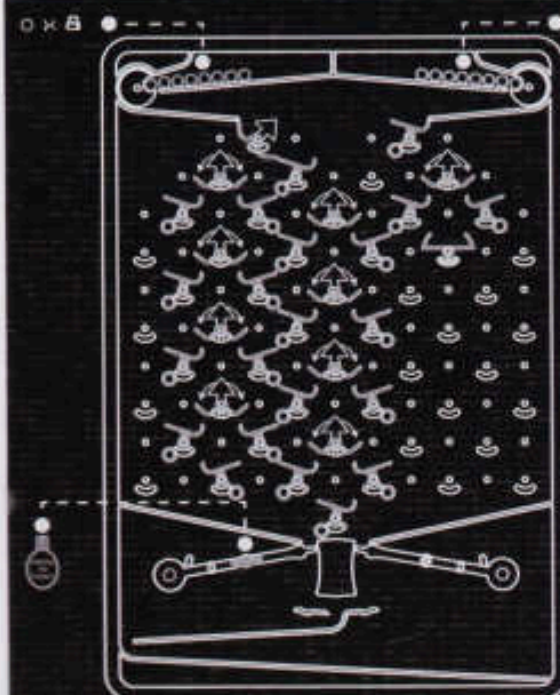
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_26.P2L



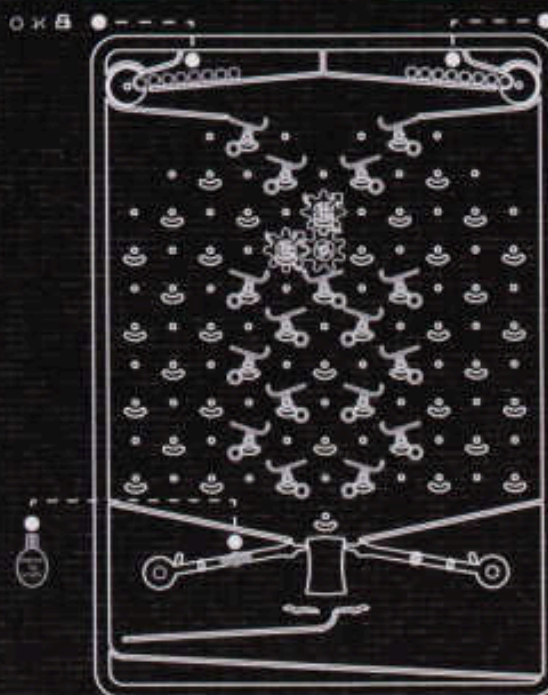
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_27.P2L



