TURING TUMBLE™

BUILD MARBLE-POWERED COMPUTERS

Practice Guide

Version 1.0 - Covers challenges 1 to 30

Let's practice!

Welcome to the Turing Tumble Practice Guide! This is a free companion to Turing Tumble. This version of the guide covers the first 30 challenges in the book. If it's useful, we'll do the same for the rest of the challenges.

The purposes of this guide are:

1. **To cement important concepts.** Practice challenges give another opportunity to apply what you learned.
2. **To offer hints when you're stuck.** Solve a practice challenge or read the explanation of the solution. This guide lowers the learning curve.
3. **To learn how puzzle solutions work.** Each solution has an explanation that describes how it works.
4. **To offer the puzzles in an easily printable black and white format.** Make as many copies as you like.

What is the best way to use this practice guide?

The practice guide is meant to be used **alongside** the Turing Tumble puzzle book, but it's not meant to replace it. Unlike the Turing Tumble puzzle book, it doesn't contain instructions for how to assemble the computer, how to play, how the parts work, and other bits of useful information.

Is this guide useful to you?

Please tell us what you think! We're always looking for ways to make Turing Tumble better. Just send us an email at hello@turingtumble.com.

Did you find an error?

Please send a quick email to hello@turingtumble.com and we'll fix it right away. We don't like bugs.

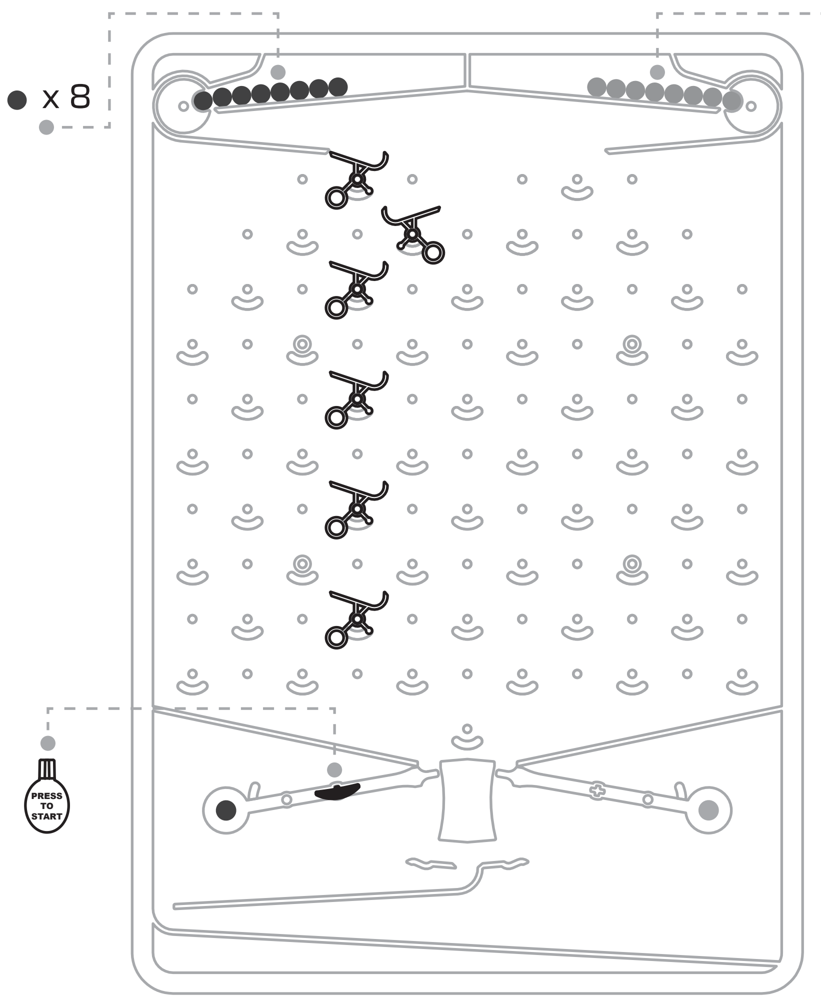
Contents

Challenge 1: Gravity

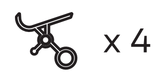
Objective: Make all of the blue balls (and only the blue balls) reach the end.

Required output:

Starting setup



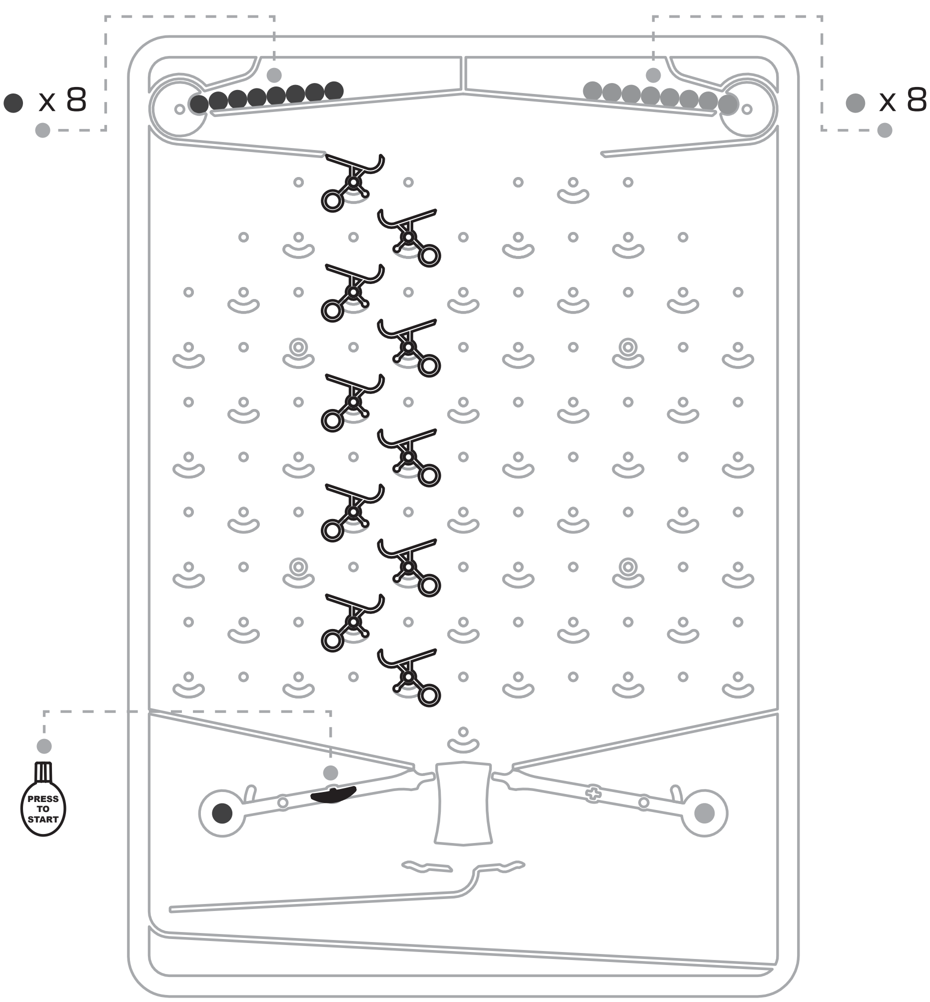
Available parts



Challenge 1 Solution

Explanation: The four ramps complete the path from the top of the board to the bottom of the board.

Remember that it's against the rules to allow balls to fall freely for **any** distance! When a ball rolls off a part, it must immediately land on the next part.

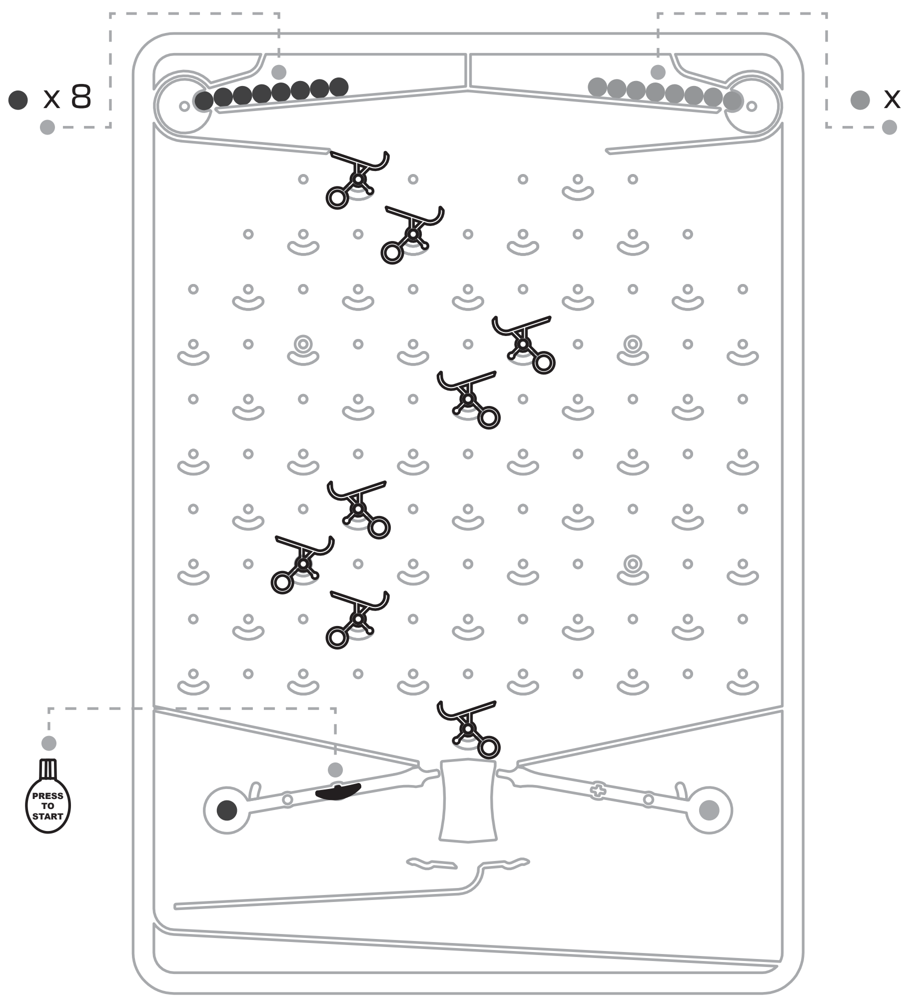


Practice Puzzle A for Challenge 2

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

Required output:

Starting setup

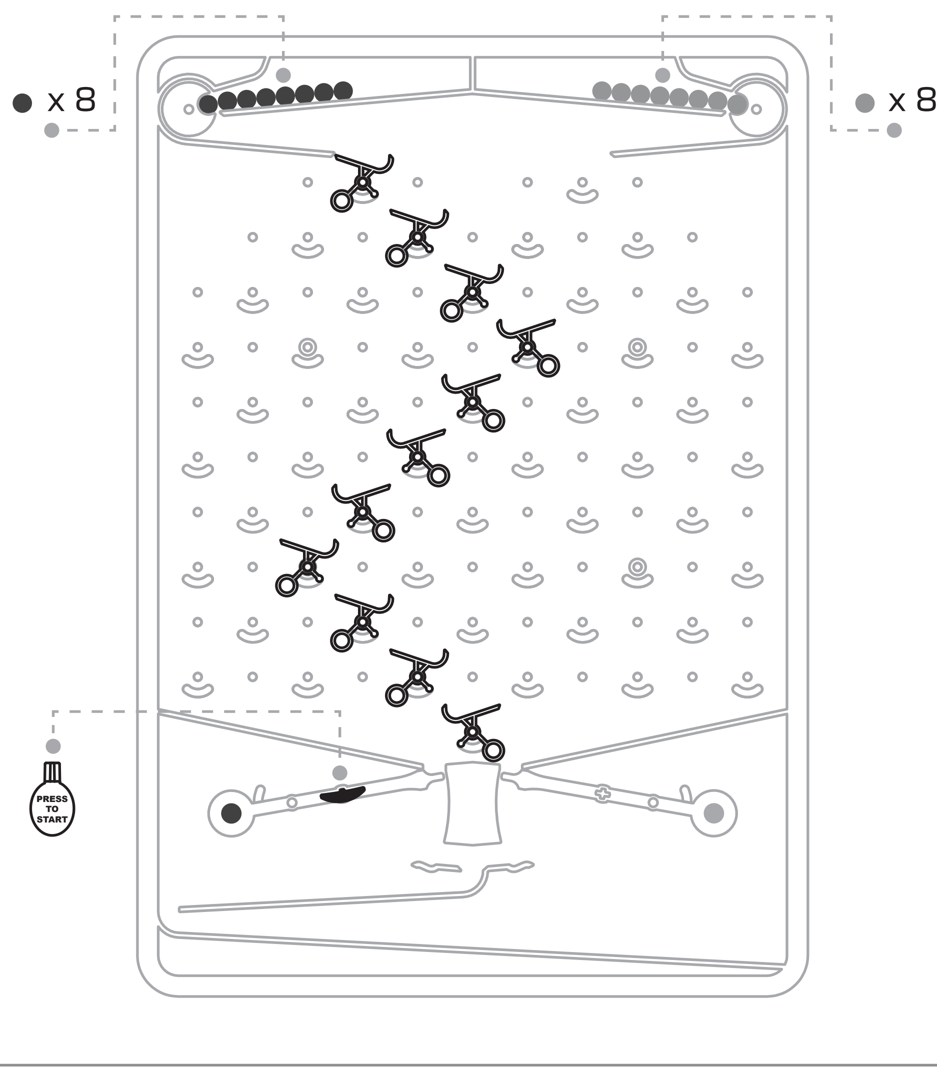


Available parts

x 3

Practice Challenge 2-A Solution

Explanation: The ramps fill the gaps in the path from the top of the board to the bottom of the board.

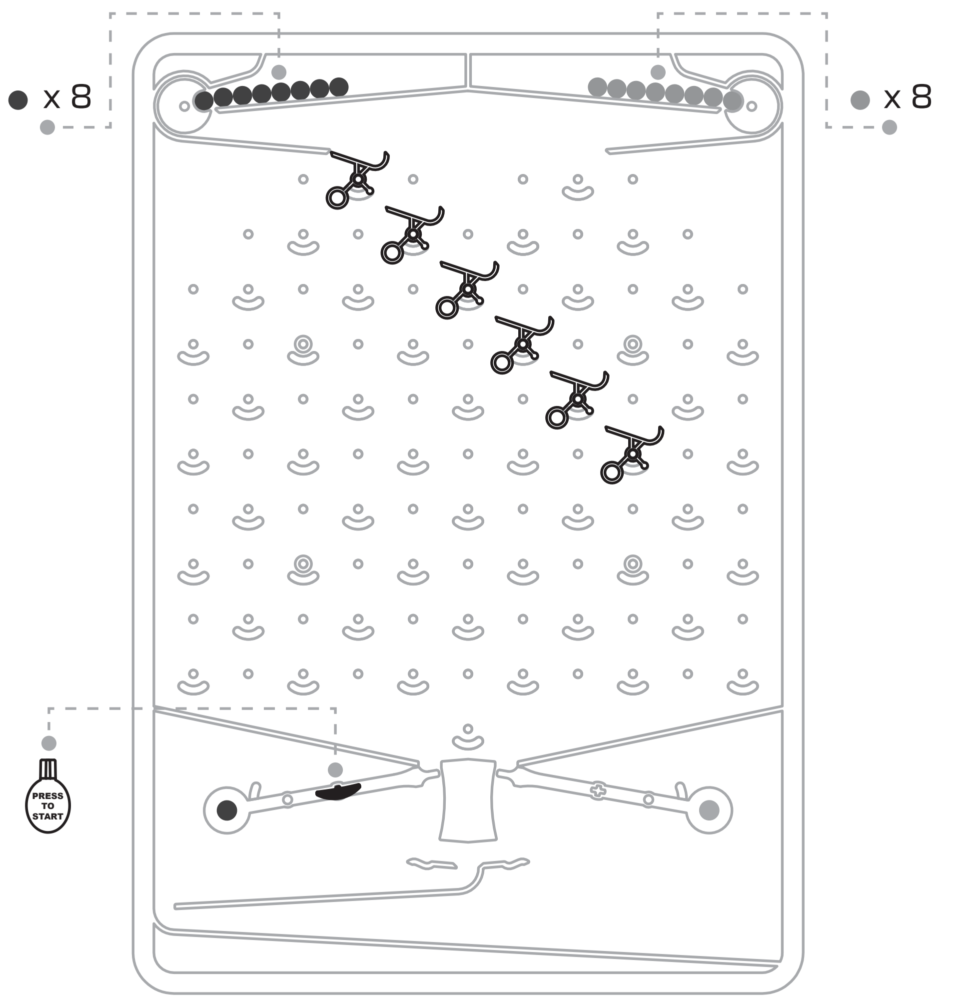


Challenge 2: Re-entry

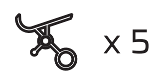
Objective: Make all of the blue balls (and only the blue balls) reach the end.

Required output:

Starting setup



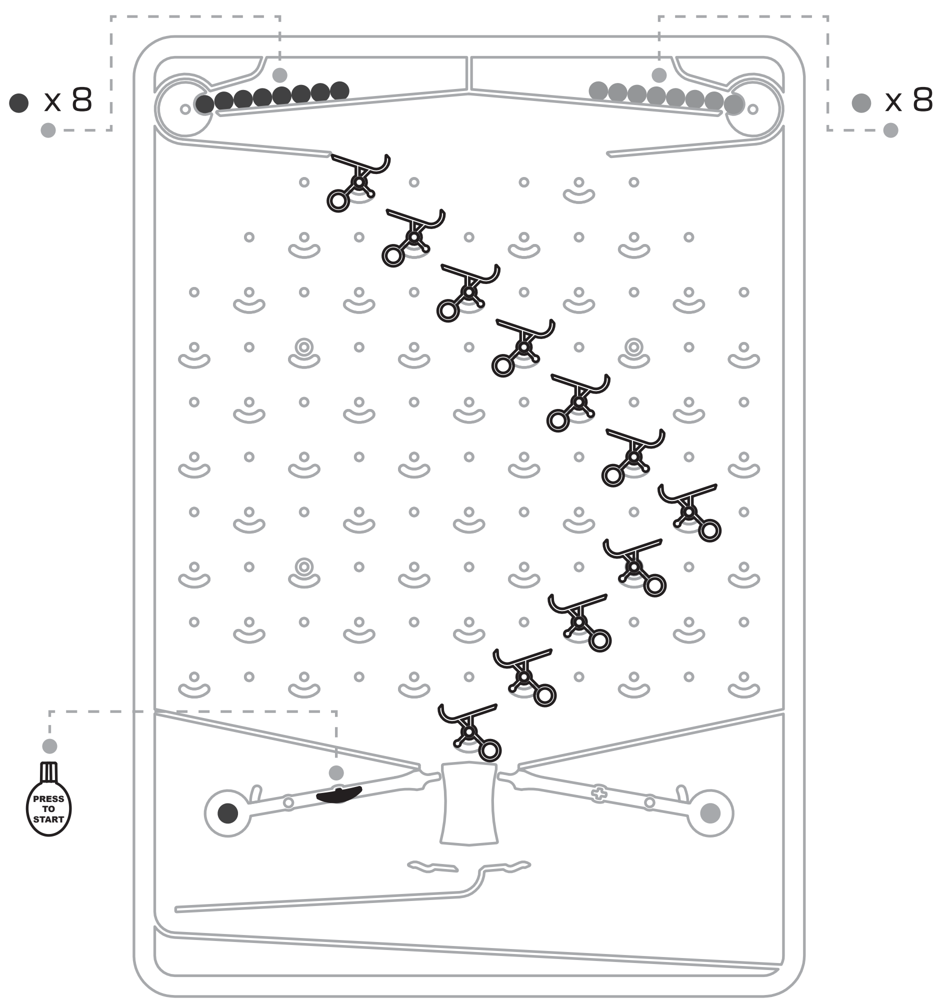
Available parts



Challenge 2 Solution

Explanation: The starting setup leads the balls over onto the right side. That's a problem! If the balls hit the right lever, they'd release red balls, but you're only supposed to let the blue balls get to the bottom.

To solve this puzzle, you have to use the 5 ramps to lead balls back over to the left lever.

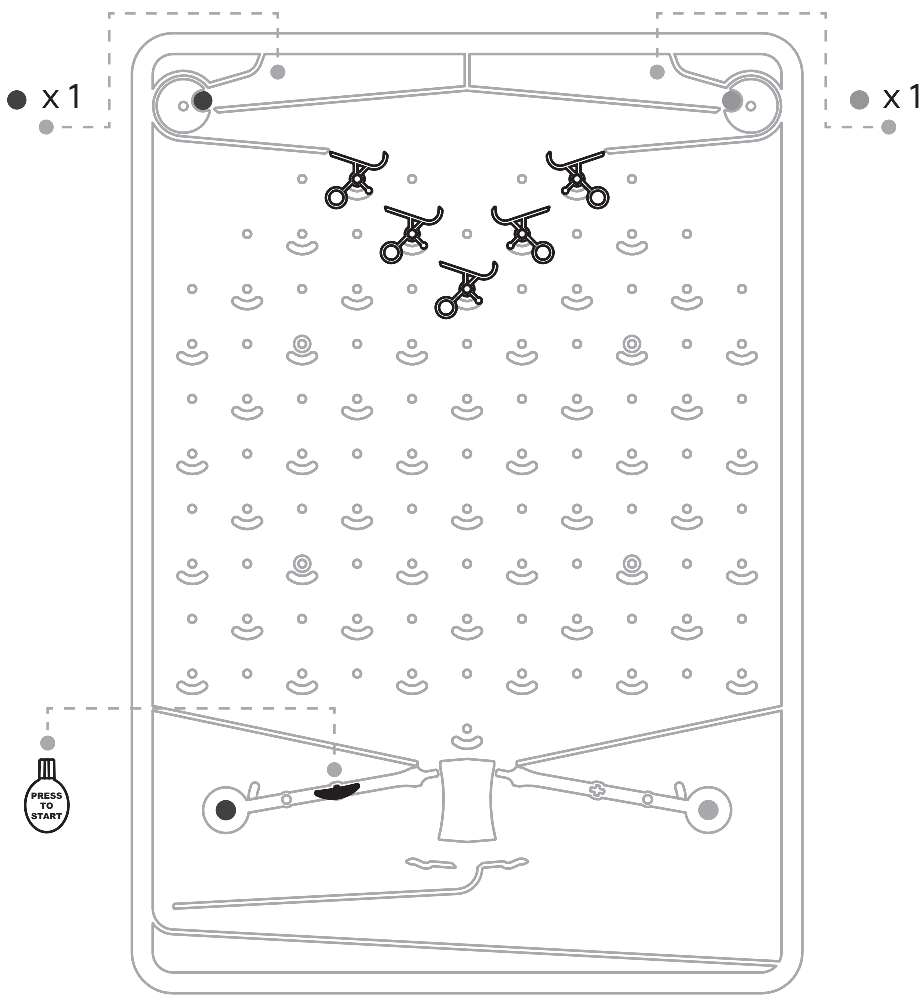


Practice Puzzle A for Challenge 3

Objective: Start the machine by releasing the blue ball. The blue ball should then release the red ball.

Required output:

Starting setup

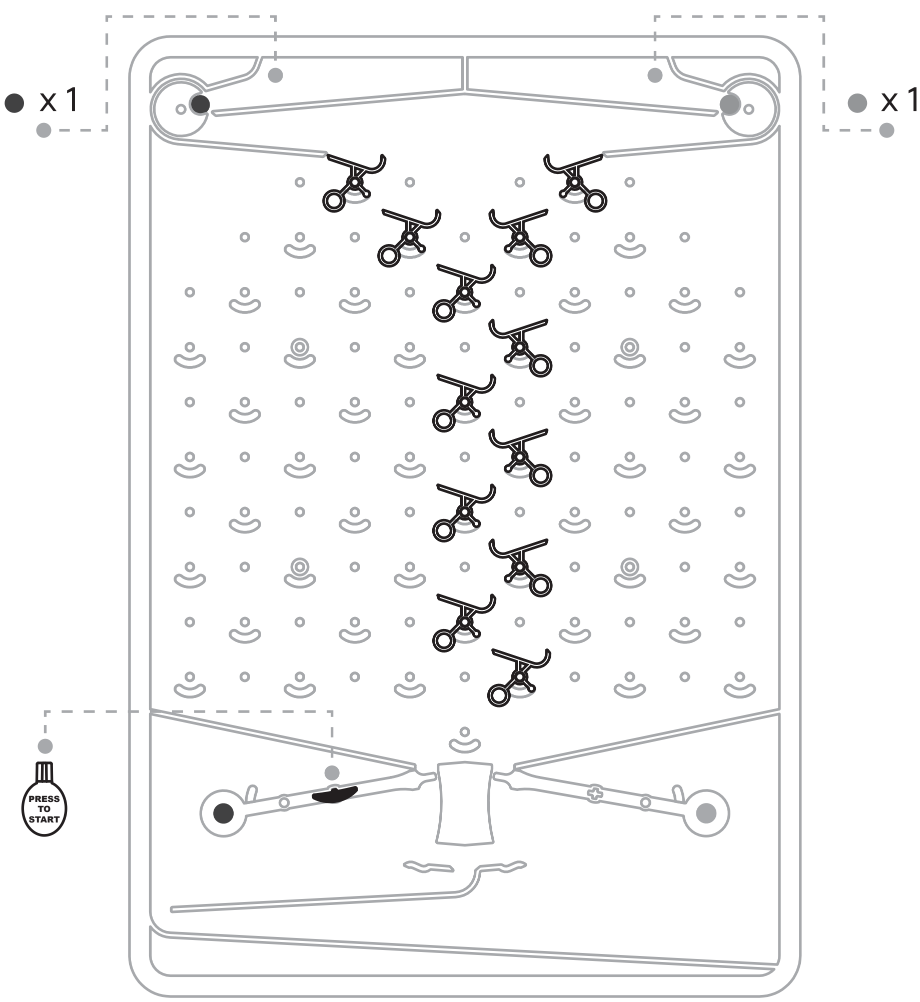


Available parts

 x 8

Practice Challenge 3-A Solution

Explanation: The 8 ramps make a path down to the right lever. When the blue ball is released, it lands on the right lever, releasing the red ball.

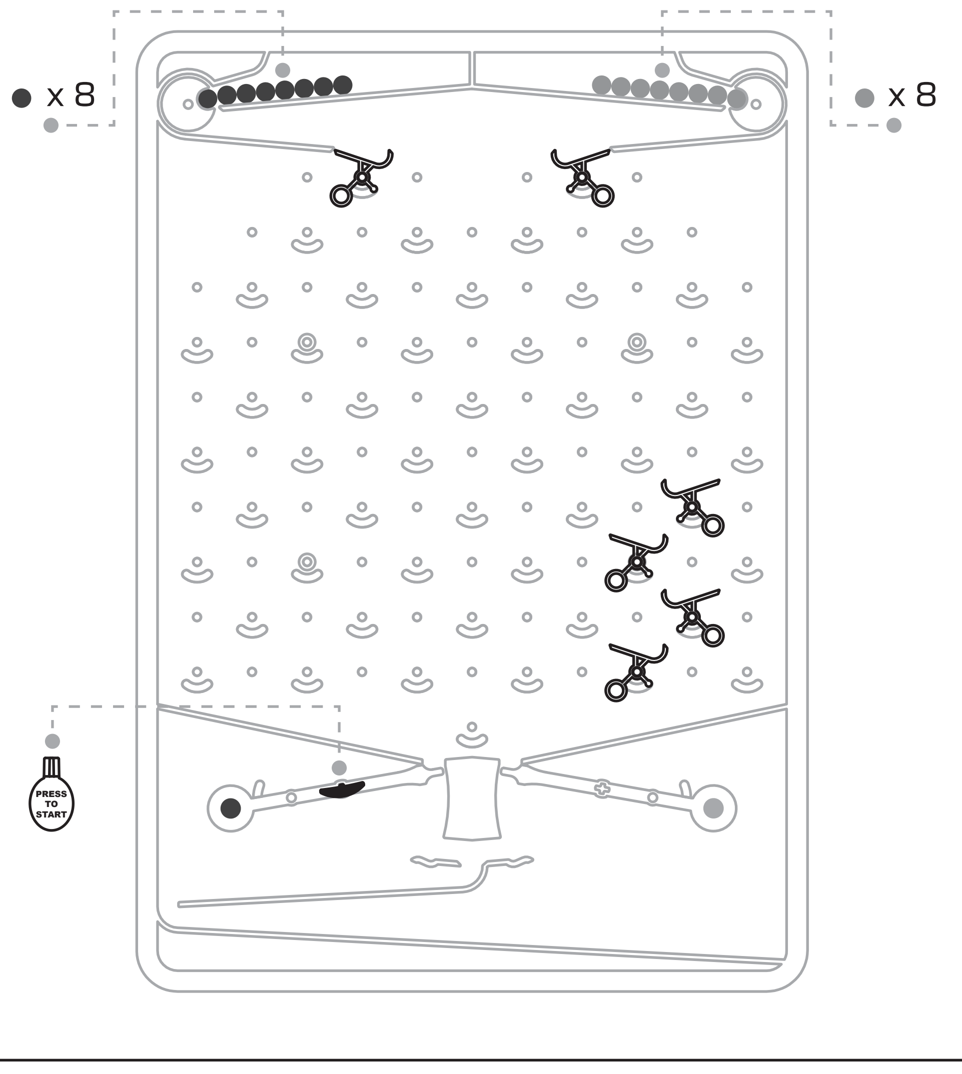


Challenge 3: Ignition

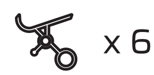
Objective: Release one blue ball and then all of the red balls.

Required output:

Starting setup

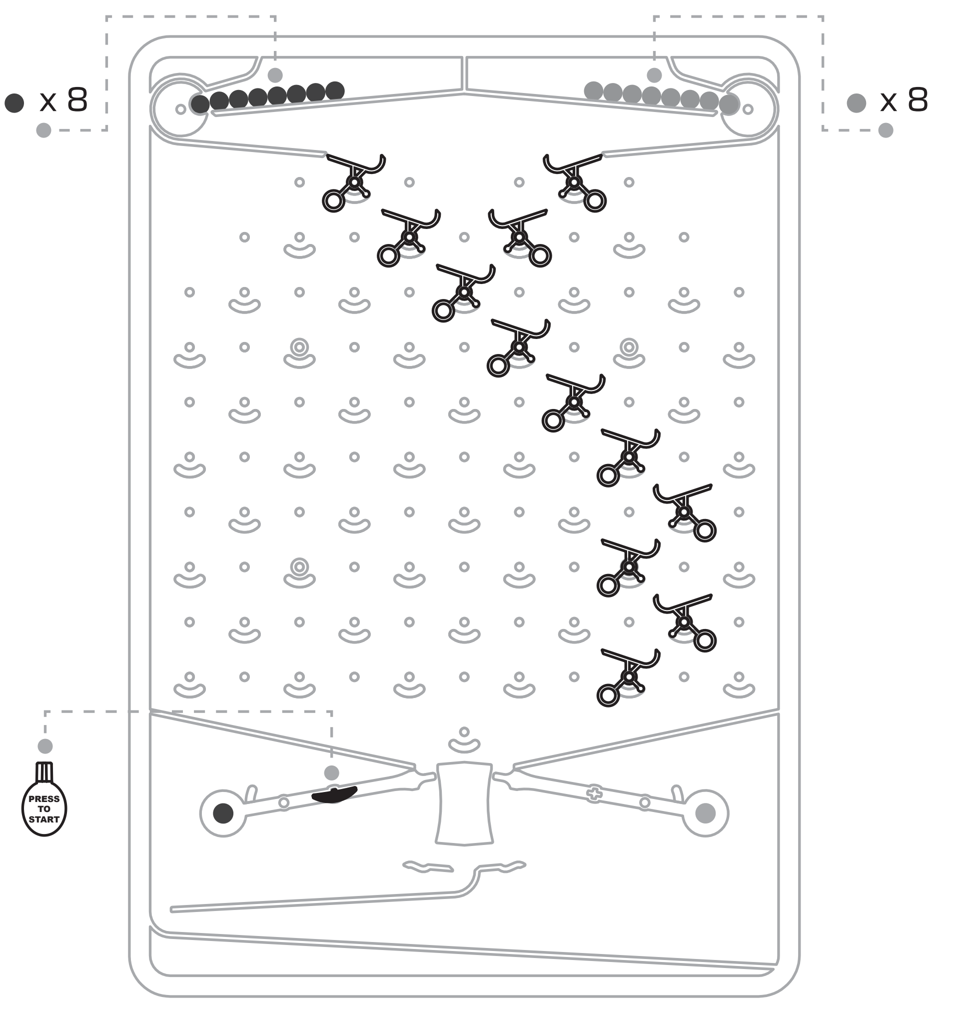


Available parts



Challenge 3 Solution

Explanation: Like the last puzzle, the ramps bring the paths of the red and blue balls into one path that leads to the right lever. After the first blue ball, all the rest are red.

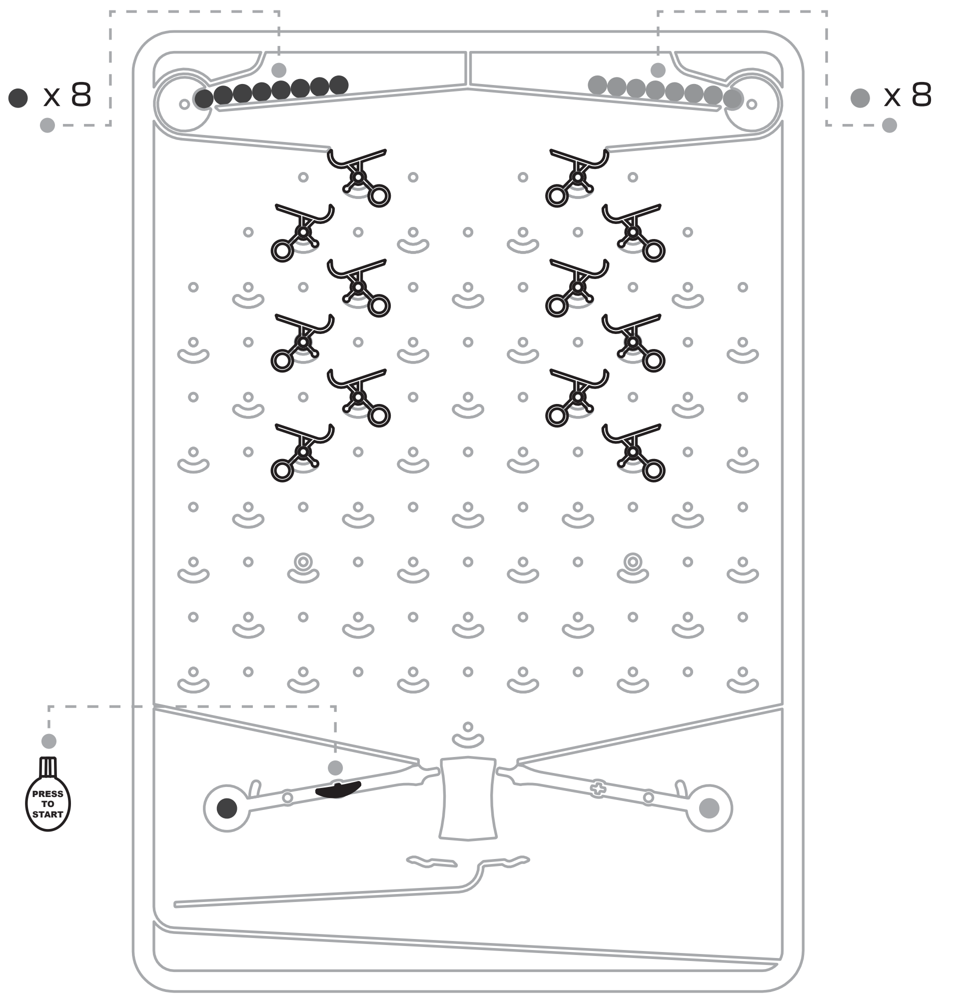


Practice Puzzle A for Challenge 4

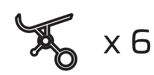
Objective: Release one blue ball and then all of the red balls.

Required output:

Starting setup

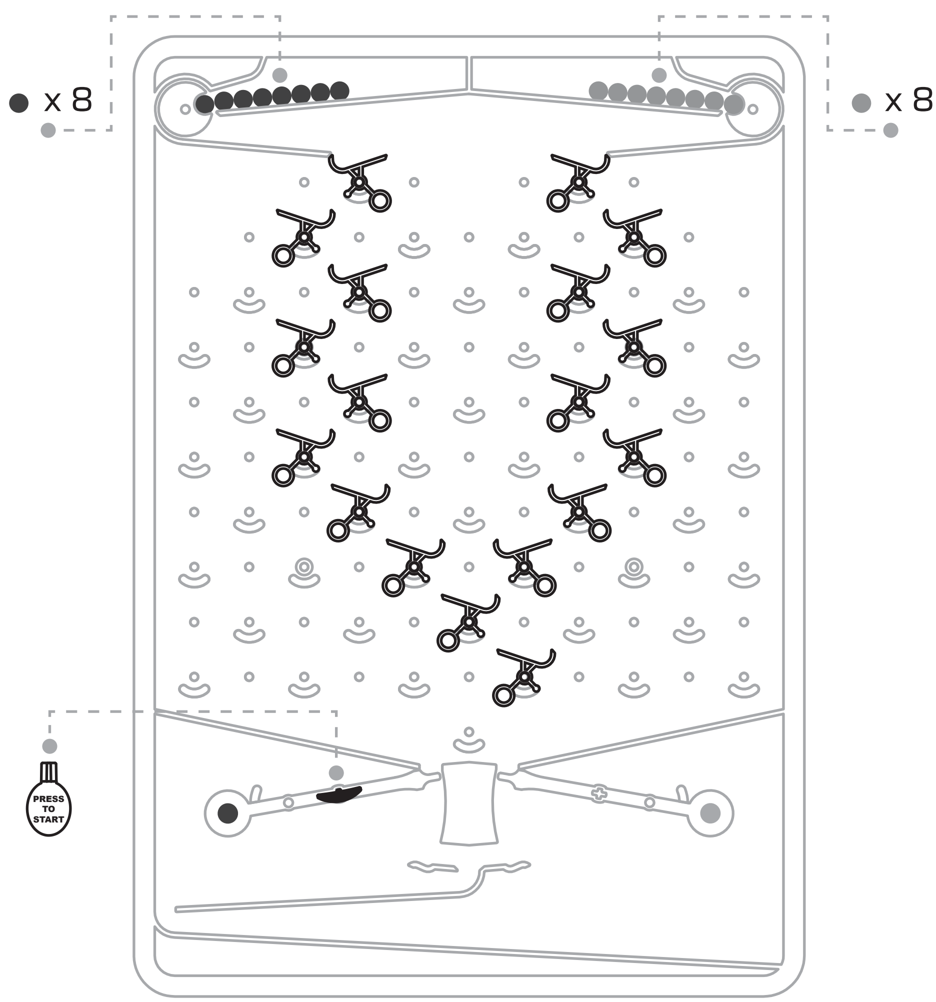


Available parts



Practice Challenge 4-A Solution

Explanation: The paths of the blue and red balls come together near the bottom of the board and then lead to the red side. Since all paths lead to the red side, only red balls are released after the first blue ball.

