

# MARBLELINK 2042

(Exercise book)



>>> Help ethical Hacker-genius and Reggaeton-DJ Niña Halo  
to escape her captors from the evil Hyper Corporation <<<

An exercise book for learning the MarblePunk programming language, as defined in the Pinocchioverse documentation (<https://pinocchioverse.org/documentation/>). You can find more about the language and why it was defined on a fictional universe here: <https://narrativedidactics.files.wordpress.com/2023/03/marblepunk-1.pdf>

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Partially based on exercises from <https://www.csunplugged.org/>

*Niña Halo was a brilliant hacker and an even more talented DJ. She loved to create amazing programs by building marble runs, the colourful tracks that let marbles roll and trigger different actions. She used her skills to expose the secrets of Hyper Corp, a powerful company that wanted to control all the tech in the world.*

*But one day, she made a mistake. She hacked into Hyper Corp's main server and tried to download their latest project: a super marble run that could do anything. But she was caught by their security system and captured by their agents. They locked her up in a secret facility and tried to force her to work for them.*

*But Niña was not going to give up. She knew she had to escape and stop Hyper Corp's evil plan. She also knew she had a secret ally: you. You are her best friend and fellow hacker, and you have been tracking her location. You have managed to hack into the facility's network and communicate with her through a hidden device.*

*Now you have to help Nina escape. You have to guide her through the facility, avoid the guards and cameras, and find a way out. You also have to use your marble run skills to hack into the systems and create diversions. But be careful: Hyper Corp is watching your every move.*

*Are you ready for the challenge? Then let's go! Grab your headphones and start building those marble tracks!*

# INSTRUCTIONS FOR TEACHERS

## Introduction

The exercises in this book are grouped in “Stations”. The “Stations” can be the basis for lessons done in class or for station works.

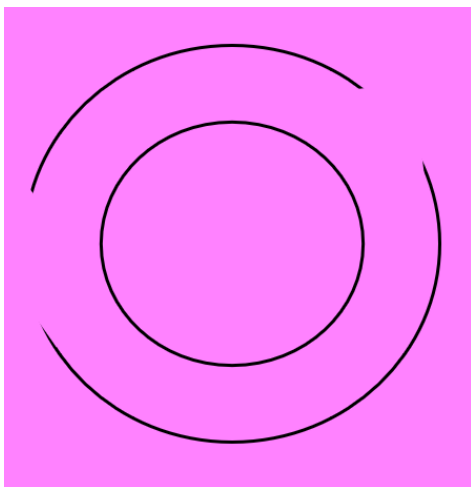
There are three kinds of exercises:

- *DOOR EXERCISES*: Every lesson begins with such an exercise. You have to help Niña to get her robo-mice “Atari” to the lock, to open the door. The door leads to the room, in which the other exercises take place (kind of the Hello-World-Exercise of the components introduced in the lesson)
- *CRAFTING EXERCISES*: Children have to solve a problem by building more complex marble tracks, possibly based on an existing marble track
- *HACKING EXERCISES*: Children have to manipulate the behaviour of an existing marble track to achieve a certain goal
- *FREE-/OUT-OF-THE-BOX-EXERCISE*: children have to find solution in a very free and broad way. It might not even be possible to verify whether it’s the correct solution but that’s not the point in this case. This can also contain solutions in which no marble runs are involved. It can also address ethical or socio-cultural questions, which could be discussed afterwards. Can also be a hacking or a crafting exercise or the combination of both. Or maybe both approaches are possible.
- Maybe in the future: *TINKERING EXERCISES*: combine the construction of devices or tools with building marble tracks

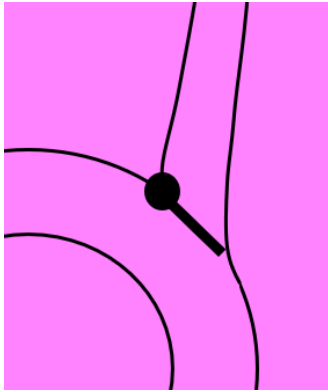
## Material

The material consists of three marbles and the following cut-out action seals and marble track pieces. In the exercises, these shapes are often only available in a limited amount:

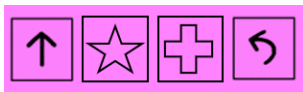
Looping track piece:



Branch:

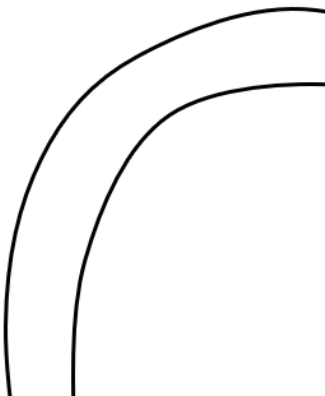


And action seals, which can be “pasted on” the track pieces (dependent on the particular exercise):

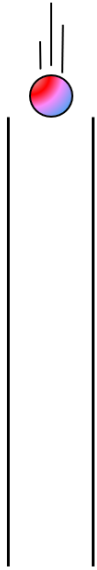


In some exercises, the number of pieces is limited. But there are secondary shapes, which can be used in any amount always.

Curve:



Linear track piece:



All of the shown pieces at least in an amount of five per child. If no specification to the material are given, all pieces may be used.

(The marble runs can also be drawn, if no cut-out shapes are available. If available in the future, the tracks can maybe also be created on a digital device)

### **“Running” Marble Tracks**

A created Marble run can be run with two persons to check whether it solves a given exercise. One person plays the marble, the other executes the actions, which are triggered.

The person, who plays the marble, slowly moves the marble through the tracks how it would run in reality and calls to the other person, which actions are triggered, who executes them exactly like being told.

In the course of this, it eventually becomes clear, whether the exercise was solved or not.

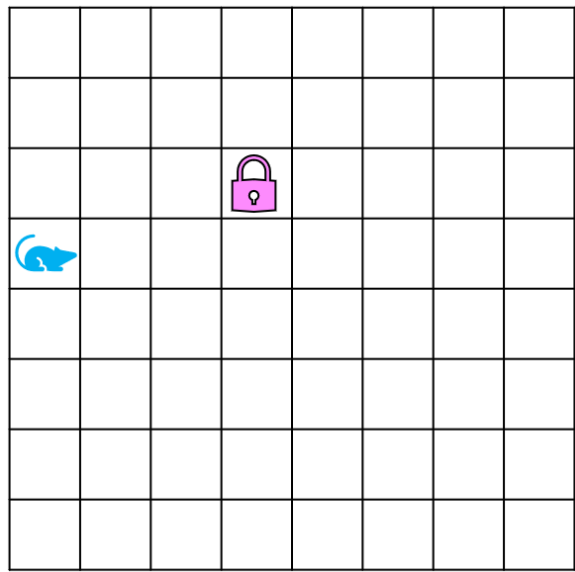
For the success of this “Human Marbles”-approach, it might be beneficial in the first lesson to bring marble tracks along and show children, how they work and also let them play with them.