-MULTIPLE SOLUTIONS EXIST-

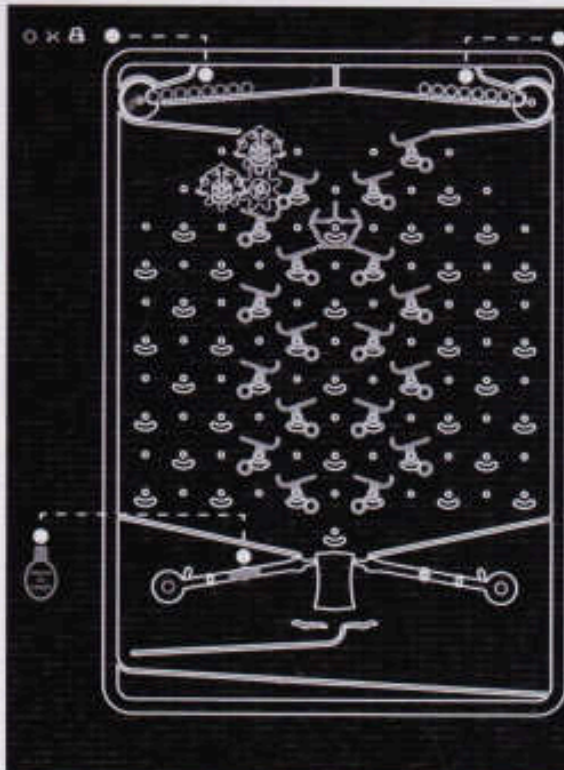
CHALLENGE_28.P2L



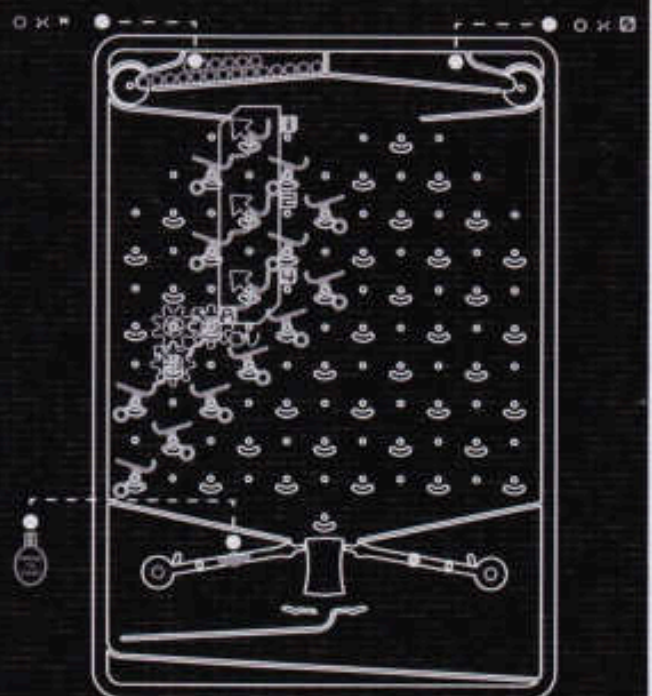
---MORE---

PUZZLE SOLUTIONS

CHALLENGE_29.PZL

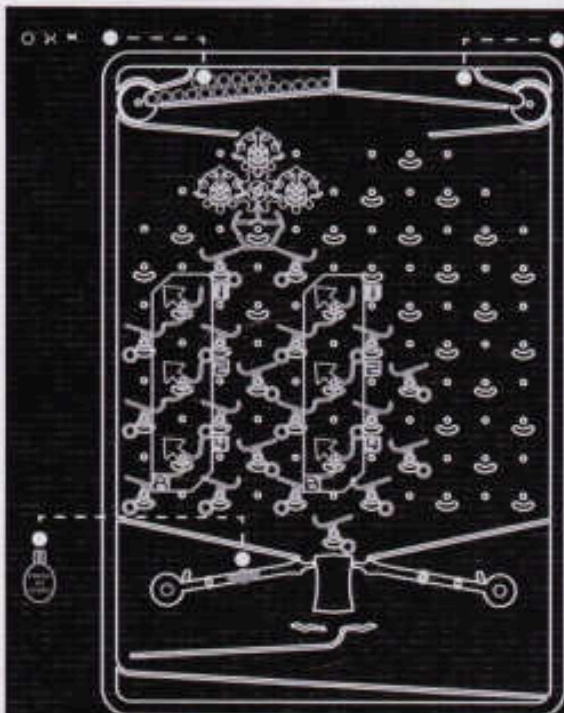


CHALLENGE_30.PZL

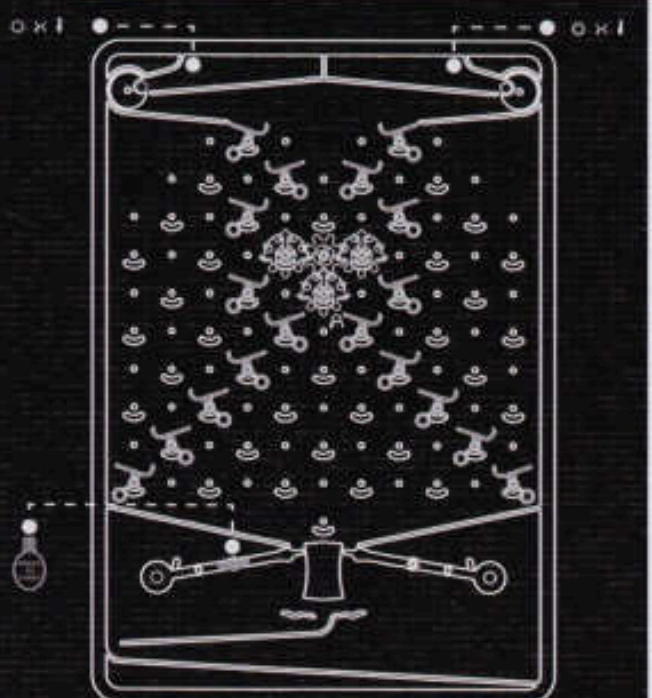


-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_31.PZL



CHALLENGE_32.PZL

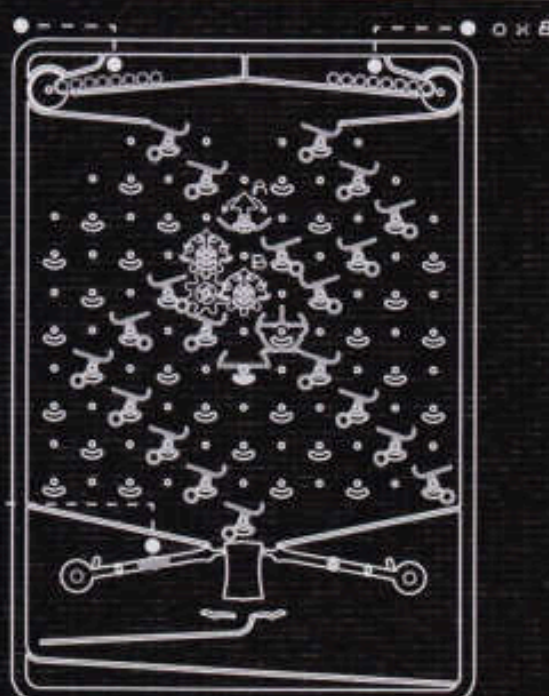
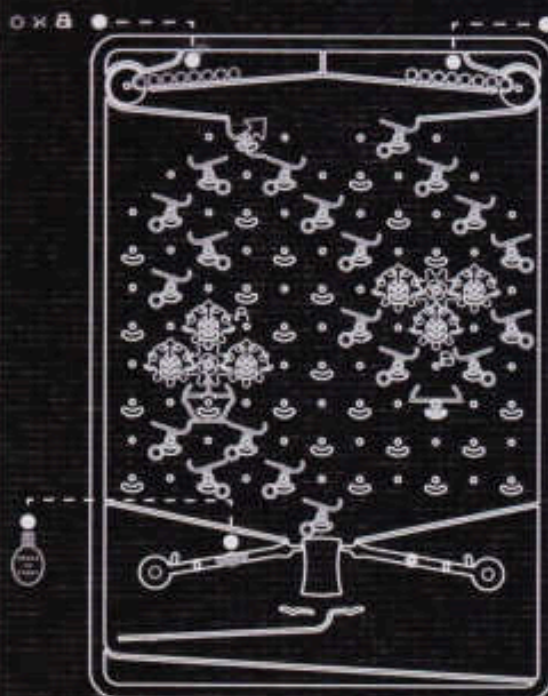


-MULTIPLE SOLUTIONS EXIST- -MORE- -MULTIPLE SOLUTIONS EXIST-

PUZZLE SOLUTIONS

CHALLENGE_33.PZL

CHALLENGE_34.PZL

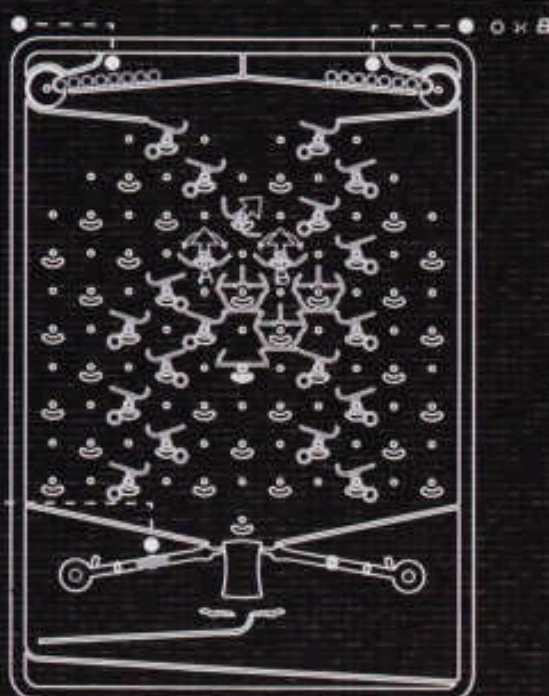
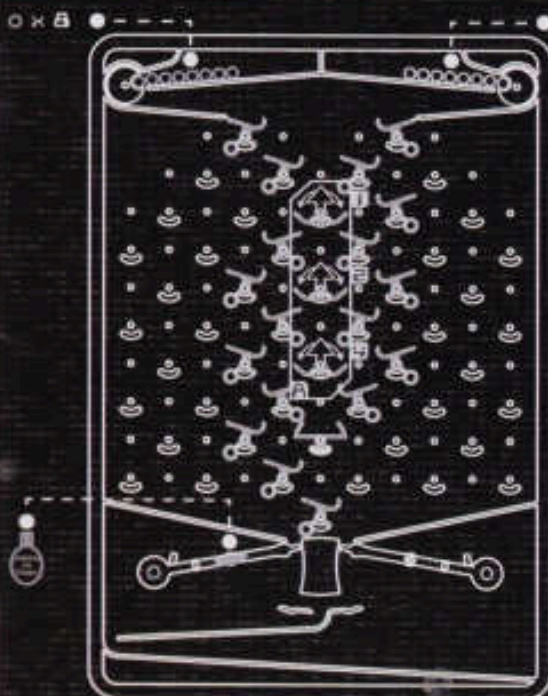