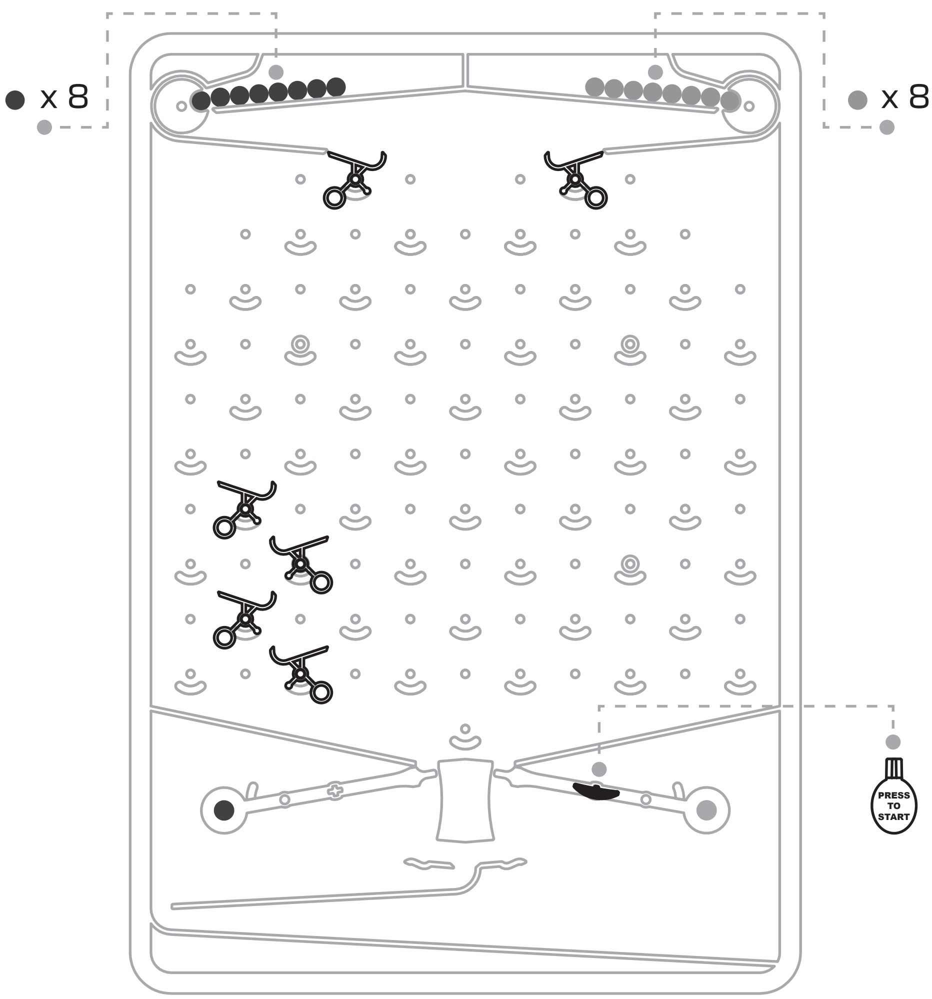


Practice Puzzle B for Challenge 4

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

Required output:

Starting setup



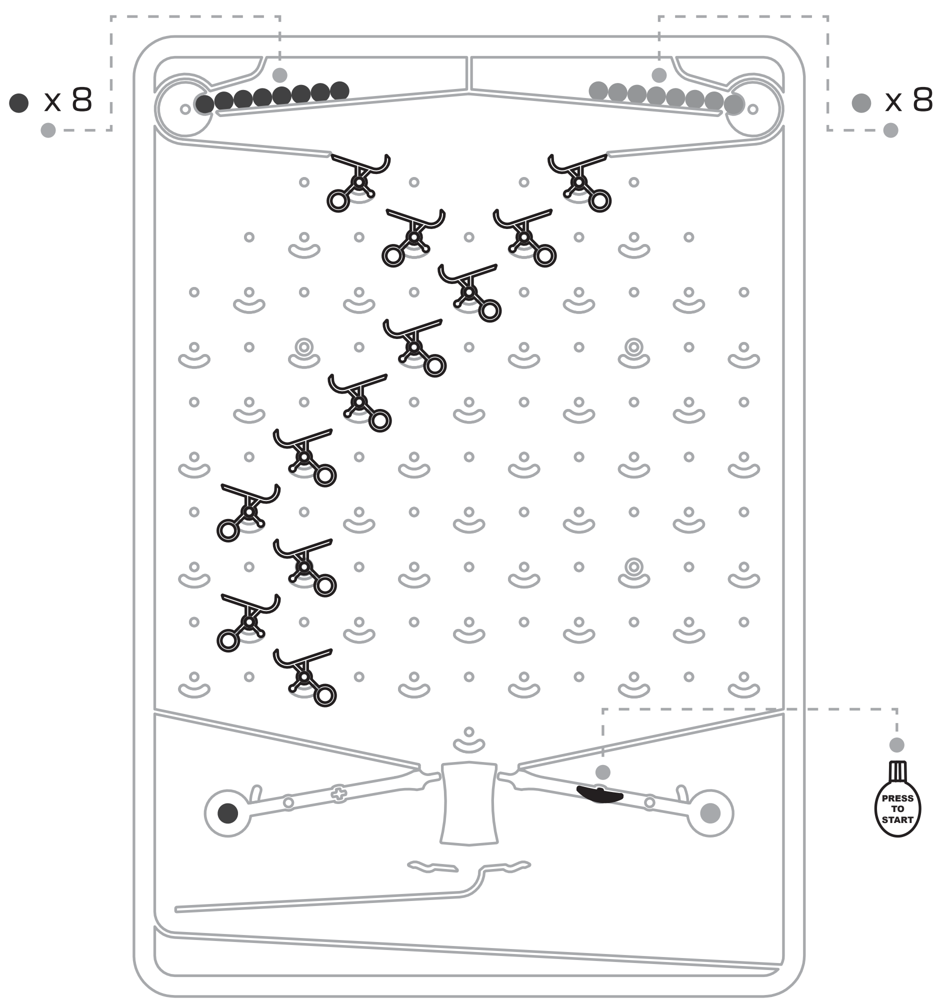
Available parts

x 6

Practice Challenge 4-B Solution

Explanation: This is just like challenge 3, but everything is reversed!

Notice that the “Presser” is on the **right** side, not the **left**, so you start the machine by pressing down the right lever. That makes the first ball red.

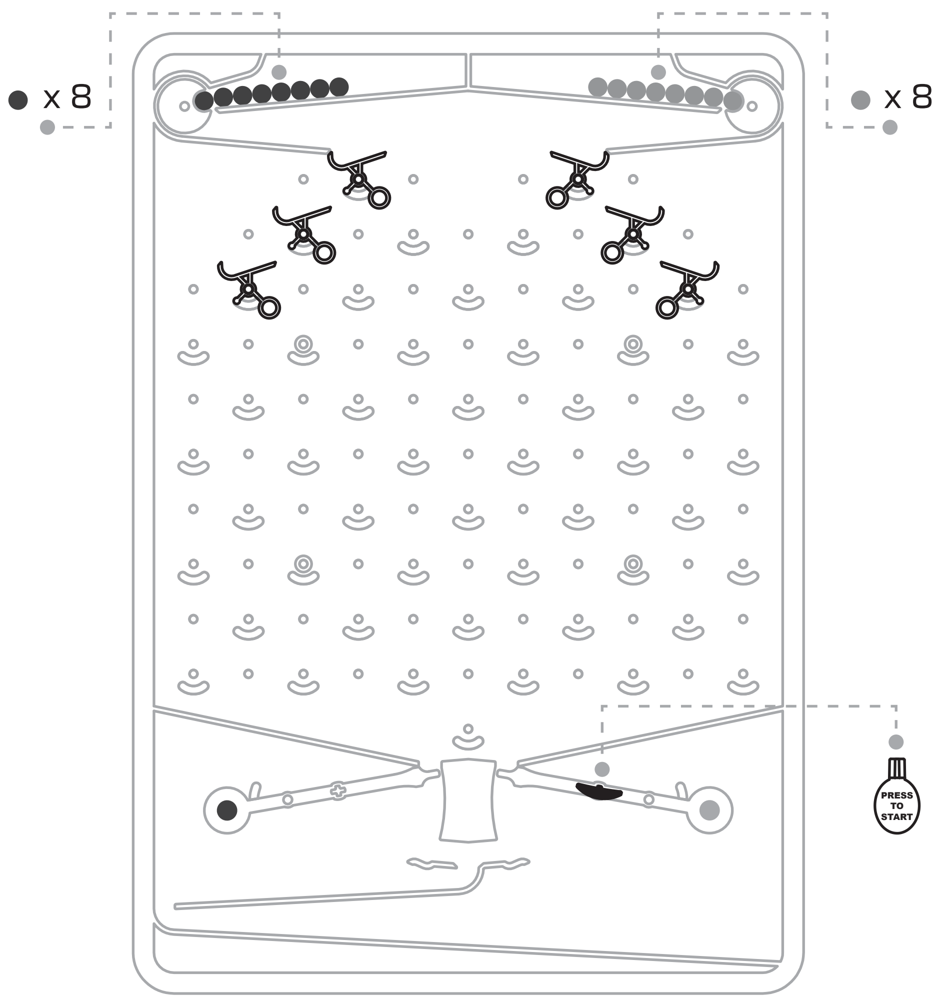


Challenge 4: Fusion

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

Required output:

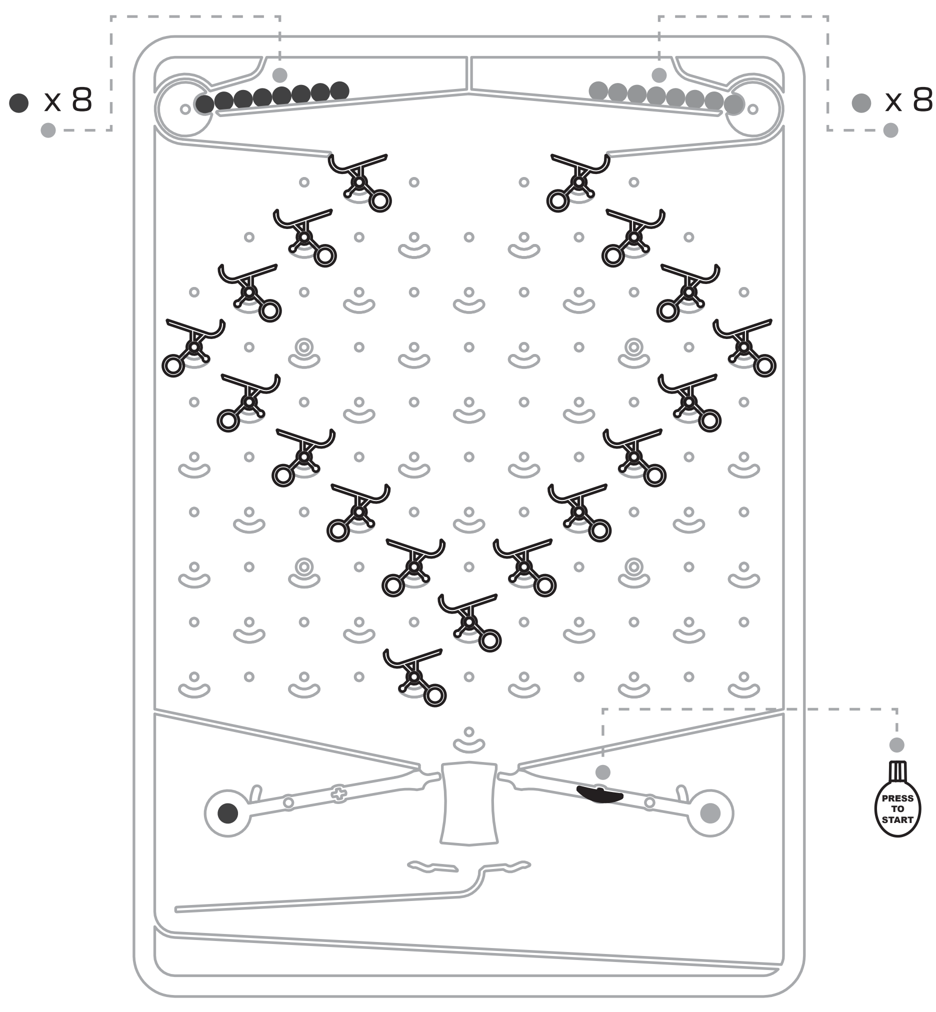
Starting setup



Available parts

Challenge 4 Solution

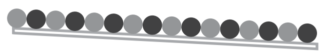
Explanation: The paths need to come together, but they start far apart! Use the ramps to bring the paths together and lead all of the balls to the left side.



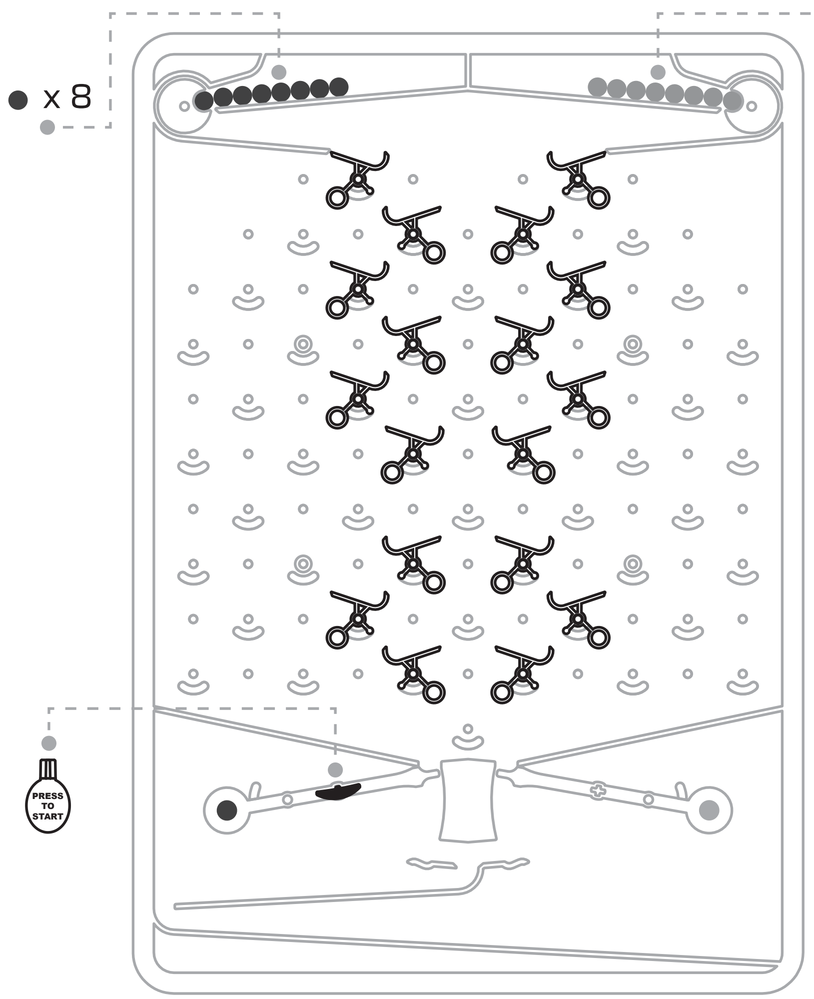
Practice Puzzle A for Challenge 5

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

Required output:



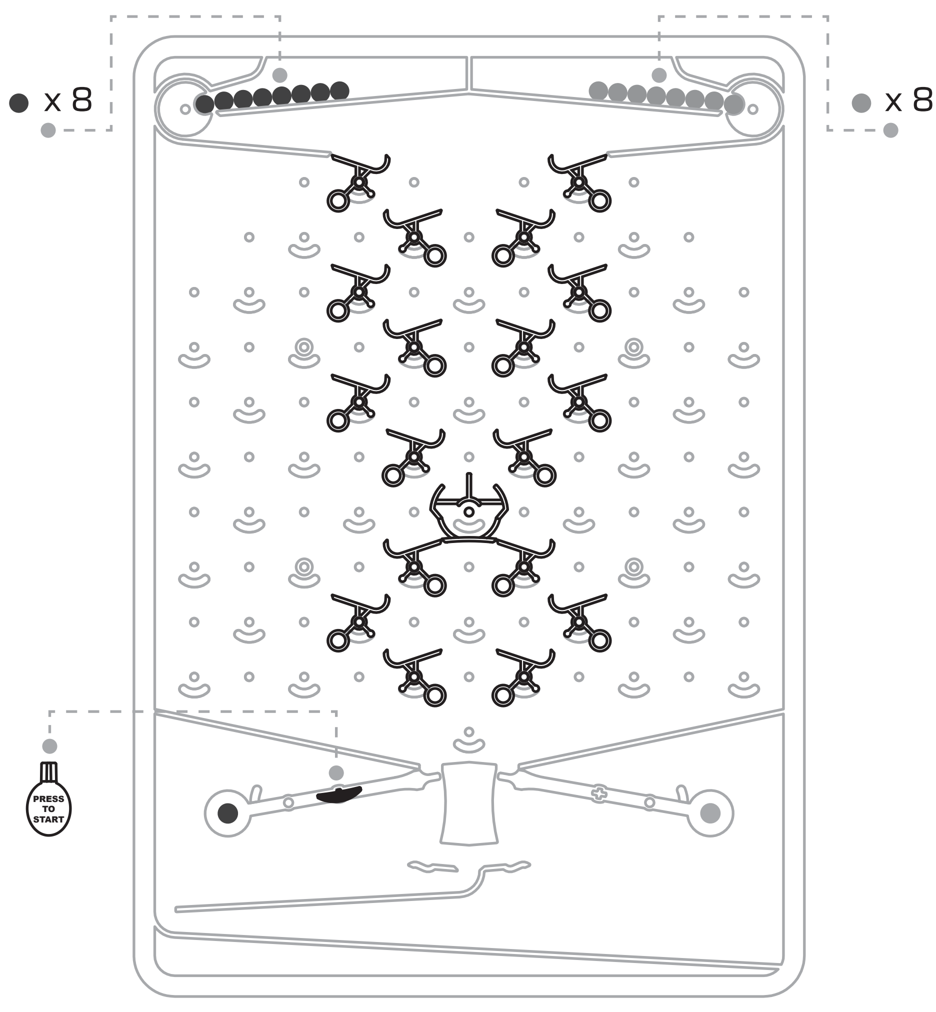
Starting setup



Available parts

Practice Challenge 5-A Solution

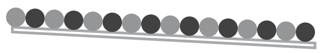
Explanation: To get the alternating pattern, blue balls have to get to the right side to release red balls, and red balls have to get to the left side to release blue balls. The paths have to cross over each other! Where they cross, use the crossover part.



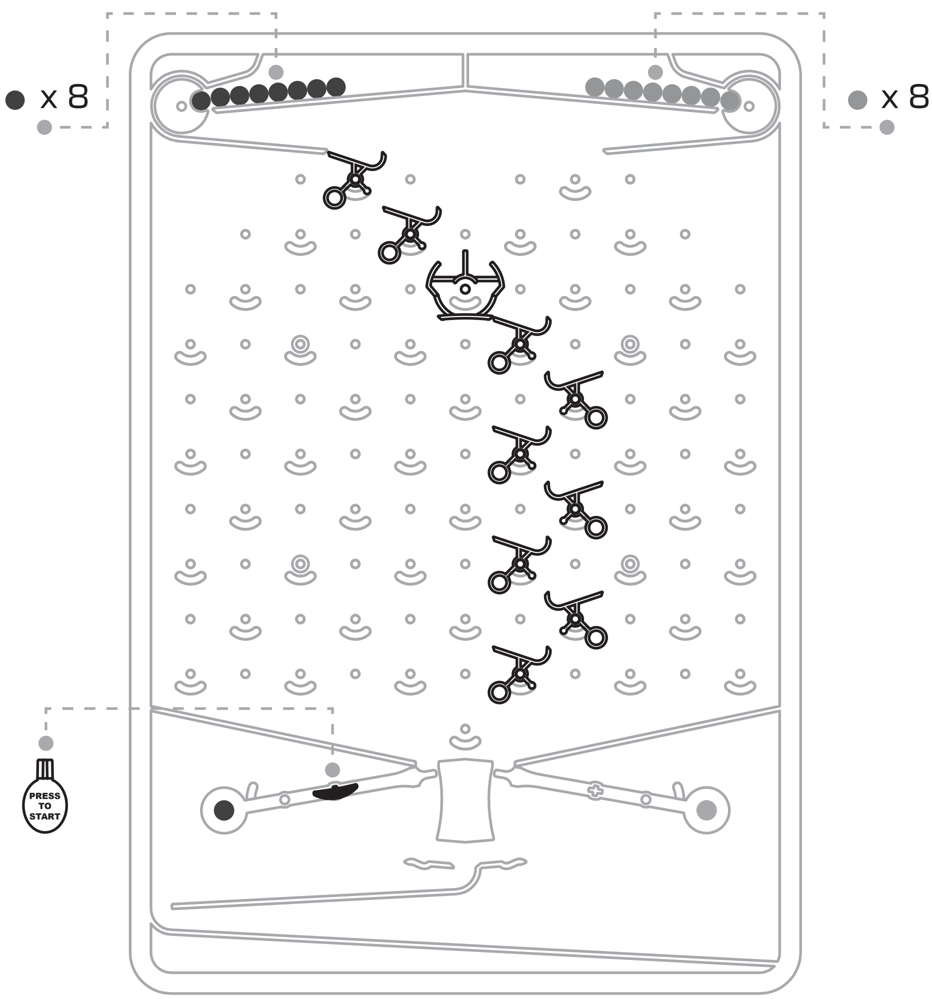
Challenge 5: Entropy

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

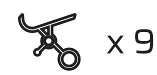
Required output:



Starting setup

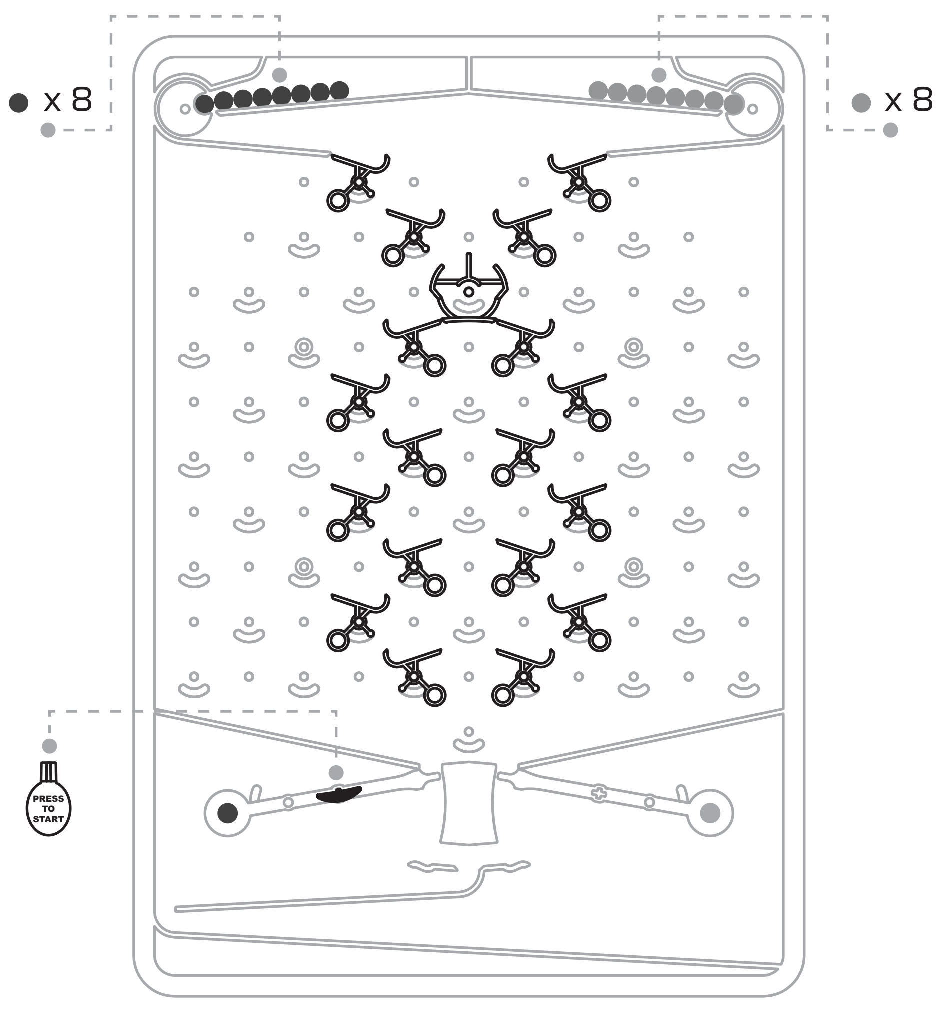


Available parts



Challenge 5 Solution

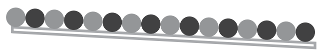
Explanation: This time, you have to create your **own** path for the red balls to get over to the left lever! You must use the crossover where your path crosses the path of the blue balls.



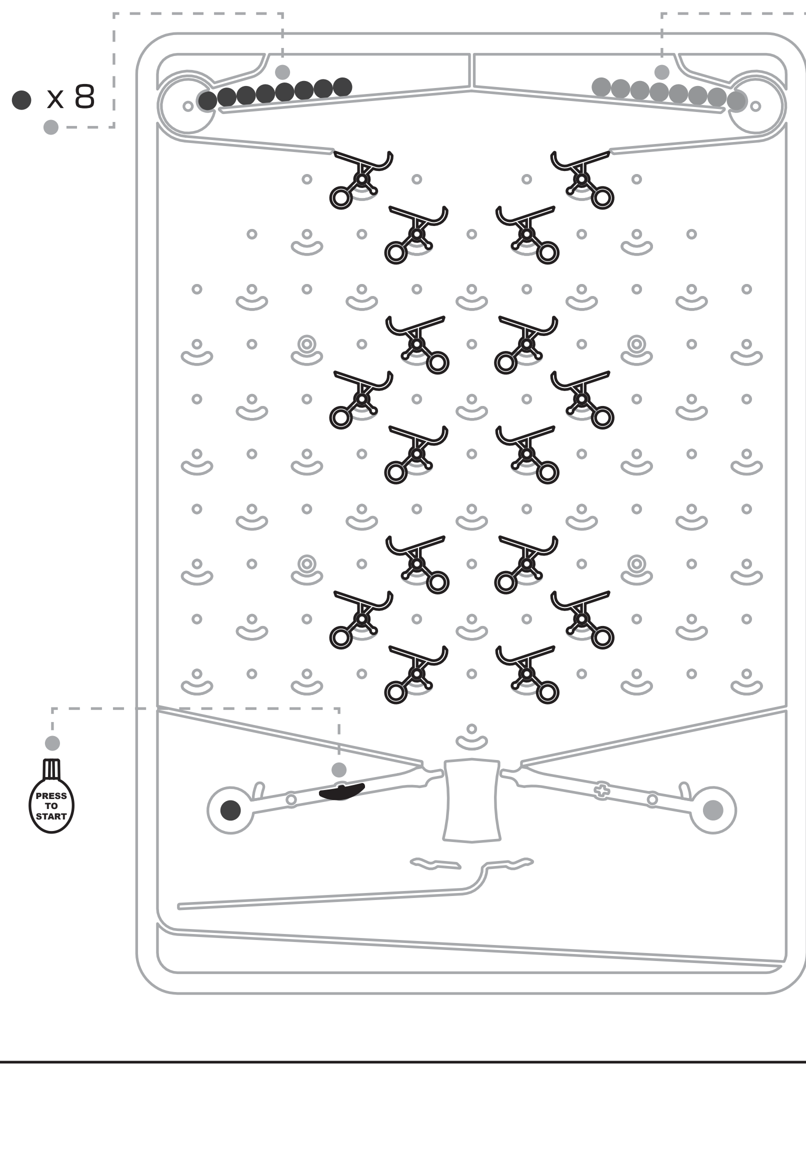
Practice Puzzle A for Challenge 6

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

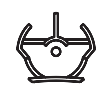
Required output:



Starting setup

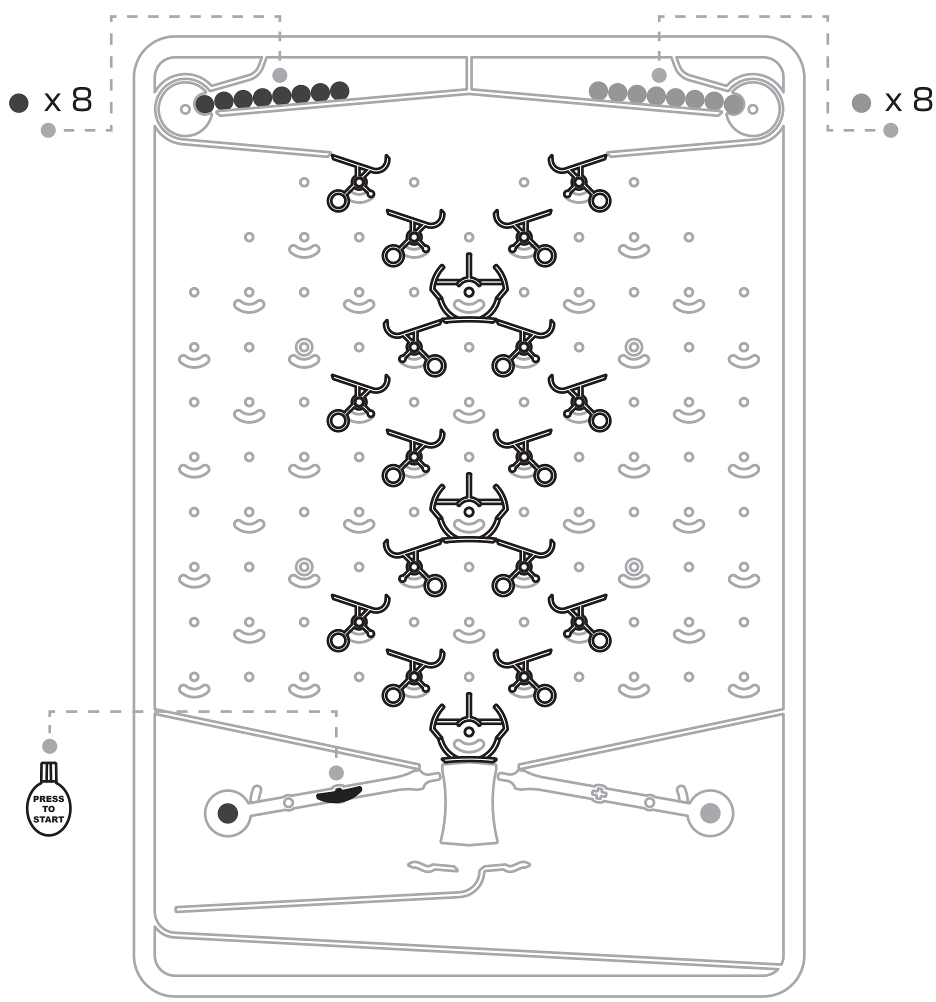


Available parts


x 3

Practice Challenge 6-A Solution

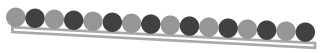
Explanation: In this puzzle, the red and blue paths cross each other three times! At each point where they cross, you must place a cross-over.



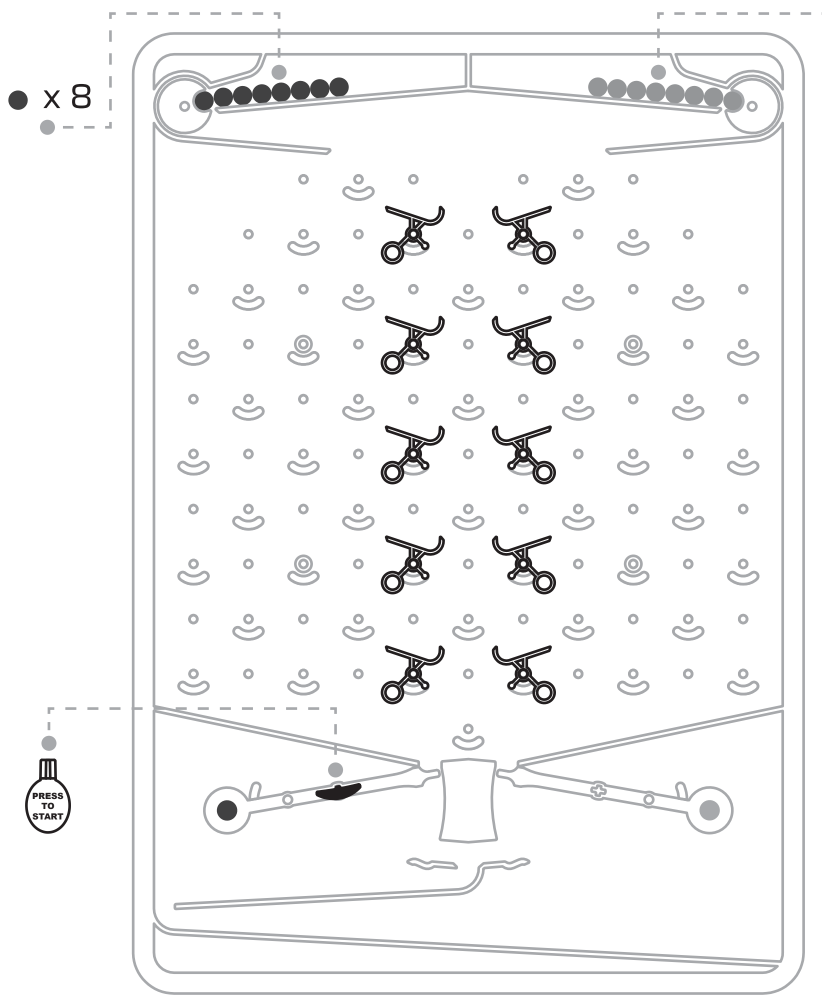
Challenge 6: Total Internal Reflection

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

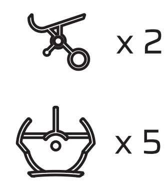
Required output:



Starting setup



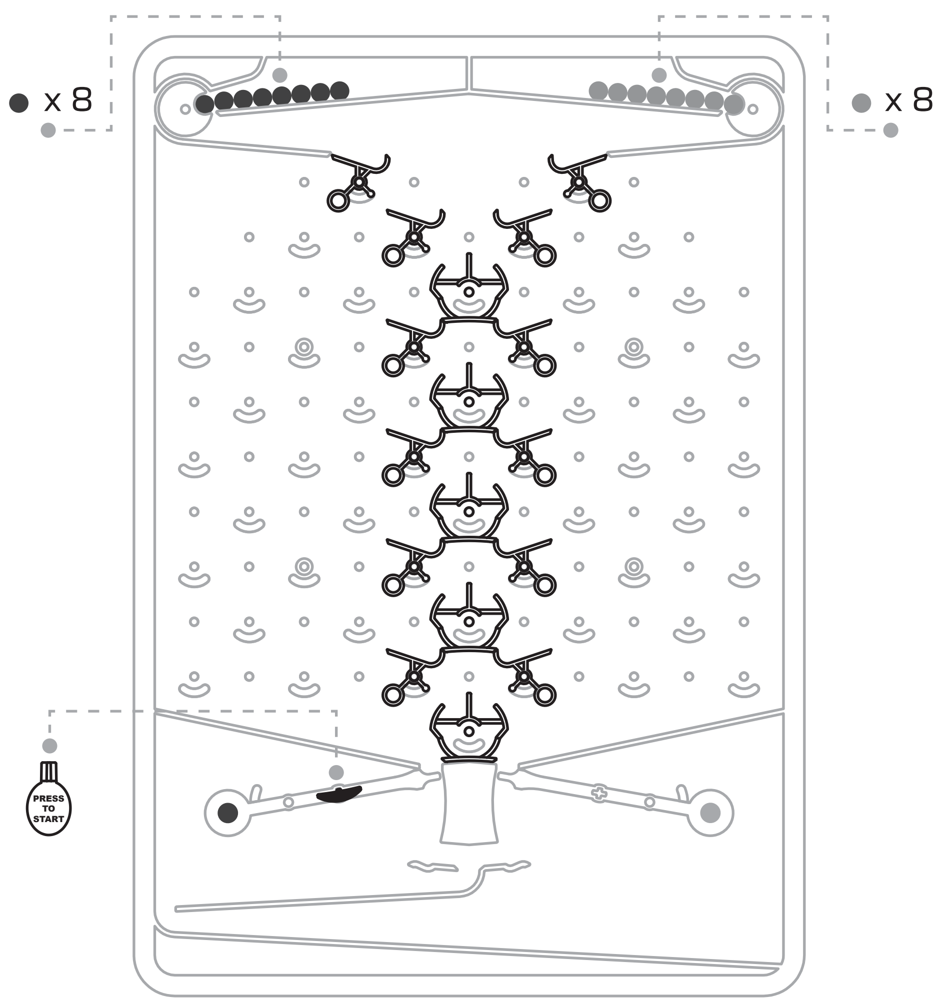
Available parts



Challenge 6 Solution

Explanation: The paths for the red and blue balls cross over each other five times. Crossovers must be placed at each point where they cross.

In the last two puzzles, the paths crossed each other one and three times. One, three, and five are all odd numbers. What would happen if the paths crossed over each other an even number of times?

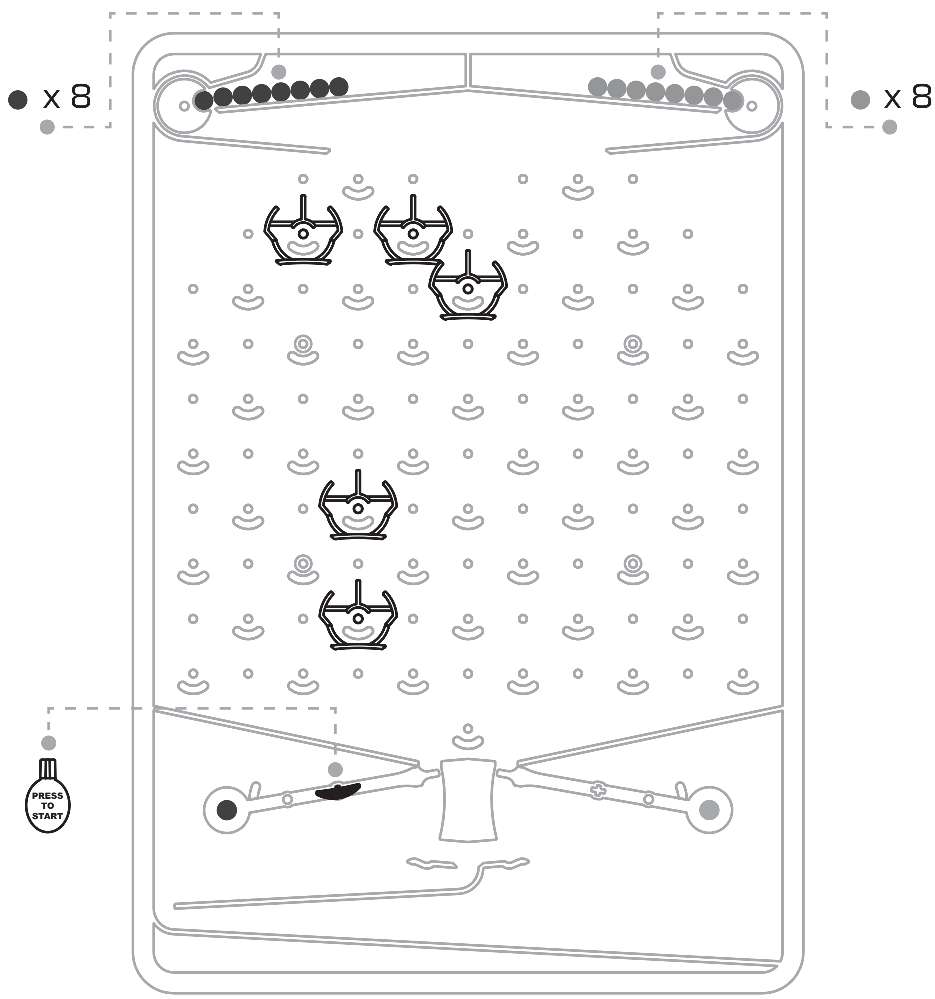


Practice Puzzle A for Challenge 7

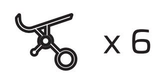
Objective: Create a path for the blue balls to reach the output with only 6 ramps.

Required output:

Starting setup

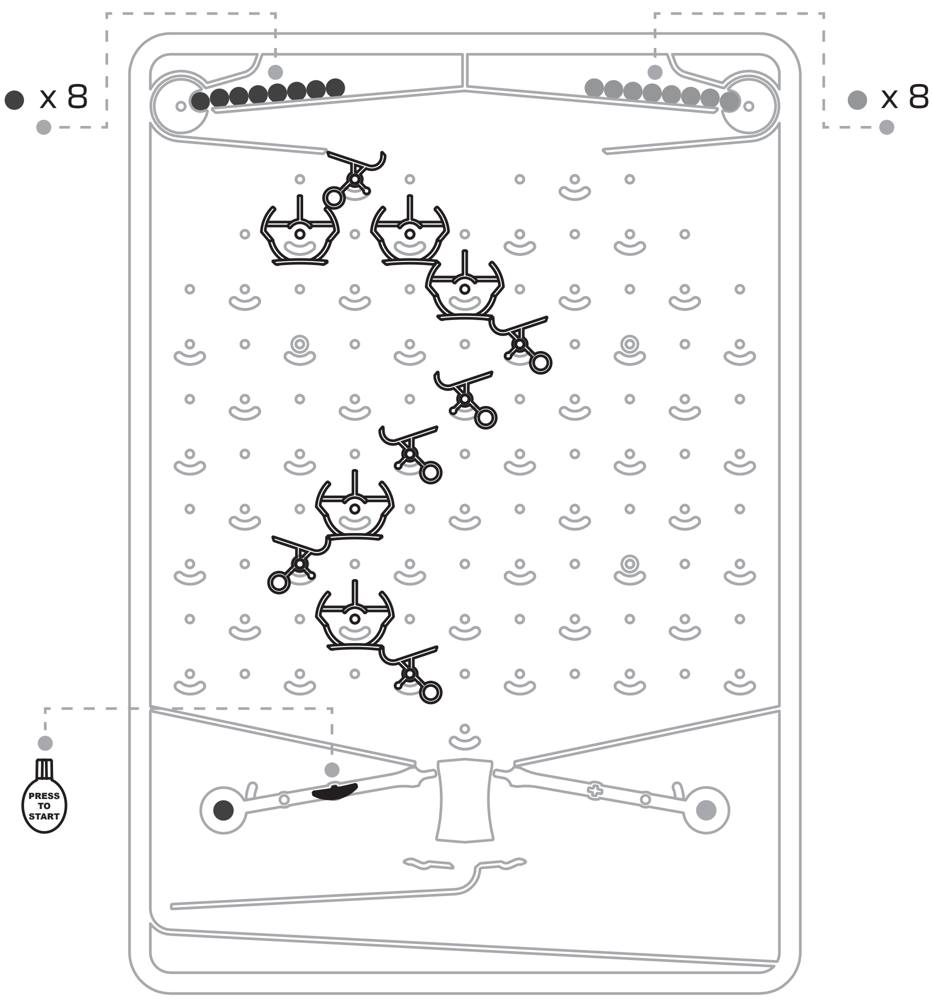


Available parts



Practice Challenge 7-A Solution

Explanation: At the top, you've got to decide, "Do I go to the left or to the right?" The right is the better path because you can use two crossovers instead of just one.