# EXERCISES

## Station 1: Action seals and linear track pieces

### DOOR EXERCISE

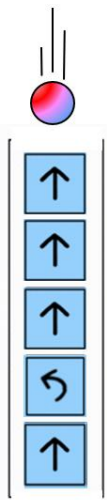
Niña and her robo-mice Atari have escaped from their cell and are looking for a way out. They come across a door that has a sign that says “Danger: High Voltage”. Niña thinks that there might be something useful behind the door, but she doesn’t want to risk getting electrocuted. She decides to use Atari as a remote control and guide him to the door switch. Can you help her?



Available pieces, marbles and action seals

- Marbles: 1
- Move forward arrows
- Move left arrows
- Move right arrows

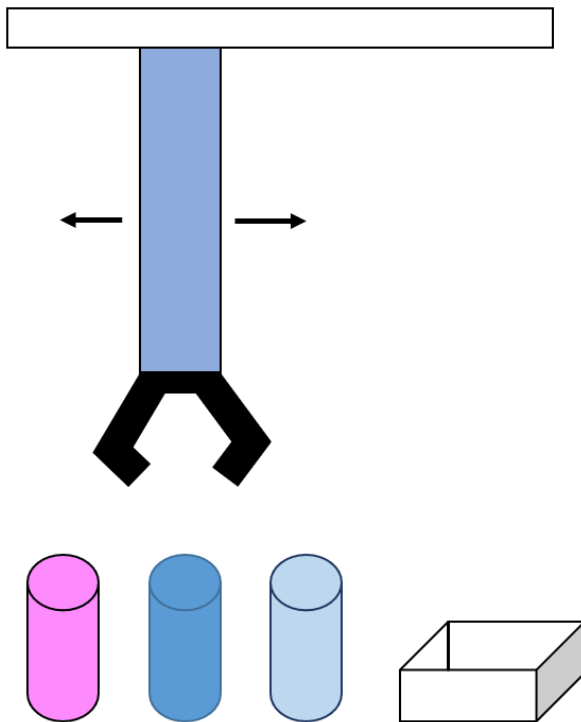
Solution



## CRAFTING EXERCISE

*The alarm goes off anyways! Niña and Atari are running for their lives, but they reach a dead end. The only way out is through a ventilation shaft. But the shaft is blocked by a heavy metal bucket that is hanging from a crane. Niña needs to find a way to remove the bucket and clear the way. She spots a giant grappler on the other side of the room that can grab and lift objects. She thinks that if she can make the grappler grab the bucket and throw it down the shaft, she can create an opening for her and Atari to escape. But she needs to build a marble track that can activate the grappler and control its movements. Can you help her?*

Throw the pink bin in the shaft on the right side.

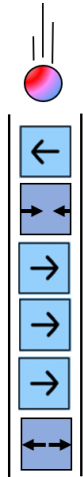


Available pieces, marbles and action seals

- Marbles: 1
- Move left arrows
- Move right arrows
- Grab arrows
- Let go arrows

Solution:

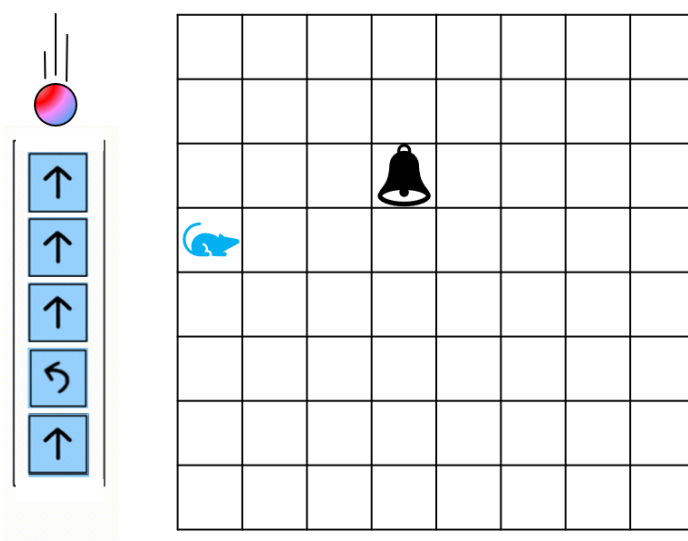




### HACKING EXERCISE

*Niña and Atari manage to hack into the grapppler and make it grab the bucket. But they face another problem: the grapppler is programmed to only move in a straight line. It can't turn or tilt. Niña needs to find a way to change the grapppler's direction and angle. She notices a control panel on the wall that has a joystick and a dial that control the grapppler's movement. She thinks that if she can hack into the control panel, she can make the grapppler move however she wants. But she needs to manipulate the behaviour of the existing marble track that connects the control panel to the grapppler and adjust the joystick and dial settings. Additionally, the panel has the build-in security mechanism, that triggers a marble immediately on touch, setting off an alarm. At the same time, Nina has to prevent the alarm from going off. Can you help her?*

Now consider the following situation. Sensors in the floor will inevitable trigger the shown marble, letting going off an alarm. But Nina is able to get access to the marble run and remove an action seal. Can she turn the alarm off?



Solution:

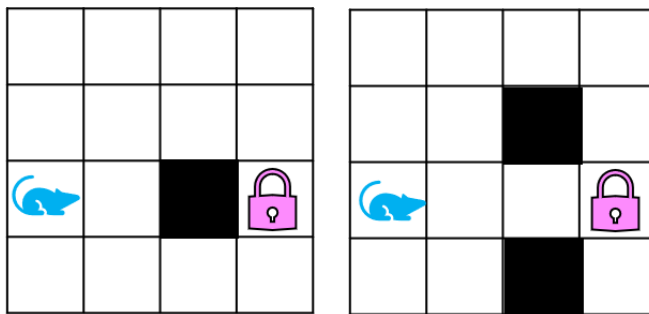
Removing any piece would work.