-MULTIPLE SOLUTIONS EXIST-

-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_35.PZL

CHALLENGE_36.PZL



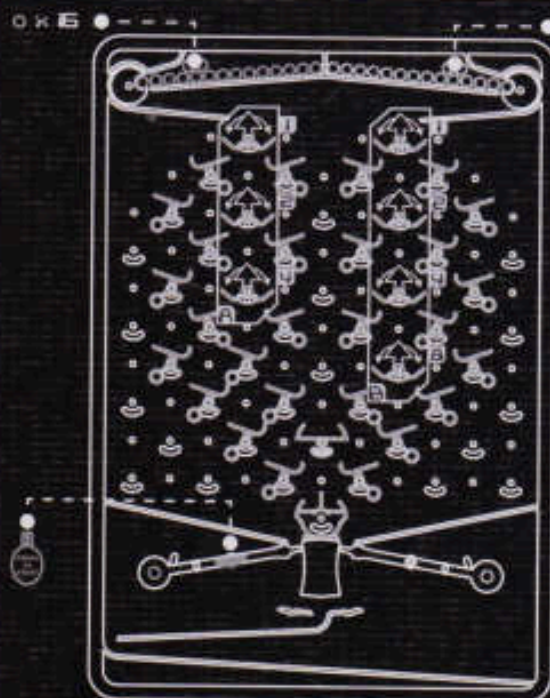
-MULTIPLE SOLUTIONS EXIST-

-MORE-

-MULTIPLE SOLUTIONS EXIST-

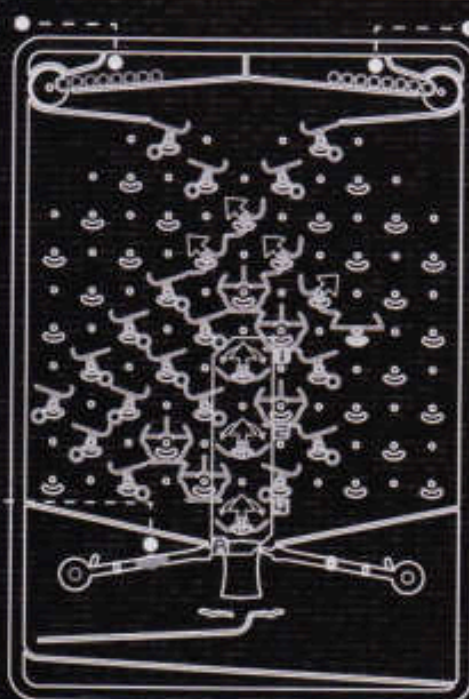
PUZZLE SOLUTIONS

CHALLENGE_37.PZL



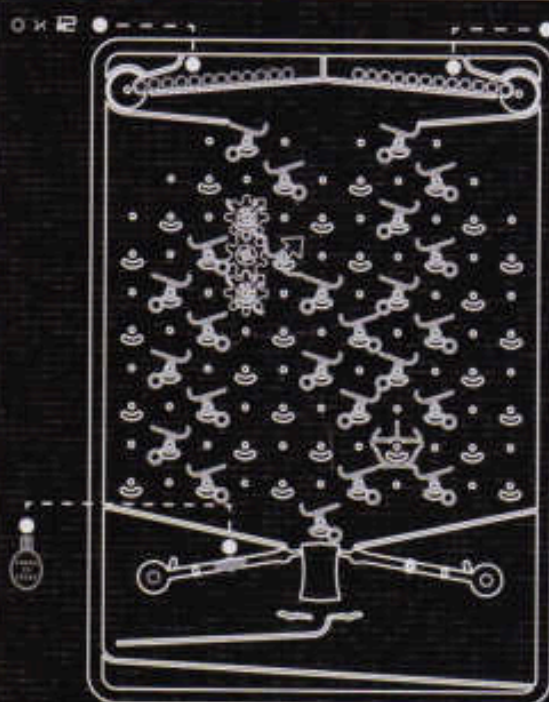
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_38.PZL



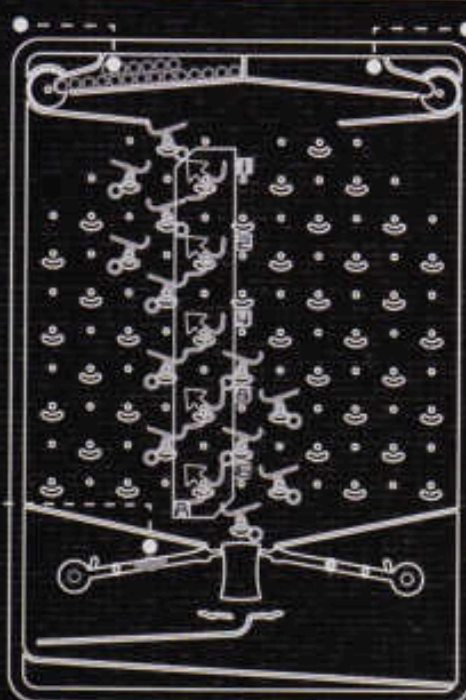
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_39.PZL