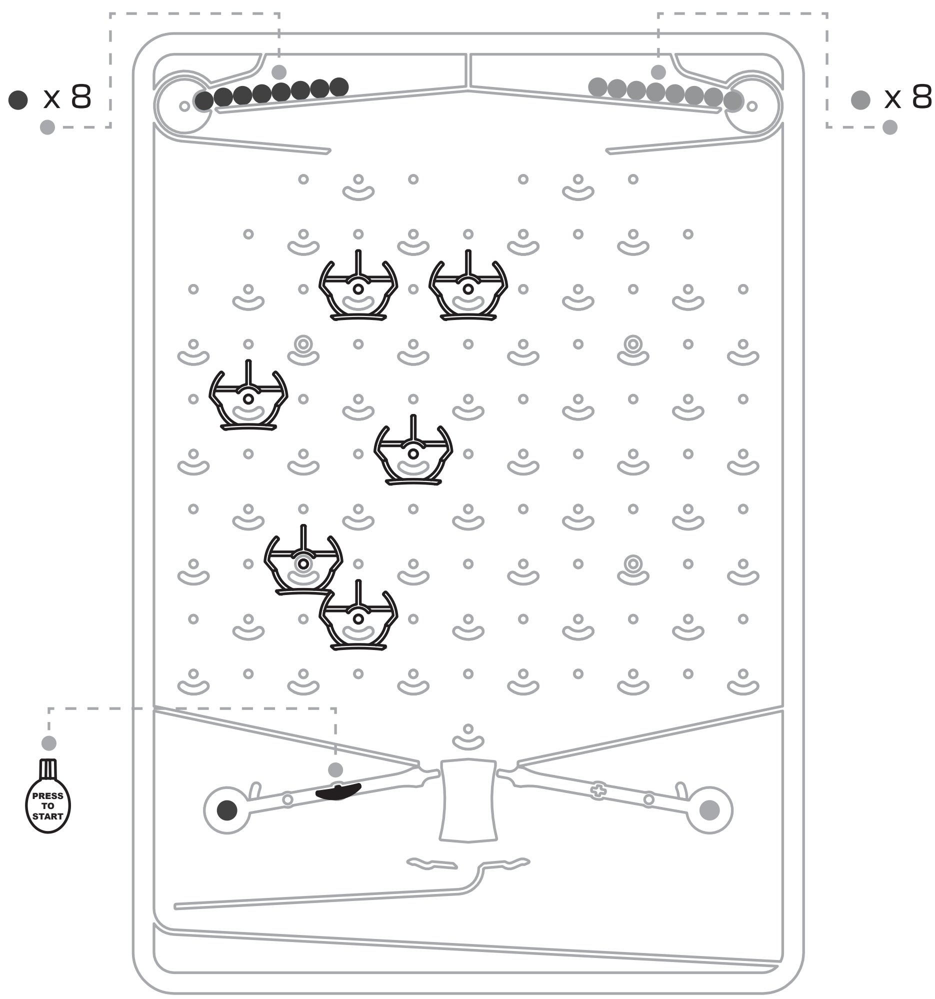


Challenge 7: Path of Least Resistance

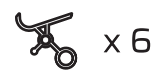
Objective: Create a path for the blue balls to reach the output with only 6 ramps.

Required output:

Starting setup

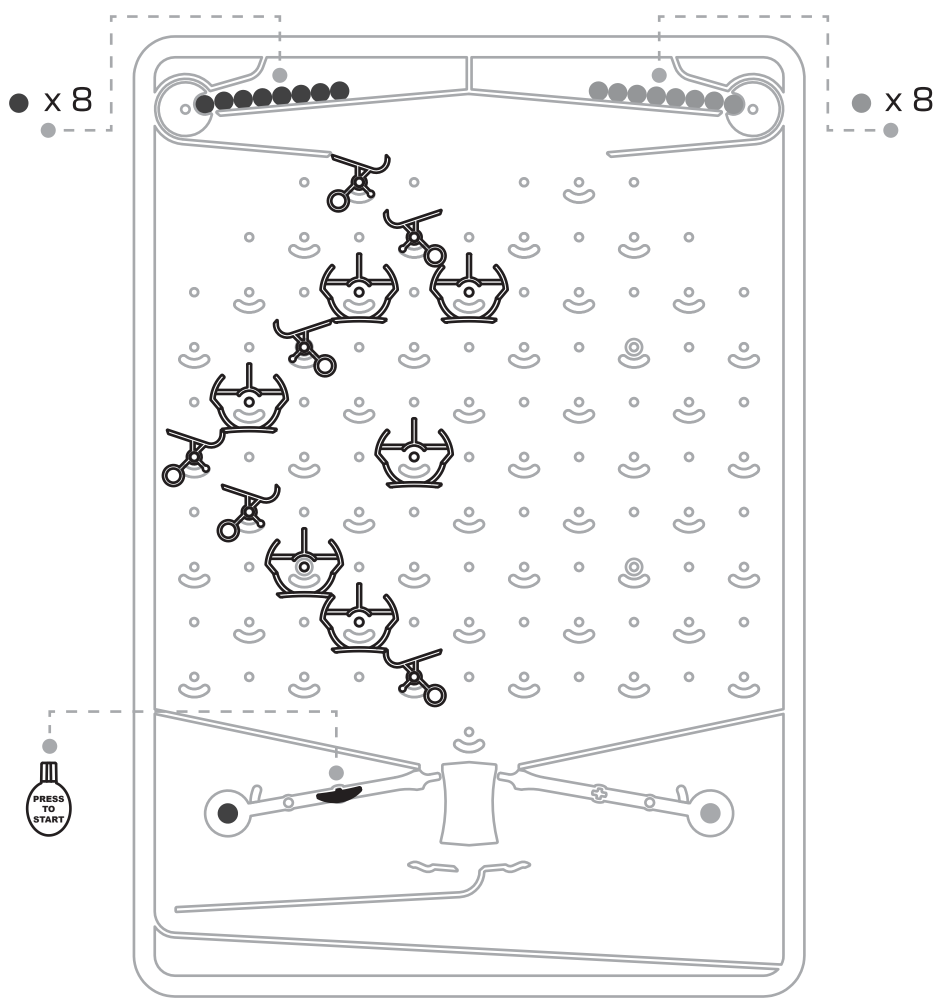


Available parts



Challenge 7 Solution

Explanation: This one is a little tricker than the last challenge. At the top, you must make a choice on whether to go to the left or to the right. You must go to the left this time.

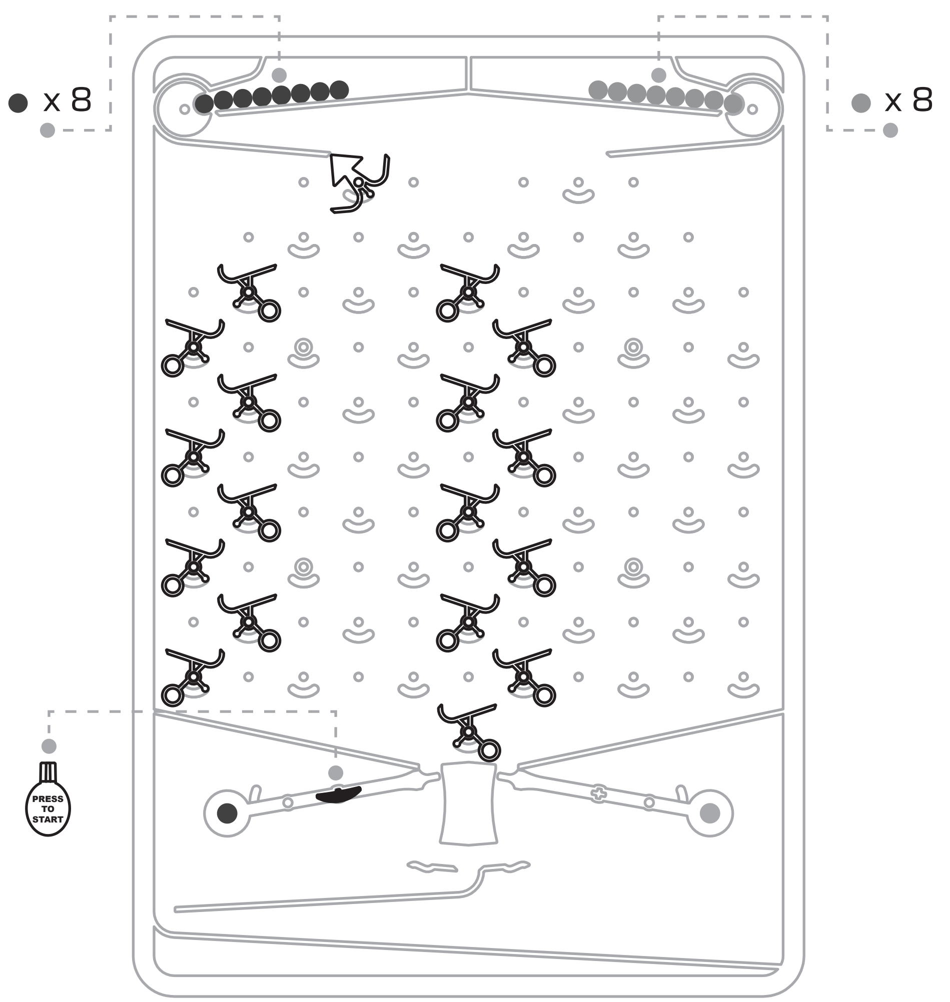


Practice Puzzle A for Challenge 8

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

Required output:

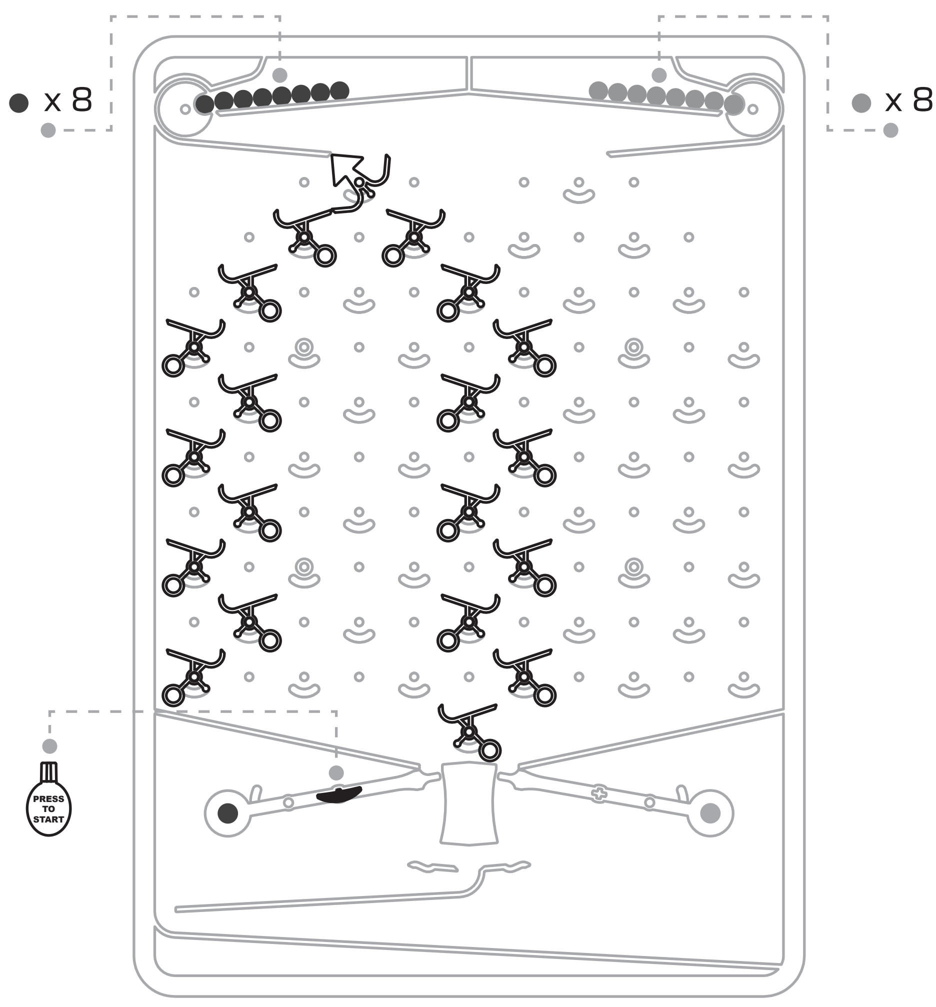
Starting setup



Available parts

Practice Challenge 8-A Solution

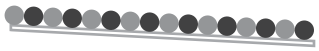
Explanation: The bit sends the blue balls in alternating directions. First right, then left, then right, and so on. You must add ramps on either side of the bit to get the balls to a path that leads to the bottom.



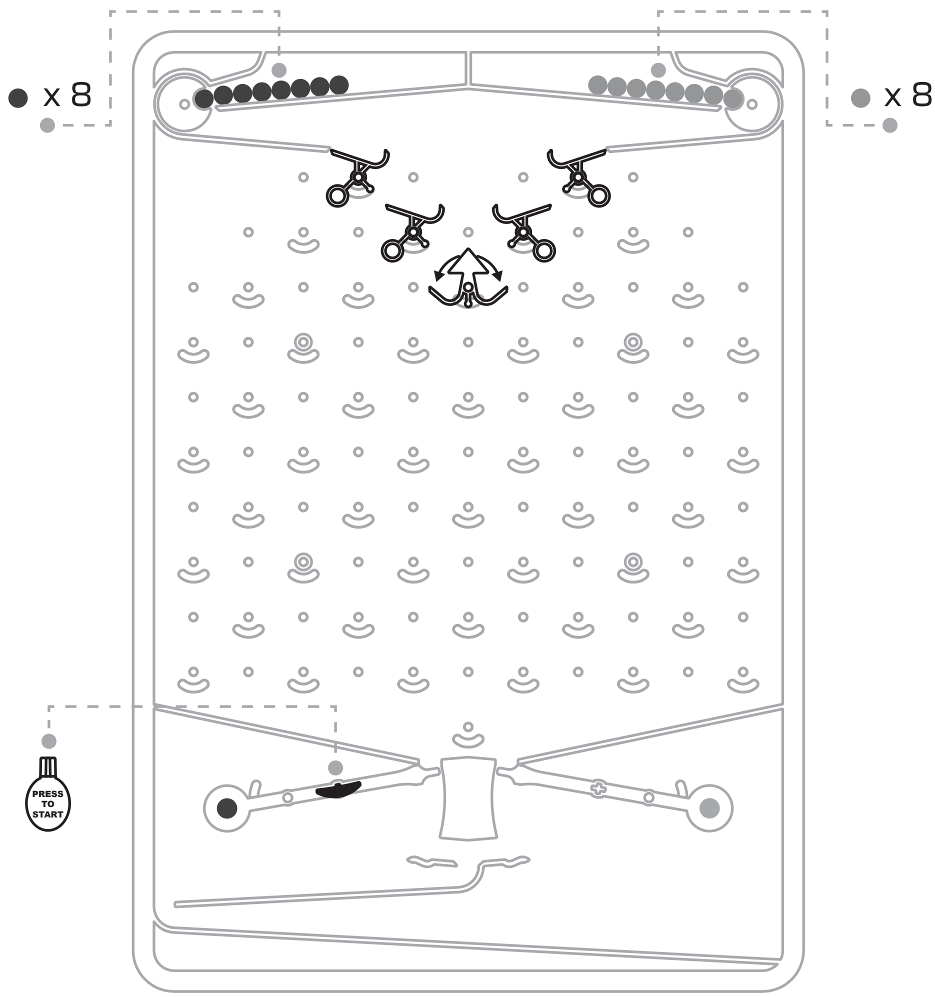
Challenge 8: Depolarization

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

Required output:



Starting setup

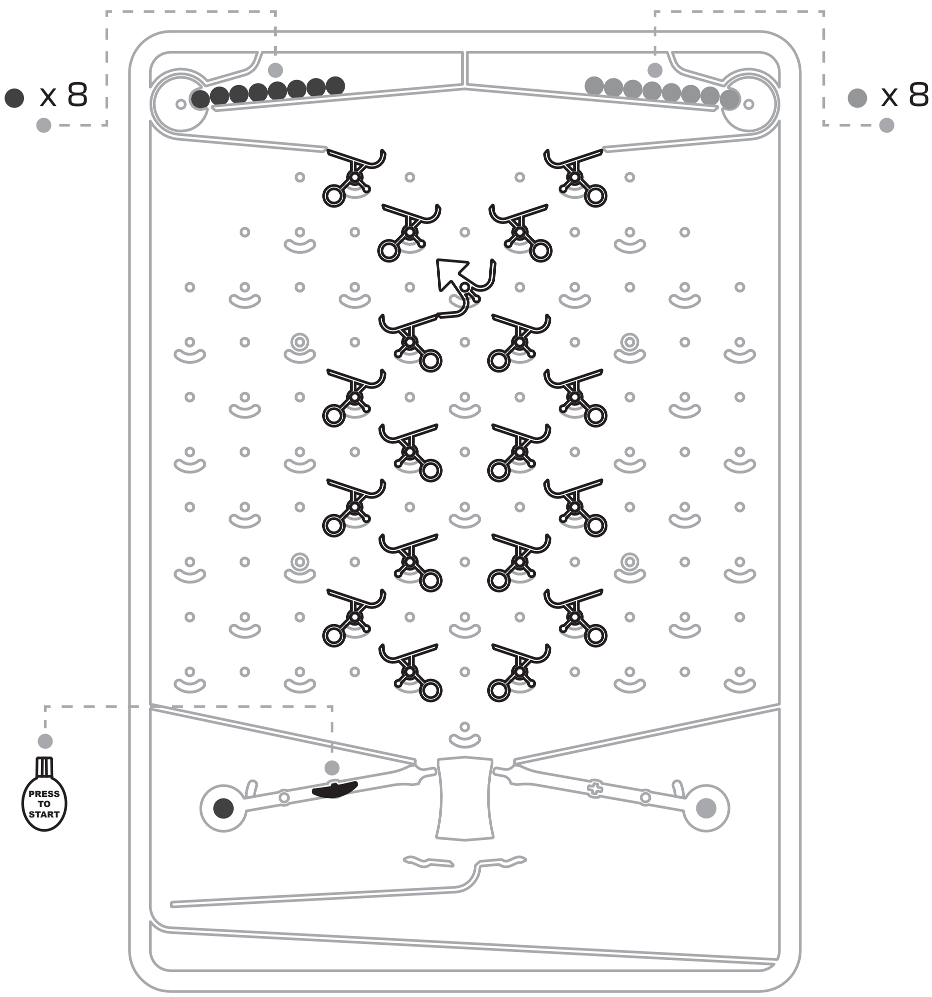


Available parts

x 14

Challenge 8 Solution

Explanation: A bit is used to alternate the color of the balls released.

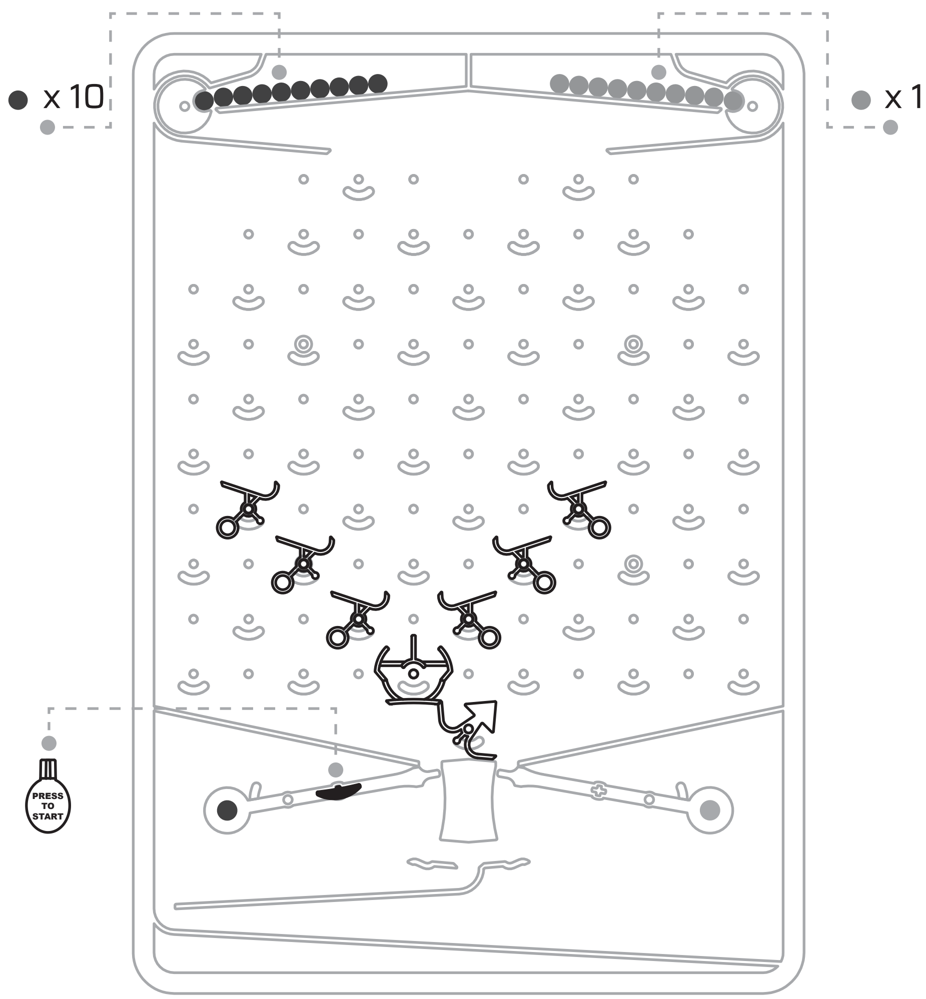


Practice Puzzle A for Challenge 9

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

Required output:

Starting setup

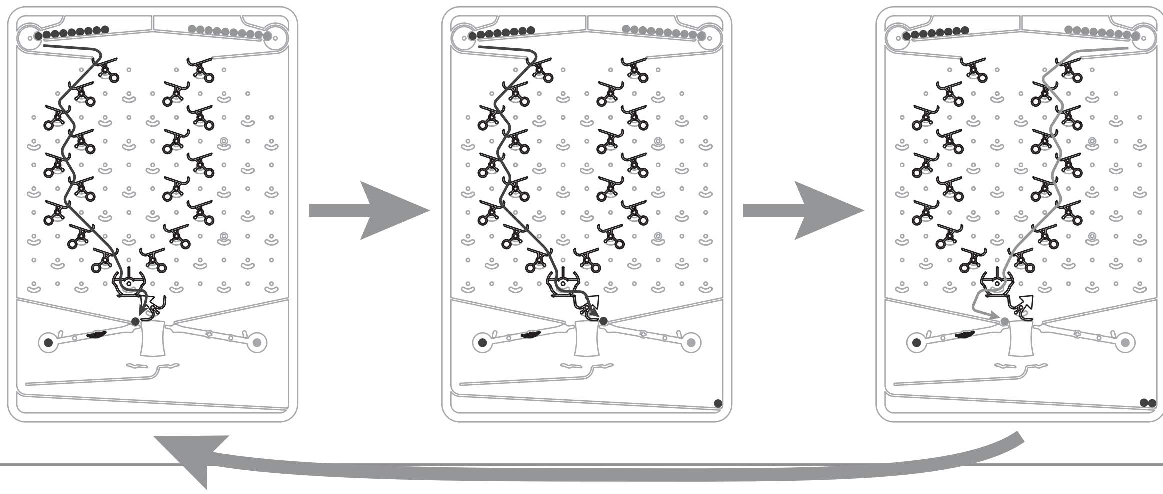


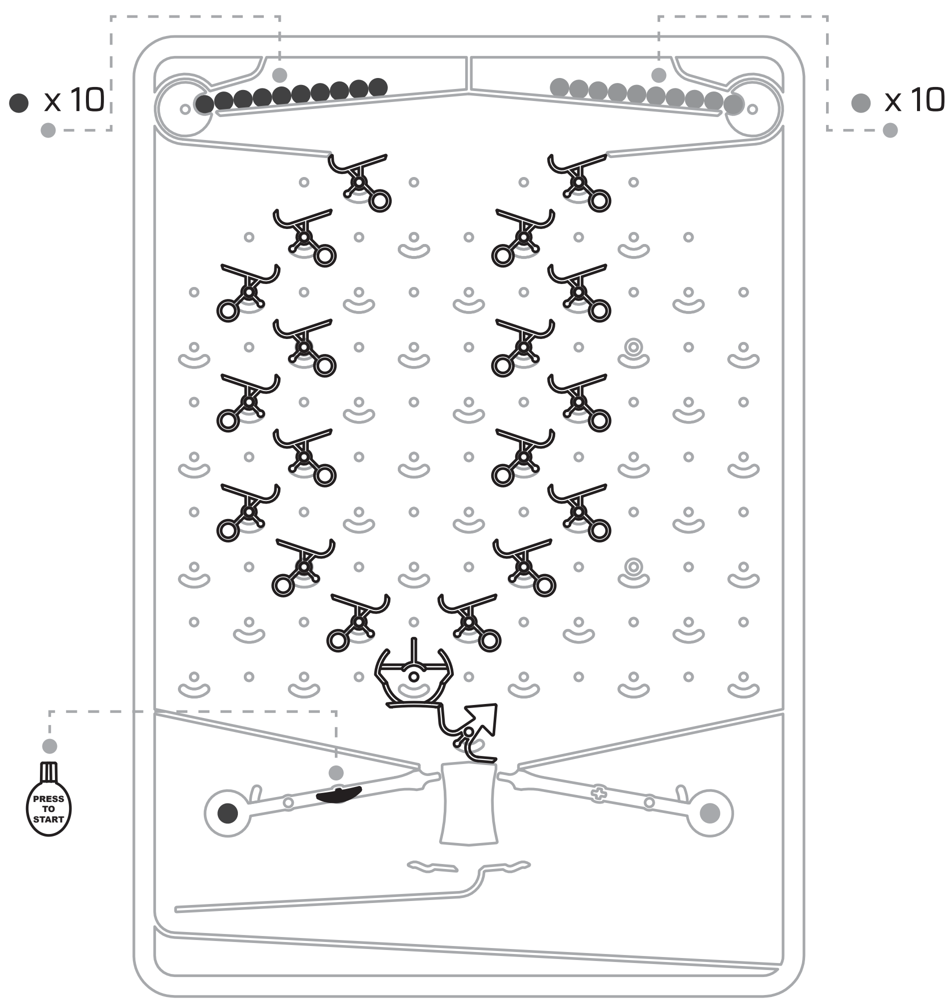
Available parts

x 13

Practice Challenge 9-A Solution

Explanation: The bit only lets every **other** blue ball reach the right lever, but every red ball ends at the left lever.



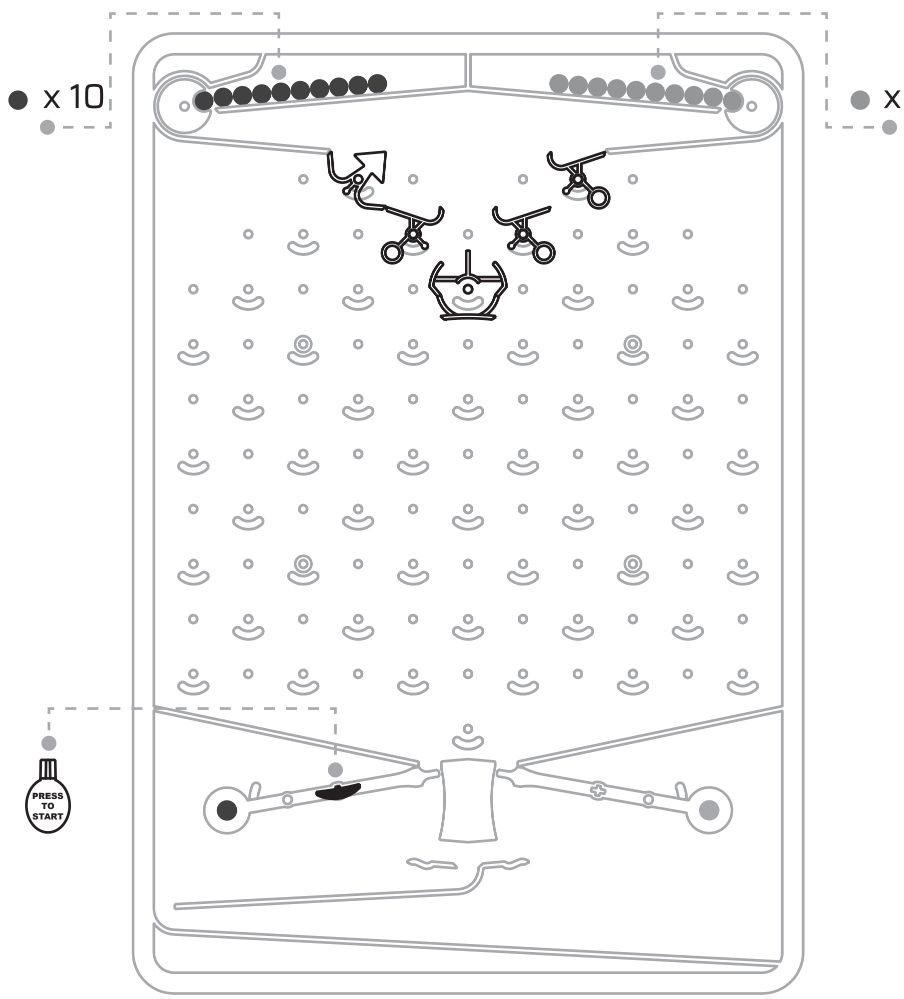


Challenge 9: Dimers

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

Required output:

Starting setup



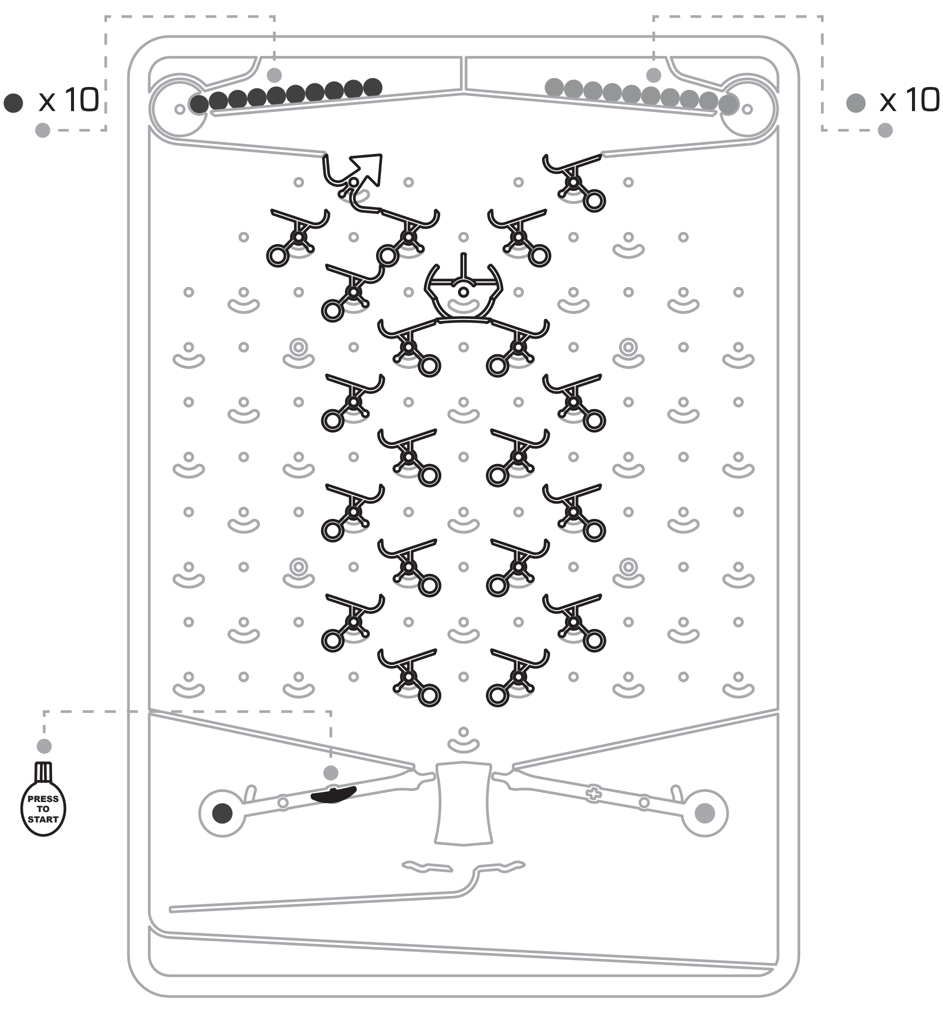
Available parts

x 18

Challenge 9 Solution

Explanation: Just like the last puzzle, the bit makes every **other** blue ball release a red ball, but every red ball releases a blue ball.

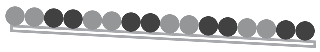
Do you see how the bit splits the path of the blue balls to go in two directions? This is very important in the coming puzzles!



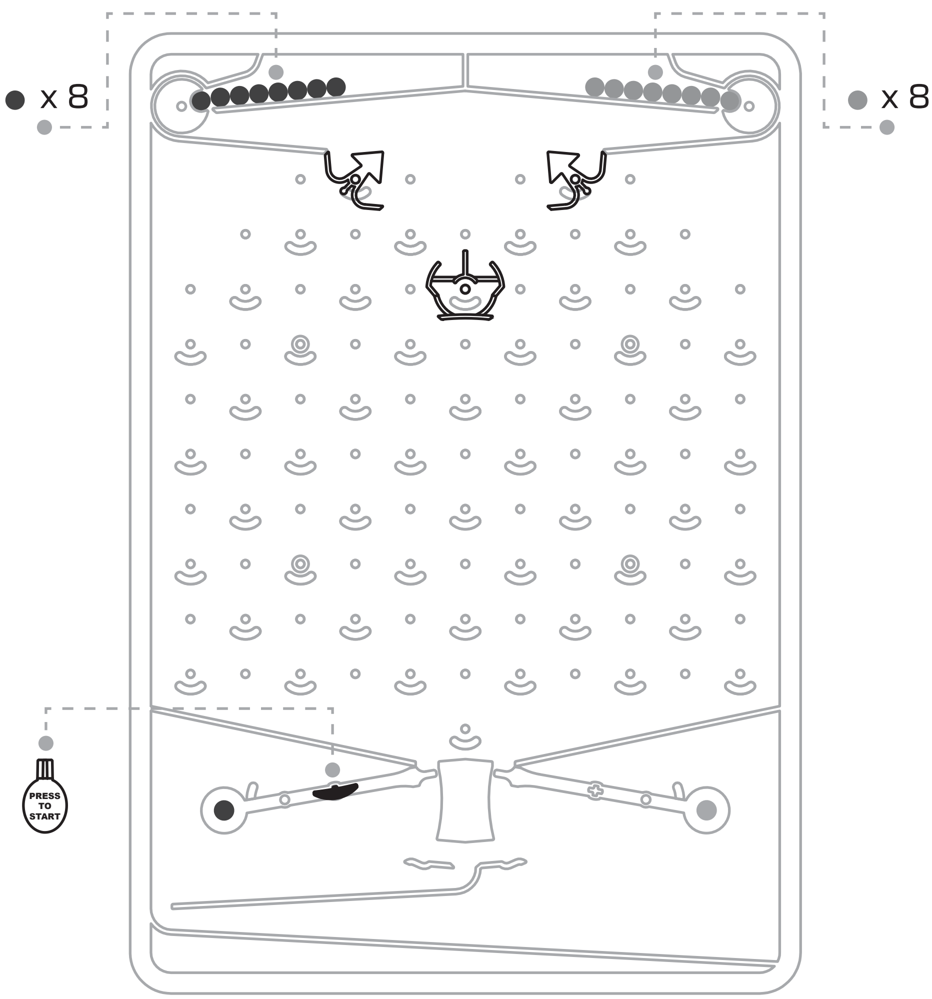
Challenge 10: Double Bond

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

Required output:



Starting setup

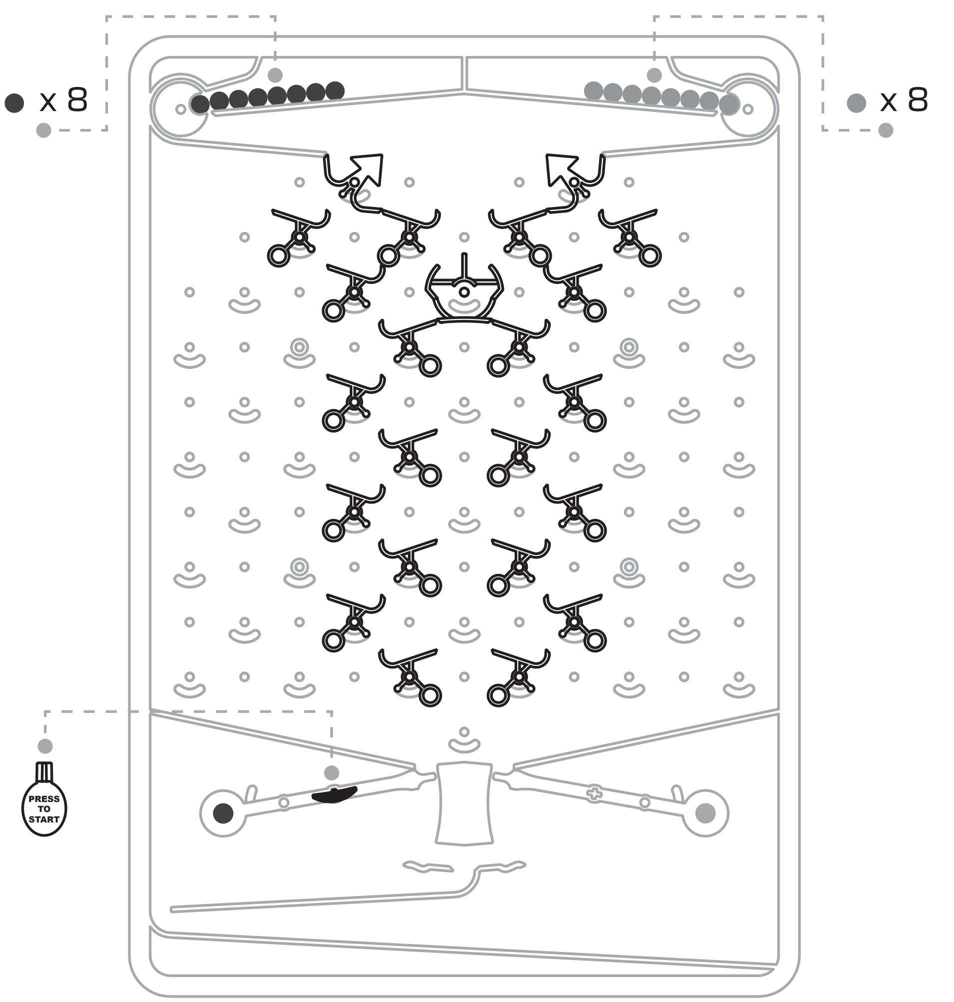


Available parts

x 22

Challenge 10 Solution

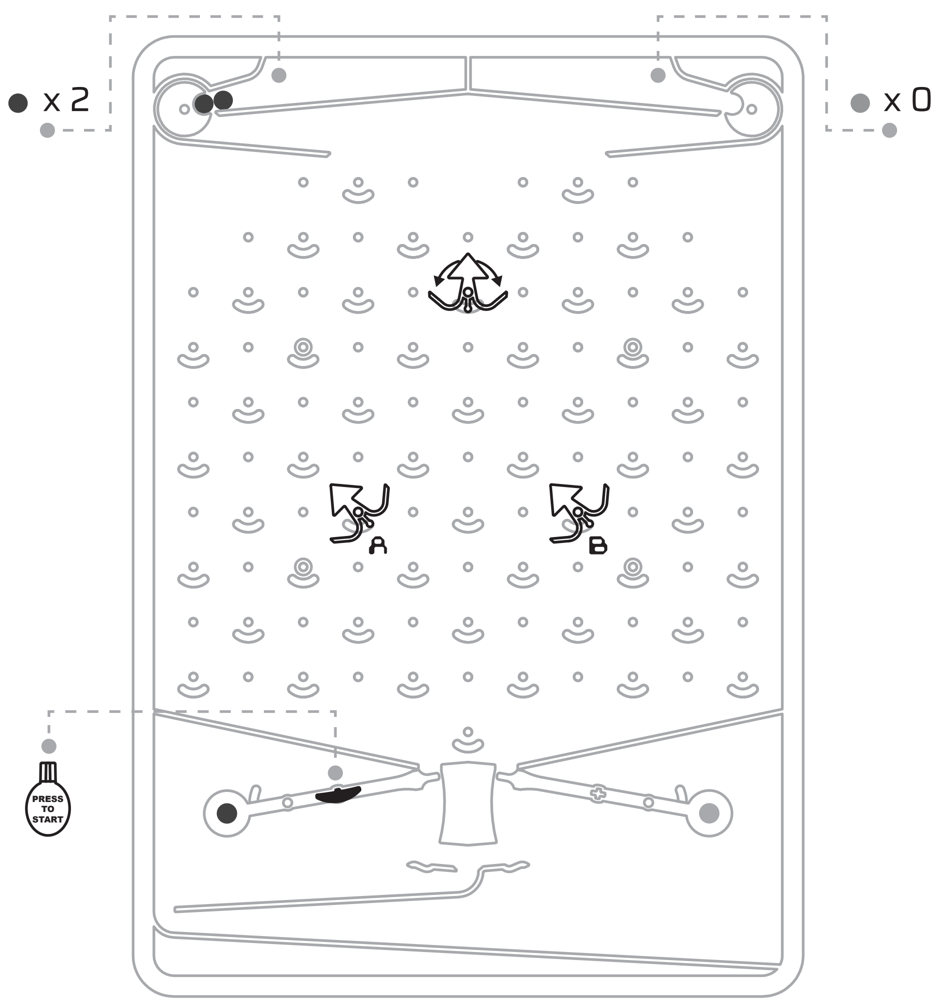
Explanation: This time, there are bits in the path of both the red **and** blue balls. The bits cause only every **other** ball to cross to the other side of the board.



Practice Puzzle A for Challenge 11

Objective: Flip bits A and B to the right.