## Station 2: Branches

### DOOR EXERCISE

*At the end of the ventilation shaft, Niña and Atari Hyper Corp's research lab, where they hope to find clues about their super marble run project. They see a door that has a label that says "Top Secret: Authorized Personnel Only". Niña is curious about what's behind the door, but she knows that it's probably guarded by security cameras and lasers. She decides to use Atari as a spy and sneak him past the obstacles. Can you help her?*

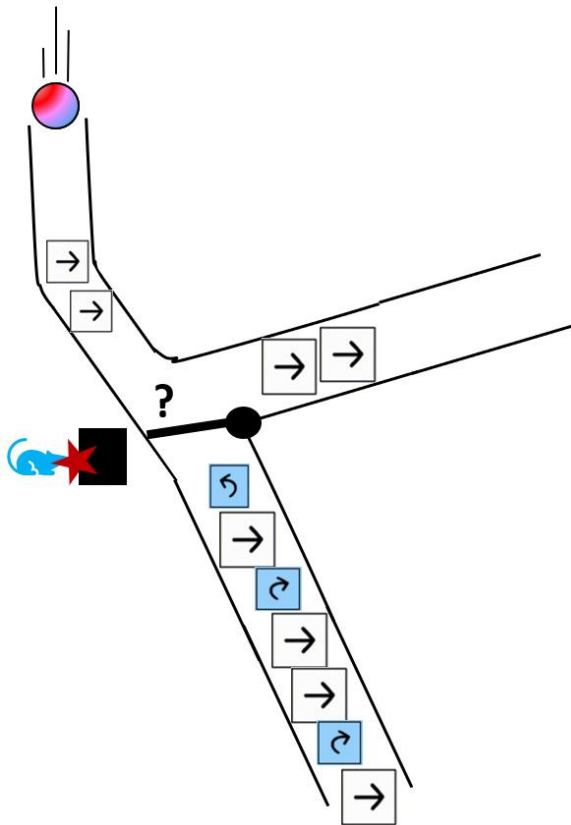
For the door to the next room, Nina has two plans and doesn't know, which one is the right. But she has only one try. The marble run has to work, no matter how the security system actually works inside.



Available pieces, marbles and action seals

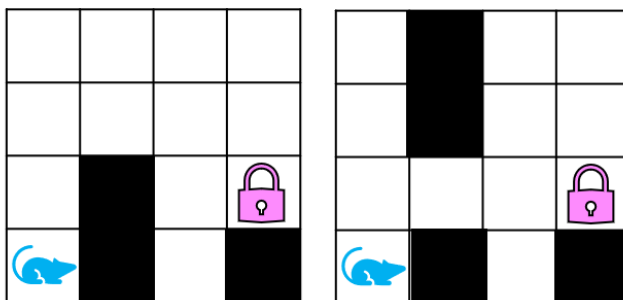
- Marbles: 1
- Move forward arrows
- Move left arrows
- Move right arrows
- Loops
- Branches

Solution:

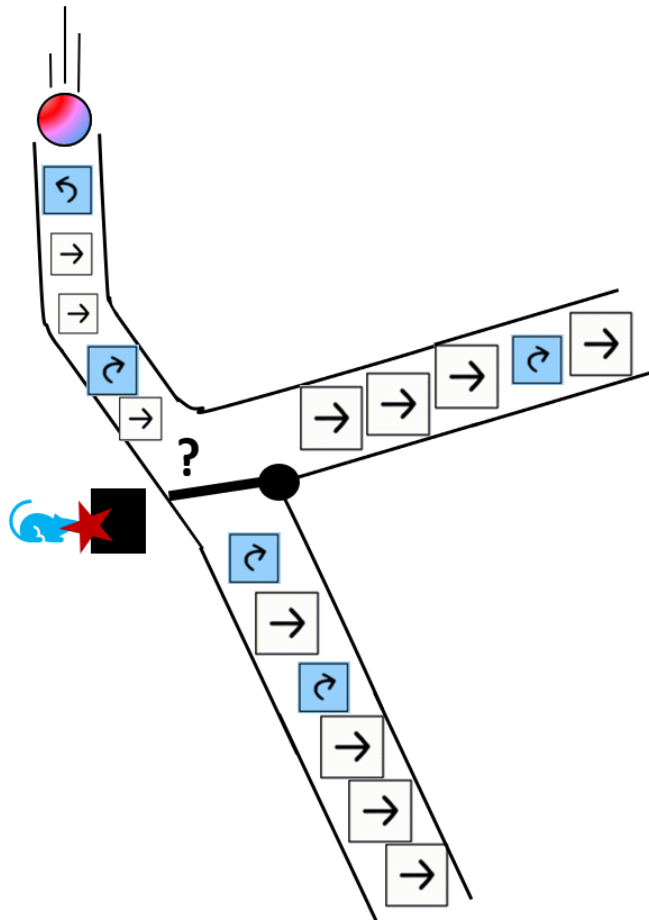


# CRAFTING EXERCISE

Niña and Atari have found a secret storage room that leads to the most secret files of the corporation. But the room is blocked by a heavy metal door. Niña notices a small hole in the wall to the right that is just big enough for Atari to fit through. She decides to send Atari to the other side and try to unlock the door from there. Can you help her?



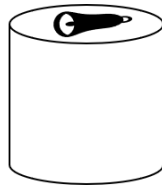
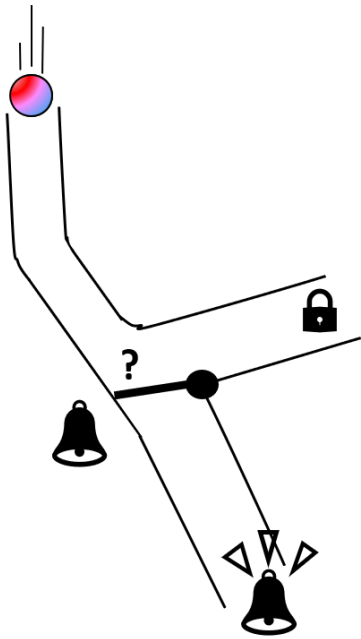
Solution:



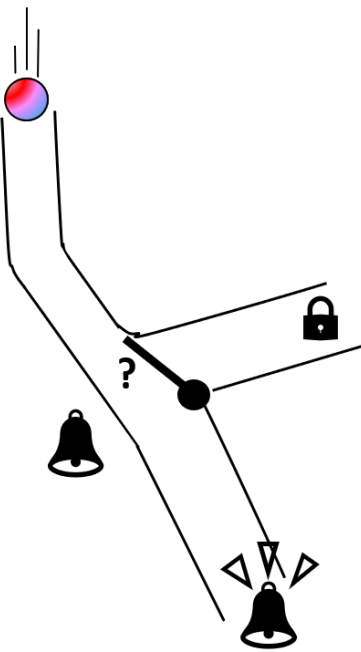
## HACKING EXERCISE

*Niña and Atari have connected their device to the secret data from the story room, but they encounter a problem. The marble run has a security system that prevents unauthorized access. They cannot download the data without letting the alarm go off again. Niña needs to use her marble run skills to hack into the marble run and bypass the security system. Can you help her?*

You are able change the behaviour of one element. Can you prevent the alarm from going of **and** prevent the door from locking?