-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_40.PZL

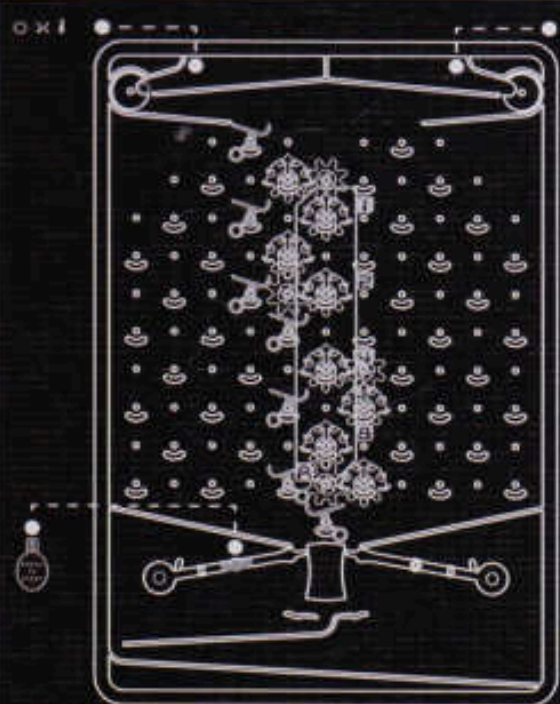


-MULTIPLE SOLUTIONS EXIST-

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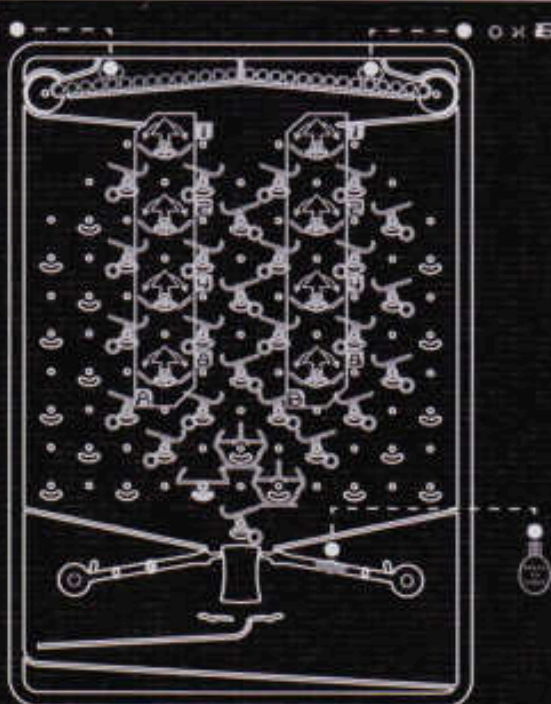
PUZZLE SOLUTIONS

CHALLENGE_41.PZL



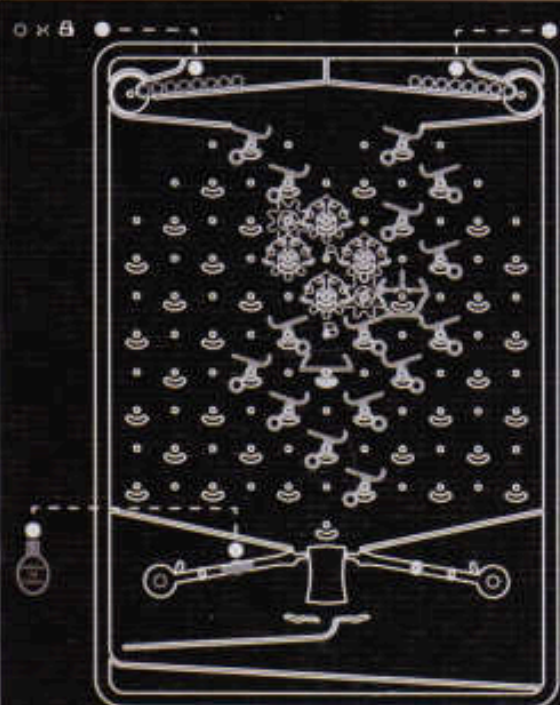
—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_42.PZL



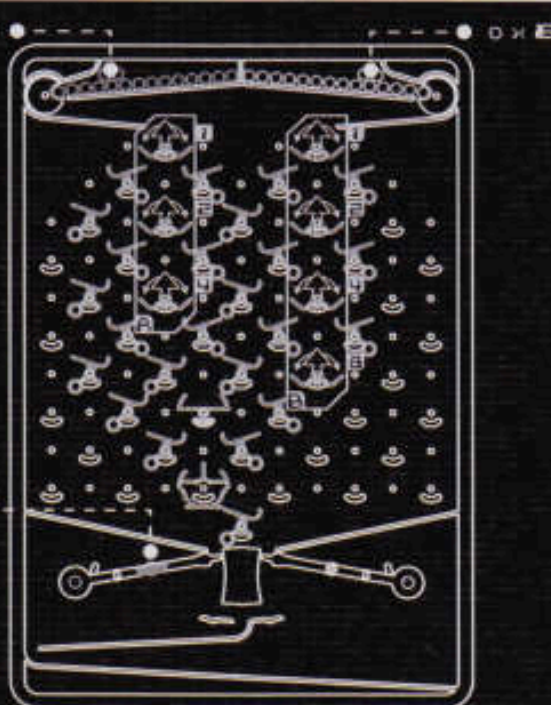
—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_43.PZL