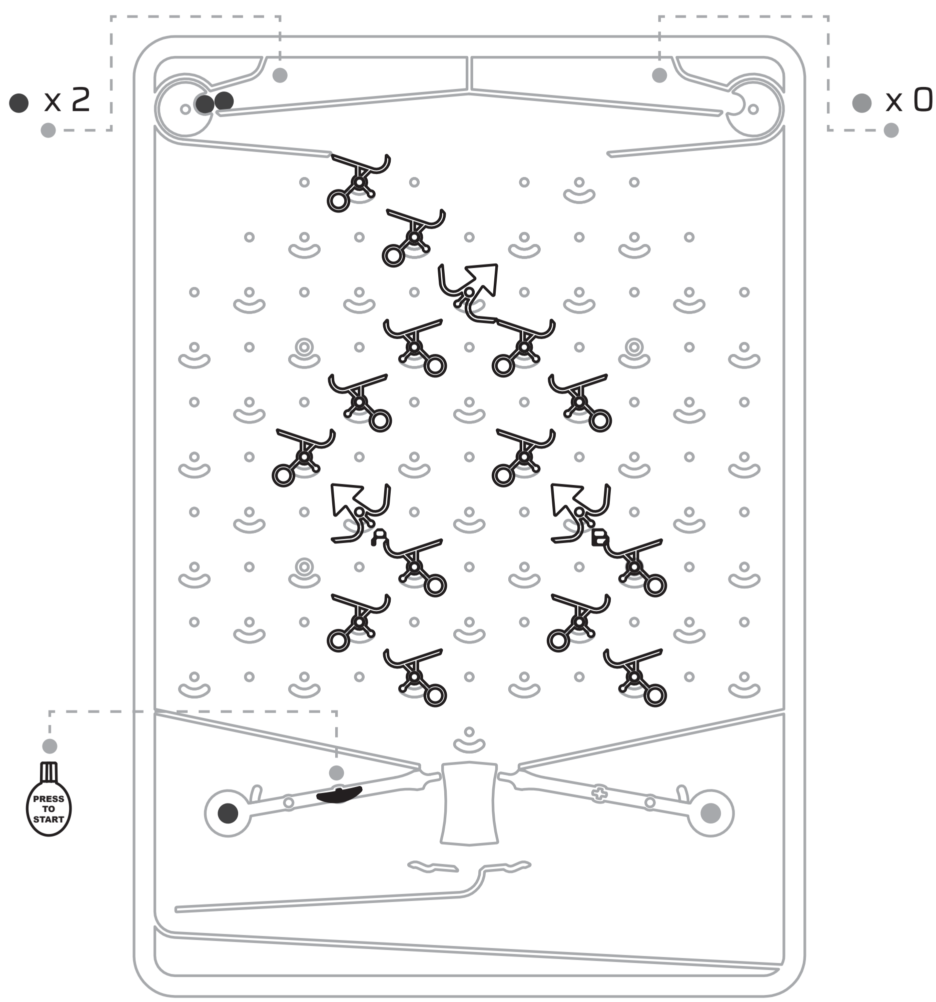
Starting setup



Available parts

Practice Challenge 11-A Solution

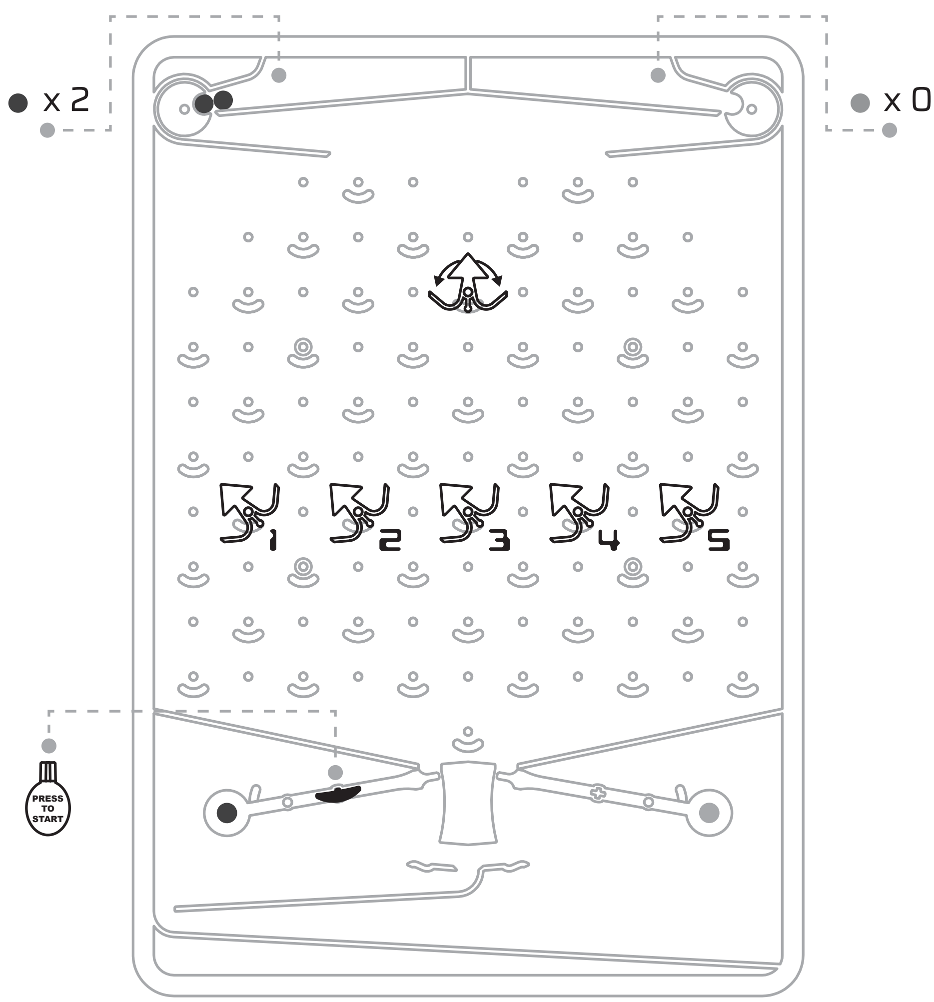
Explanation: The top bit is used to distribute the blue balls between two paths - one leads to the left bit and the other leads to the right bit.



Challenge 11: Selectivity

Objective: Flip bits 2 and 5 to the right.

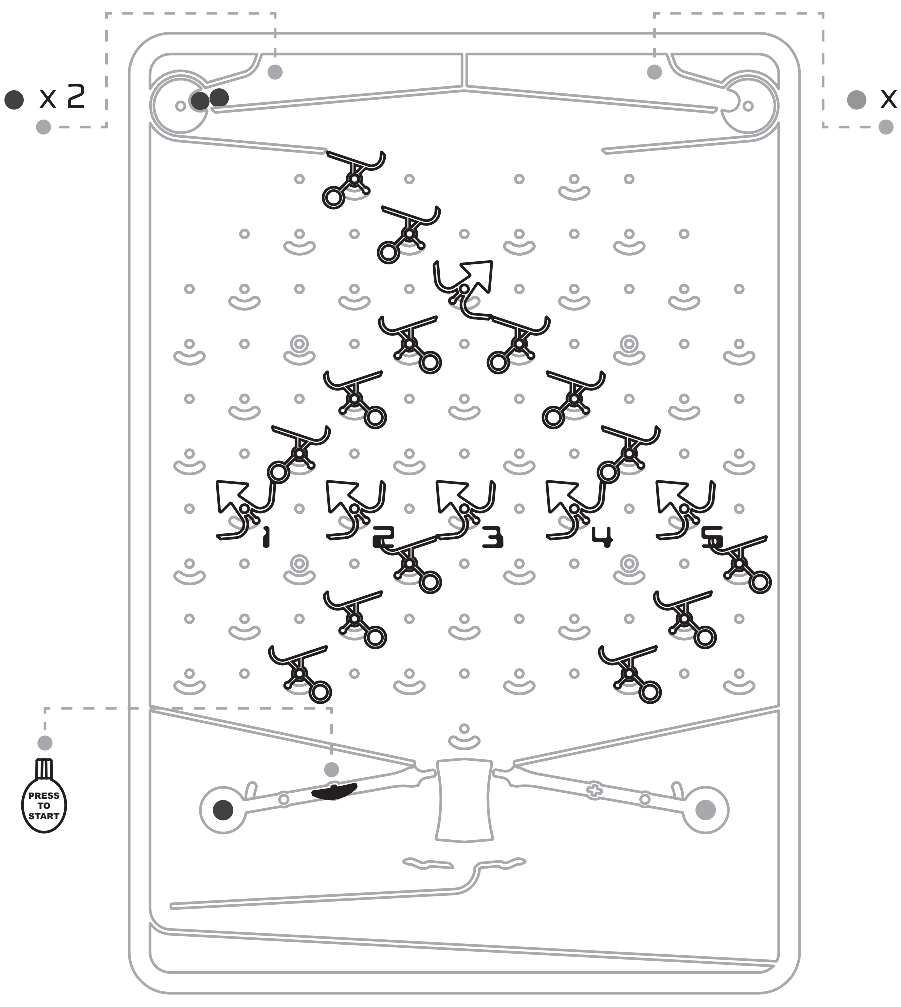
Starting setup



Available parts

Challenge 11 Solution

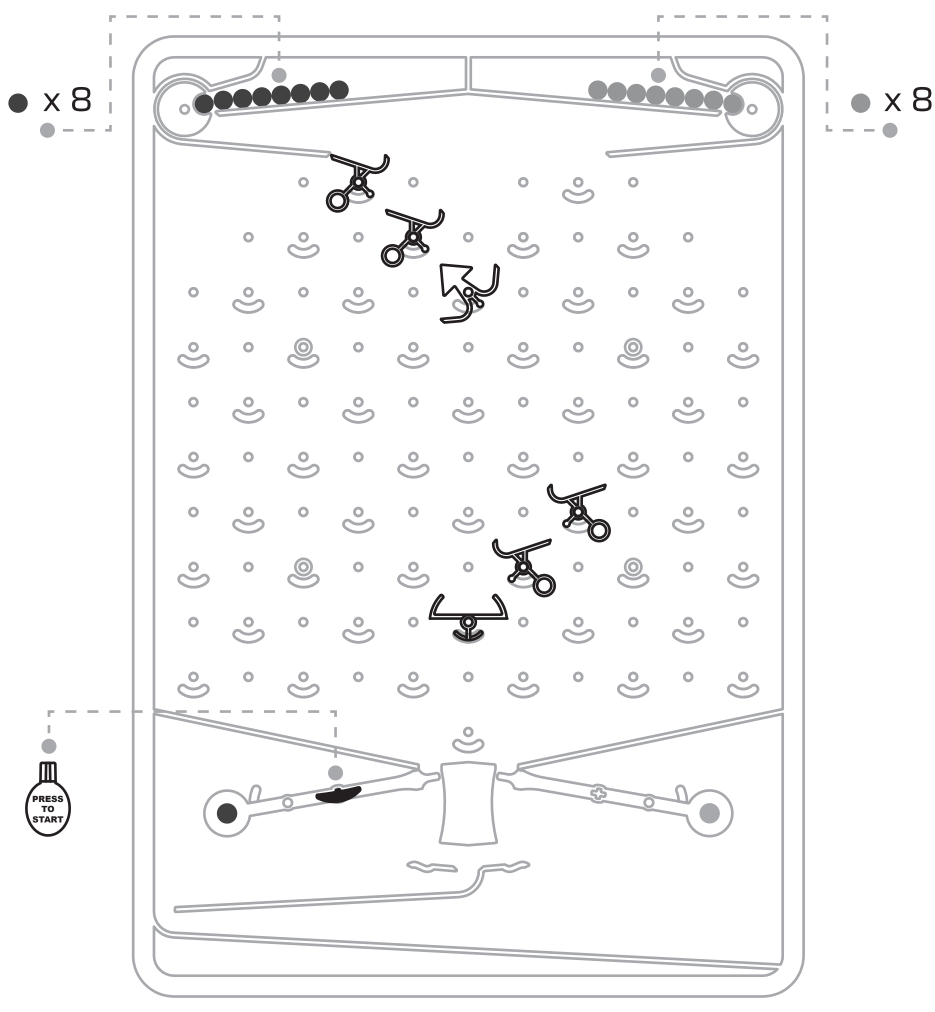
Explanation: The top bit splits the path of the blue balls. One path leads to bit 2 and the other path leads to bit 5.



Challenge 12: Duality - Part 1

Objective: Intercept a blue ball.

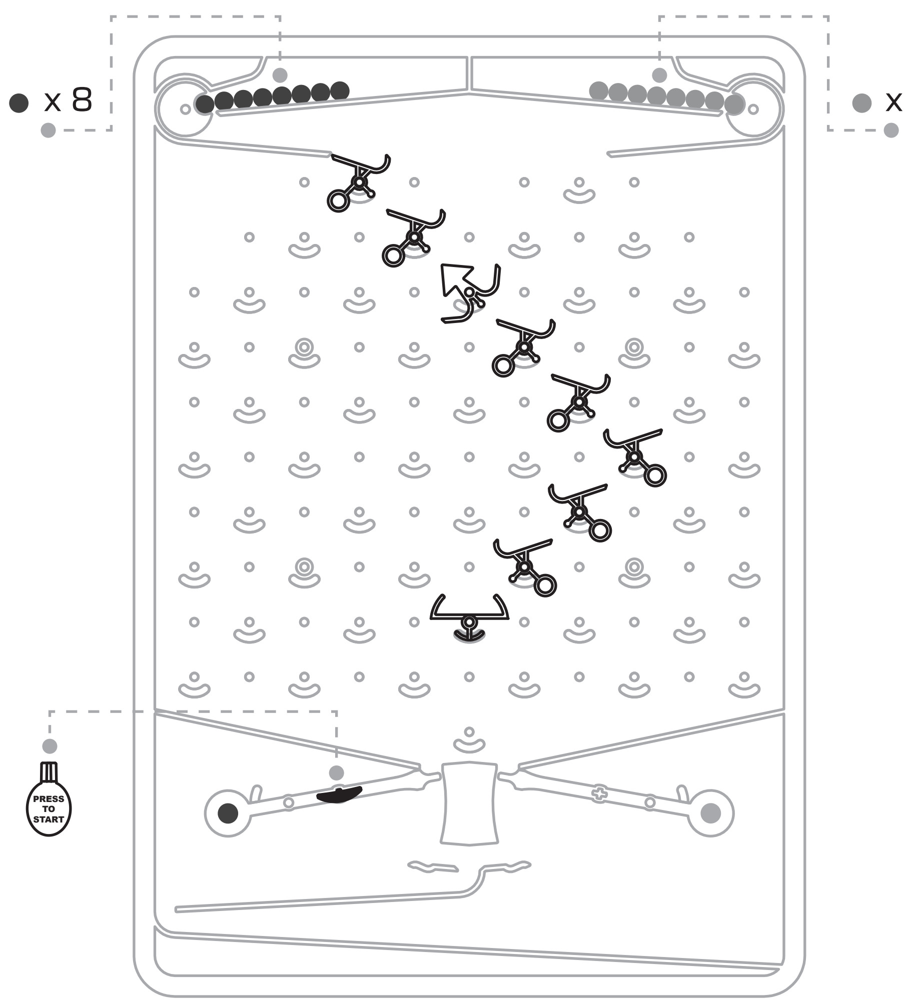
Starting setup



Available parts

Challenge 12 Solution

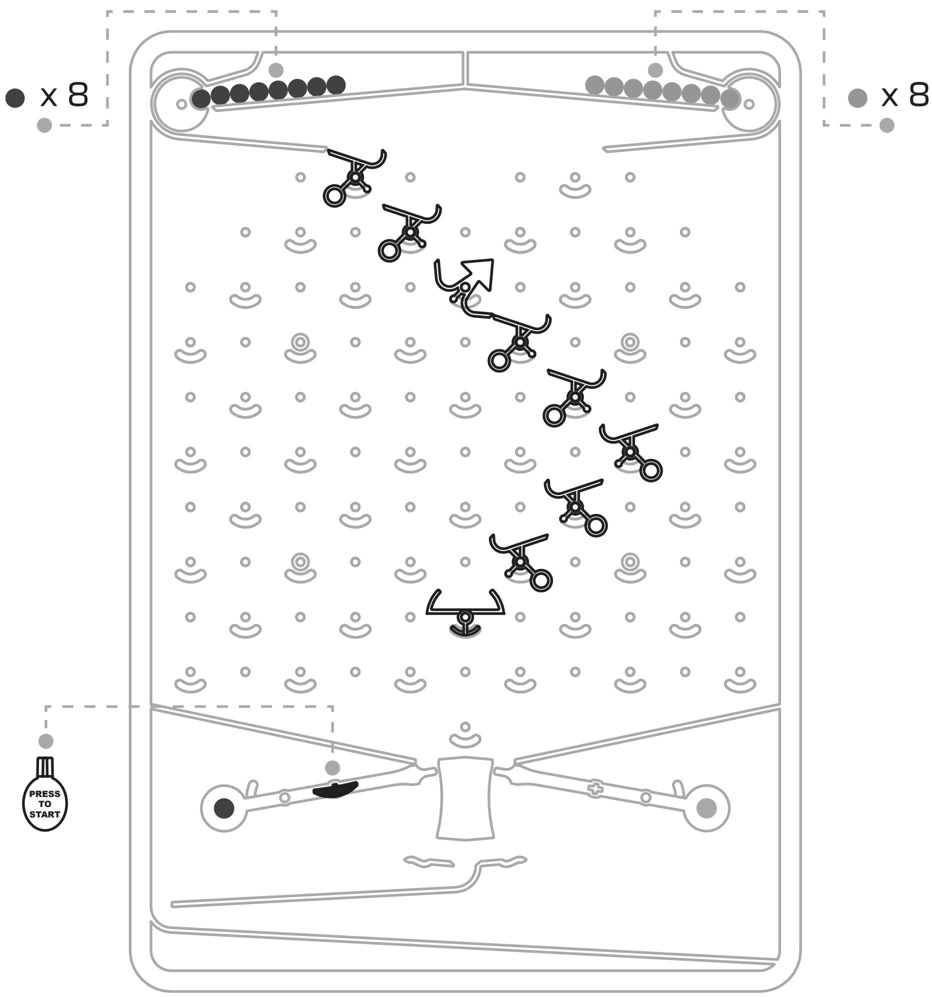
Explanation: The ramps must be used to complete the path of a single ball to the interceptor.



Challenge 13: Duality - Part 2

Objective: Intercept a red ball.

Starting setup

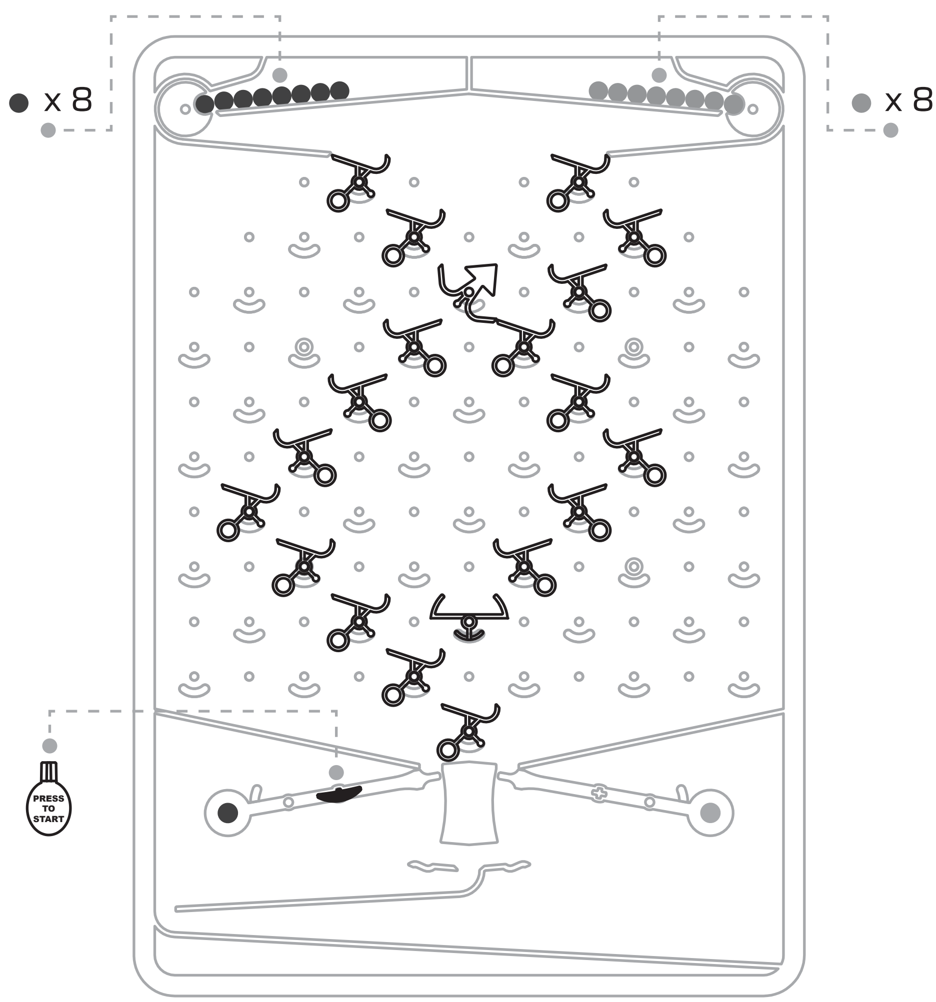


Available parts

Challenge 13 Solution

Explanation: Even though you start by releasing a **blue** ball, you've got to get a **red** ball in the interceptor. How do you do that?

Here's how: Lead the first blue ball to the **right** lever, releasing a red ball. Then lead the red ball to the interceptor with ramps.

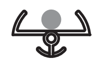


Challenge 14: Duality - Part 3

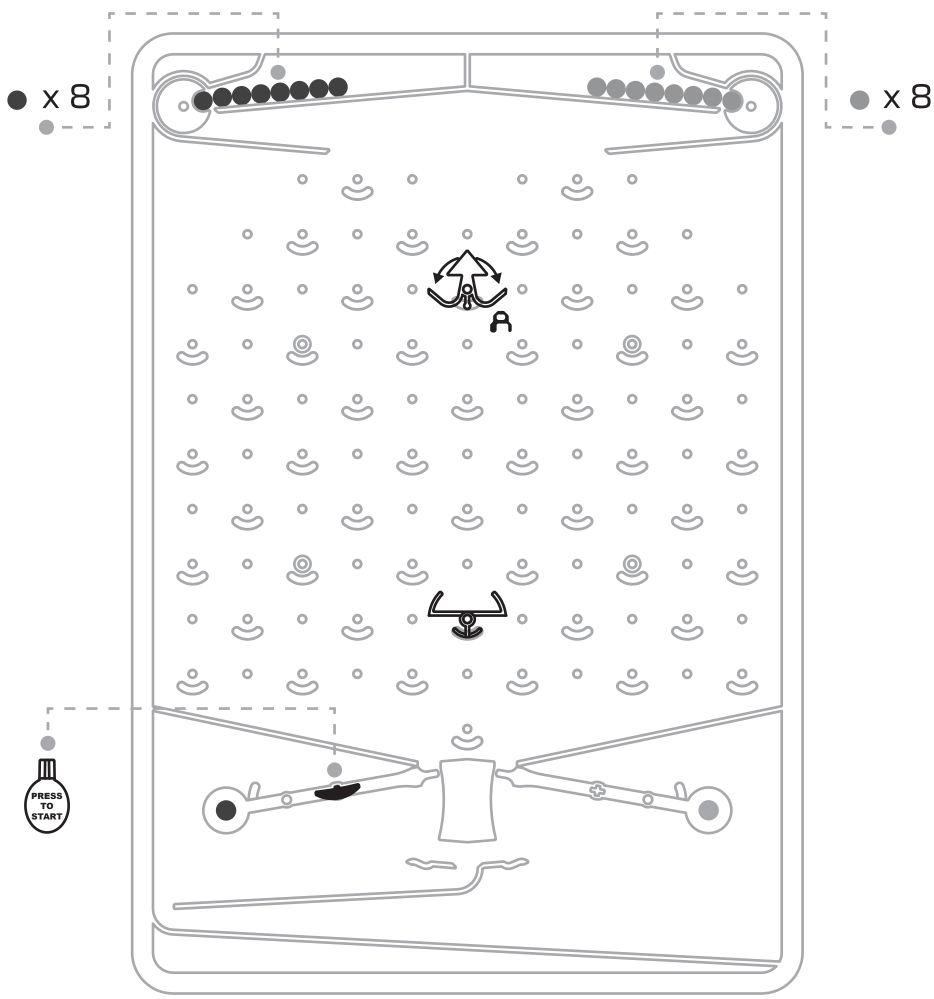
Objective: If the machine starts with bit A pointing to the left, intercept a blue ball. Otherwise, intercept a red ball.

Examples:

If  then 

If  then 

Starting setup



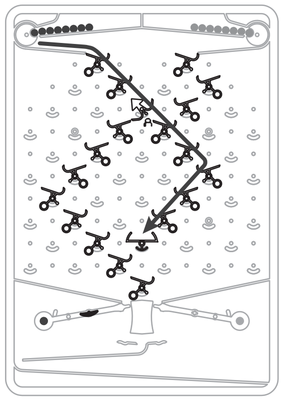
Available parts

 x 20

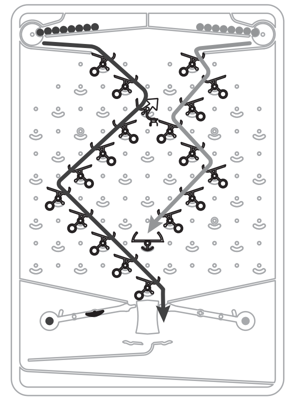
Challenge 14 Solution

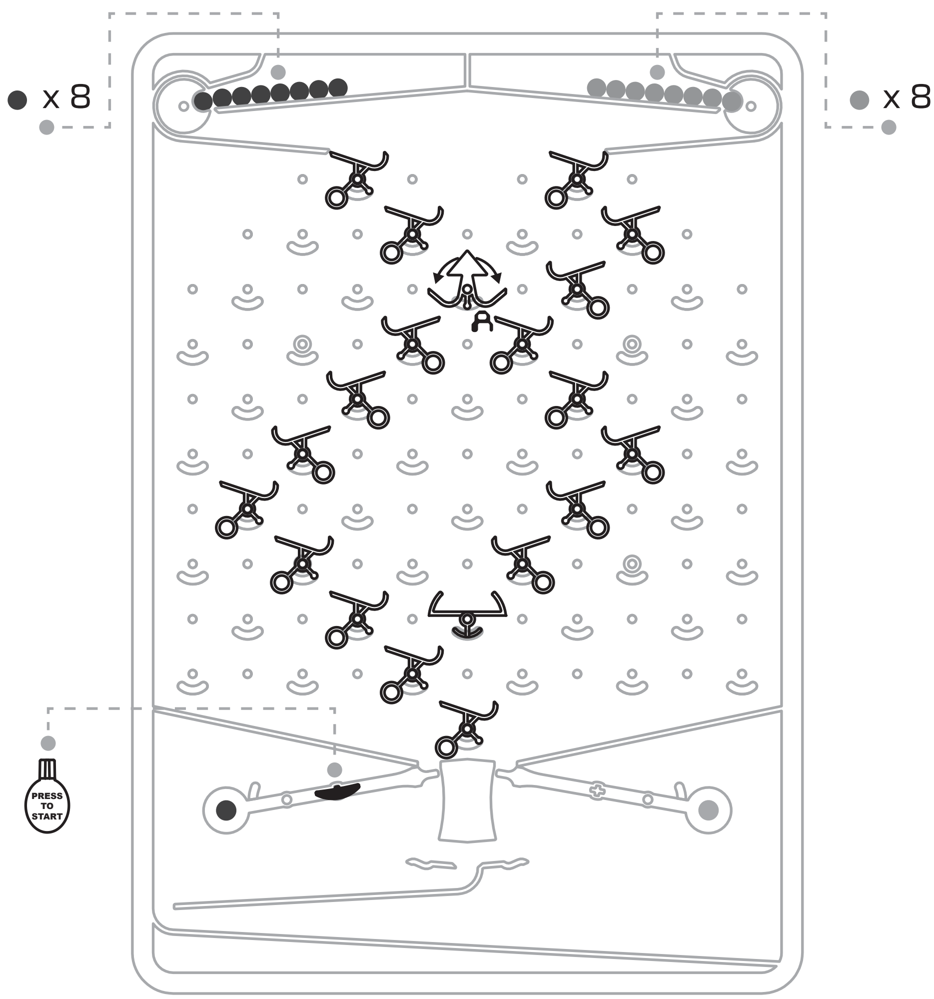
Explanation: Let's think about each of the two starting conditions separately.

A starts left:
Like puzzle 12, the first blue ball simply falls into the interceptor.



A starts right:
Like puzzle 13, the first blue ball falls onto the lever on the right side of the board, releasing a red ball that lands in the interceptor.



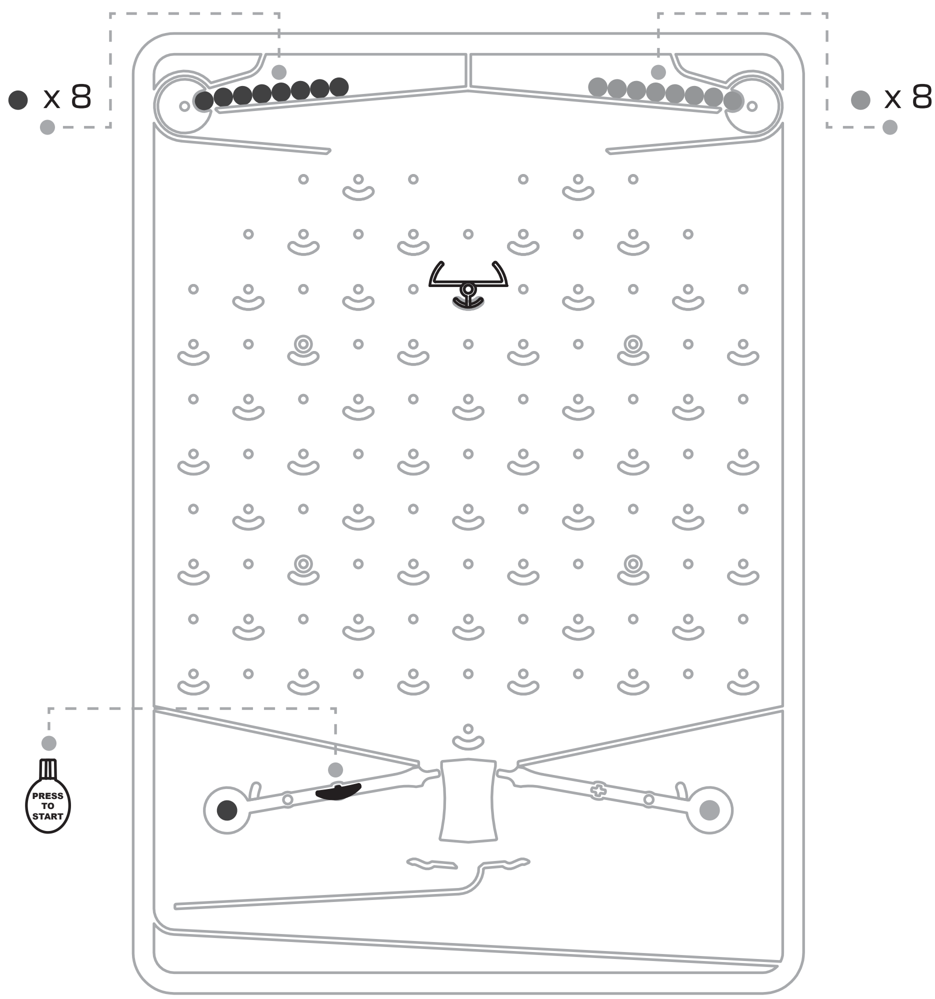


Practice Puzzle A for Challenge 15

Objective: Let only one blue ball reach the end. Intercept the 2nd ball.

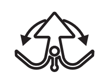
Required output:

Starting setup



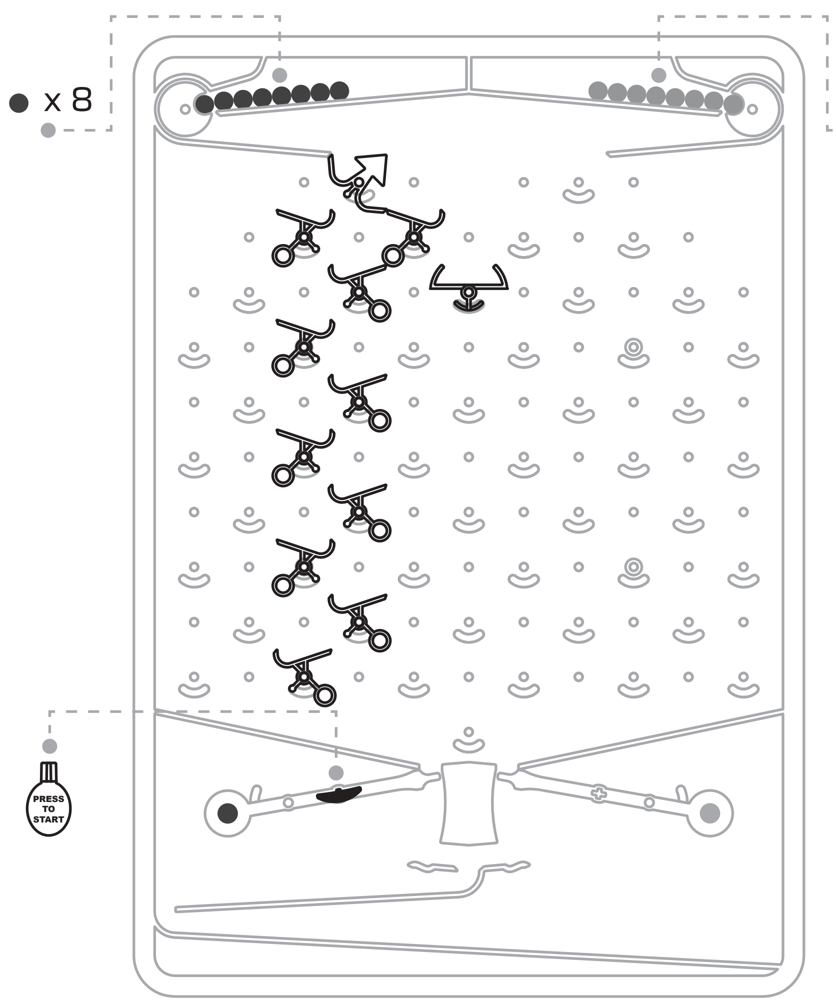
Available parts


x 12


x 1

Practice Challenge 15-A Solution

Explanation: Use the bit to make the first ball take a path that leads to the bottom and the second ball take a path to the interceptor.

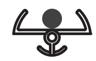


Practice Puzzle B for Challenge 15

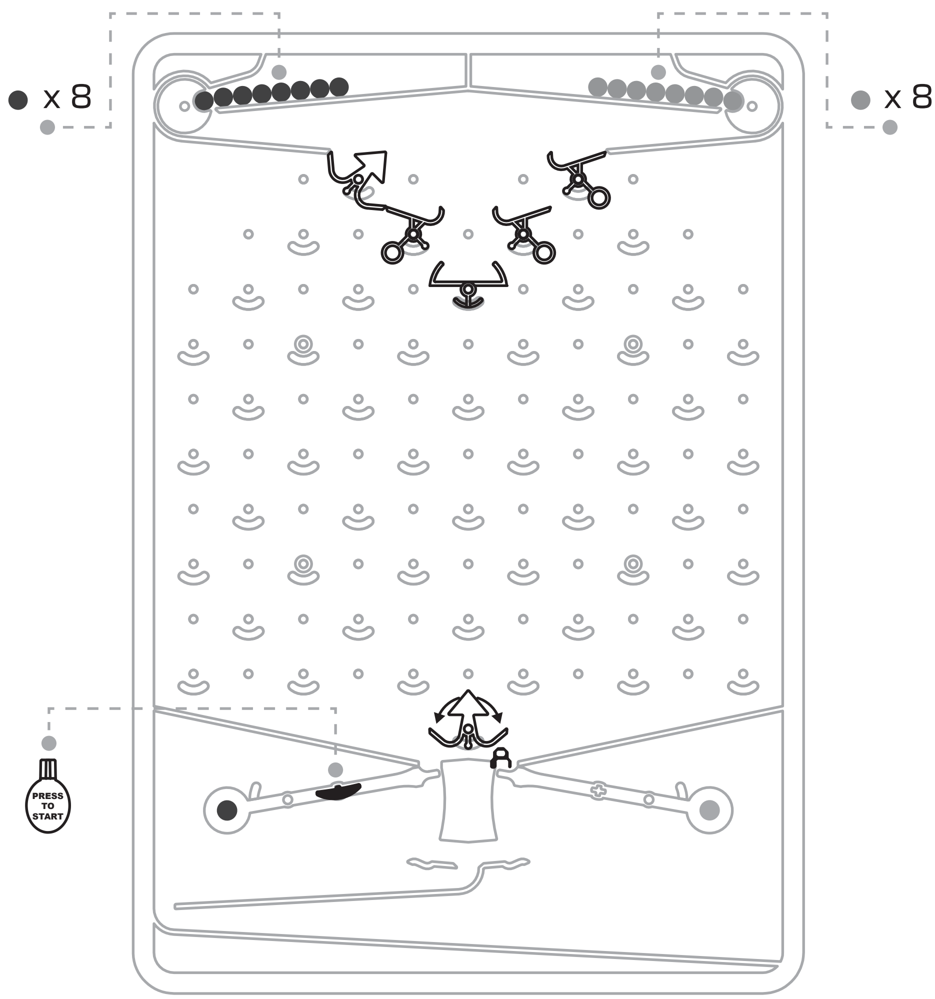
Objective: If bit A starts to the left, intercept a red ball. If bit A starts to the right, intercept a blue ball.

Examples:

If  then 

If  then 

Starting setup



Available parts

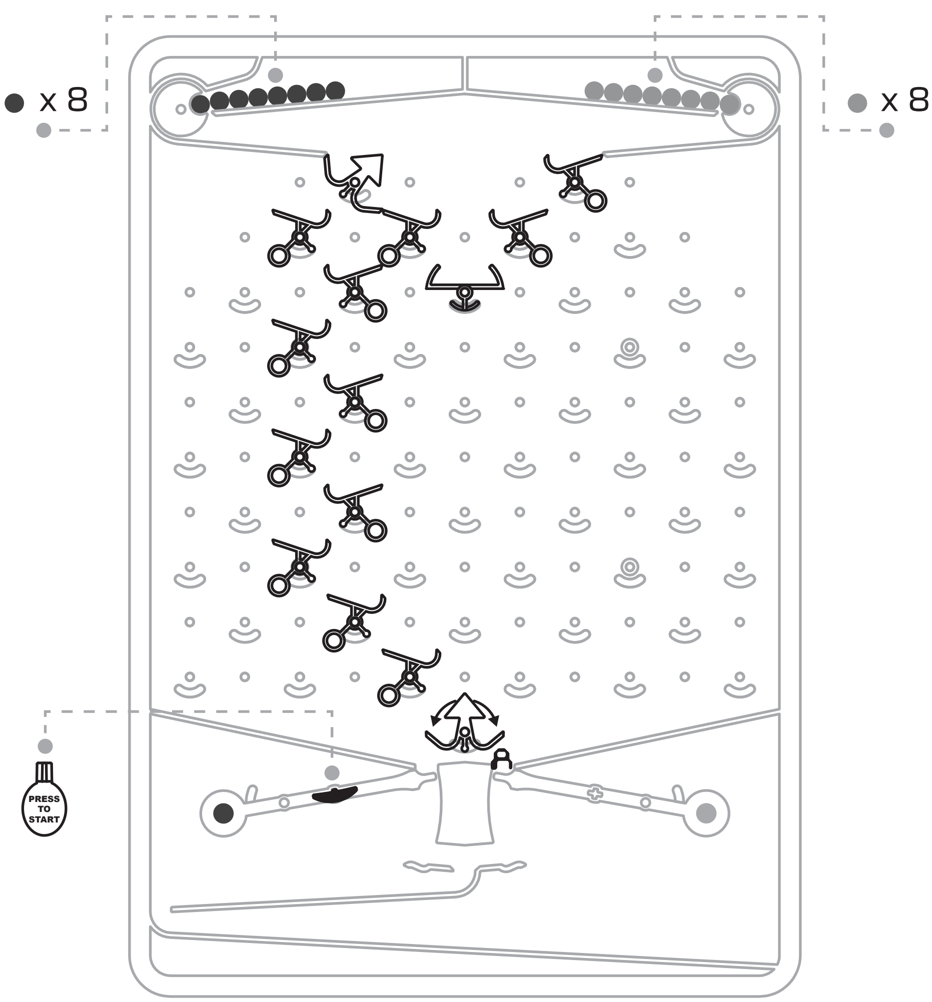
 x 11

Practice Challenge 15-B Solution

Explanation: This one is tricky! Bit A is all the way at the bottom of the board. How can you set the color of the ball that goes in an interceptor based on a bit that is **below** the interceptor?

You need to send information **up** the board! There are two ways to do that. The first way (the way we do it here) is to use the right and left levers. The color of the second ball released from the top will tell you the direction the bit at the bottom was pointing.