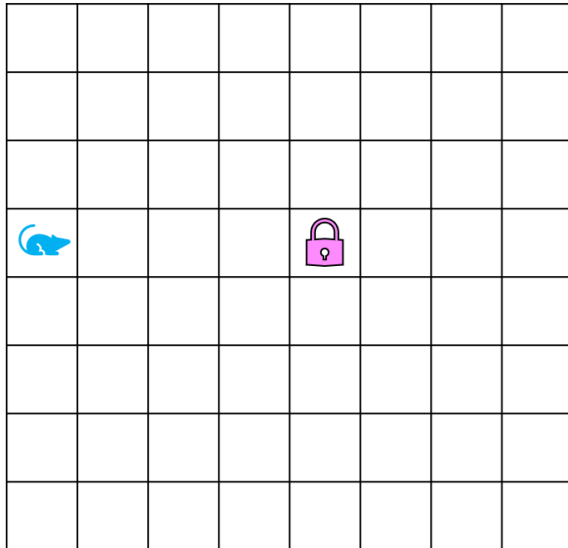
Solution:



### Station 3: Loops

#### DOOR EXERCISE

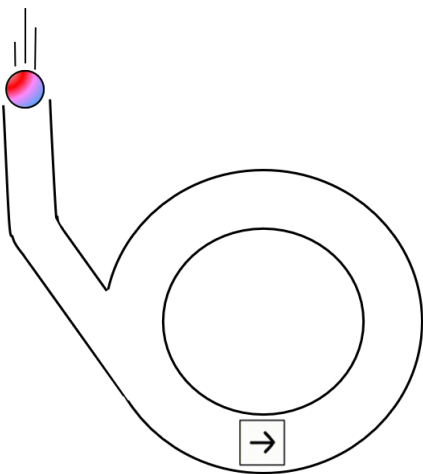
*The security cameras will have recorded Niña activity in the secret room. They need to erase their traces. Luckily, they find a map of the building and after a while, Niña and Atari have reached the door to the surveillance room, where they can erase Hyper Corp's security footage. But the door is locked with a simple marble lock. Niña needs to use her marble run skills to create the right programming for Atari and open the door. Can you help her?*



Available pieces, marbles and action seals

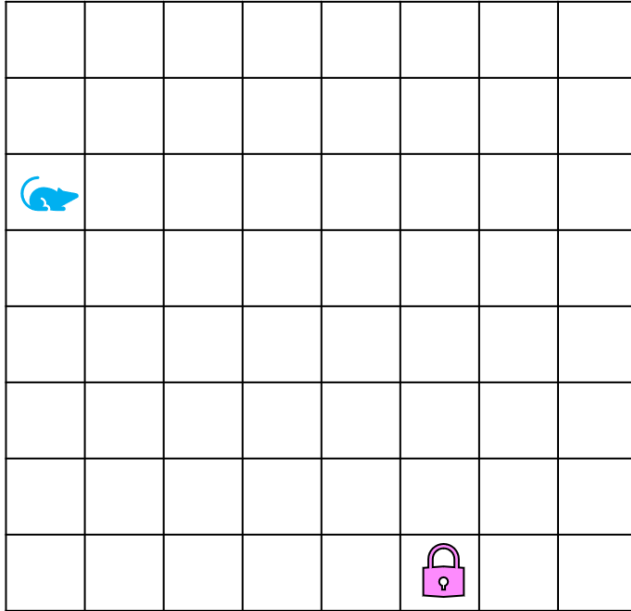
- Marbles: 1
- Move left arrows: 1
- Move right arrows: 1
- Move forward arrows: 1
- Loop piece: 1

Solution:

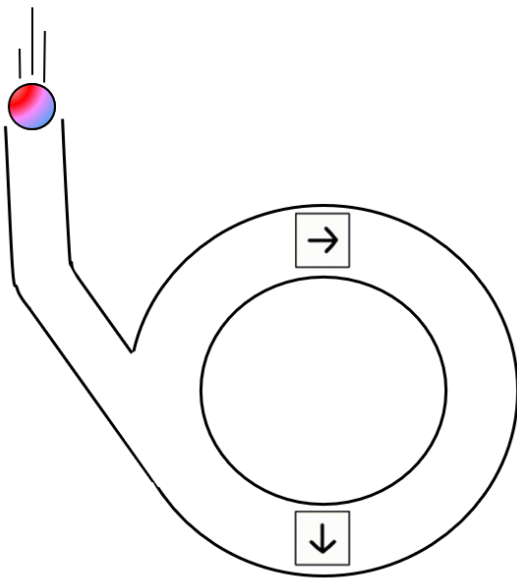


## CRAFTING EXERCISE

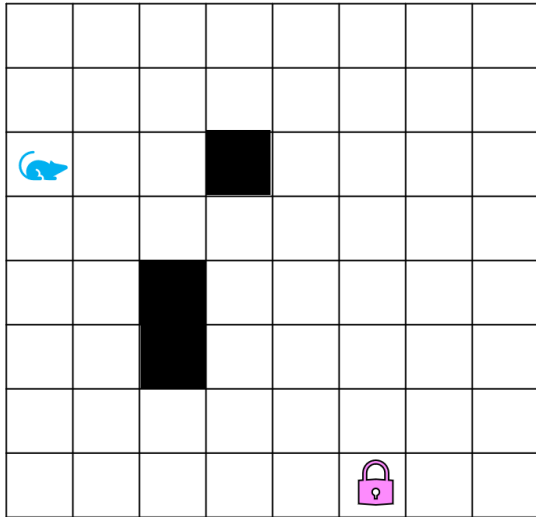
*Niña and Atari have entered the surveillance room, where they see a lot of monitors and cameras that record Hyper Corp's activities. Niña needs to use her marble run skills to build a device that can access and delete the footage. For that, she already has Atari, but how does he could get to the story? Can you help her?*



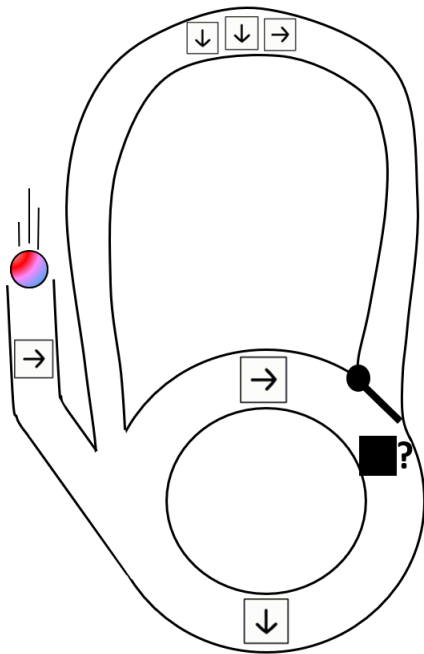
Solution:



## CRAFTING EXERCISE

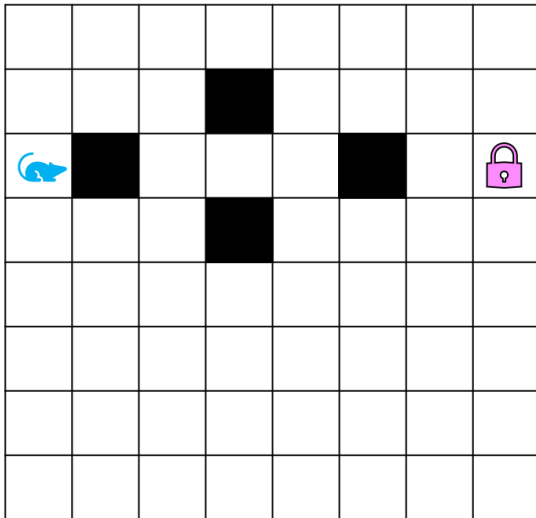


Solution:

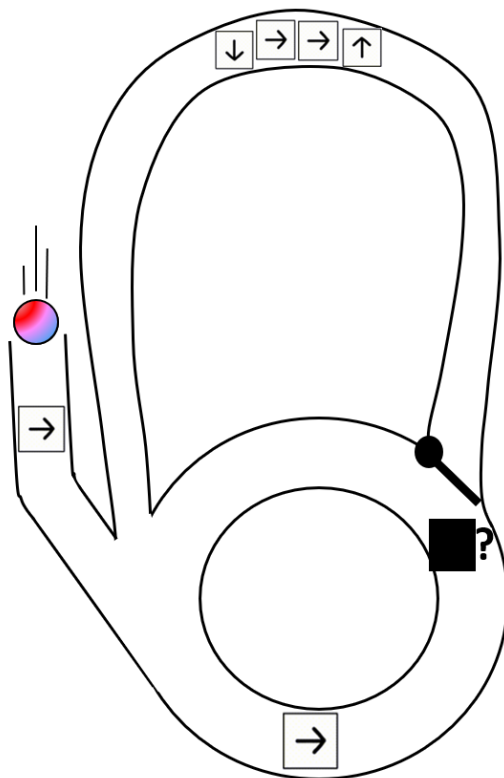


CRAFTING EXERCISE





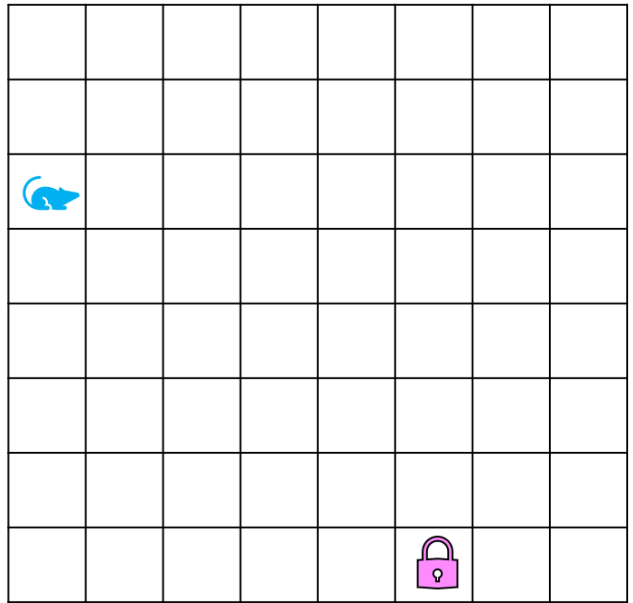
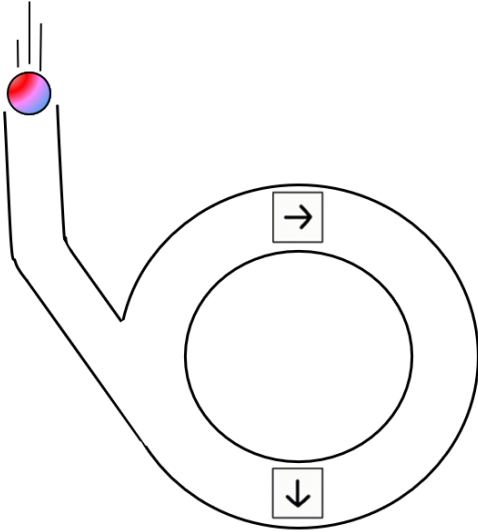
Solution:



## HACKING EXERCISE

*Niña and Atari have accessed the footage, but they face another challenge. The footage has a watermark that identifies Hyper Corp as the owner. Niña needs to use her marble run skills to hack into the system that paints the watermark on the footage. If she can alter it in a way, that it draws something different, she will be fine. Can you help her?*

Can you modify the track in a way that it draws something different?



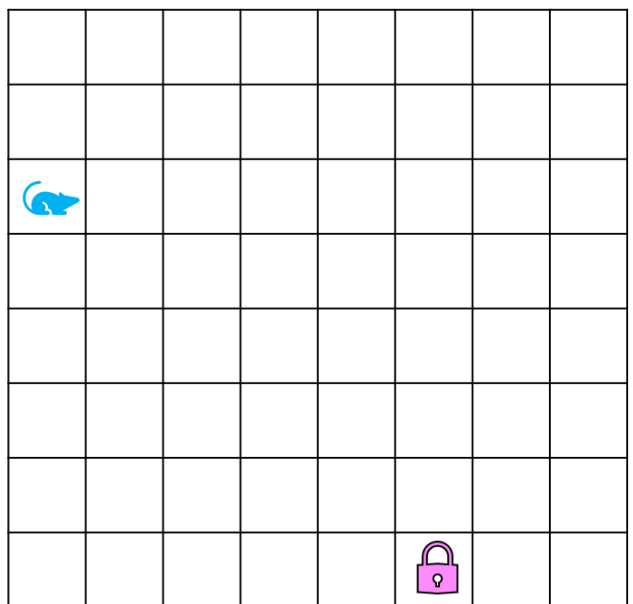
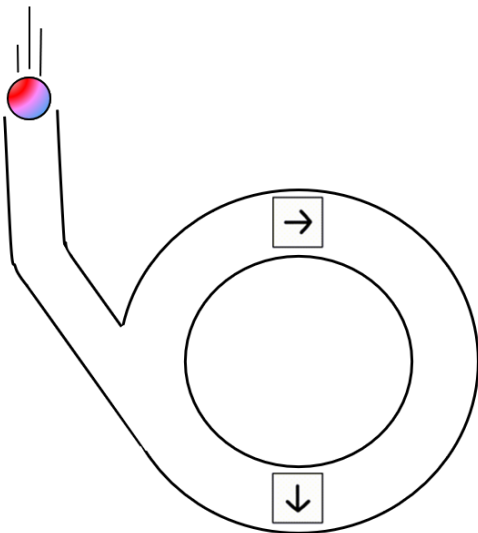
One possible solution:

Remove any seal.