—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_44.PZL

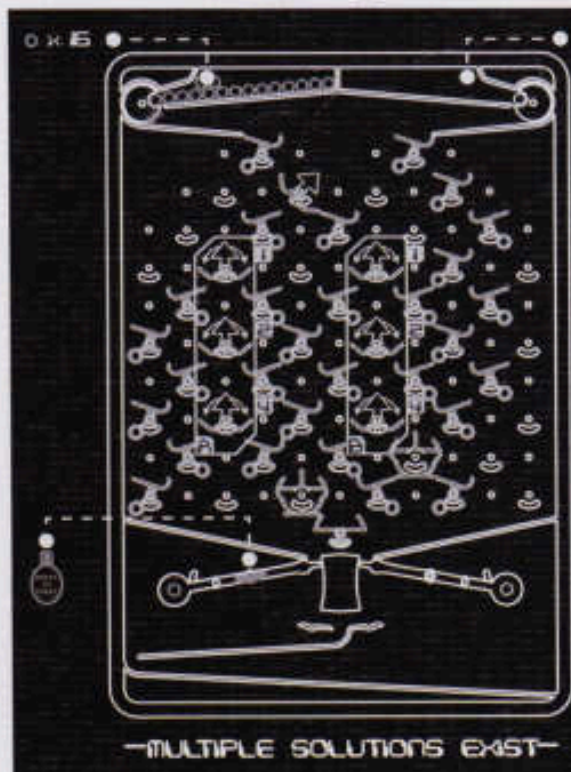


—MULTIPLE SOLUTIONS EXIST—

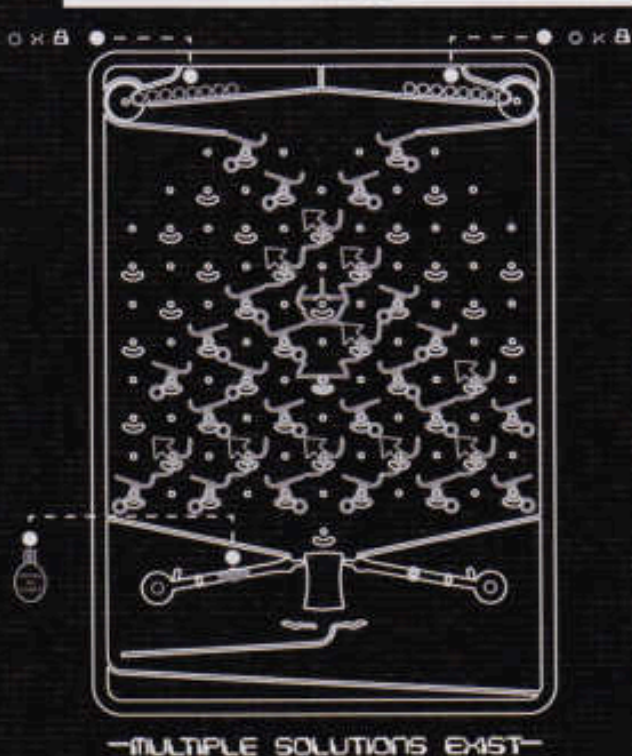
—MORE—

 * PUZZLE SOLUTIONS *

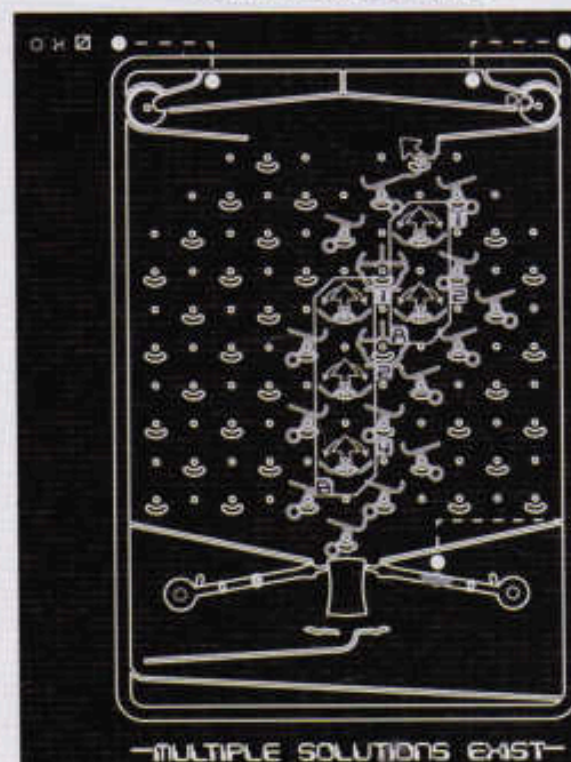
CHALLENGE_45.PZL



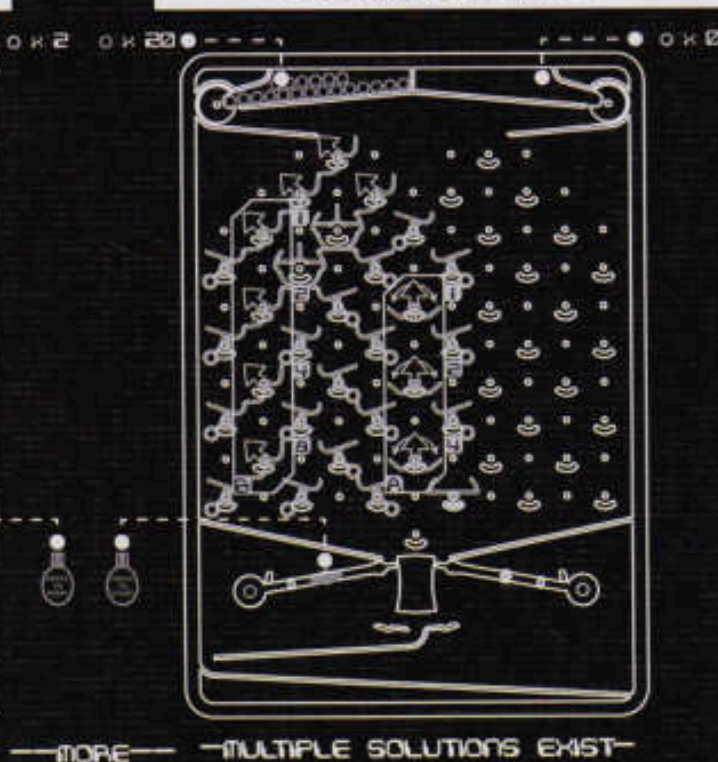
CHALLENGE_46.PZL



CHALLENGE_47.PZL

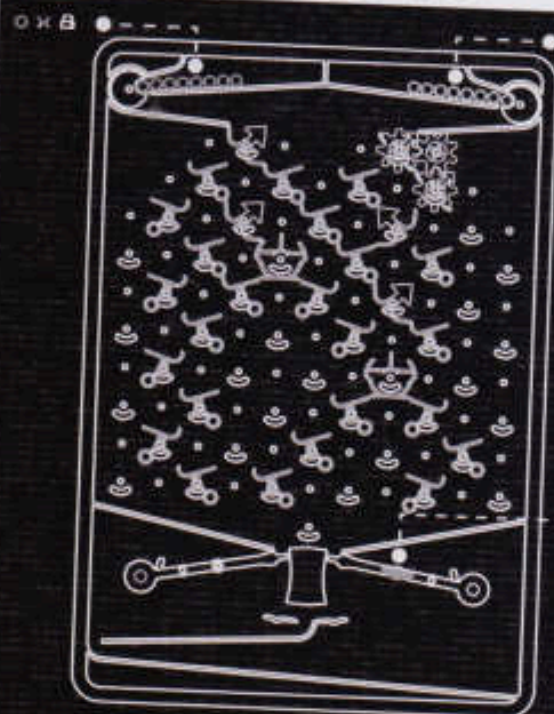


CHALLENGE_48.PZL



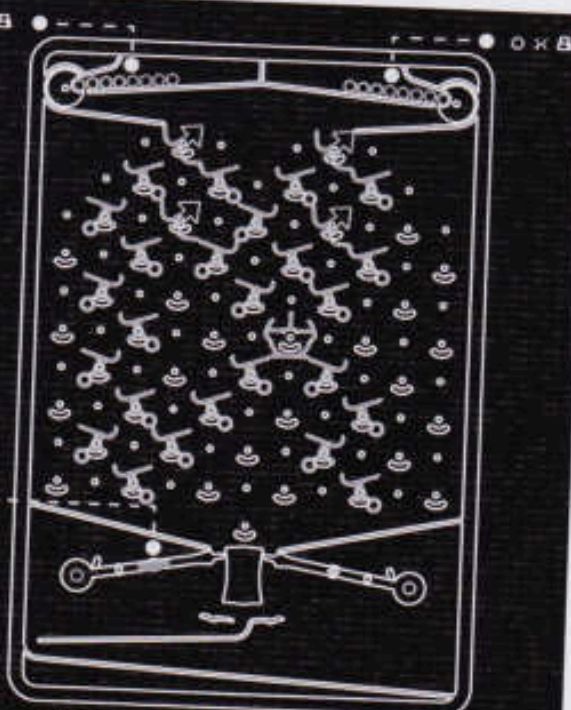
Puzzle Solutions

CHALLENGE_49.PZL



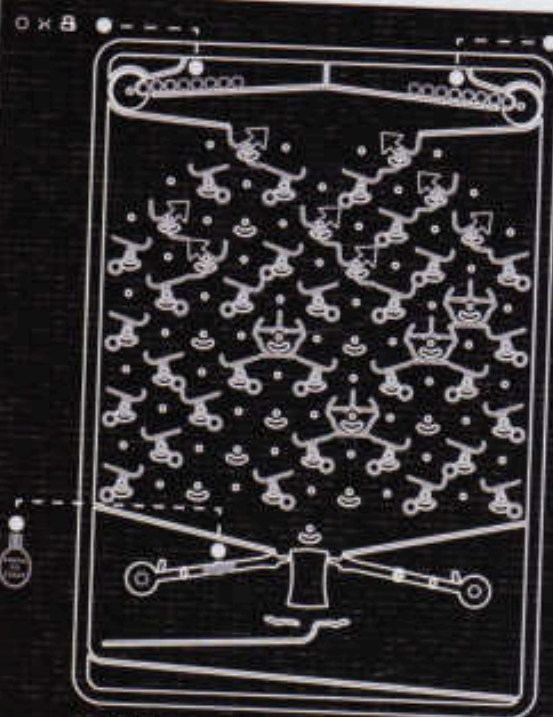