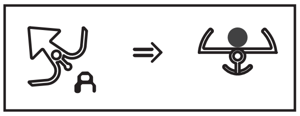
The second way to send information up the board is with gears and gear bits. We'll get to that later. :)

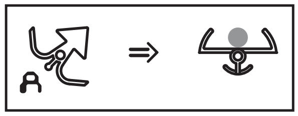


Challenge 15: Inversion

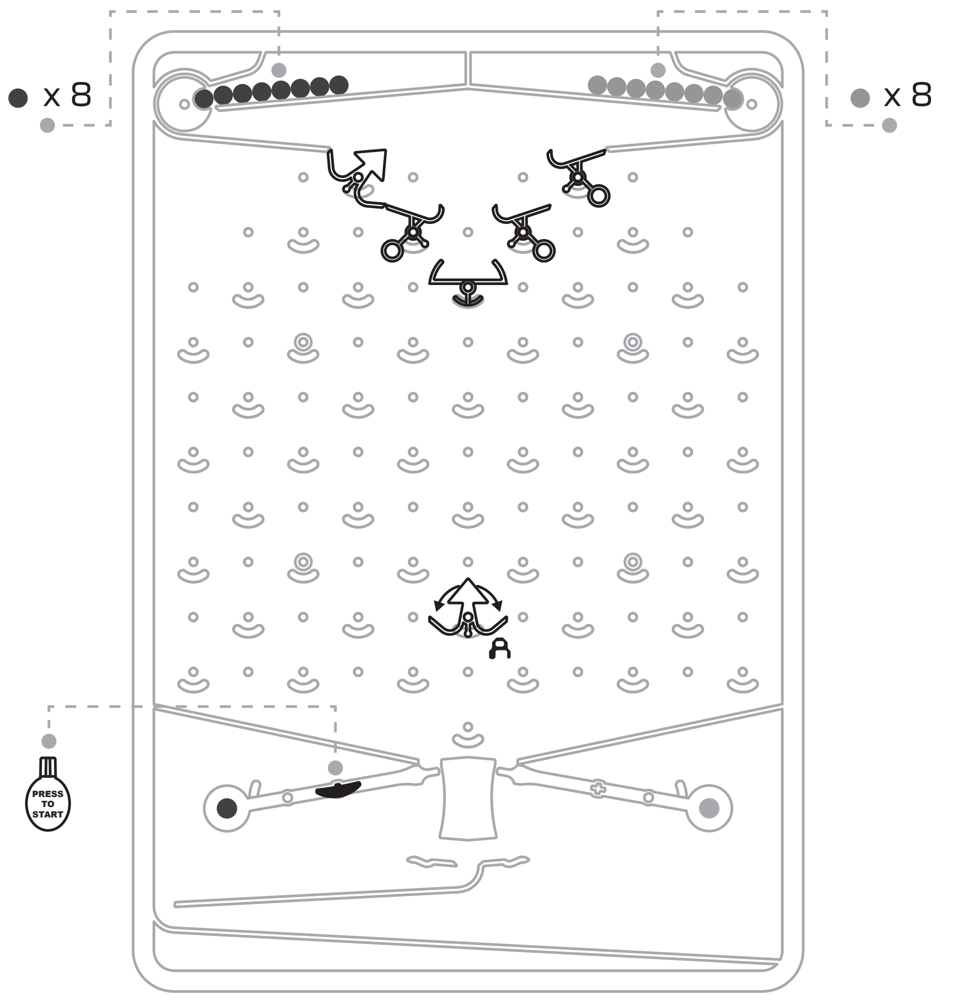
Objective: If bit A starts to the left, intercept a blue ball. If bit A starts to the right, intercept a red ball.

Examples:

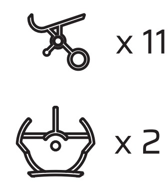




Starting setup

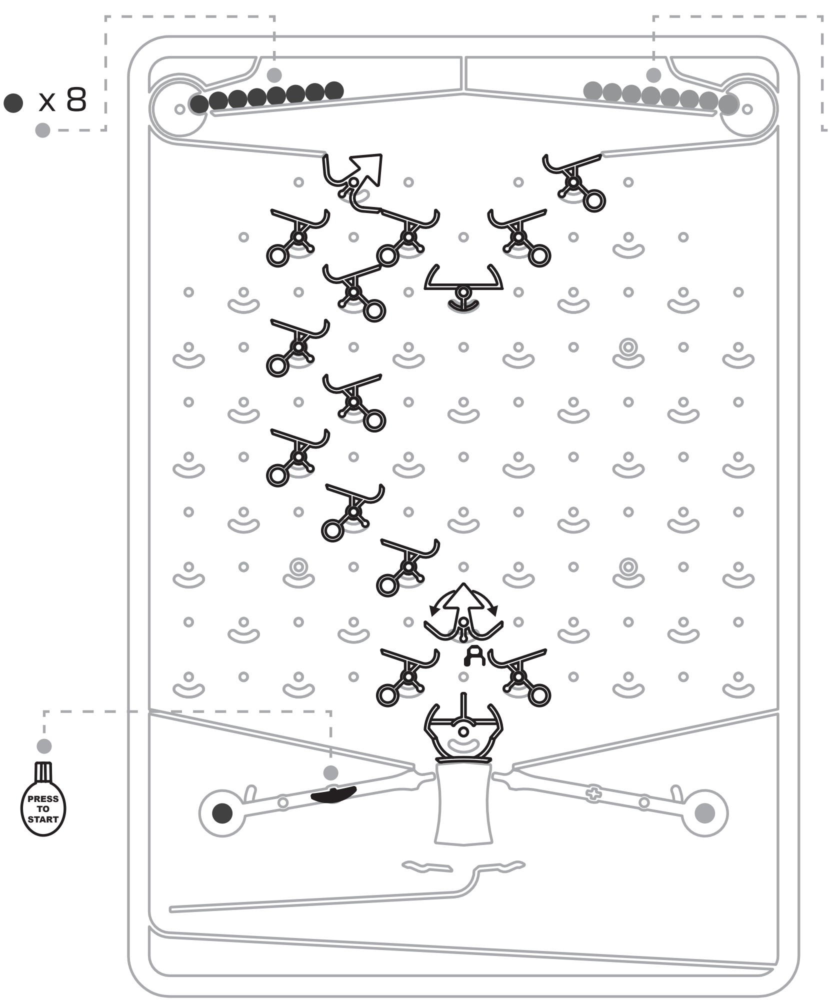


Available parts



Challenge 15 Solution

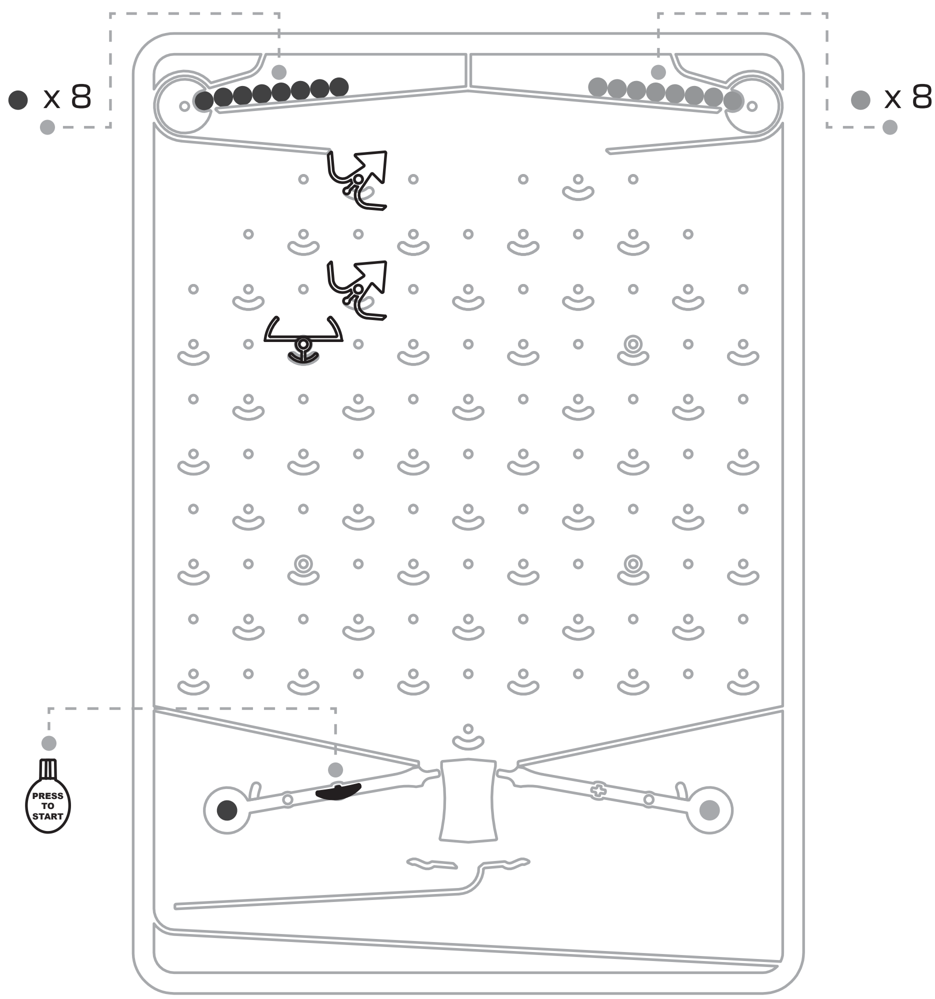
Explanation: Like the previous puzzle, the bit at the bottom of the board decides the color of the ball that must go in the interceptor. But for this puzzle, **the colors are reversed**! Here we do that with a carefully placed crossover.



Practice Puzzle A for Challenge 16

Objective: Catch the 1st blue ball in the interceptor.

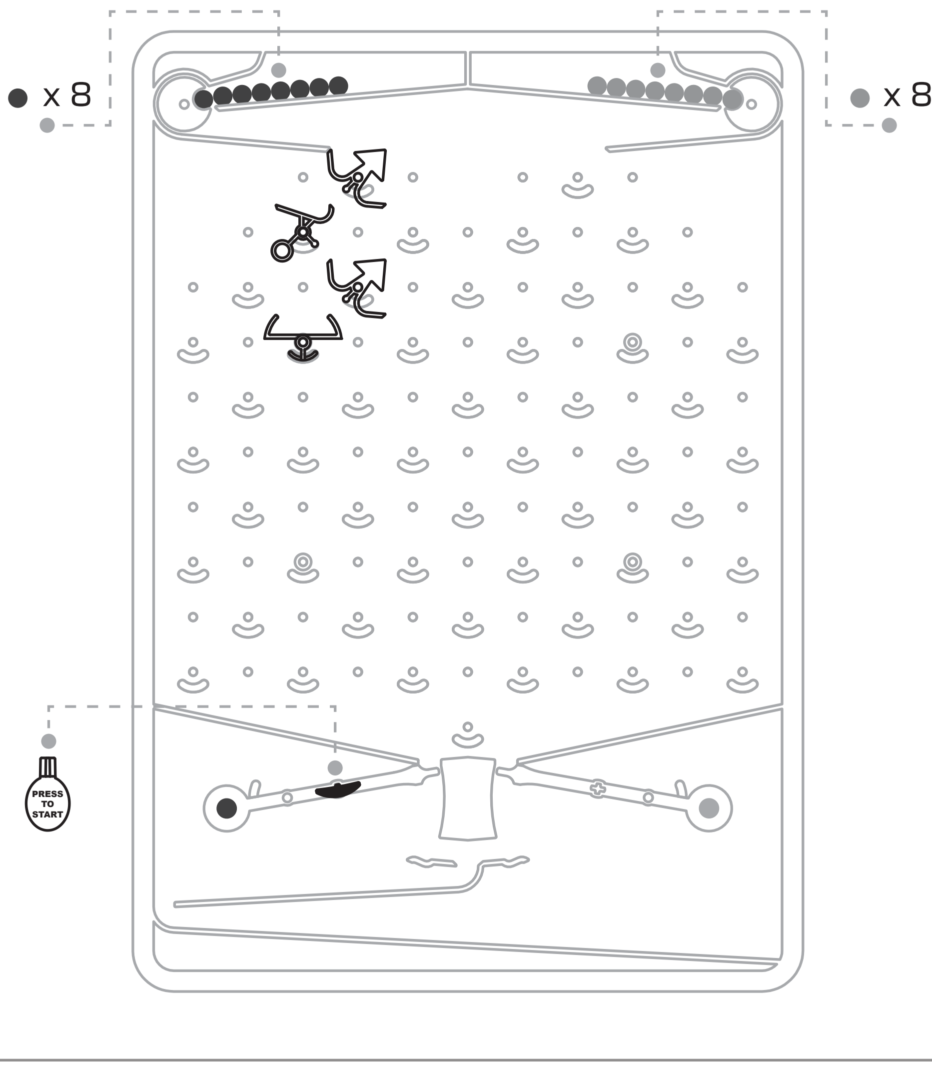
Starting setup



Available parts

Practice Challenge 16-A Solution

Explanation: Since both bits start pointed to the right, you only need to add a single ramp to finish the path to the interceptor.

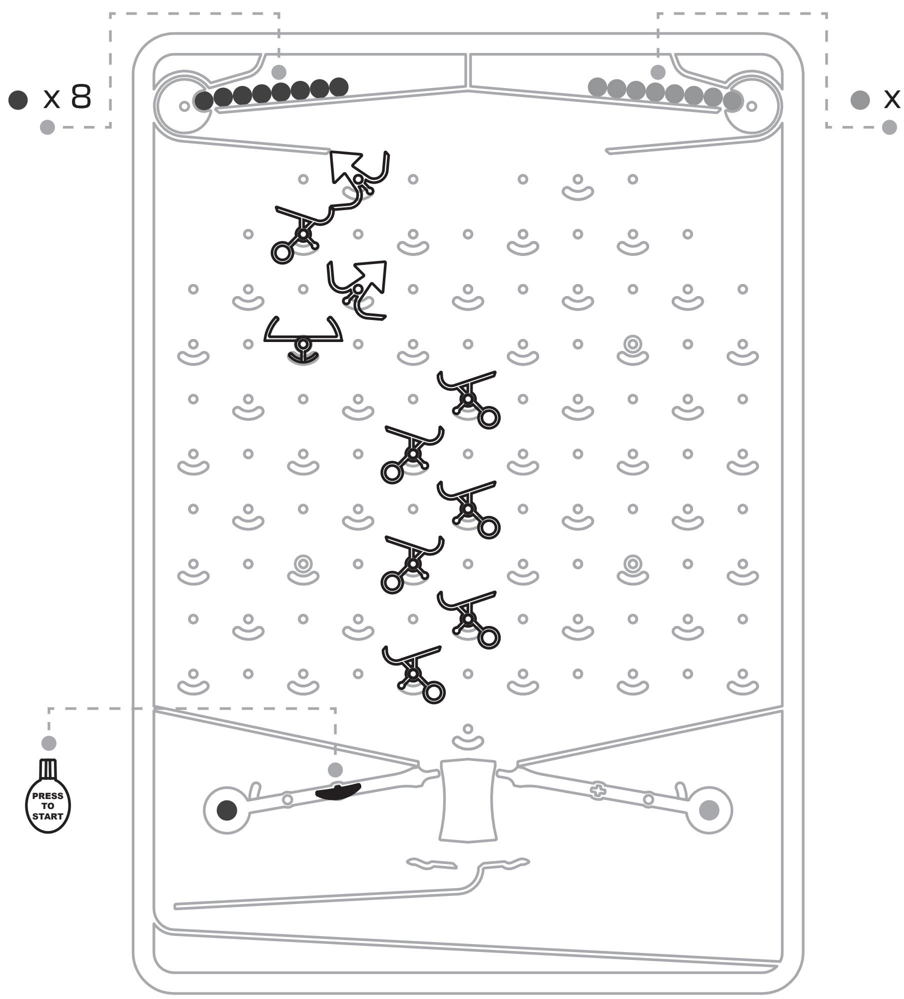


Practice Puzzle B for Challenge 16

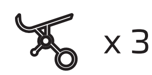
Objective: Let only 1 blue ball reach the bottom and catch the 2nd ball in the interceptor.

Required output:

Starting setup

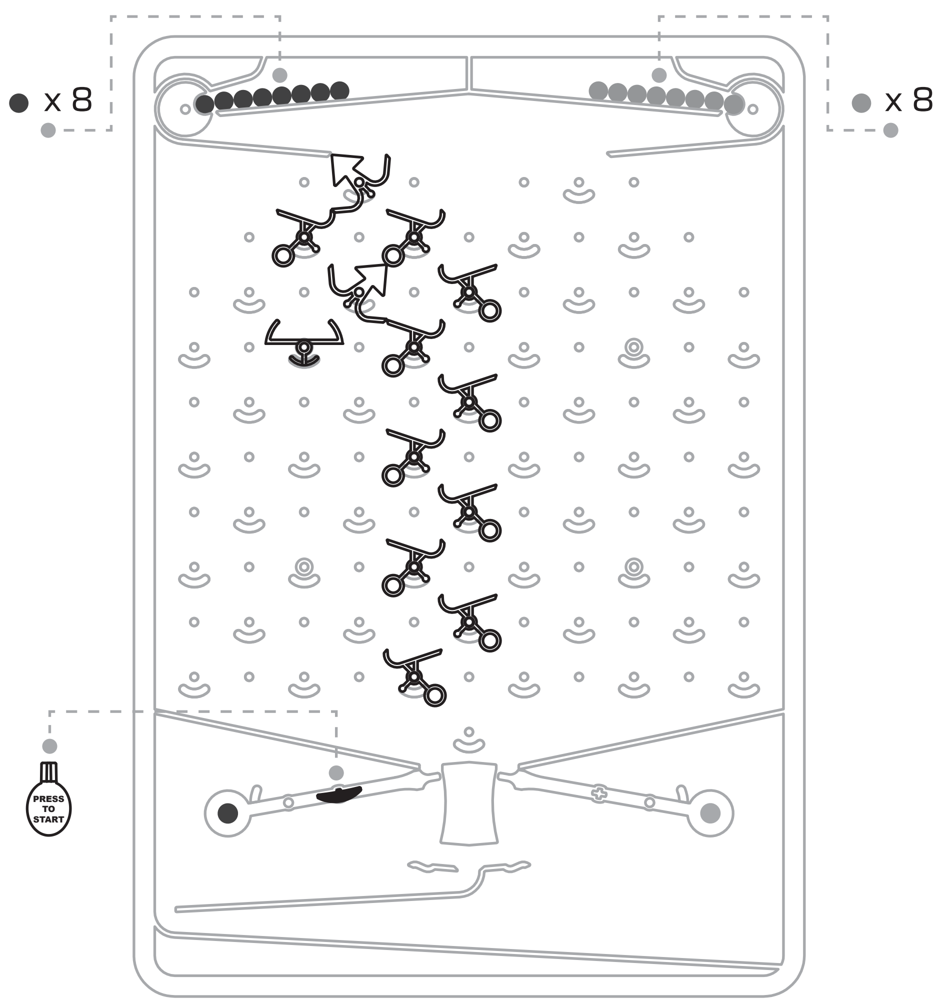


Available parts



Practice Challenge 16-B Solution

Explanation: The top bit sends the first ball to the right, which leads to the left lever. Then, when the second ball is released, both bits point right, just like in the previous challenge. The second ball travels to the interceptor.

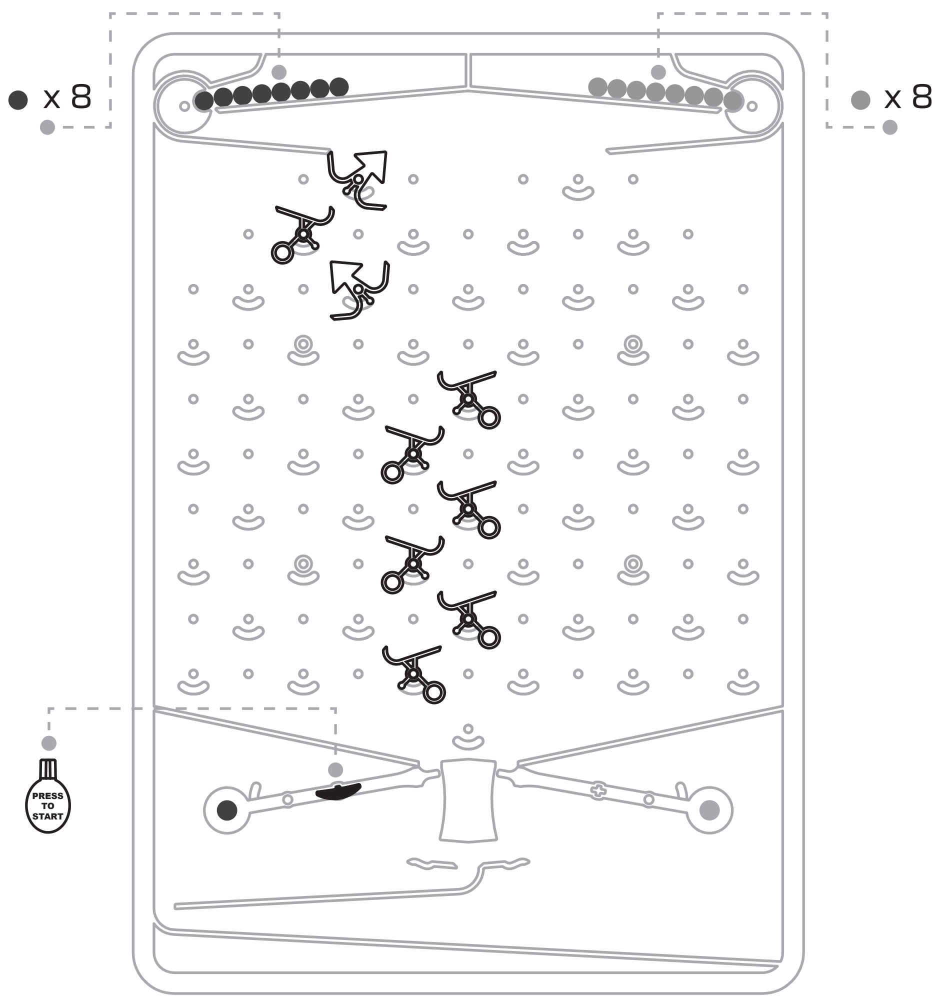


Practice Puzzle C for Challenge 16

Objective: Let only 2 blue balls reach the bottom and catch the 3rd ball in the interceptor.

Required output:

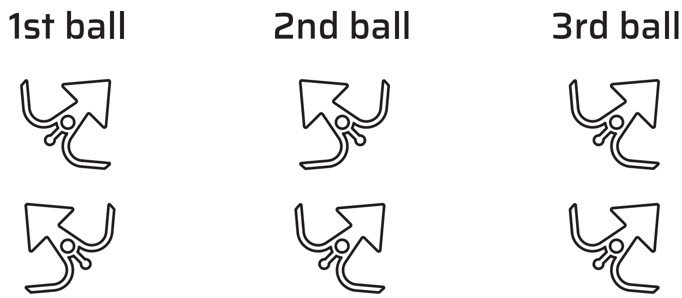
Starting setup



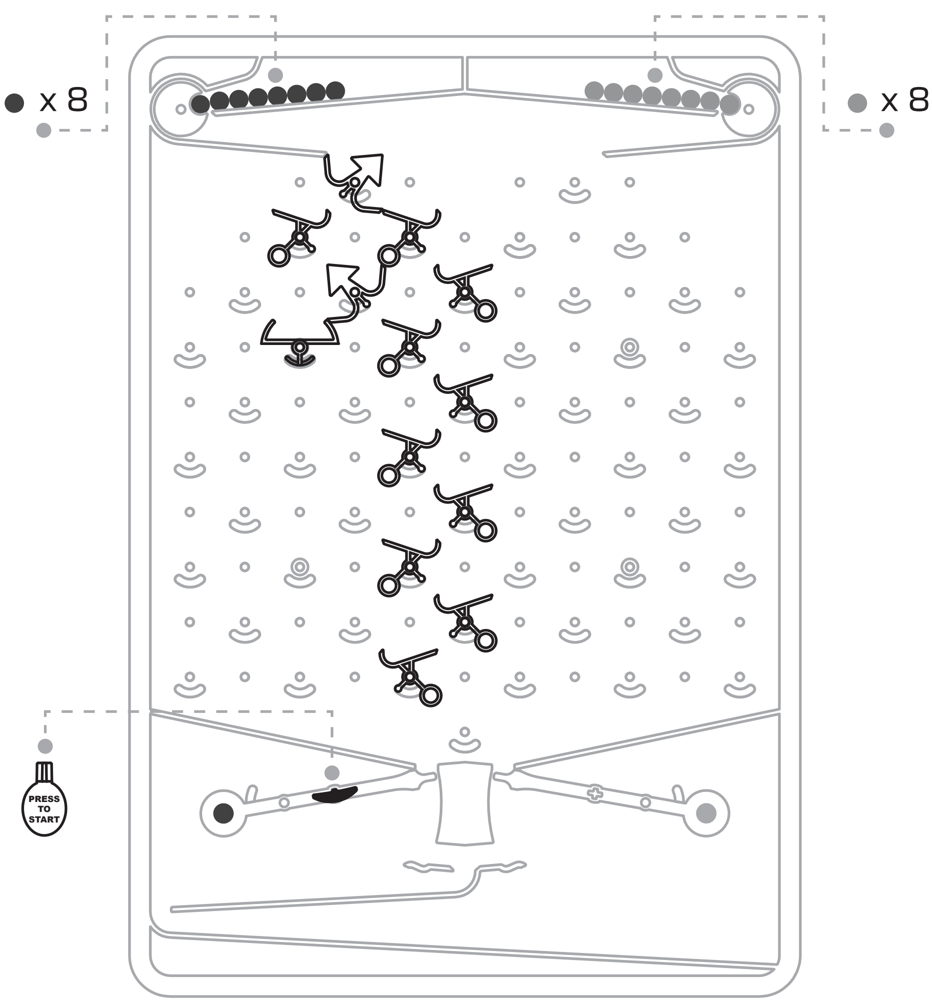
Available parts

Practice Challenge 16-C Solution

Explanation: Think about the direction the bits are pointing when each ball is released:



Notice that the top bit flips with every ball, but the bottom bit only flips when the top bit points left.

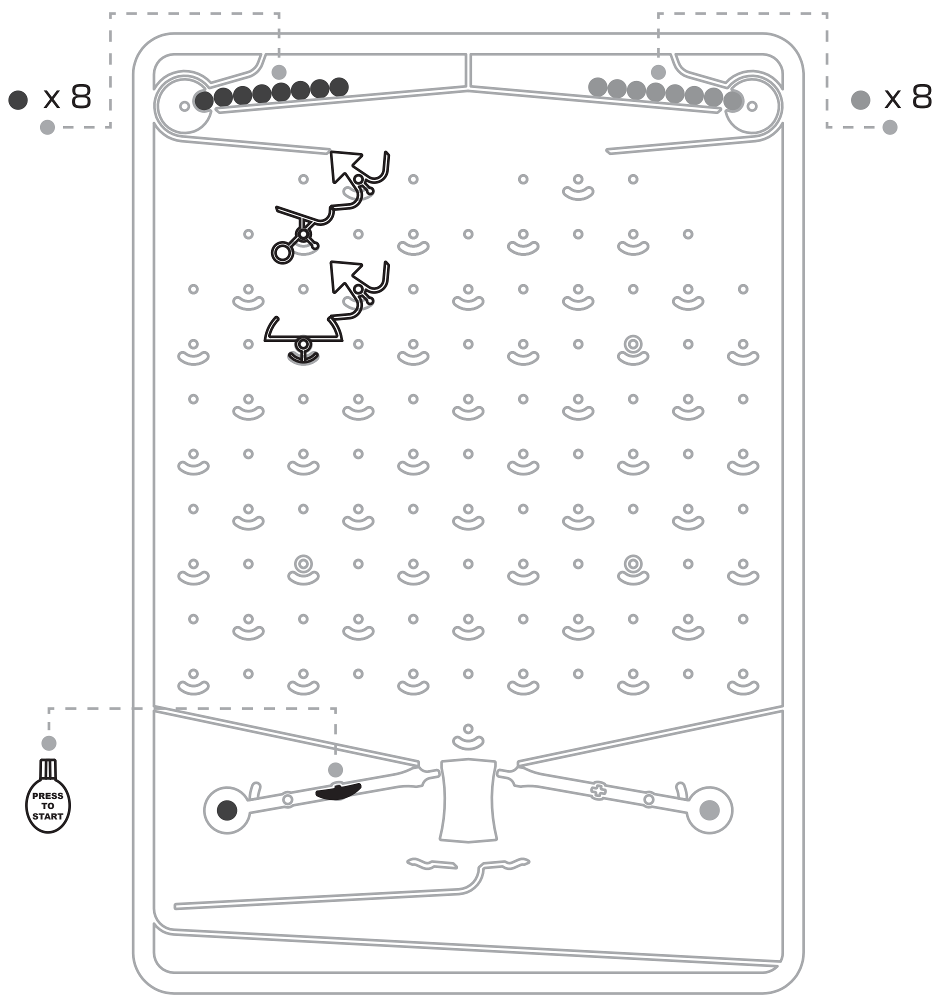


Challenge 16: Termination

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

Required output:

Starting setup

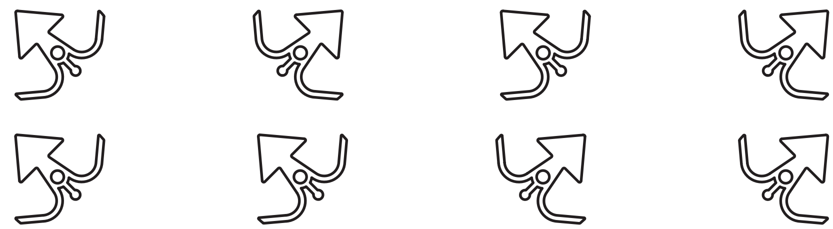


Available parts

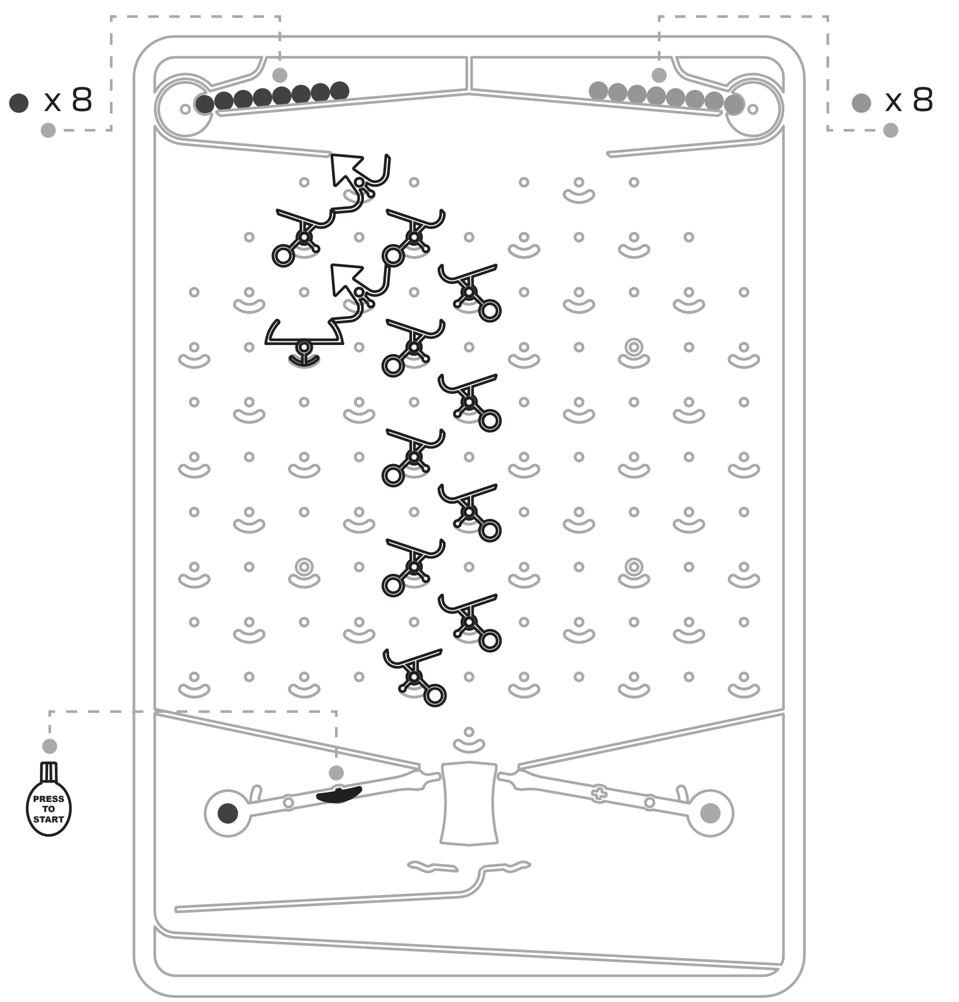
Challenge 16 Solution

Explanation: Like the previous puzzle, think about the direction the bits point when each ball is released:

1st ball	2nd ball	3rd ball	4th ball



The way these bits count out balls is important! You'll use it many times in the coming puzzles.

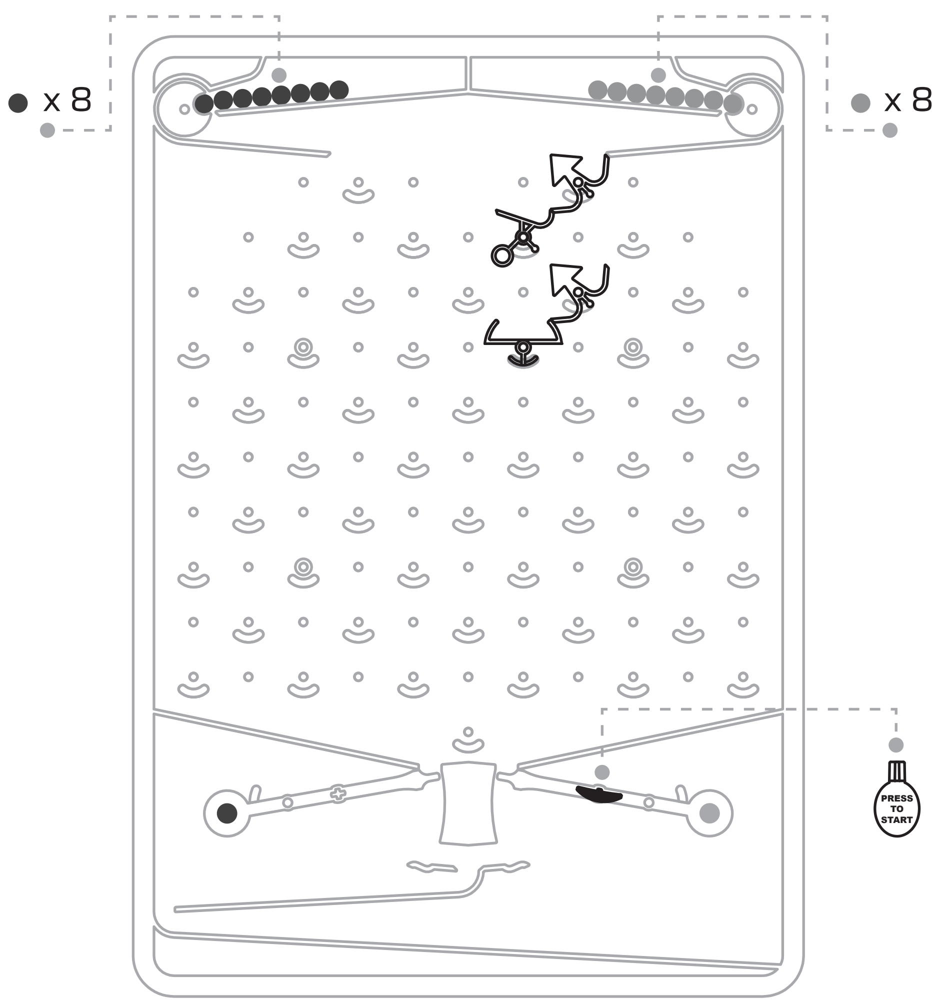


Practice Puzzle A for Challenge 17

Objective: Let only 3 red balls reach the bottom and catch the 4th ball in the interceptor.

Required output:

Starting setup

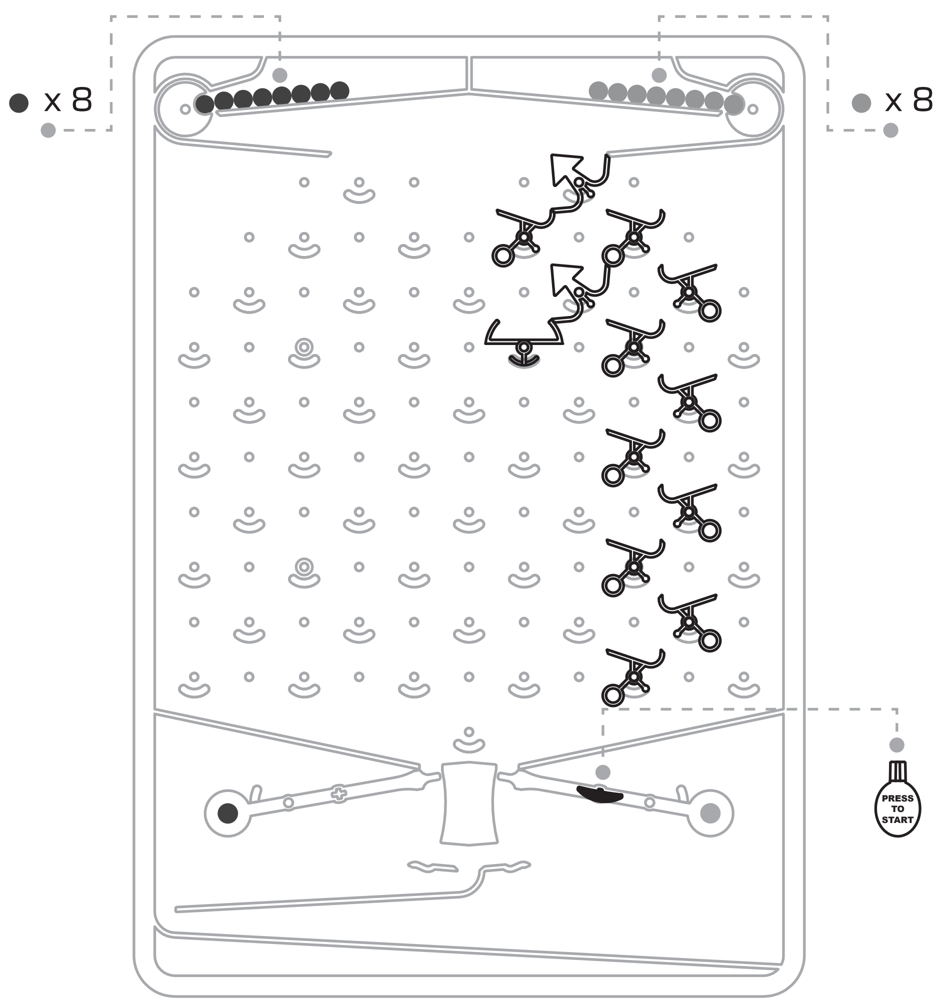


Available parts

x 10

Practice Challenge 17-A Solution

Explanation: This puzzle demonstrates how you can flip the solution to the previous puzzle around and get the same thing.