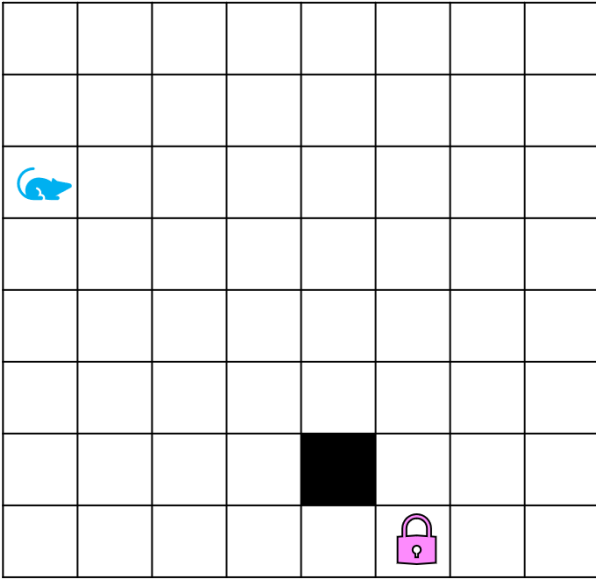
#### HACKING EXERCISE

*Niña and Atari have deleted the footage, but they notice that it's intercepted by Hyper Corp's agents. Niña needs to use her marble run skills to hack into the radio transmitter and scramble their message. Can you help her?*

You can place one tile on the map to stop the marble run from working.



One possible solution:

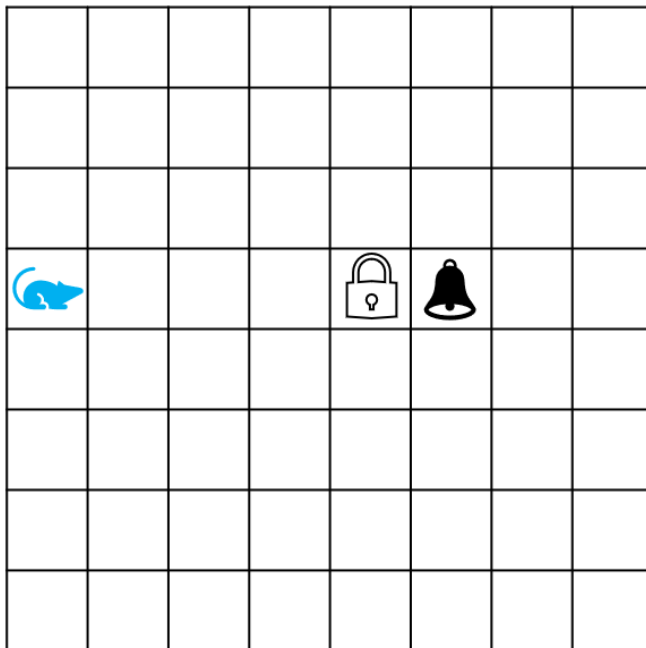


## Station 4: Saving and checking Values in Marbles

### DOOR EXERCISE

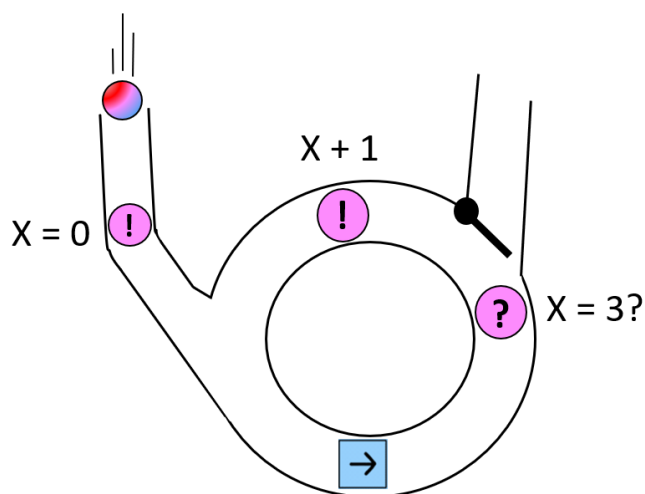
Niña and Atari have discovered a hidden elevator that leads to the rooftop, where they can signal for help. But the elevator is locked with a voice recognition system. Niña needs to mimic the voice of one of Hyper Corp's agents and say the correct password. She decides to use Atari as a recorder and play back the voice samples she has collected. But she needs to get Atari close to the lock so that they can circumvent the system that detects whether the system was said by a machine or a robot. Can you help her?

Get as close to the voice recorded as possible without enabling the alarm trigger.



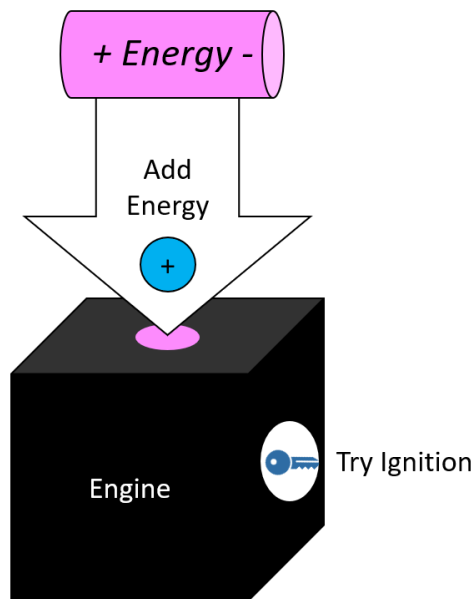
Solution:

For the solution, we need marble operation seals.