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_50.PZL



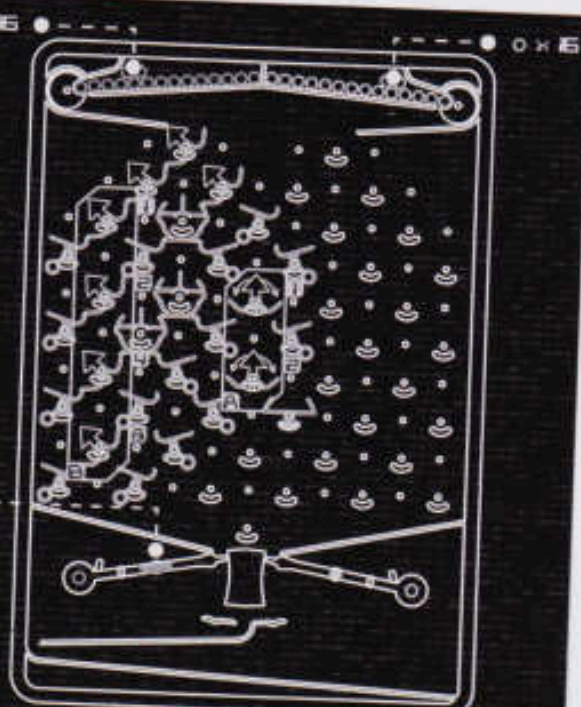
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_51.PZL



-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_52.PZL

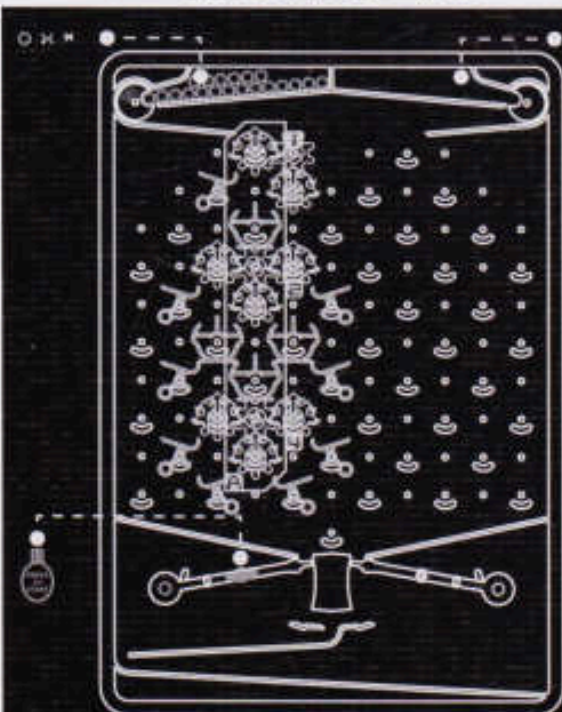


-MULTIPLE SOLUTIONS EXIST-

-MORE-

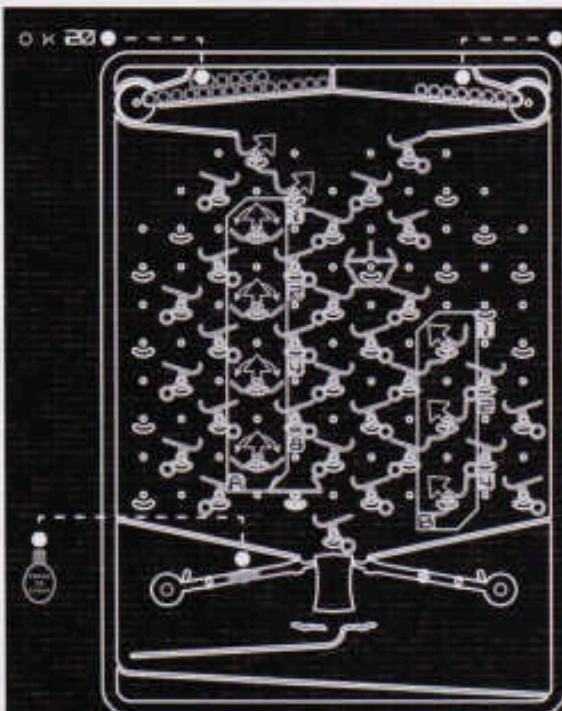
PUZZLE SOLUTIONS

CHALLENGE_53.PZL



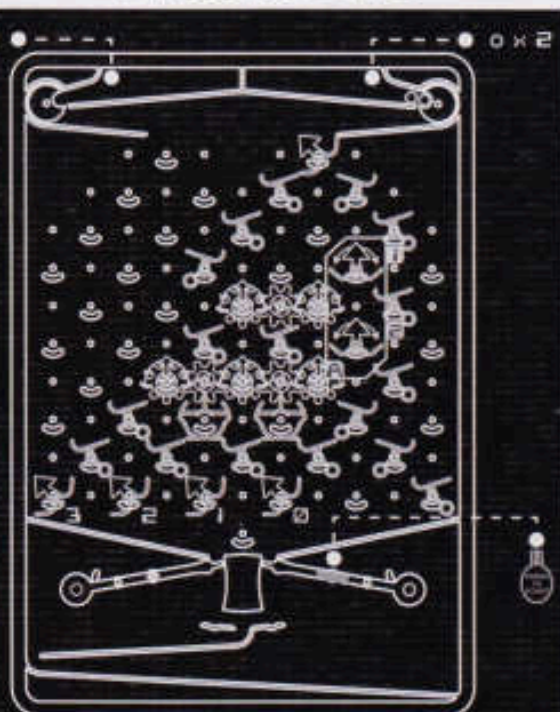
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_55.PZL