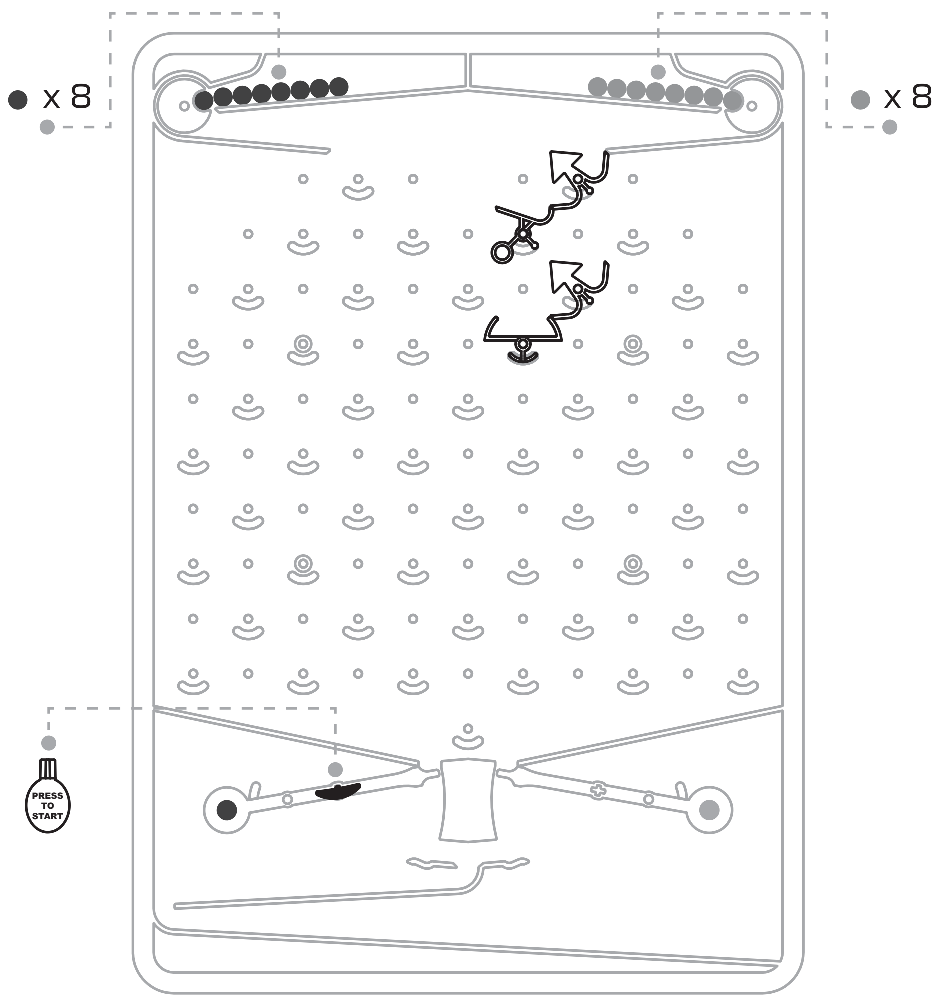


Practice Puzzle B for Challenge 17

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

Required output:

Starting setup

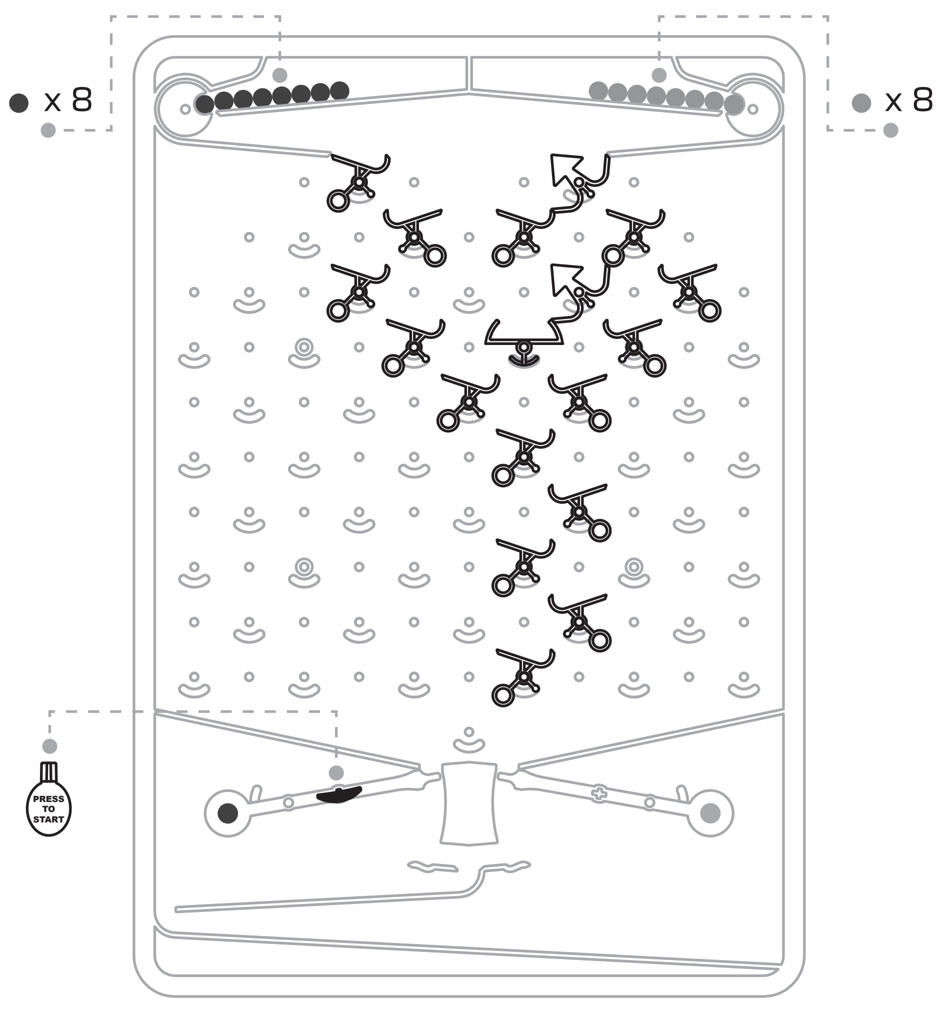


Available parts

x 16

Practice Challenge 17-B Solution

Explanation: Here you can kick off the computer by releasing a blue ball that travels to the right lever and releases a red ball. The red ball starts the two bit counter (just like the previous puzzle) that stops after 4 red balls are released.

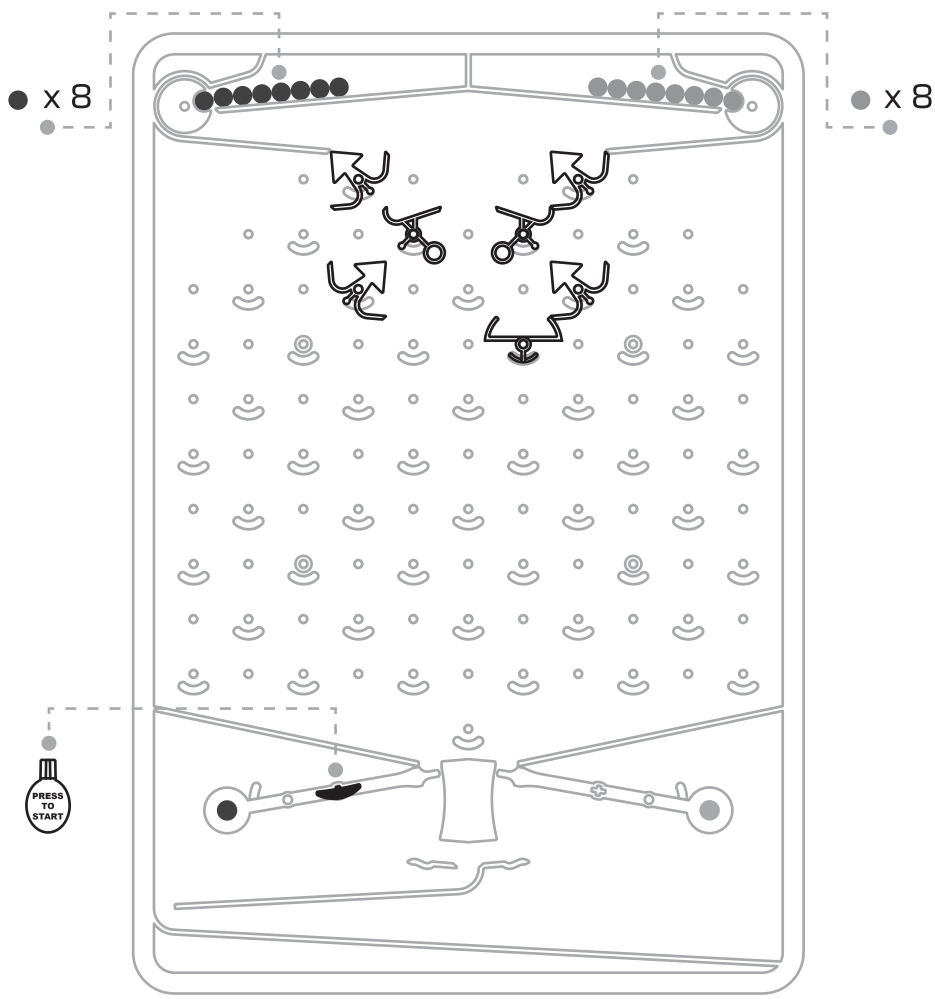


Challenge 17: Fixed Ratio

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

Required output:

Starting setup

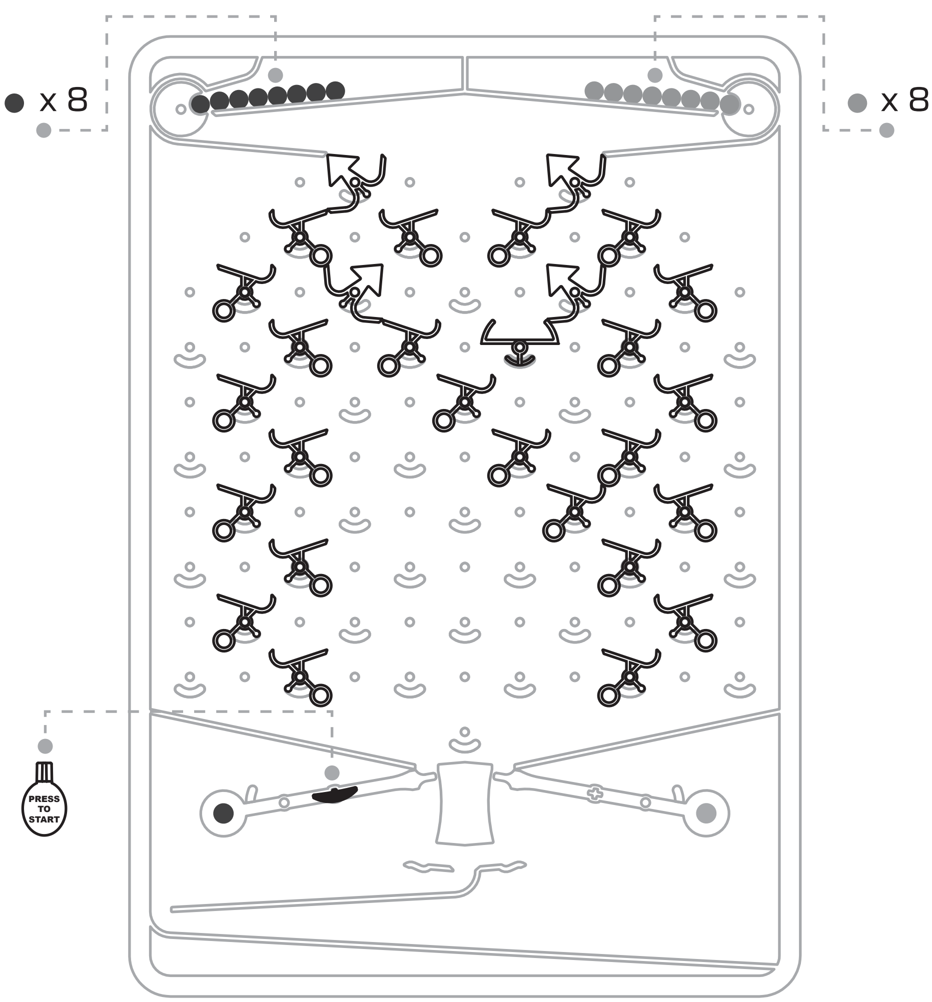


Available parts

x ∞

Challenge 17 Solution

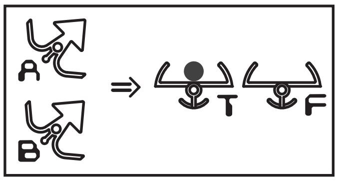
Explanation: Now we have two 2-bit counters - one on the left and one on the right. Notice the starting positions of the bits! To get three blues and three reds in the output, we have to count out **3 blue balls**, and **4 red balls** (the 4th ball goes into the interceptor!).

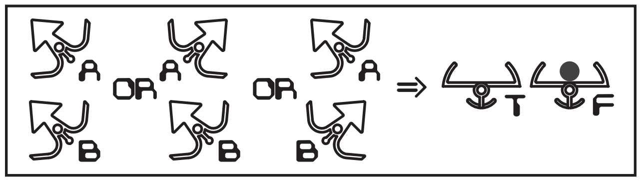


Practice Puzzle A for Challenge 18

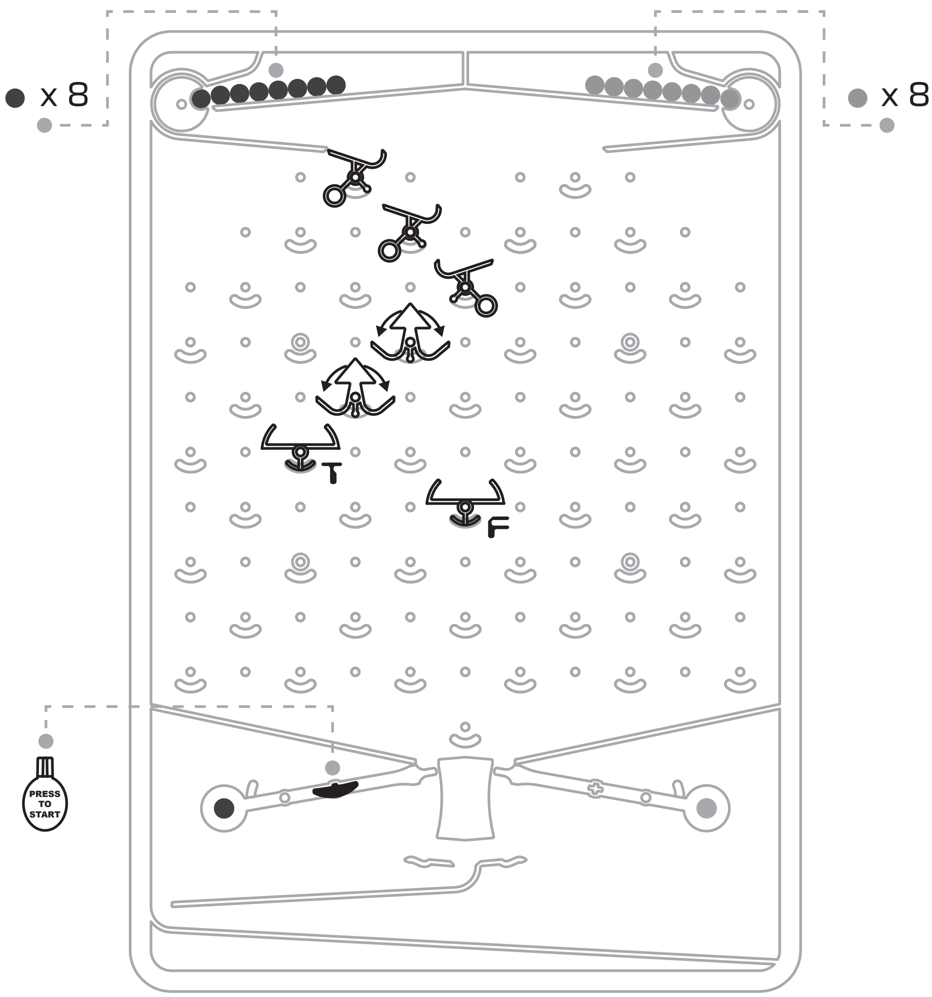
Objective: If both bits start pointed to the right, put a ball in interceptor T. Otherwise put a ball in interceptor F.

Examples:





Starting setup

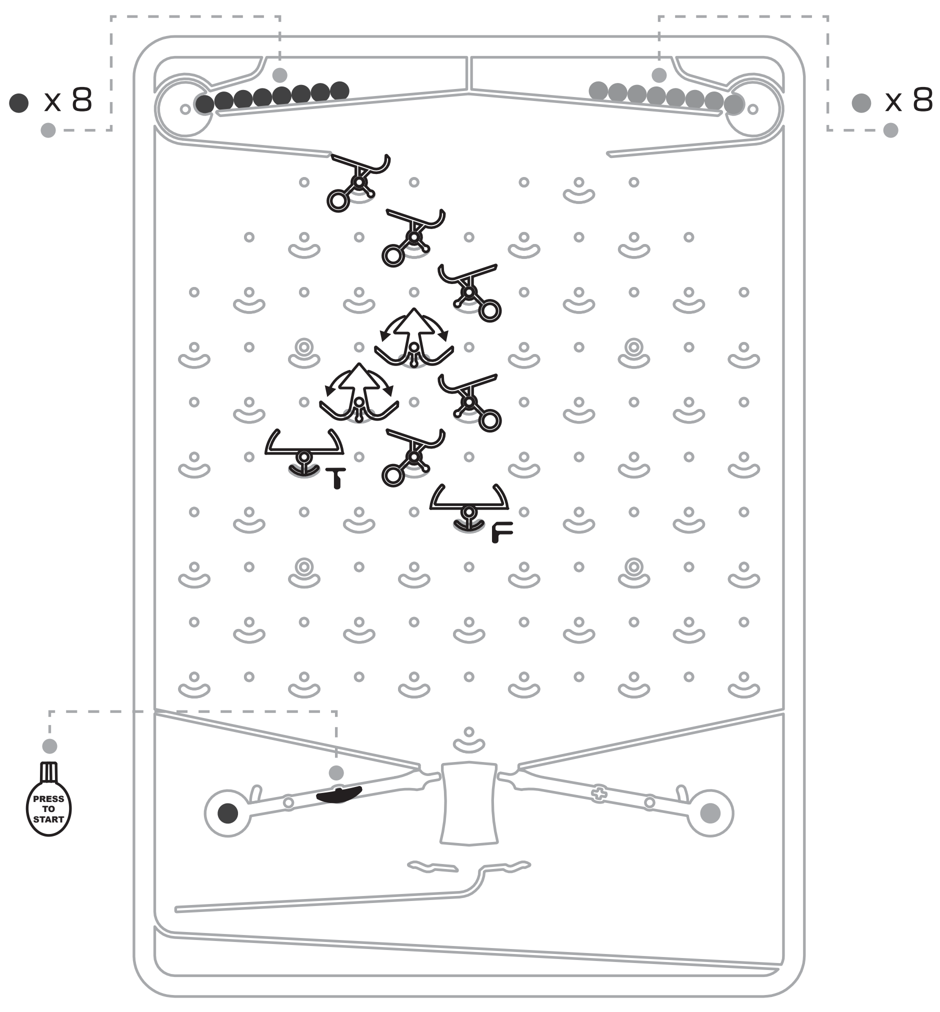


Available parts

x 3

Practice Challenge 18-A Solution

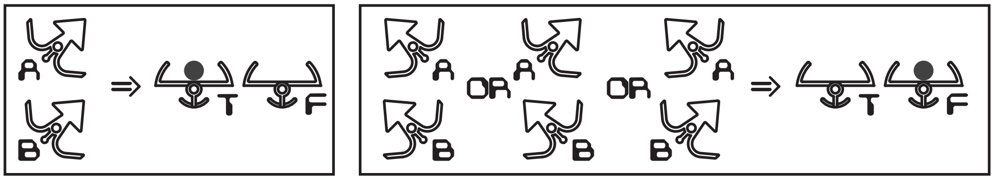
Explanation: When both bits point right, it's a straight shot to interceptor T. Your job is to add ramps to get the ball to interceptor F when either one of the bits start pointed left.



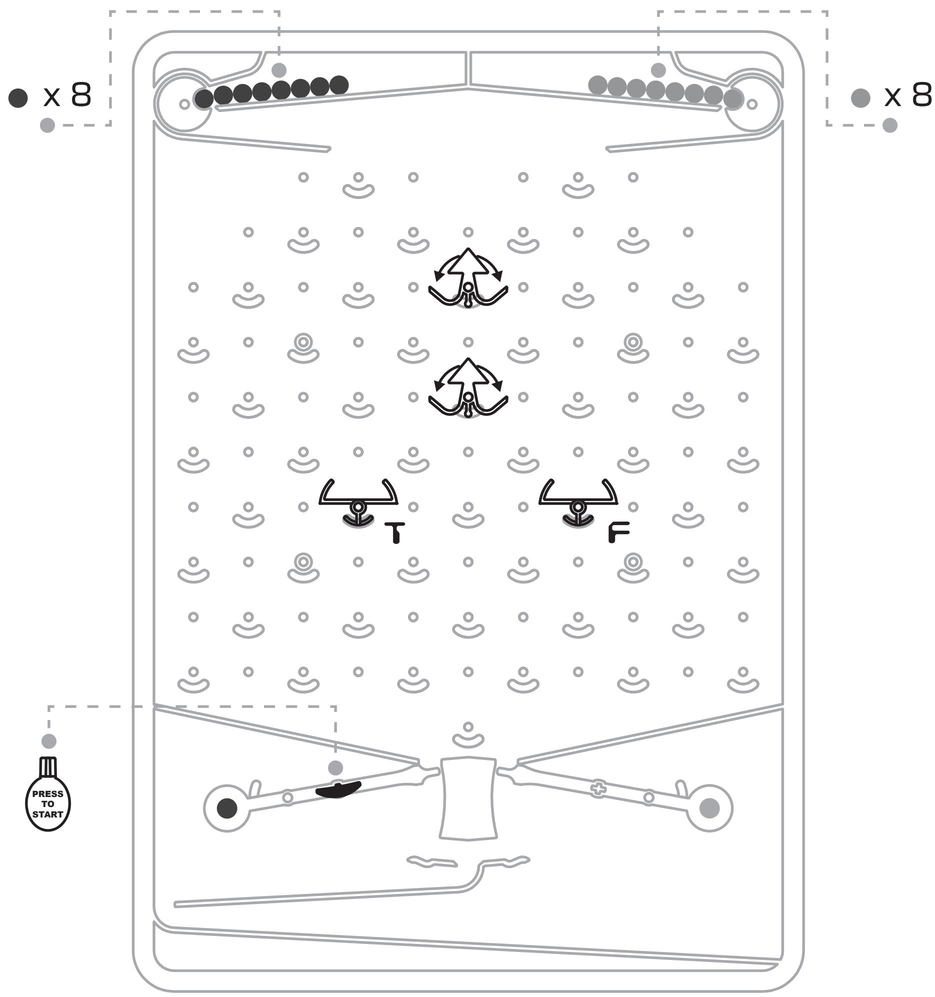
Challenge 18: Entanglement

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.

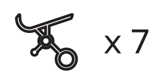
Examples:



Starting setup

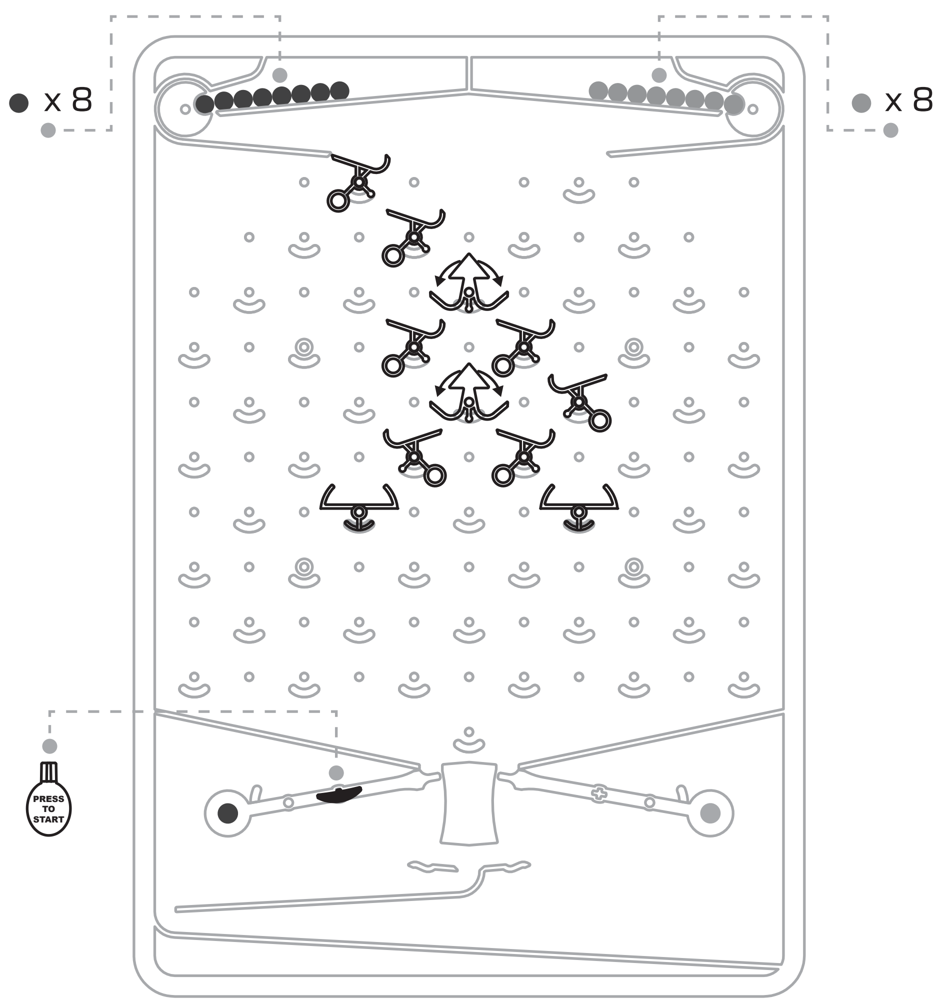


Available parts



Challenge 18 Solution

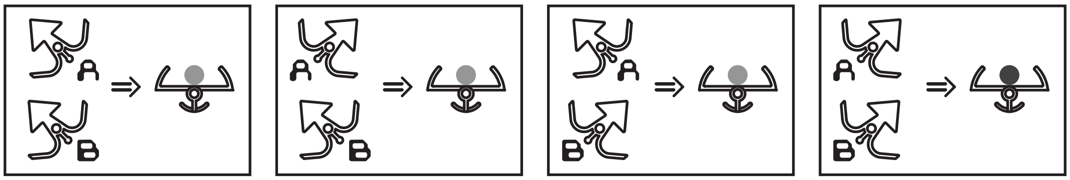
Explanation: This puzzle is the same as the last puzzle, except that the path the ball must take in each case is a little different.



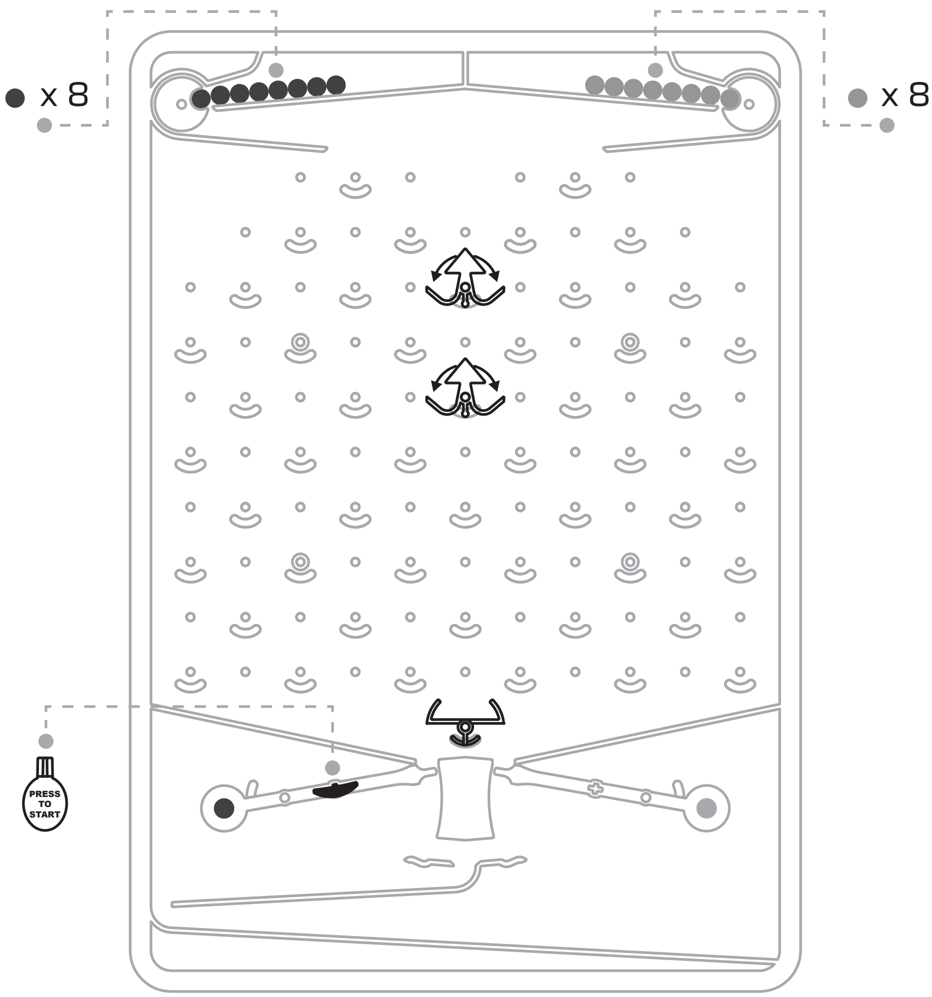
Challenge 19: Entanglement

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

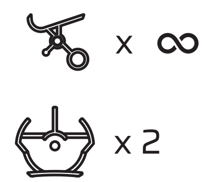
Examples:



Starting setup

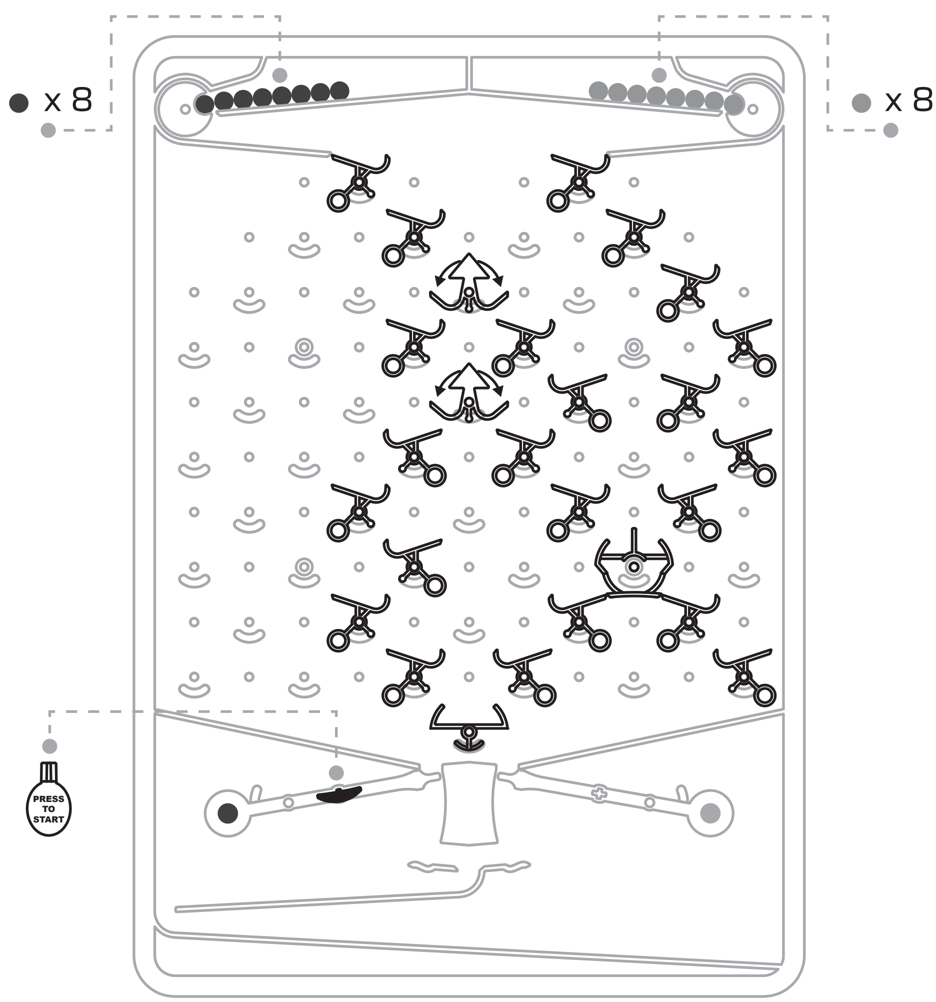


Available parts



Challenge 19 Solution

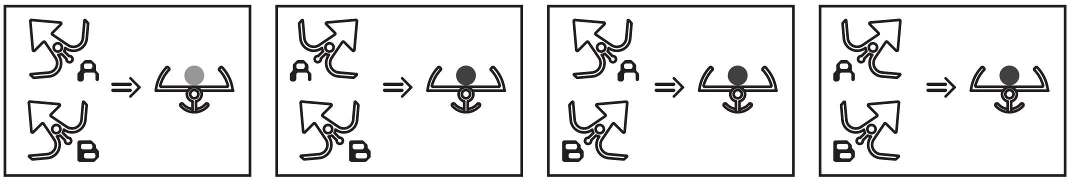
Explanation: This time there is only one interceptor. Instead of sending the ball to interceptor F if the bits aren't both pointed right, you must direct the ball to the right lever. Then direct the red ball that's released to the interceptor.



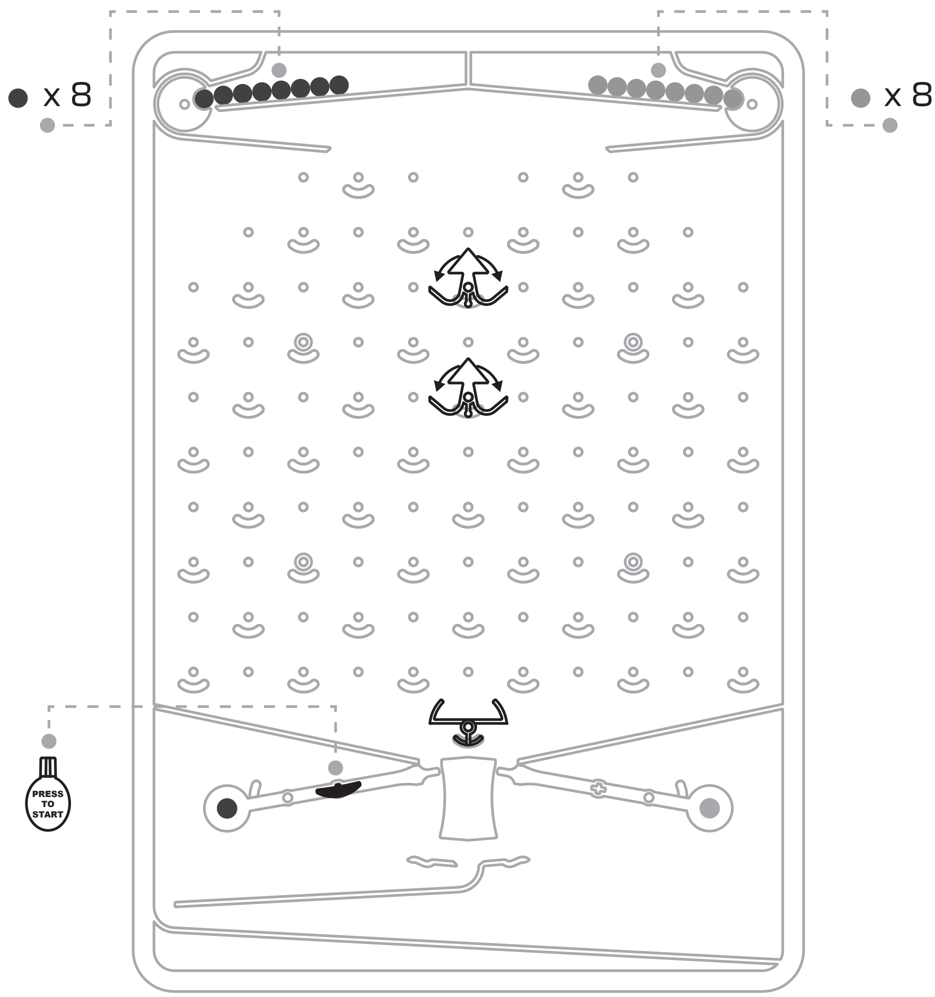
Challenge 20: Symbiosis

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

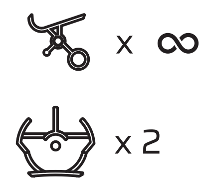
Examples:



Starting setup

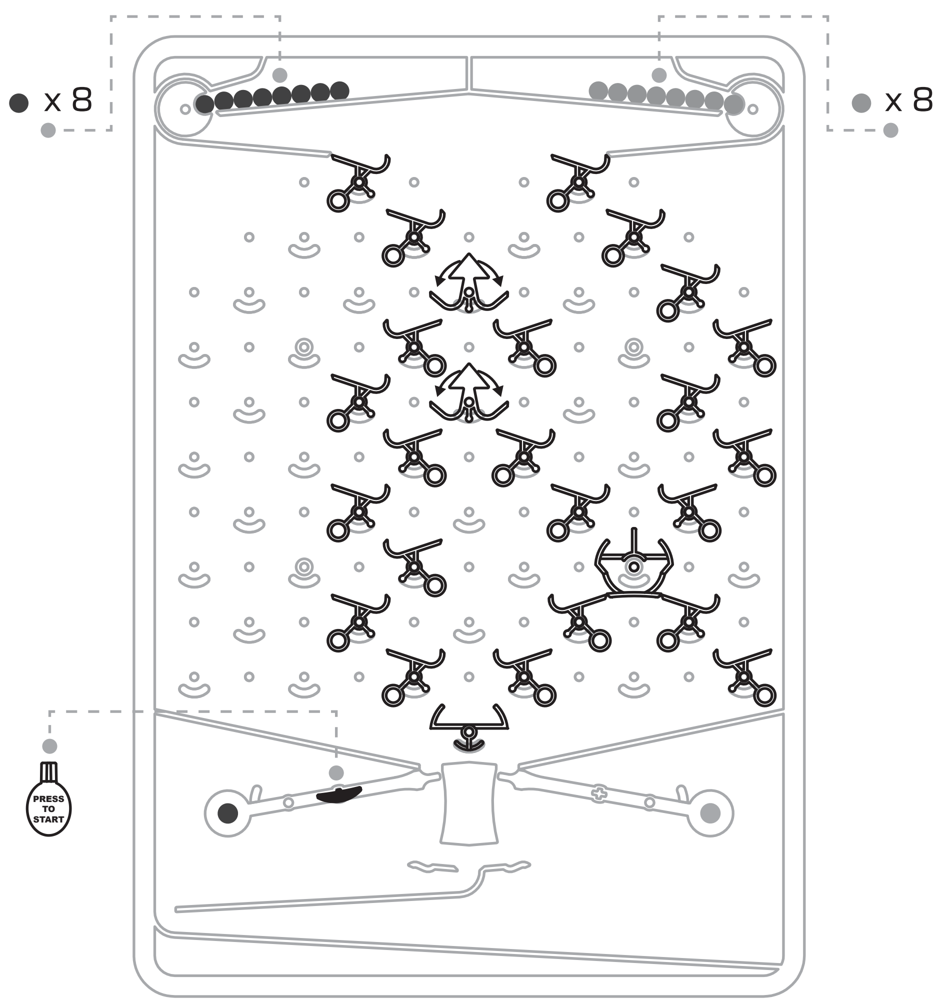


Available parts



Challenge 20 Solution

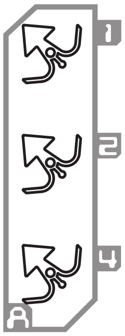
Explanation: It's easiest to consider the first condition - when both bits are pointed left. Make that path go directly to the red lever and make a path for the red ball to go directly to the interceptor. Then make every other possible path for that first blue ball lead to the interceptor.



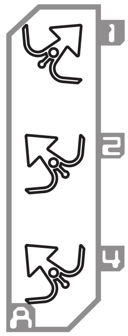
Practice Puzzle A for Challenge 21

Objective: Each register below shows a number. Can you figure out what number is shown by each one?

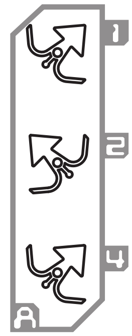
Examples:



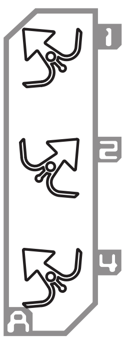
= 0



= 1



= 5



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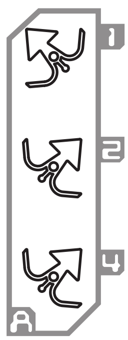
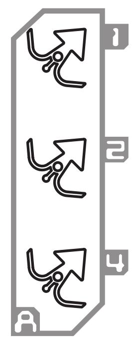


= ______



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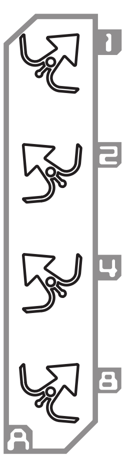

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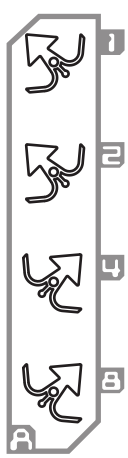

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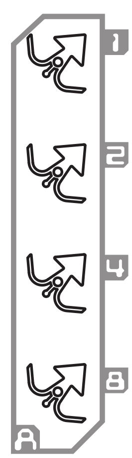


= ______

Practice Challenge 21-A Solution

Explanation: Remember - to figure out the number shown, simply add the number next to each bit that is pointed right.

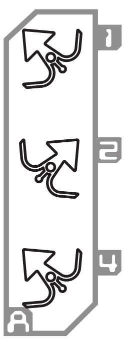
A. How many numbers can be represented by a 3-bit register?

B. How many numbers can be represented by a 4-bit register?

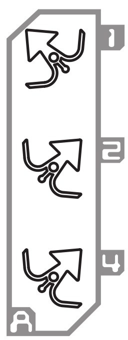
C. What is the smallest number that can be represented on a 4-bit register?