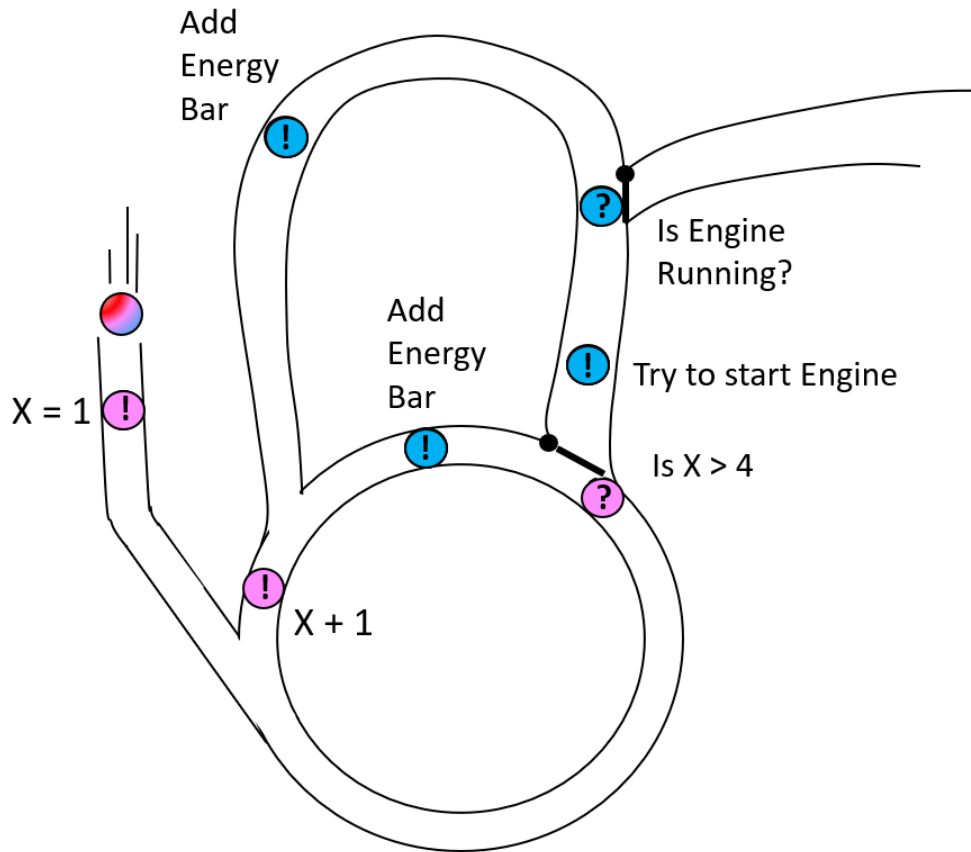
## CRAFTING EXERCISE

*Niña and Atari have reached the rooftop and found a helicopter that they can use to escape. But the helicopter is turned off and the keys are missing. Niña needs to find a way to start the helicopter without the keys. She decides to use Atari as a jumper cable and connect him to the helicopter's battery and ignition. But she needs to build a marble track that can deliver a strong electric current to Atari and make him spark the ignition. Can you help her?*



Create a marble run that adds ten energy bars to a vehicle and then tries to start the engine. If it still doesn't run, more energy bars are added.

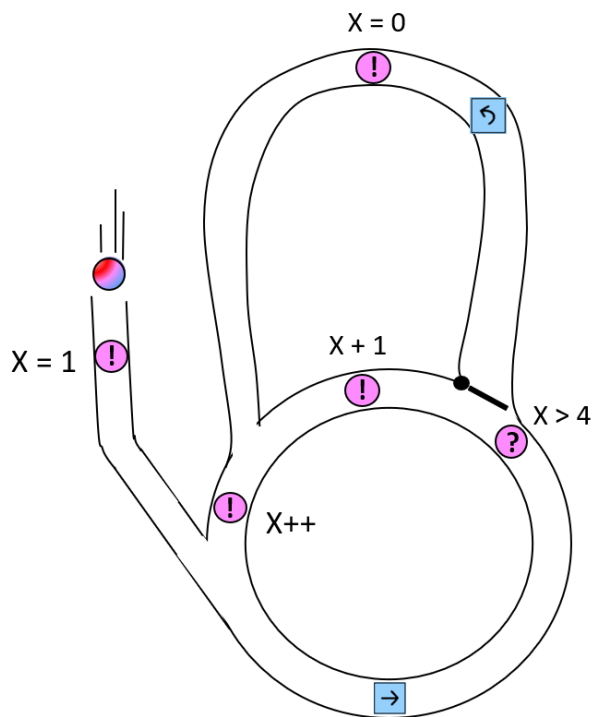
Solution:



#### HACKING EXERCISE

*Niña and Atari have started the helicopter and are ready to escape. But they face a problem: there is a bot guarding the rooftop that shoots lasers at them. Niña needs to find a way to avoid the bot and take off safely. She decides to hack into the bot's control tower and change its route. But she needs to manipulate the behaviour of the existing marble track that connects the tower to the bot and adjust the direction and speed settings. Can you help her?*

The bot is guarding the premise in the shape of 4 by 4 rectangle. Manipulate his marble run such that we walk against a wall. You can add or remove one marble seal.



🤖							

One possible solution: Remove check whether  $X > 4$ -seal.

## Station 5: Input and Output of Marble runs

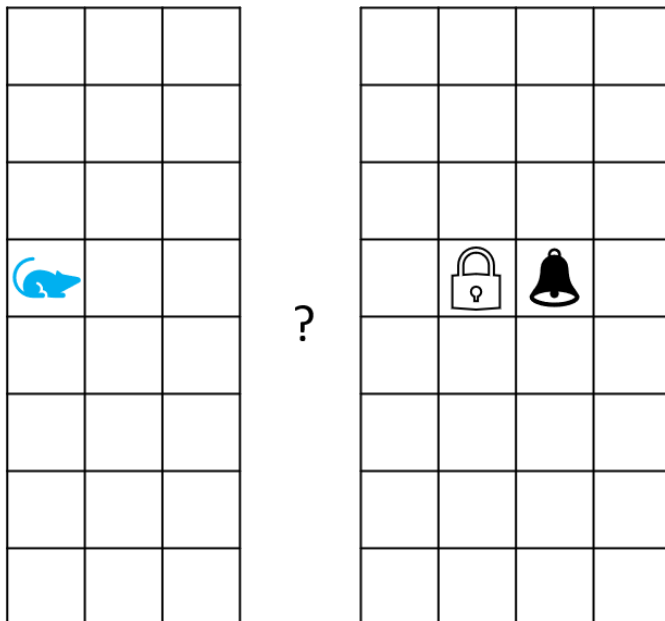
### DOOR EXERCISE

*While they hack into the guard tower, the helicopter behind them flies into the air and crashes into a wall of a nearby tower. As it turned out, he, too, was controlled by the tower to guard the premise. They now have to find another way out of the corporation's building.*

*They look around and see a zip line that connects the rooftop to another building. Niña thinks that they can use it to slide down and escape. But for that, they need to de-activate the deadly lacers attached to the sides of the building.*

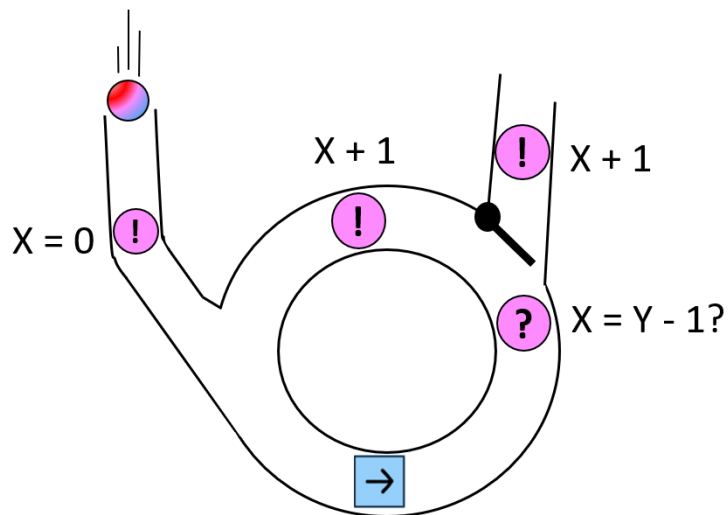
*She decides to use Atari as a remote and a magnet. But she needs to build a marble track that can send Atari to the lacer's control panel and deactivate them. Also, she has no clue, how for the laser actually is away. Can you help her?*

Now we don't know how many cells until the end. This only knows a person from the corporation, who doesn't know Nina is Nina and who only scratches the value on the marble. We cannot ask how much he entered. That means the program needs to work for every value. The other person will scratch the value on the marble, assigned to the variable "Y". Afterwards we want to look on the marble and see how many cells it actually was for the future to publish.