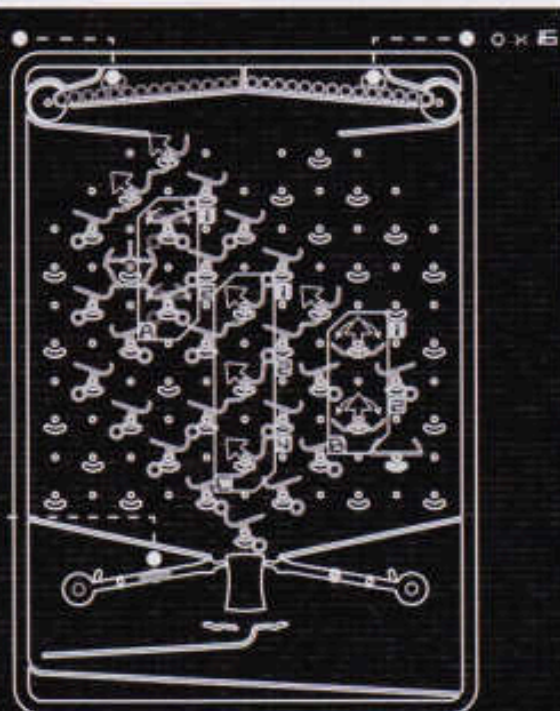
-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_54.PZL



-MULTIPLE SOLUTIONS EXIST-

CHALLENGE_56.PZL

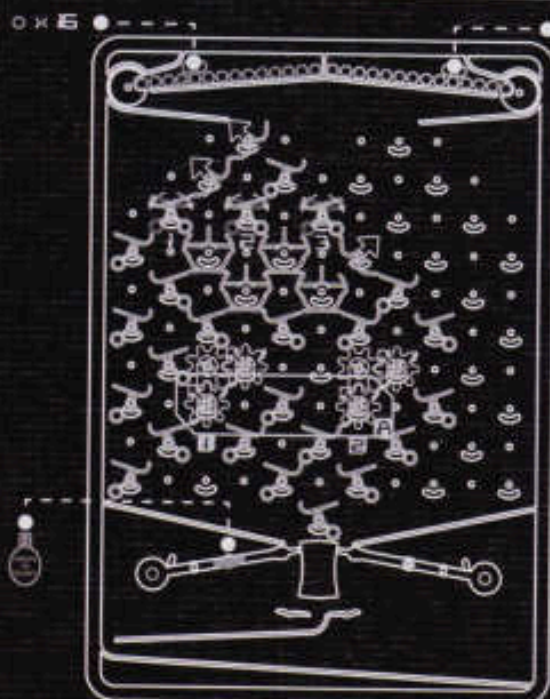


-MULTIPLE SOLUTIONS EXIST-

-MORE-

PUZZLE SOLUTIONS

CHALLENGE_57.PZL

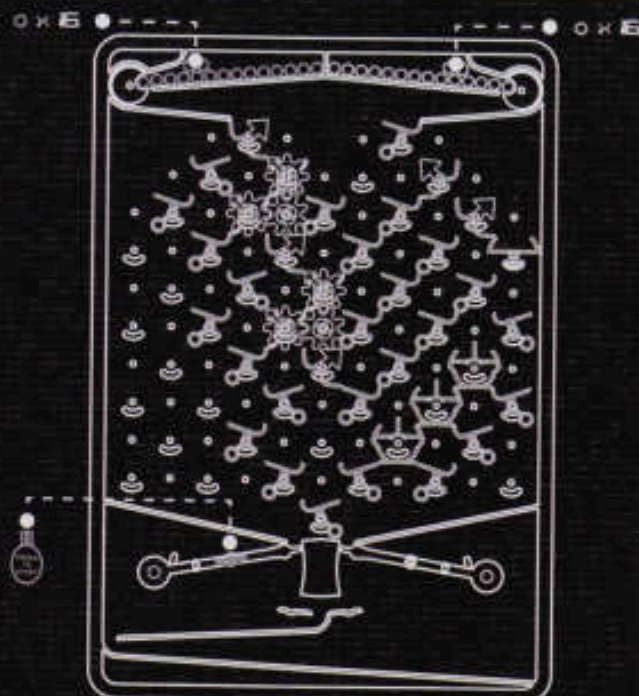


—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_59.PZL

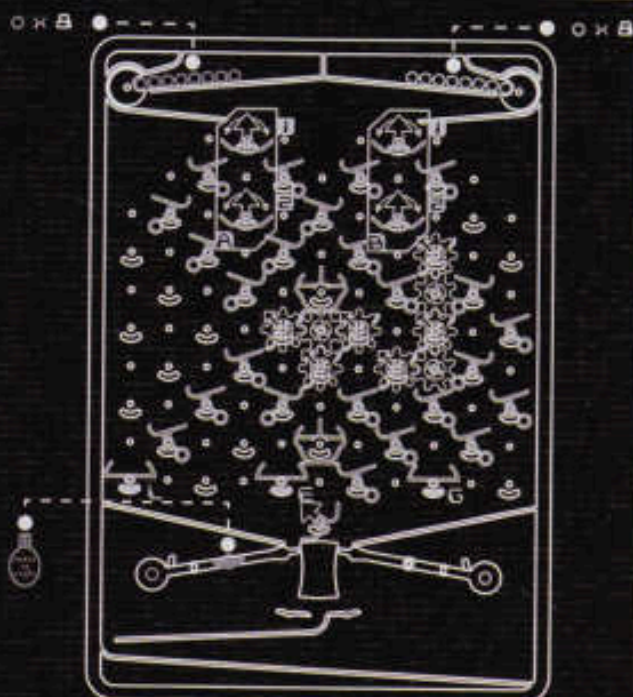
TURN 1: TAKE 2 BALLS
[MAGNUS TAKES 1 BALL]
TURN 2: TAKE 3 BALLS
[MAGNUS TAKES 1 BALL]
TURN 3: TAKE 3 BALLS
[MAGNUS TAKES 1 BALL]
TURN 4: TAKE 3 BALLS
[MAGNUS TAKES THE LAST BALL]
You win!