D. What is the largest number that can be represented on a 4-bit register?

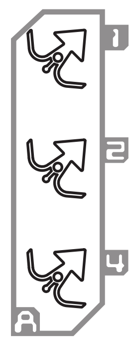
A. 8 B. 16 C. 0 D. 15



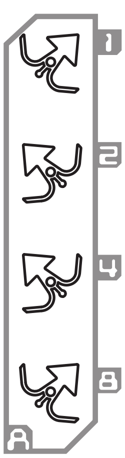
= 2



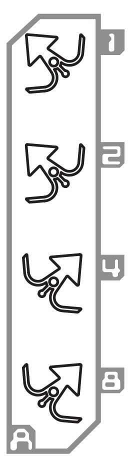
= 6



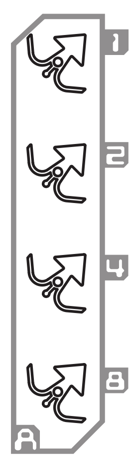
= 7



= 9



= 12



= 15

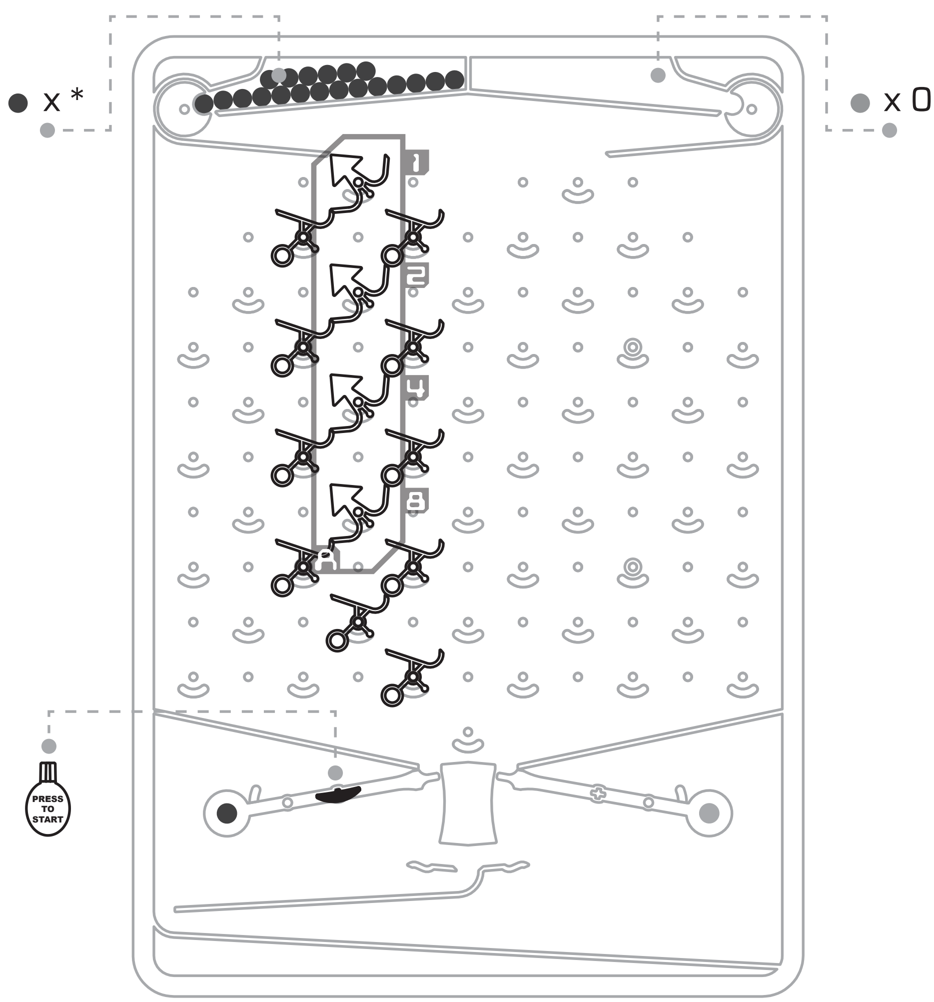
Challenge 21: Quantum Number

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

Examples:

● x 5 ⇒ A = 5	● x 14 ⇒ A = 14
● x 7 ⇒ A = 7	● x 11 ⇒ A = 11

Starting setup



Available parts

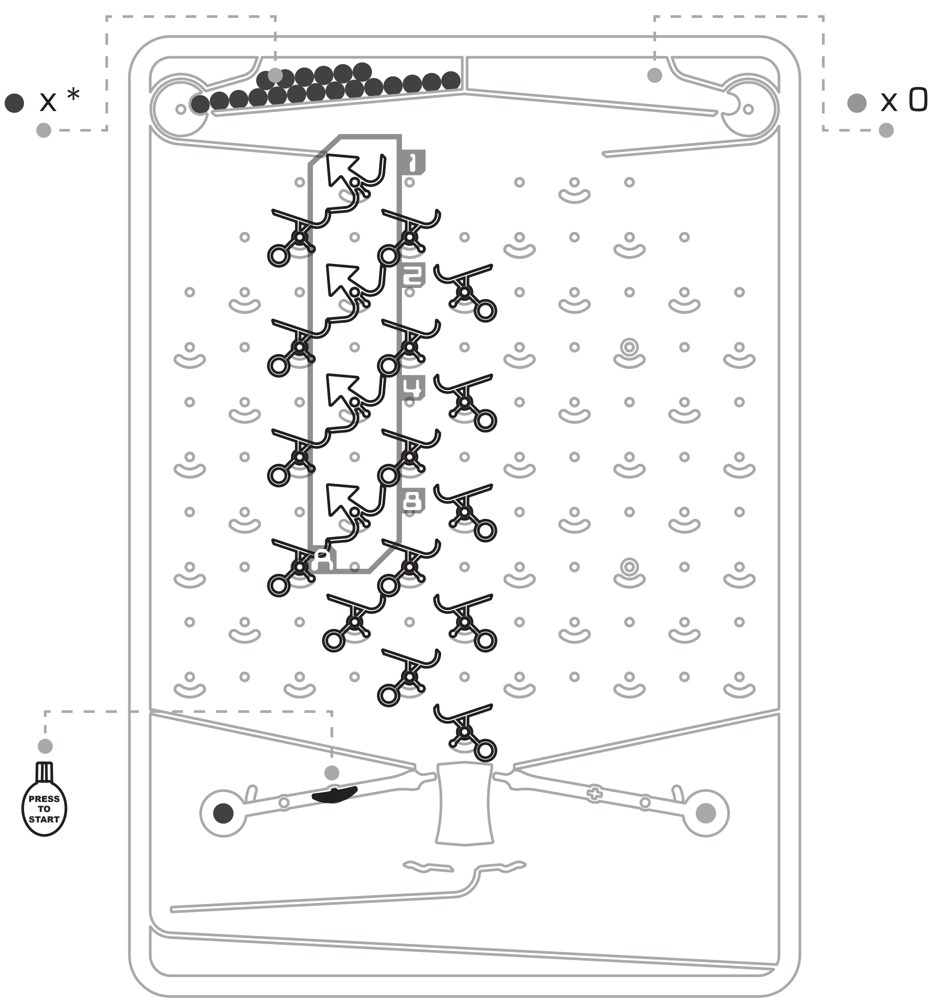
 x 5

Challenge 21 Solution

Explanation: This seems a lot more complicated than it really is!

The top bit flips with every ball.
The 2nd bit flips every 2nd ball (whenever the top bit flips to the left).
The 3rd bit flips every 4th ball (whenever the 2nd bit flips to the left).
The 4th bit flips every 8th ball (whenever the 3rd bit flips to the left).

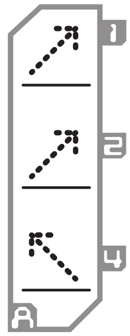
That’s it! Remember how this works - it’ll be in a lot of the puzzles to come.

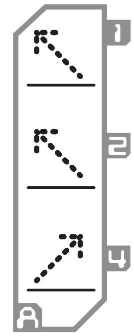


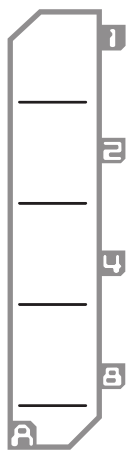
Practice Puzzle A for Challenge 22

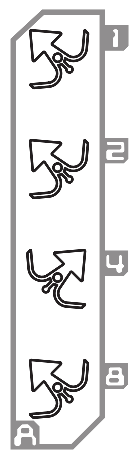
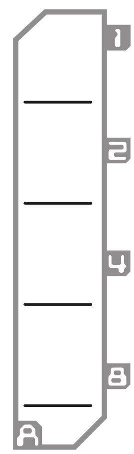
Objective: Draw bits to solve the following problems.

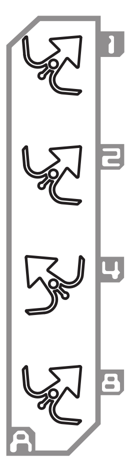
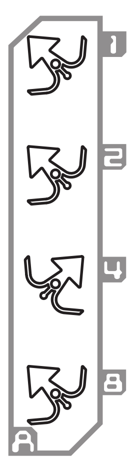
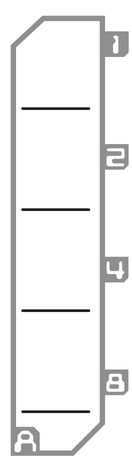
Examples:

7 – 4 = 

6 – 2 = 

10 – 5 = 

12 –  = 

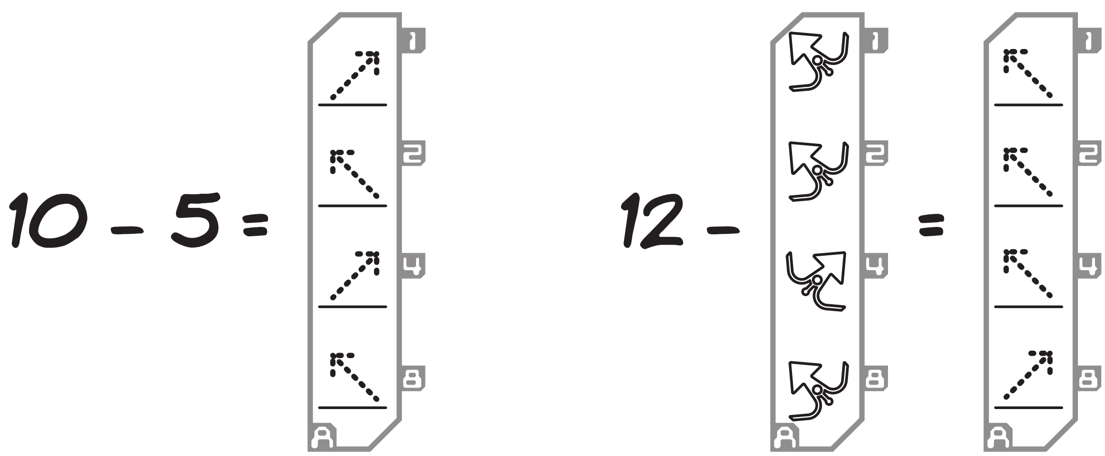
 –  = 

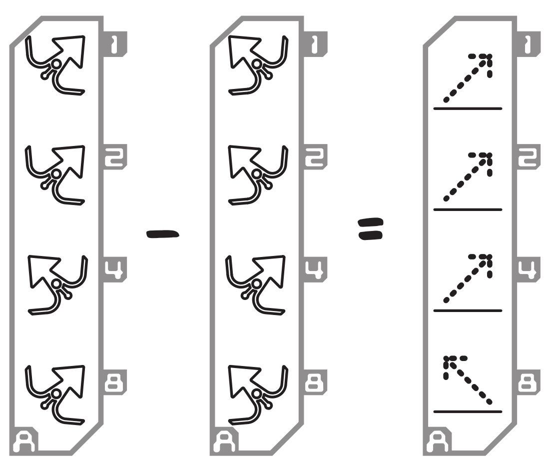
Practice Challenge 22-A Solution

Explanation: You're getting the hang of it now!

Now see if you can answer the question: Why do computers use binary numbers instead of regular, base 10 numbers?

Because you can represent them with simple switches.





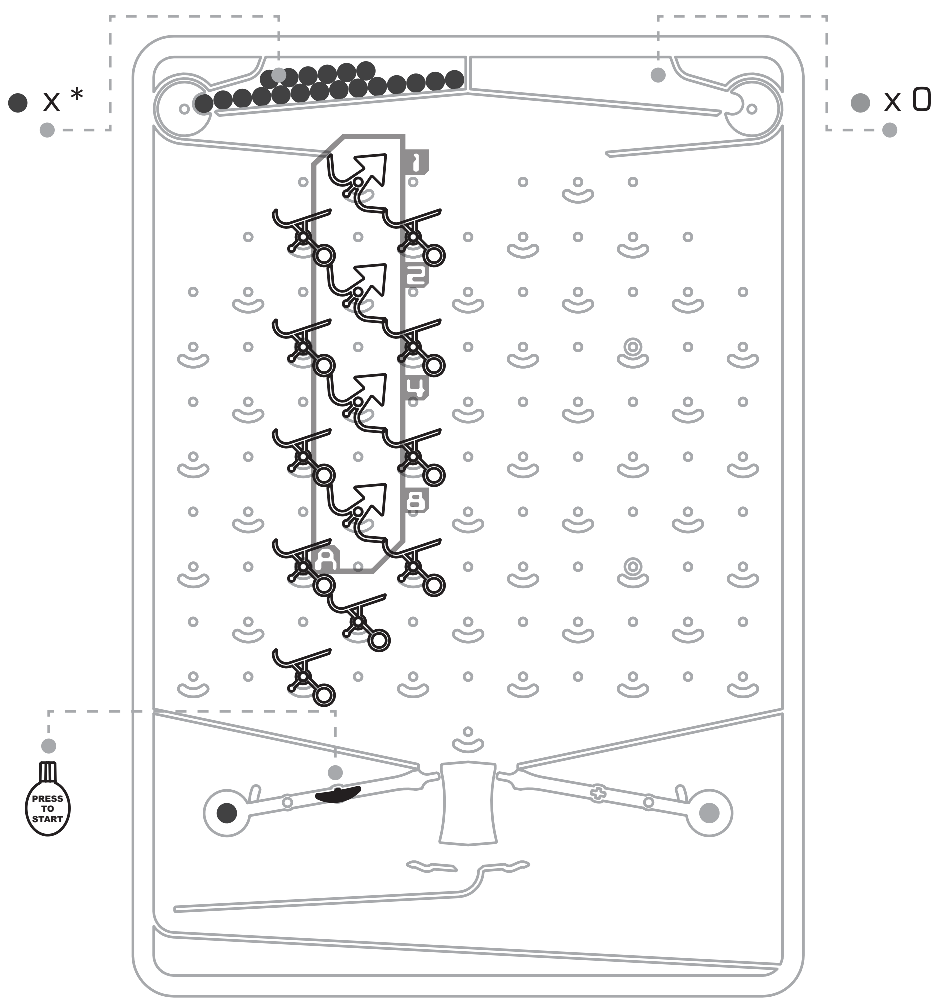
Challenge 22: Depletion

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

Examples:

● x 1 ⇒ A = 14	● x 4 ⇒ A = 11
● x 10 ⇒ A = 5	● x 15 ⇒ A = 0

Starting setup

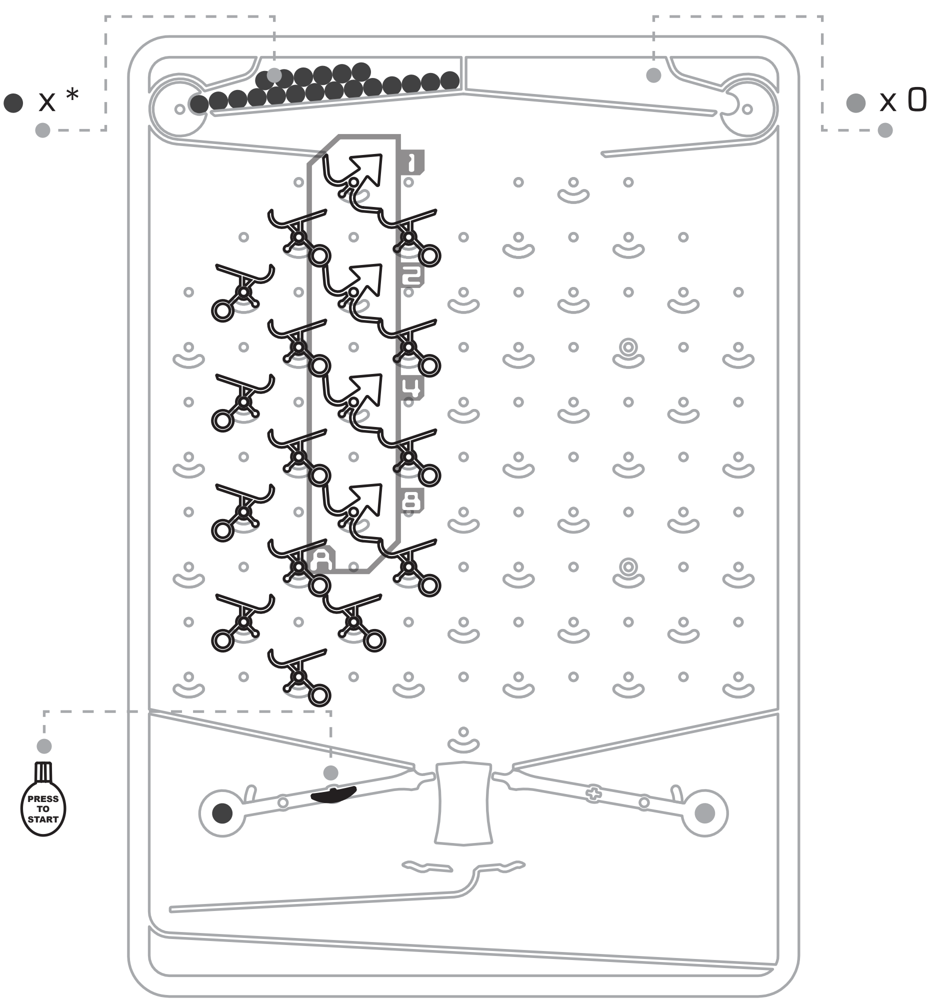


Available parts


x 4

Challenge 22 Solution

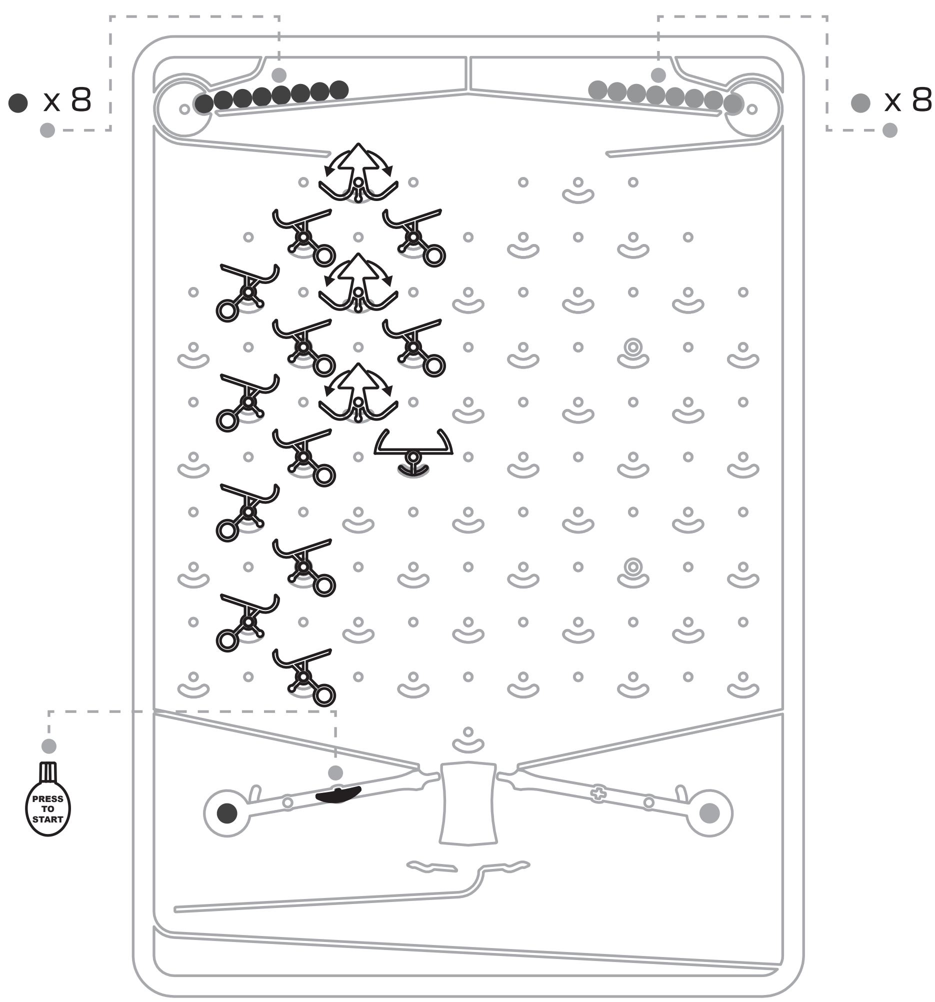
Explanation: You can make a register count down instead of up by flipping the ramps around to the other side of the register!



Practice Puzzle A for Challenge 23

Objective: Let no blue balls reach the end. (Intercept the 1st ball.)

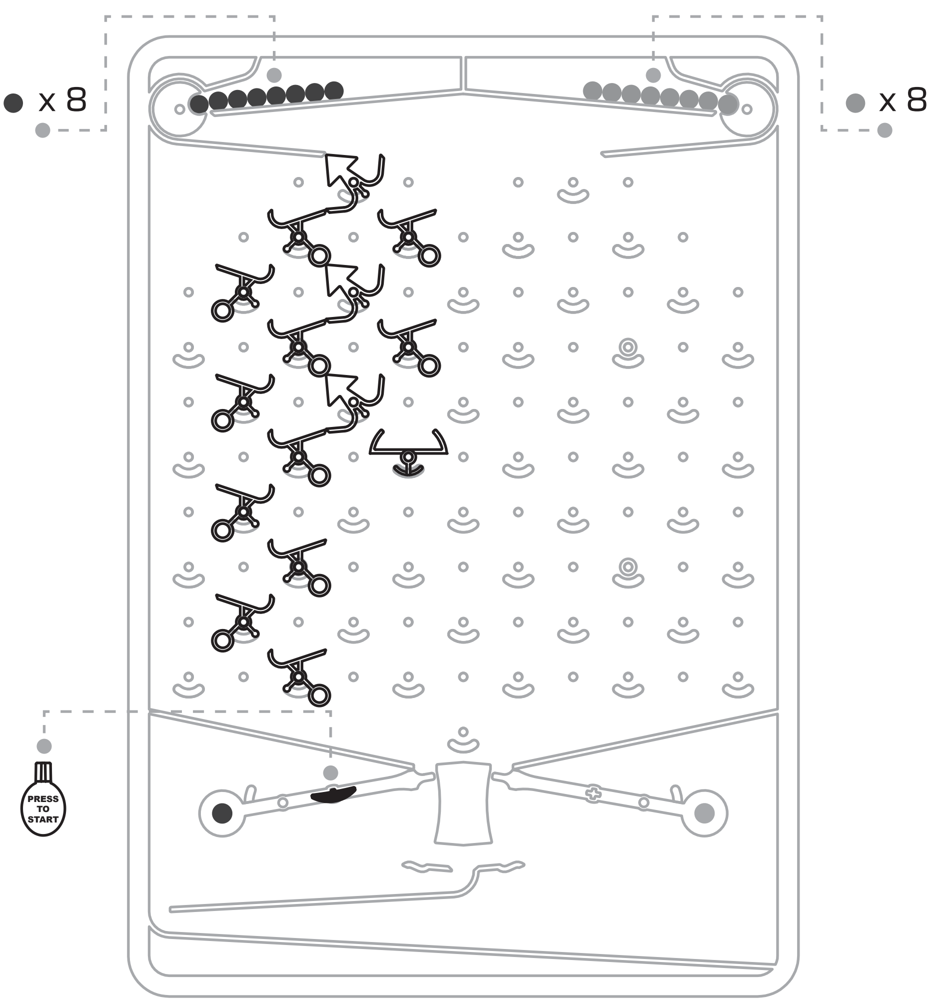
Starting setup



Available parts

Practice Challenge 23-A Solution

Explanation: Think of the bits as a register. The register is set up to count down. To capture the 1st ball that falls, you must set the register to a value of 0 before starting the computer.

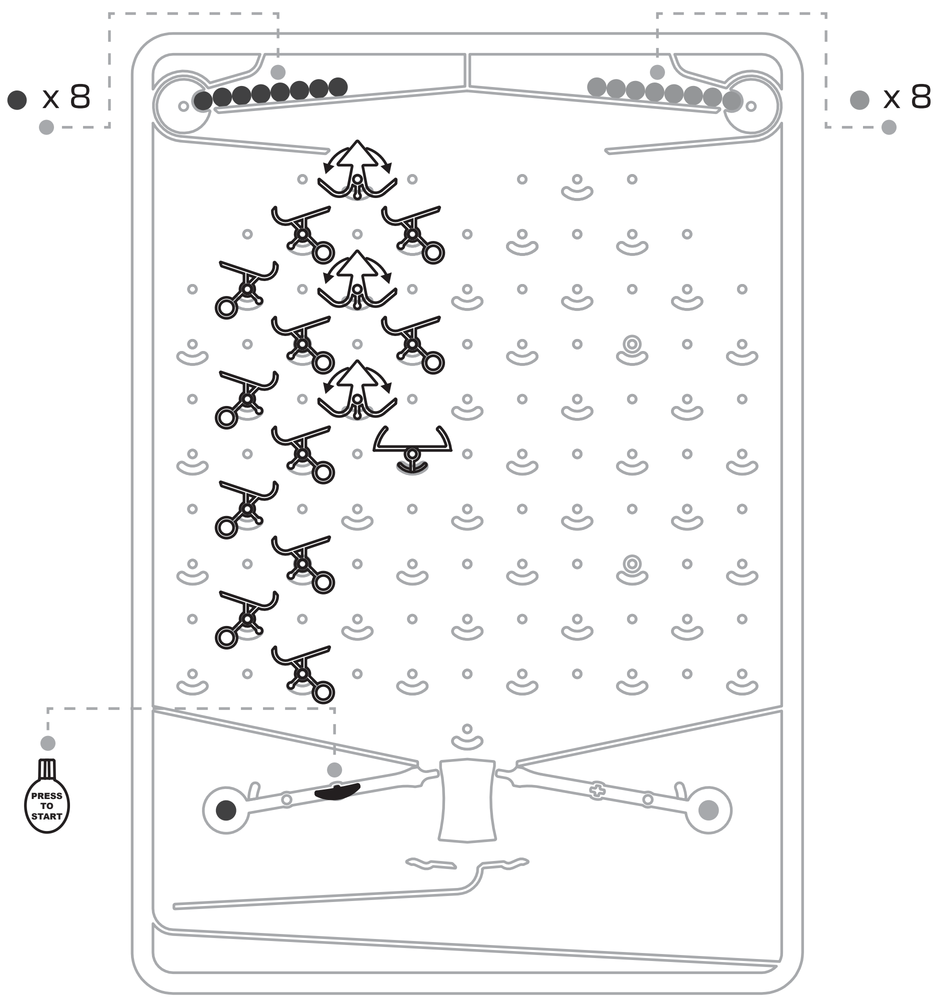


Practice Puzzle B for Challenge 23

Objective: Let exactly one blue ball reach the end. (Intercept the 2nd ball.)

Required output:

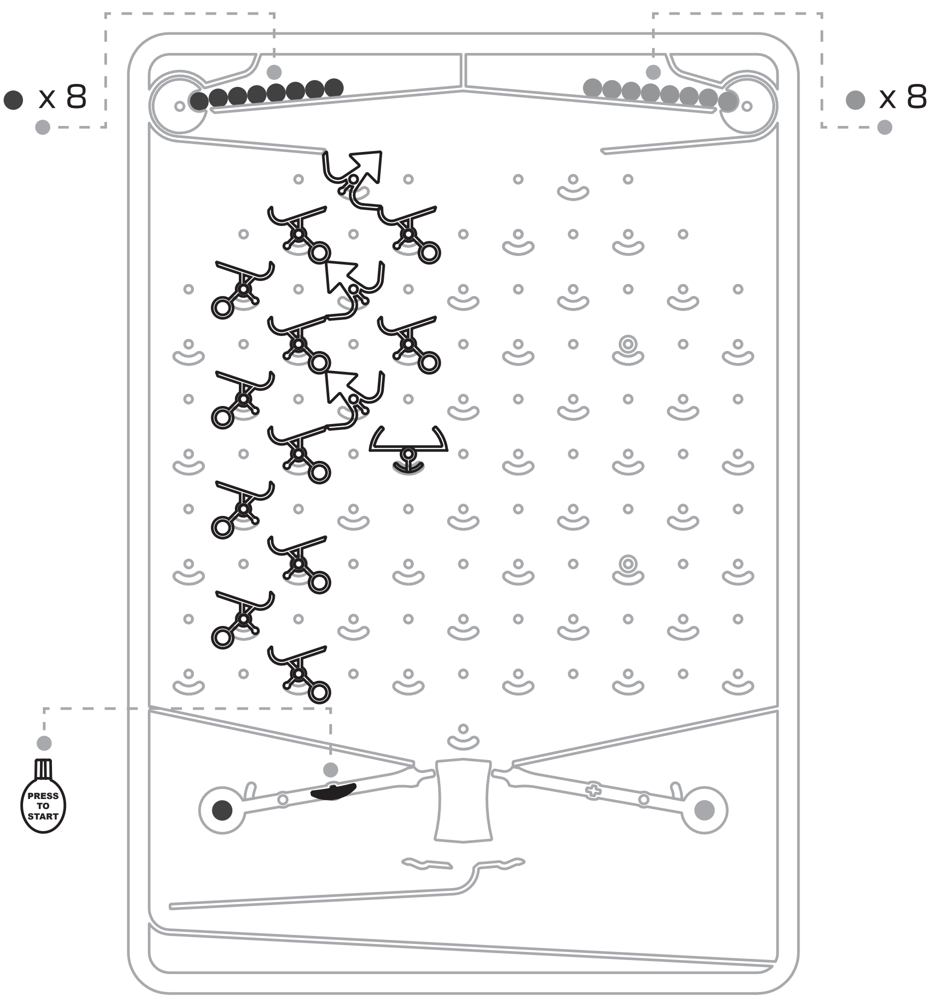
Starting setup



Available parts

Practice Challenge 23-B Solution

Explanation: This time, set the register to a value of 1 before starting the computer. It will let one ball through and capture the next ball.

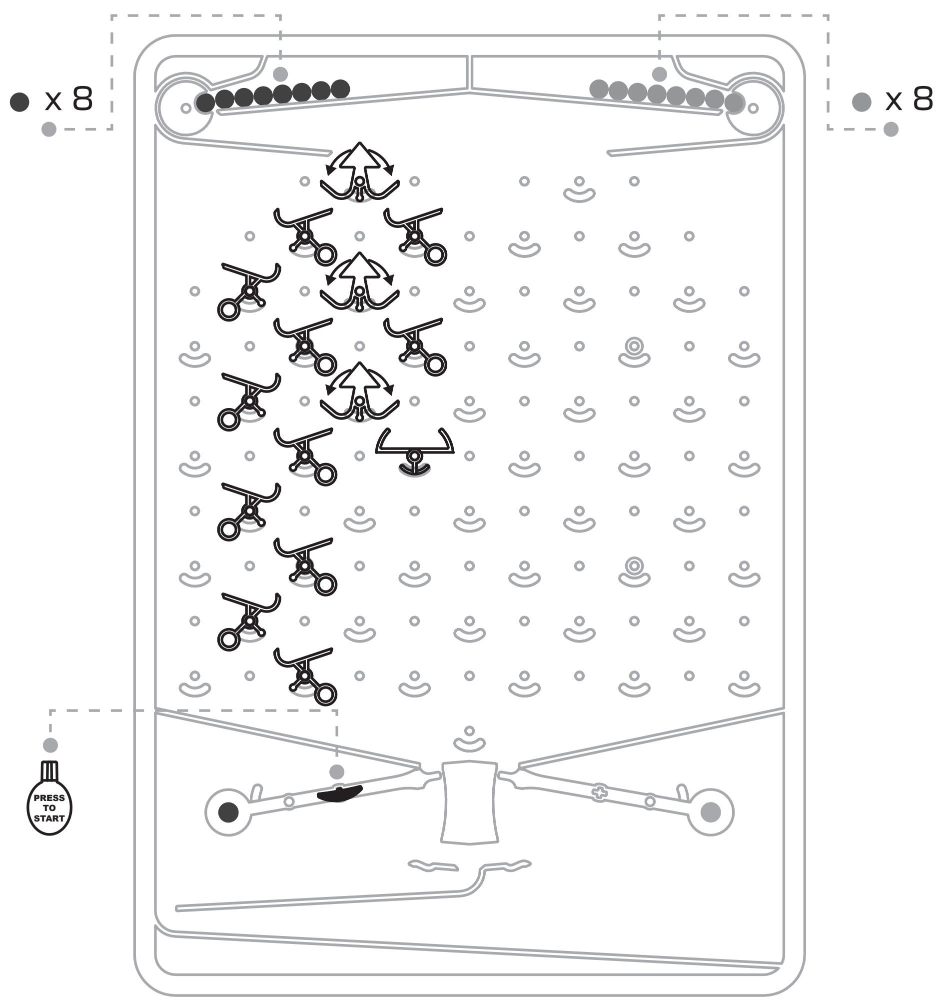


Practice Puzzle C for Challenge 23

Objective: Let exactly two blue balls reach the end. (Intercept the 3rd ball.)

Required output:

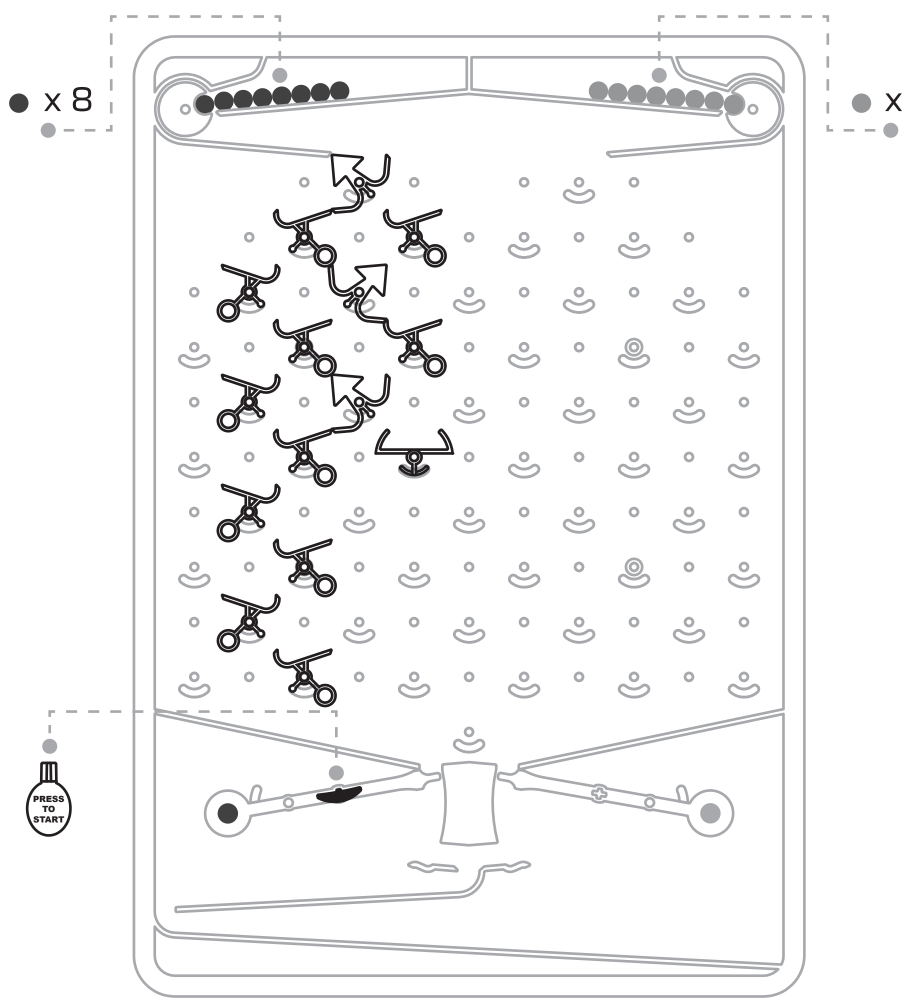
Starting setup



Available parts

Practice Challenge 23-C Solution

Explanation: Set the countdown register to a value of 2 before starting the computer. It will let two balls through and the third ball will be captured in the interceptor.

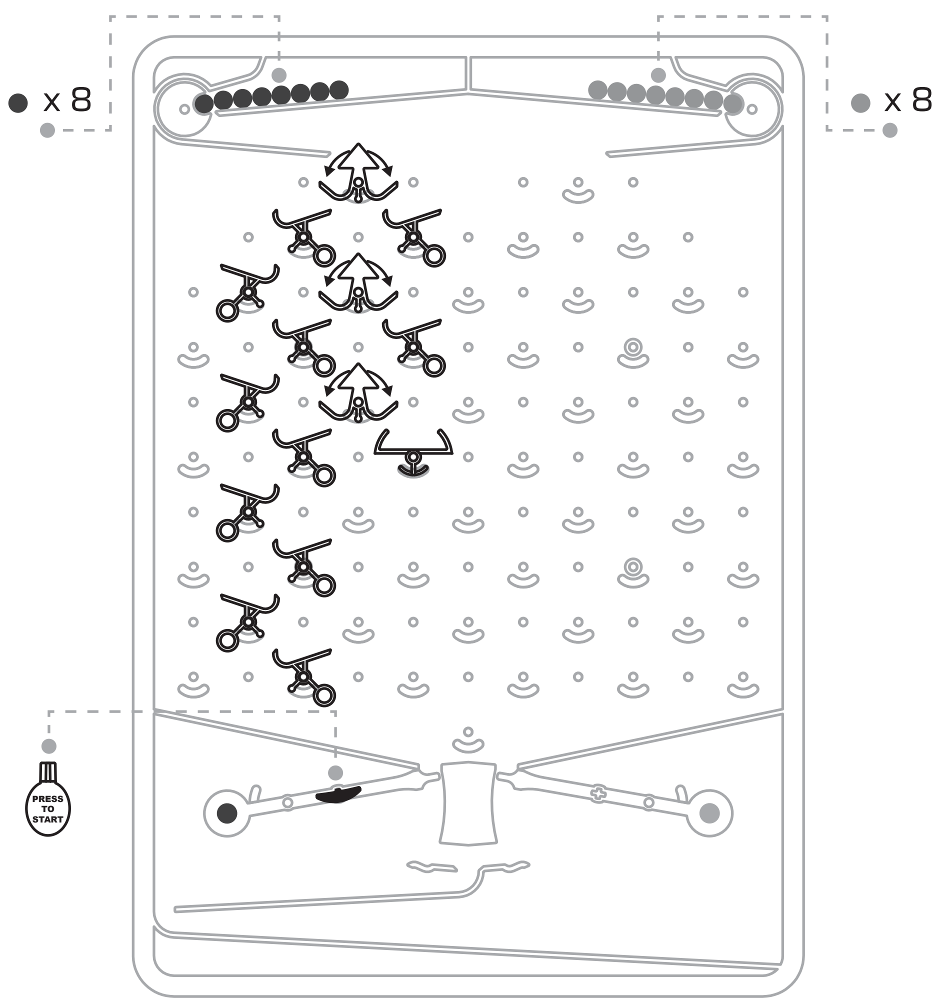


Challenge 23: Tetrad

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

Required output:

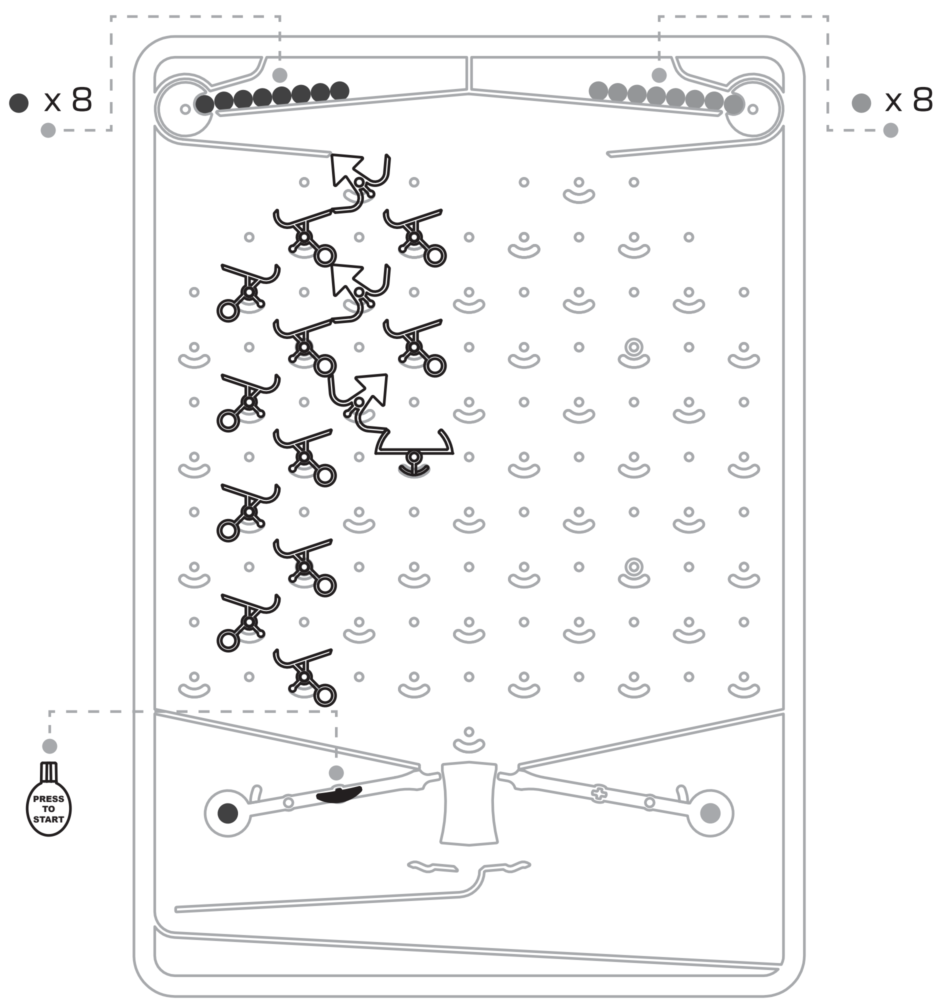
Starting setup



Available parts

Challenge 23 Solution

Explanation: Again, think of the bits as a register. The register is set up to count down. Set the starting value of the register to 4. When you start the computer, it will allow 4 balls to pass through and capture the 5th ball in the interceptor.