Solution:









## CRAFTING EXERCISE

*Niña and Atari have escaped from the Hyper Corp building and reached a safe place. Niña needs to send a signal to her hacker friends and let them know that she is okay. She decides to use the Hyper corporation's online shop for that. She sees a list of items that she can buy with some numbers next to them. She knows that these numbers are codes that represent different features of the items, such as size, shape, colour and function. She also knows that some of these codes are hidden messages from her hacker friends, who have hacked into the shop's website and left some clues for her. She needs to figure out which items she needs to put in her shopping basket and what codes they have by ordering them.*

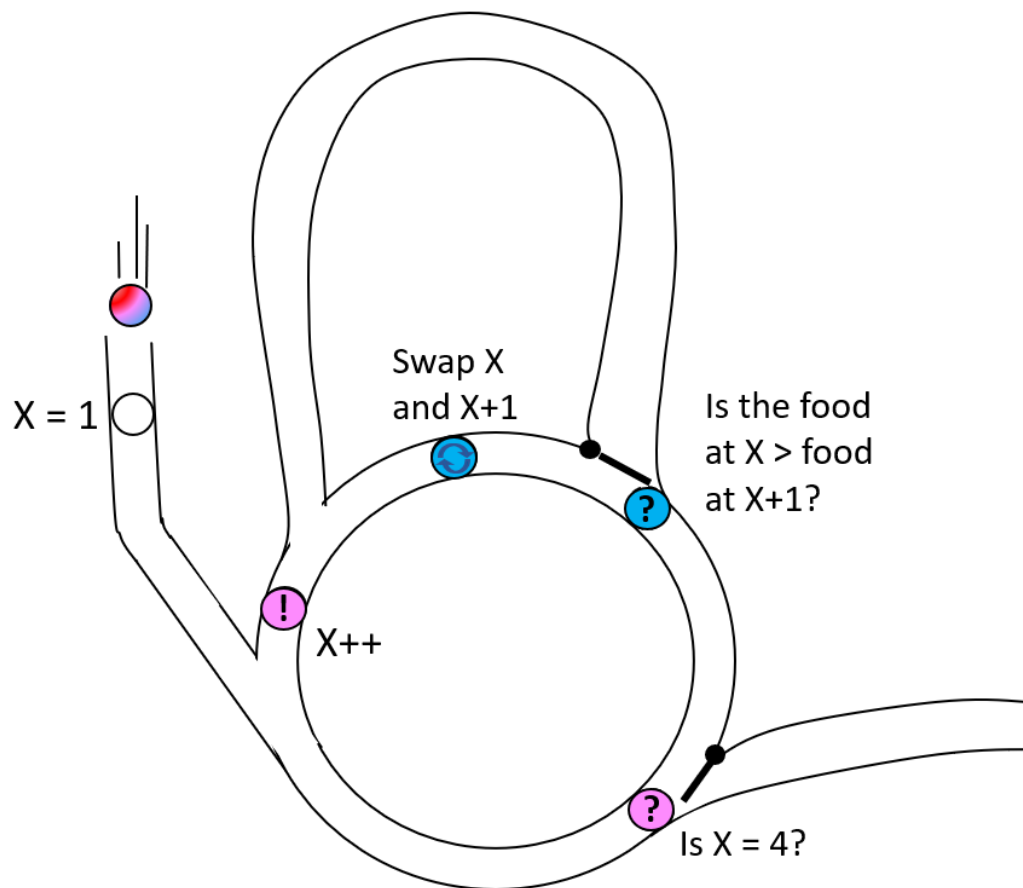
Help order this stuff. The initial positions of the items are written on the marble.

Stuff				
Price per item	40	15	18	30
Place on table	1	2	3	4

Available  
Actions:



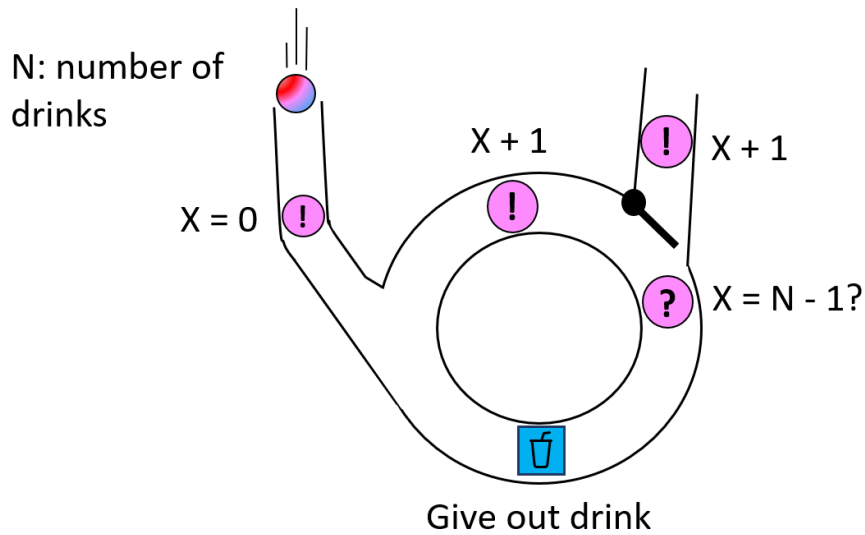
### Solution



## HACKING EXERCISE

*Niña and Atari are thirsty after their escape. They decide to go to the local automatic bar, where they can order energy drinks from a vending machine. But there is a problem: the machine only accepts Hyper Coins, the digital currency of Hyper Corp. Niña doesn't have any Hyper Coins, and she doesn't want to support Hyper Corp. She decides to hack the machine and get some drinks for free. She needs your help to do that.*

Coins are inserted into drink-machine and the number of coins is written by a special mechanical device on the marble, which is then automatically inserted into a machine, which gives out the number of drinks. Nina does not have any money but desperately needs a drink. She manages to get access to the marble track, in which the marble is inserted. She can now insert her own marble. Will she be able to manipulate the marble in a way that she gets as much drinks as she wants?



Solution:

She scratches the number of drinks she wants on the marble in the variable N.

*Nina drinks the energy drinks in one go and then calls a Taxi. And as Nina and Atari see the corporate buildings of Hyper get smaller in the distance, Nina has a great idea for new reggaeton piece to make.*