CHALLENGE_58.PZL



—MULTIPLE SOLUTIONS EXIST—

CHALLENGE_60.PZL



—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)

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.

Special Thanks

@WillColfin • ~Phi • 0x4a6f7368 • Aaron Charles Oliver • Aaron Liu • Aaron Pape • Abigail Wood • Ada • Addie Bee • Adeline • Aditya Prabhu • Aeschlimann Family • Ai Hang • Aidan Lugo • Aiden Tupper • Alan Whitaker • Alastair Thomas • Albert & Rosemarie Lao • Albert T. Wong • Alex Bendig • Alex M. Ellis • Alexander Spahr • Alexia P. Idoura • Alfi Dare • Amanda and Grace Jachinthal • Andreas Thomas • Andrew Carletti • Andrew Dona-Couch • Andrew Hudson • Andrew Morrow • Andrew Robinson • Andy Long • Ange Albertini • Anne Black-Sinak • Annelies van der Veen • Annie & Iver Olsen • anonymous • Antoine Jacoutot • Antoine O - QuickContest • Archer + Simone • Argent, Artemis & Nicola Cooper • Arjan Timmerman • Arthur, Petra, Pepijn, Elin en Vera van Leeuwen • Ashland, Sawyer and Maximus Theis • Ashley Leon • Atlas Kyi Chin • Bekka and Bruce MacKenzie • belair • Benjamin • benjotron • Blair Talom Heald • Blaize, Jett, Porscha & Ad Marquez-Marzo • Boumetis Family • Bram Kok - The 4th Jawa • Brandon Conway • Brandon Scheuerman • Brett "bretski" Slaski • "Brian Fortney • Erin Atwood • Clare Helen Atwood-Fortney" • Brian Hanley • Brian Hirschfield • Bruce W. Kramer • Bruce & Sherry Cochran • Bruno • Bull Family • busybodykids.com.au • Caleb & Silas Maki • Candice R. 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Ospital • David King • David Lugo • David North • David Pease • David Stranz • David Vega • David Wagner • Dejmontree Pitaktham • Denis Reviakins • Dennis de Vries • Dennis Kronebusch, Rochester Community and Technical College • Derek & Tiffany Kuper • Devon K. • Dick & Karen Waringa • Didi • Diego Vázquez Jr. • Dillon and Charlotte Tomson • Dimitri Joe • Diya Kaul • dm • Doogie Proffitt • Doug Frye • Doug Johnson • Dr. Patricia Paulson • Drew Leffelman • Duchess Chloe Chewdrop • Eddie Freeman • Edgard Moraes • Edmond Circus NZ • Elizabeth Reiff & John Daniels • Elizabeth S. Wittliff • Eljakim Schrijvers • Emma Kathleen Haas • Ender Wiggin • Eric Y.J. Park • Eric, Martha, and Grace Davis • Erik Peterson • Ethan Michael Thompson • Ethan Murray • Everett • Everett G. & Otis Q. Lichty • Every Kliver • Family Christiaens Marredy • Fast Family • Fuhrmann • G. Jordan • G. Wright • Gabor Kolonits • Gabriella Fainberg • Gareth J. Coster • Gary Duke • Gemma & Caelan Murray • Geordi • Gina Lee • Gloria Bosshard • Goku • Grady & Josie Malley • Graham Marshall • Green Bay Area Public Schools • Grey Son Klein • griapiros • Grumps • GUILD • Haenel Family • Halls of Learning • Hannah Maguire • Harriet and Gray MacMillan • Henry and Heidi Robertson • Henry Stewa • Herbert M. Sauro • Hiroyuki Kojima • "Hobbs" S = k log W • Hugo Drozd • Humzah Ladiwala • Huy Duong • IAEJJ Swenson • Ian Kelly • Ian Viemeister • idehara.n • Irene G. Wong • Isabelle • Isabelle Luna • J&M Rosenthal • Jacob Lee • Jake and Ali • Jake and Eli • Jake Monty Auld • Jake Swenson • James • James B. Montney II • James Butler • James D. Balmer • Jan Dadik • Jan-Erik Suttle • Jara Priehn • Jared Rohrer • Jascha Grubel • Jason Bender • Jason White • Jeff DeSurra • Jeff Jaites • Jeffery • Jena Greiner • Jeremy Rayner • Jesper Lillesø • Jesse & Parker Owens • Jim Anders • Jim Beaudreau • Jing, Kai & Qian • Jizhou ren • Joachim Jellinek • Joe Paris • Joel Stitzel • Johan P.G. Hjertman • Johannes Schneider & Mao Otsuki • Johannes Spielmann • John "Snowdrama" • John Aldis • John Bigelow • John Carr (Mezada) • John Malone • John Mulder • John W. Boone • John W. C. McNabb • John Yeung Schade • Jones Lipps • Jonathan & Tracy Bennett • Jonathan Barnoud • Jonathan Dy • Jonathan Perez • Jonathan White • Jordan Ng • Joseph K. Woodard • Joseph M. Hill • Josh Herron • Joshua Luke Roberts • Joshua M. Pactor • Joshua Romeo • Joy Lindsay • Julian Christopher Kotsis • Julie Boms • Jun A. Cristini • Kaelan & Lyettie Yim • Kai To • Kankaewnikh • Karin & Doug Petty • Kate and Ellie Linne • Keith Hall • Kelvin Chin • Kelvin Li • Kendrick & Klara • Kevin Sullivan • Kian & Taralyn Lacoste • kngo • Koichi Suzuki • Krishna Ashutosh • Kunihiro Saito • Ladmore Family • Laura K. Kochevar • Laura Reasoner Jones • Laurana Przystas • Laurence Gonsalves • Laurie Humphrey • Lawrence • Lawrence Deck • Leilani • Len and Susan Kaplan • Lenny • Lenny Pitt • Leron Culbreath • Letitia J. Yao • Liam and Vanessa Roycroft • Logan and Olivia Wells • Luc Willemars • Lukas & Annaliese • Lukas & Holly Long • Mabry & Calliope Herring • Madison Family, Waterloo, Ontario • Malte Schmitz • Manuel • Marc Petit-Huguenin • Marc Vaz • Marcus Dicander • Mark Biggar • Mark C. Chu-Carroll • Mark Christenson • Mark Danley • Mark Dodson • Mark Green • Mark Gritter • Mark Peebles • Marko Mikulic • Markus Mehrwald (brainbugfix.fail) • Martin Butler Spillane • Martin S. Olivier • Mary E. 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