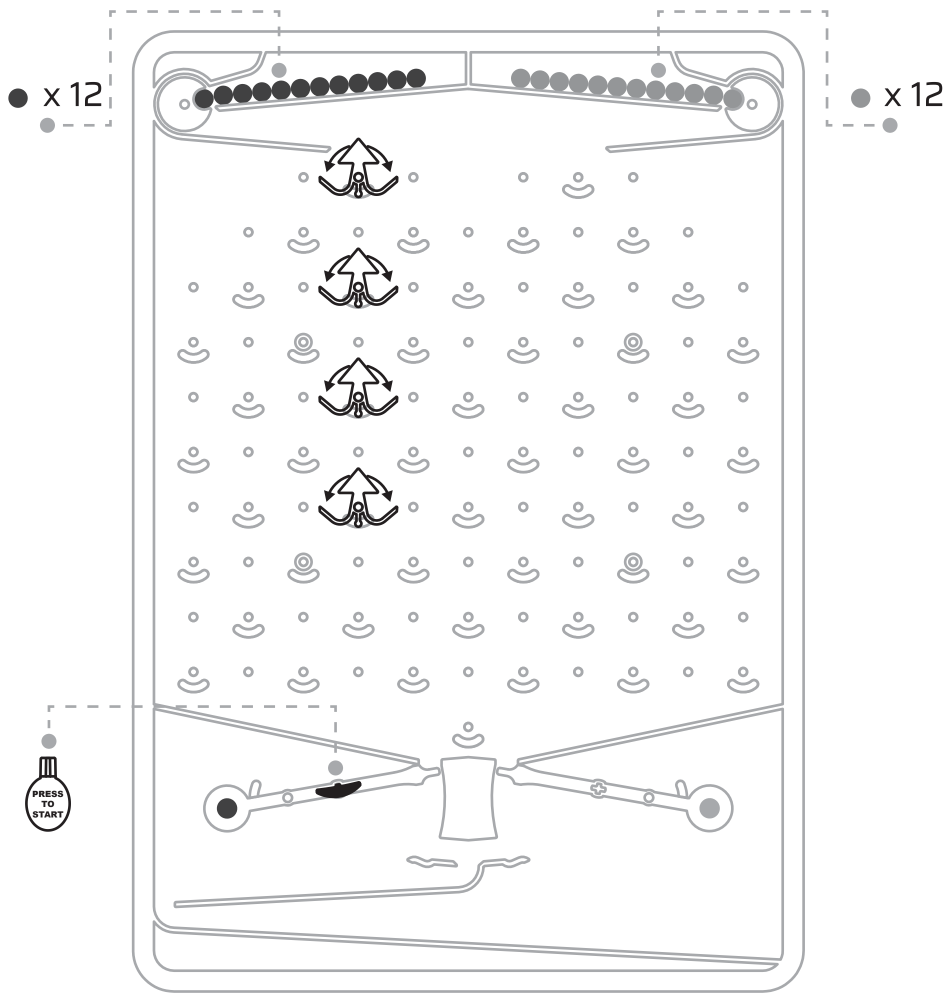


Challenge 24: Ennead

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

Required output:

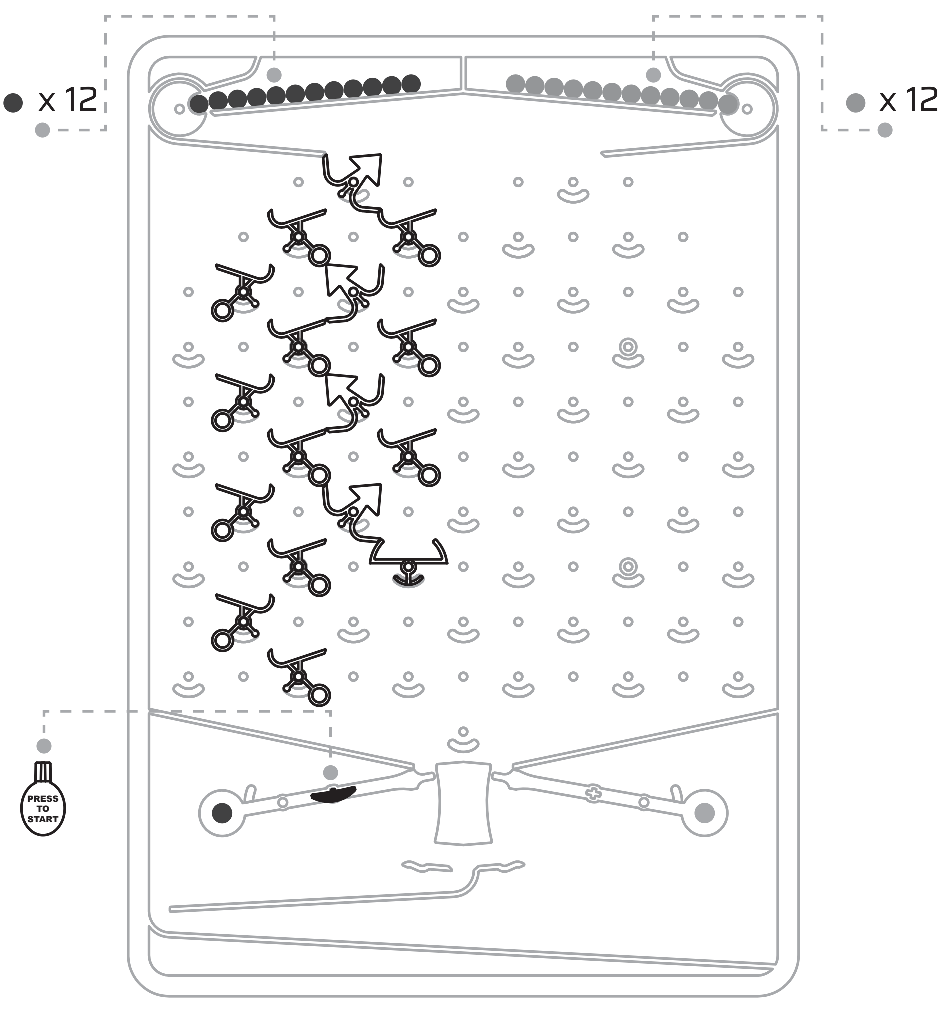
Starting setup



Available parts

Challenge 24 Solution

Explanation: Think of the four bits as a register. The ramps are set up to make it count down. Set the starting value of the register to 9. When you start the computer, it will allow 9 balls to pass through and intercept the 10th.

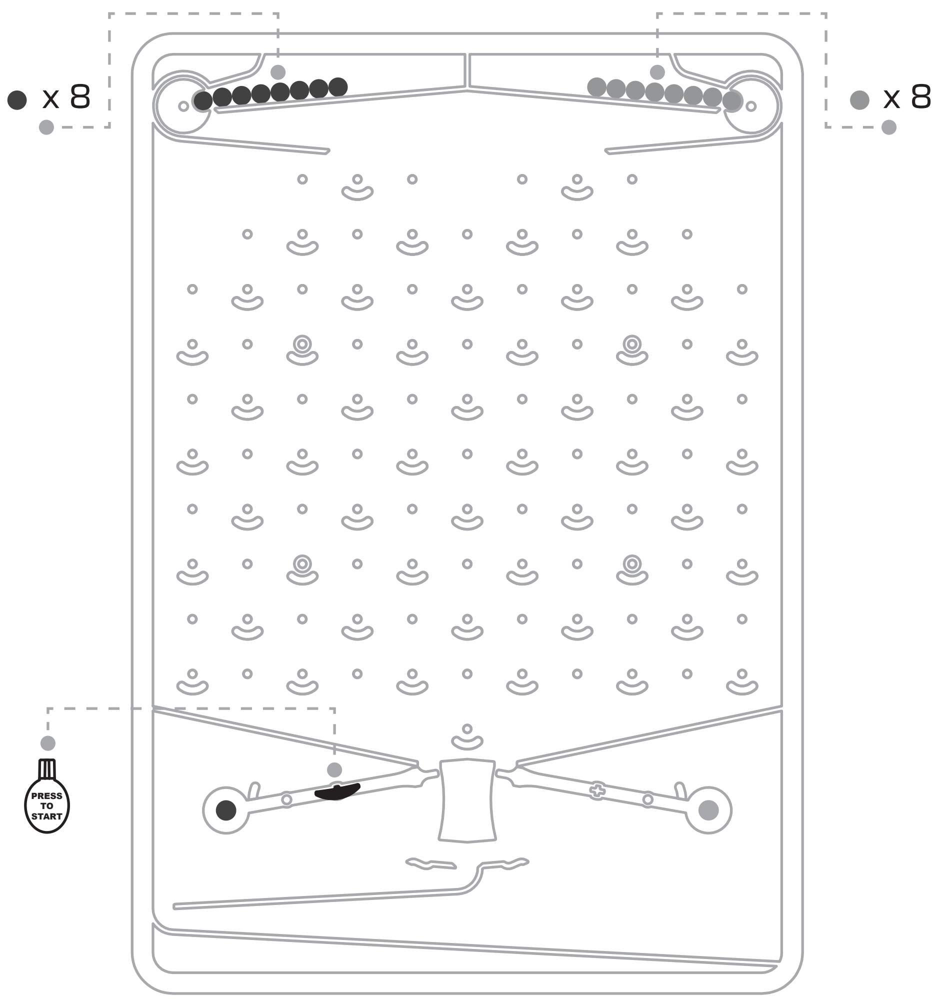


Challenge 25: Regular Expression

Objective: Generate the required pattern.

Required output:

Starting setup



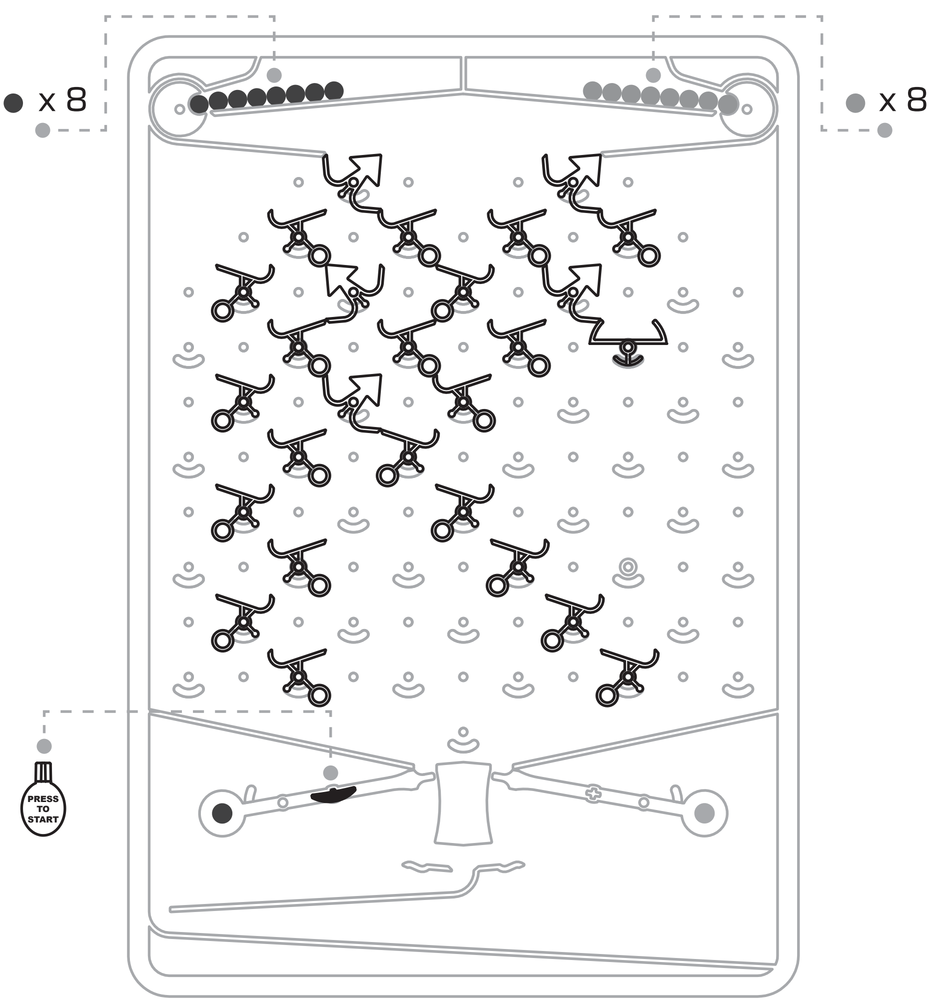
Available parts

Challenge 25 Solution

Explanation: Make two countdown registers - one on the left side and one on the right.

To let out 6 blue balls, start the left register with a value of 5 (the 6th ball will be used to trigger the right lever).

To let out 3 red balls, start the right register with a value of 3. It will allow three red balls to reach the bottom and intercept the 4th ball.

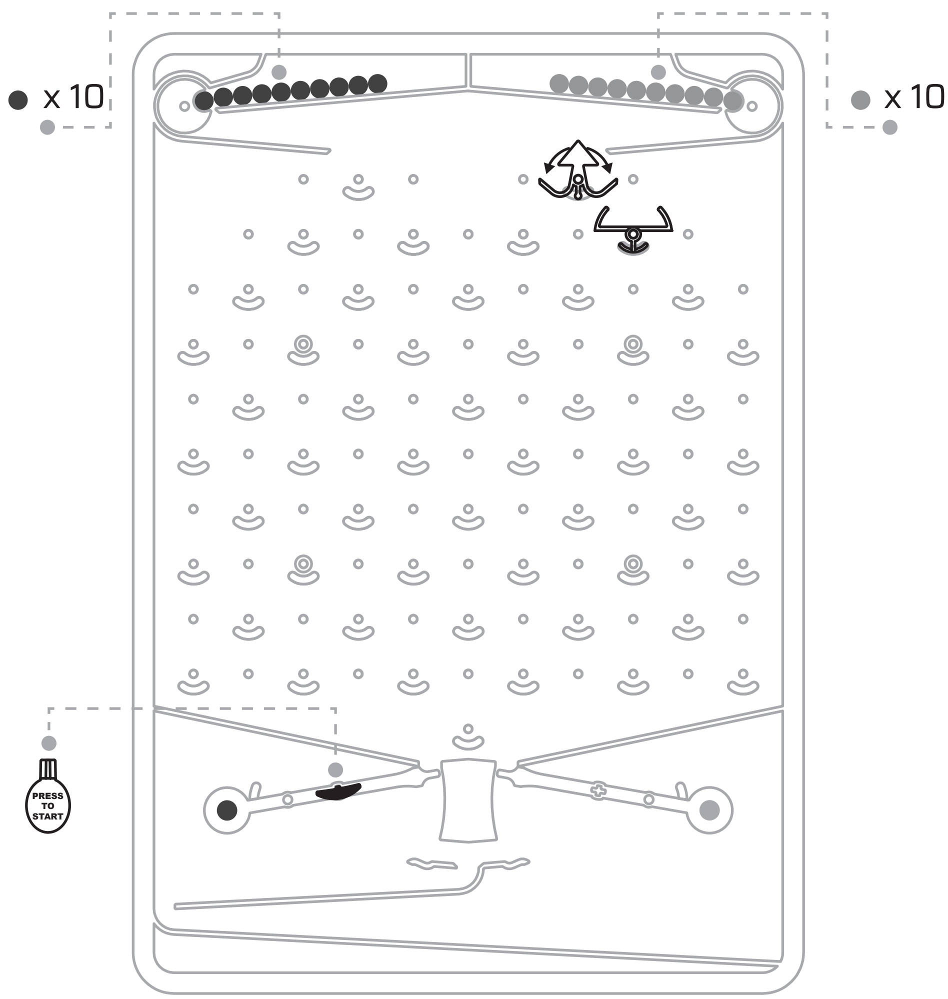


Challenge 26: Nucleus

Objective: Generate the required pattern.

Required output:

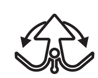
Starting setup



Available parts

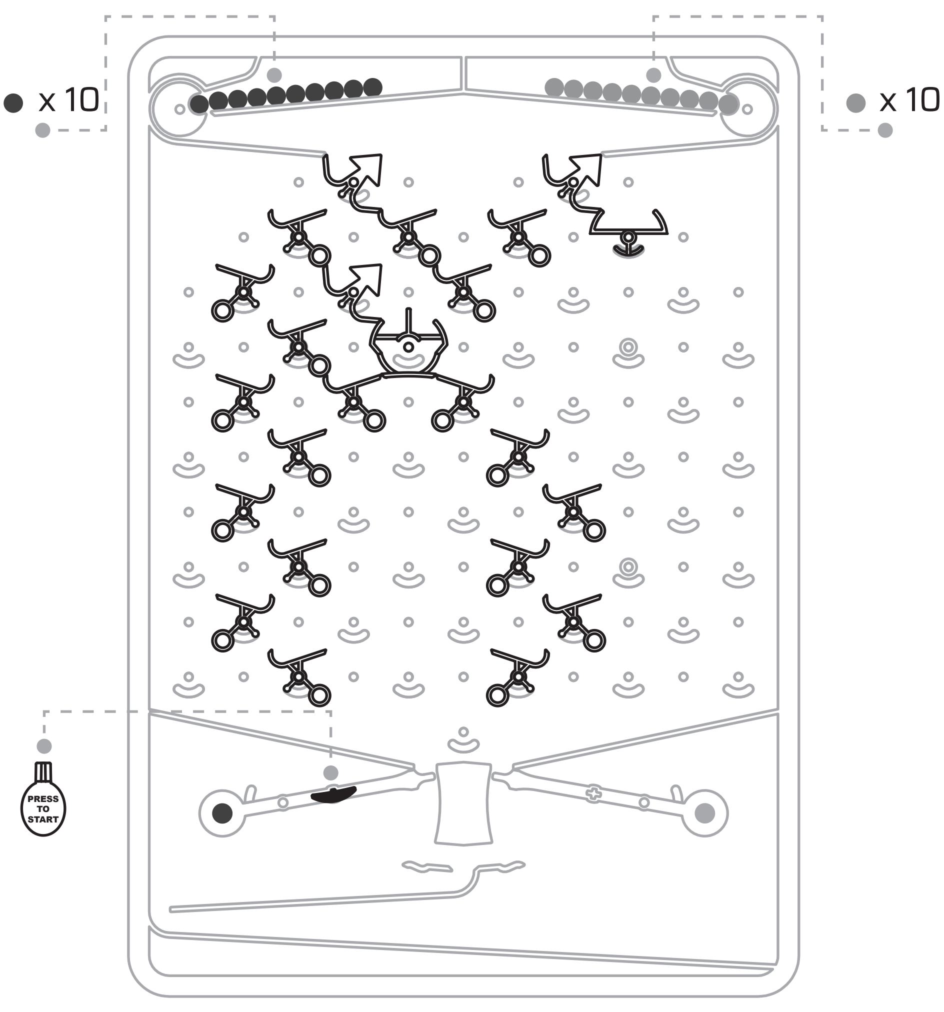
 x ∞

 x 2

 x 2

Challenge 26 Solution

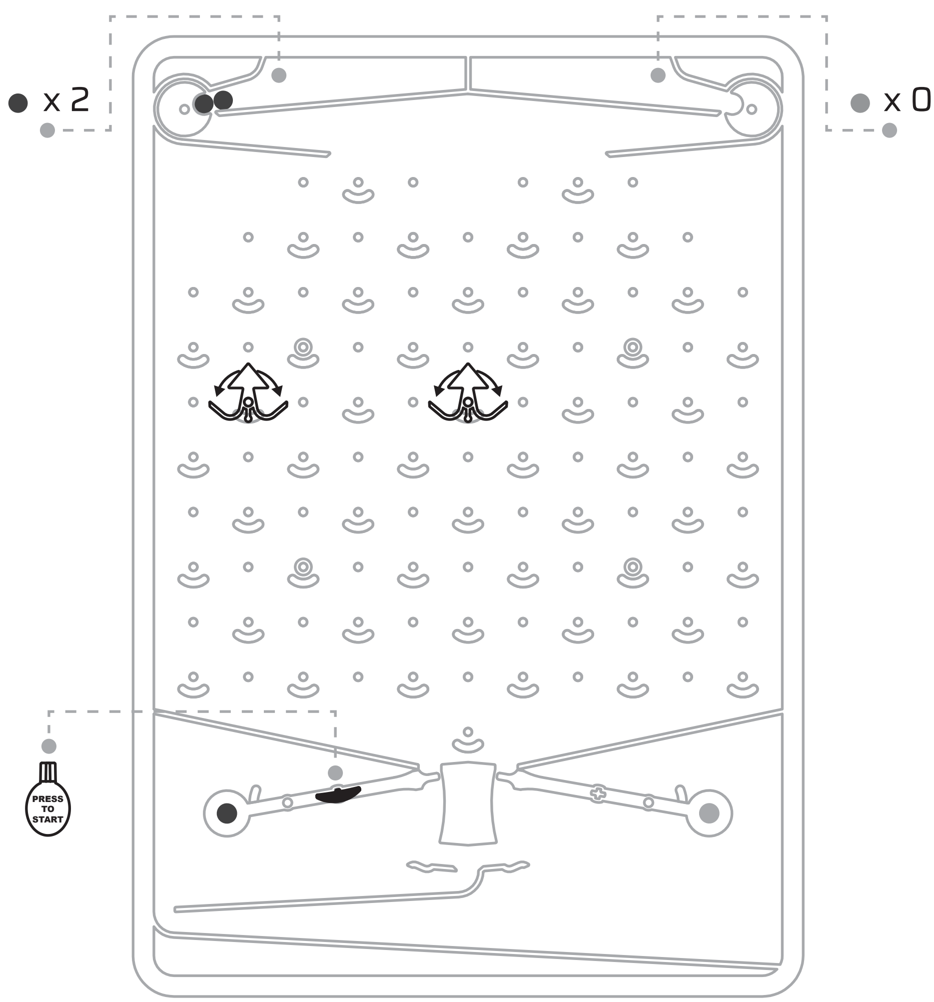
Explanation: The 2-bit countdown register on the left releases four blue balls, the last of which triggers the right lever, releasing a red ball. That red ball goes back over to the left side, triggering the release of four more blue balls, the last of which triggers the release of a second red ball. That second red ball is caught by the interceptor.



Practice Puzzle A for Challenge 27

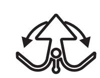
Objective: Reverse the direction of each of the two starting bits, regardless of the direction they point to start.

Starting setup



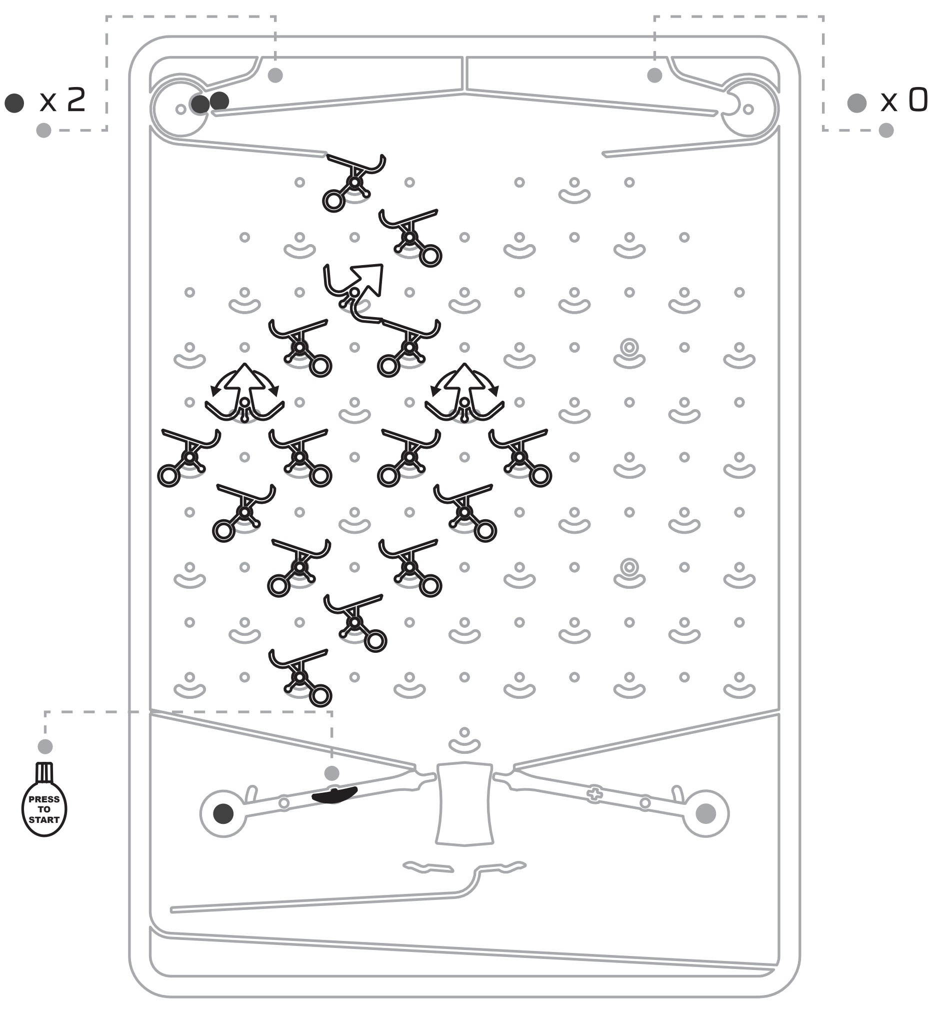
Available parts


x 16


x 1

Practice Challenge 27-A Solution

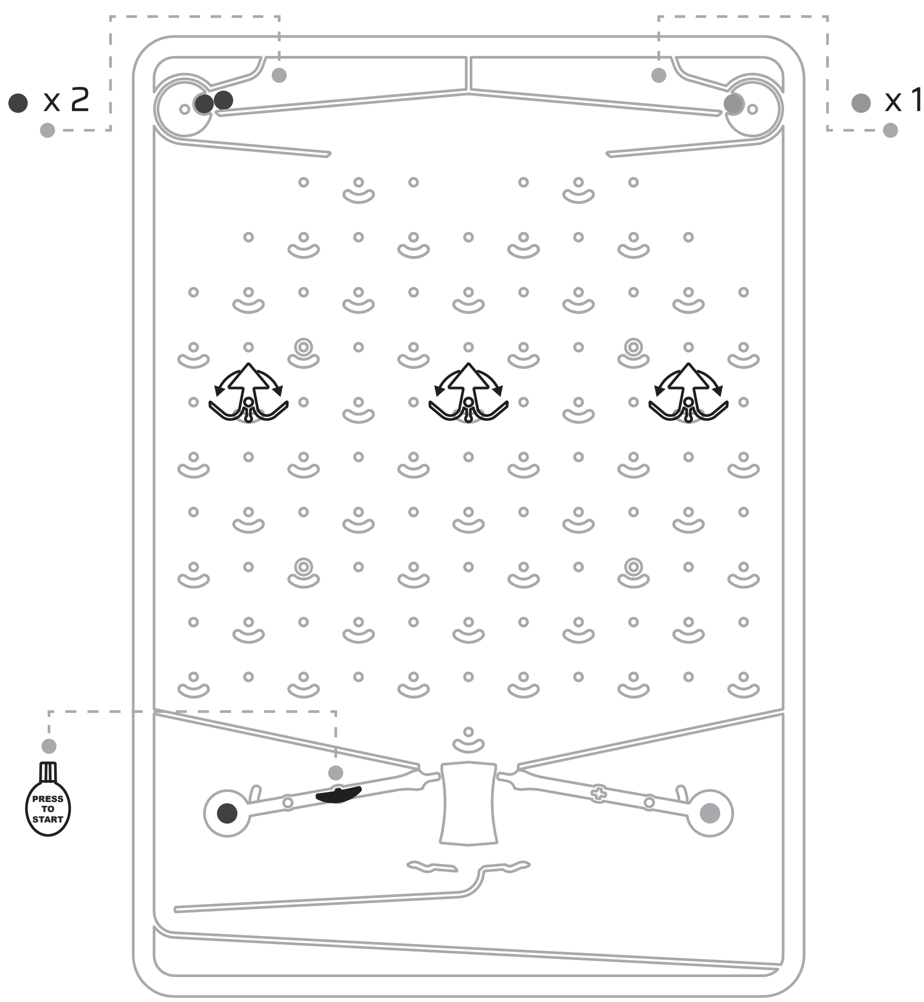
Explanation: The key is to split the path of the blue balls so that one flips the left bit and the next flips the right bit.



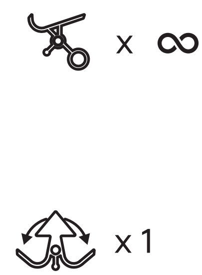
Practice Puzzle B for Challenge 27

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

Starting setup



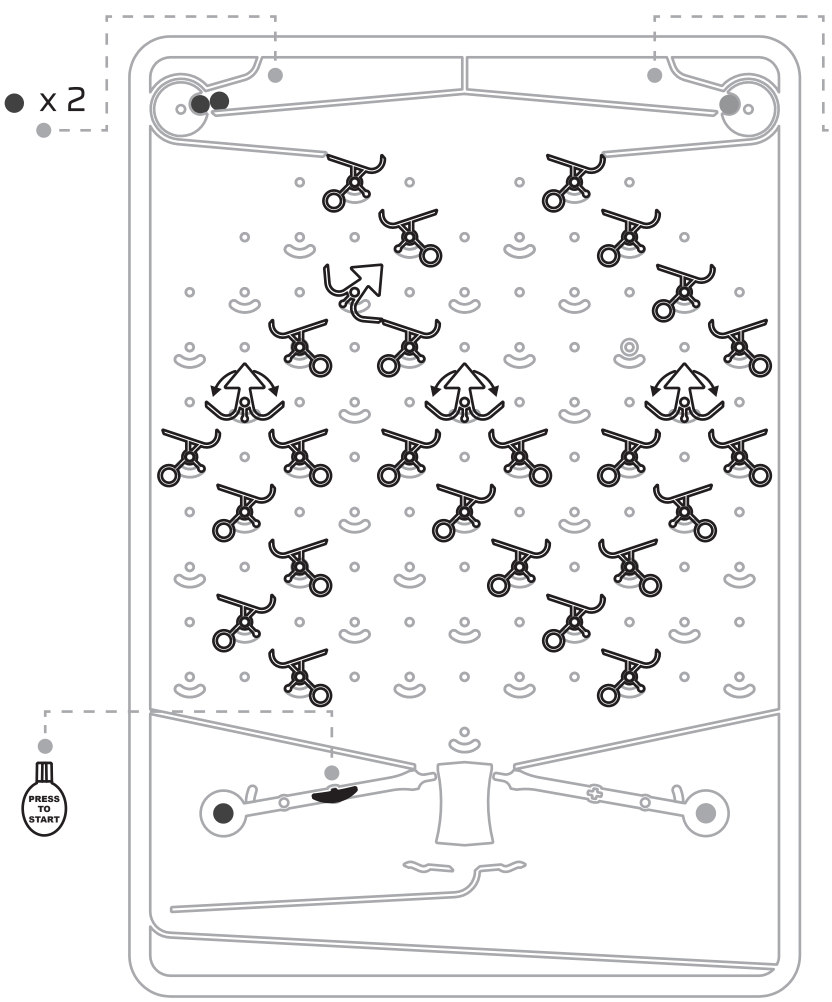
Available parts



Practice Challenge 27-B Solution

Explanation: We have one bit to split the path of the blue balls. That allows us to flip two of the bits, but how can we flip the third bit?

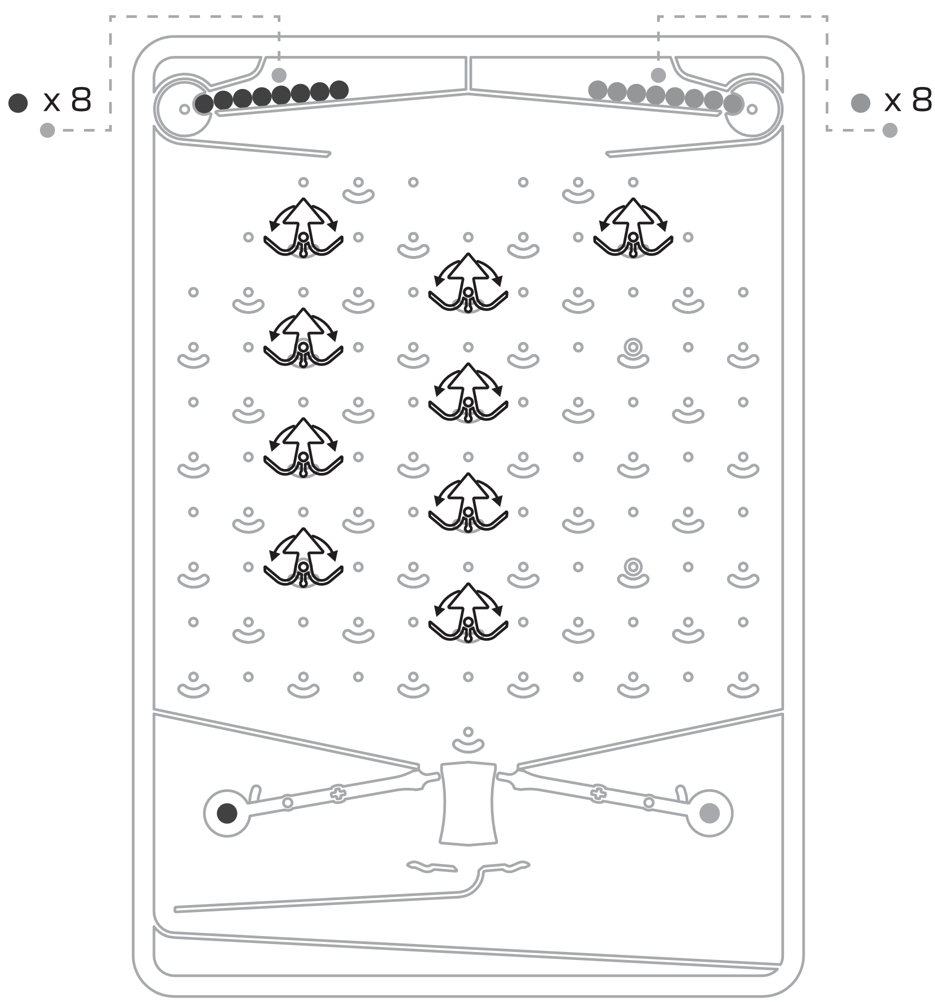
Use the second blue ball to trigger the release of a red ball that flips that third bit.



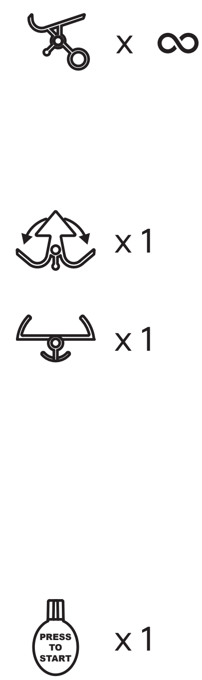
Challenge 27: Reflection

Objective: Reverse the direction of each of the 9 starting bits, regardless of the direction they point to start.

Starting setup

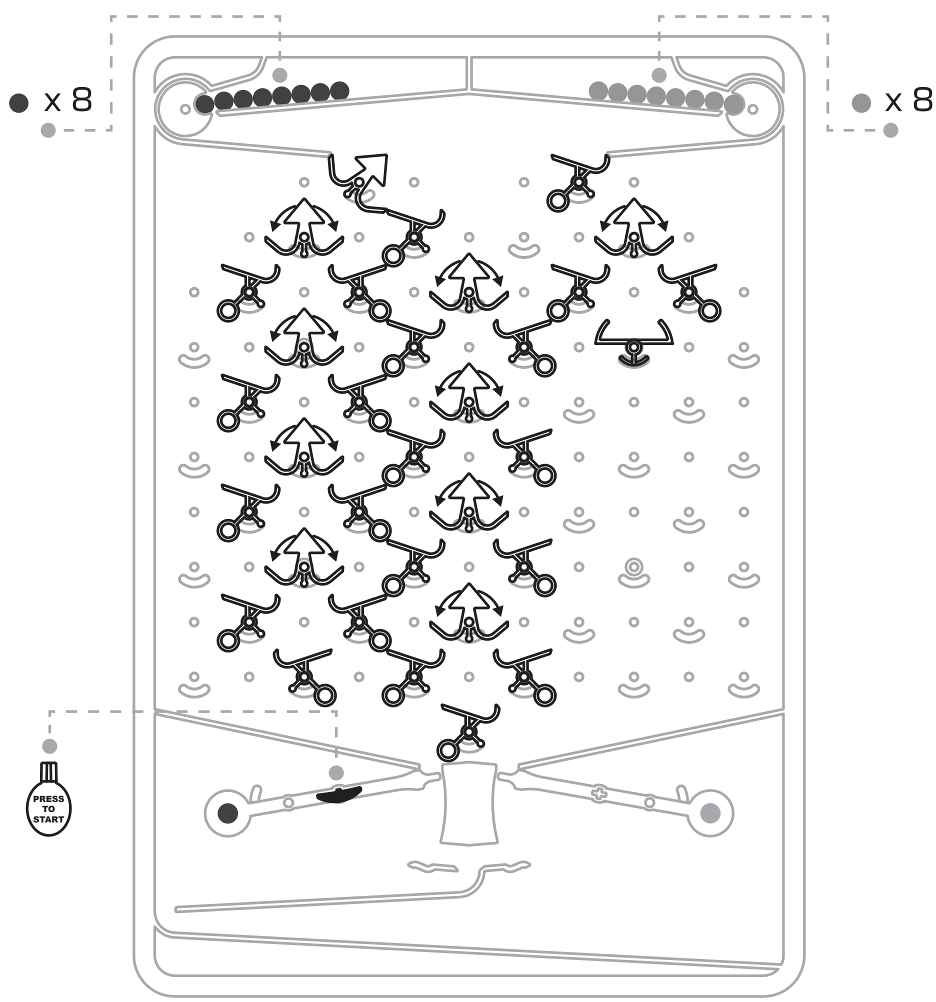


Available parts



Challenge 27 Solution

Explanation: Like the last puzzle, use one bit to split the path of the blue balls. That takes care of the first two columns of bits. The final bit on the right can then be flipped with a red ball, triggered by the second blue ball.

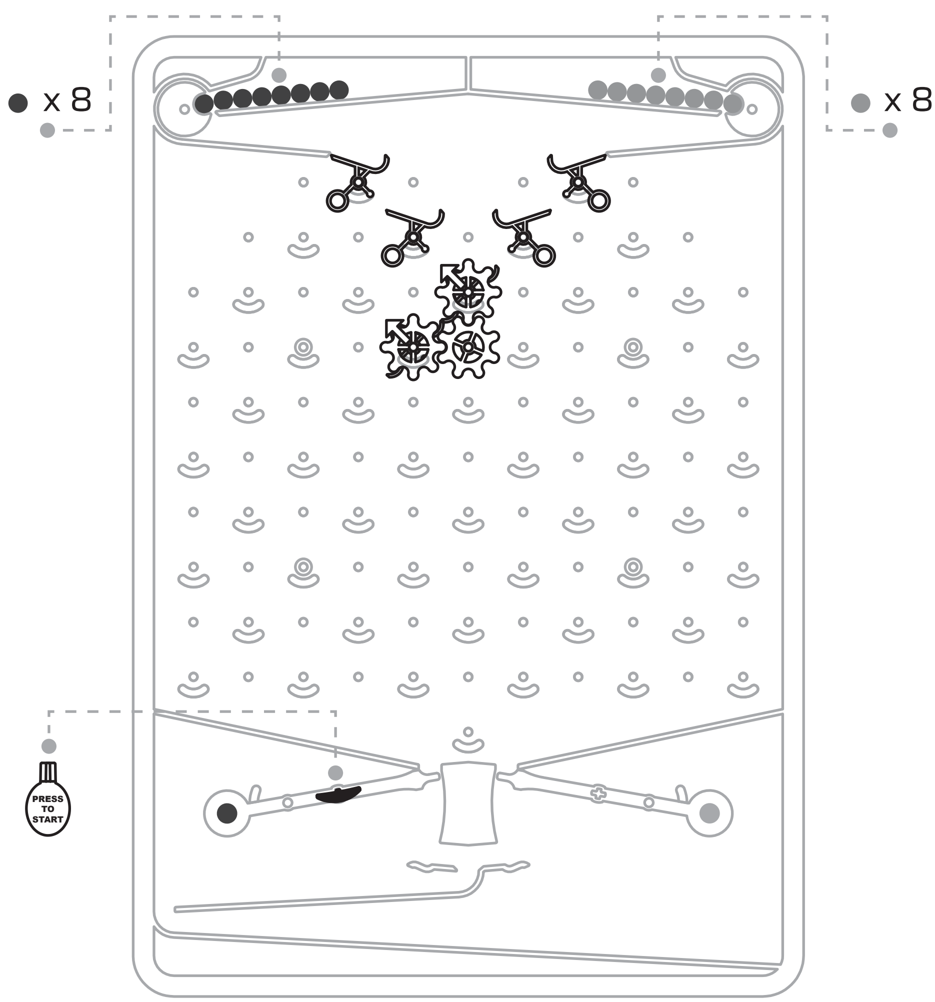


Practice Puzzle A for Challenge 28

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

Required output:

Starting setup



Available parts

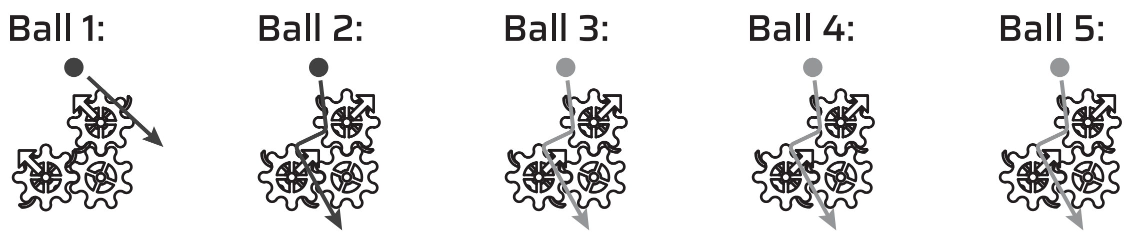

x 13


x 1

Practice Challenge 28-A Solution

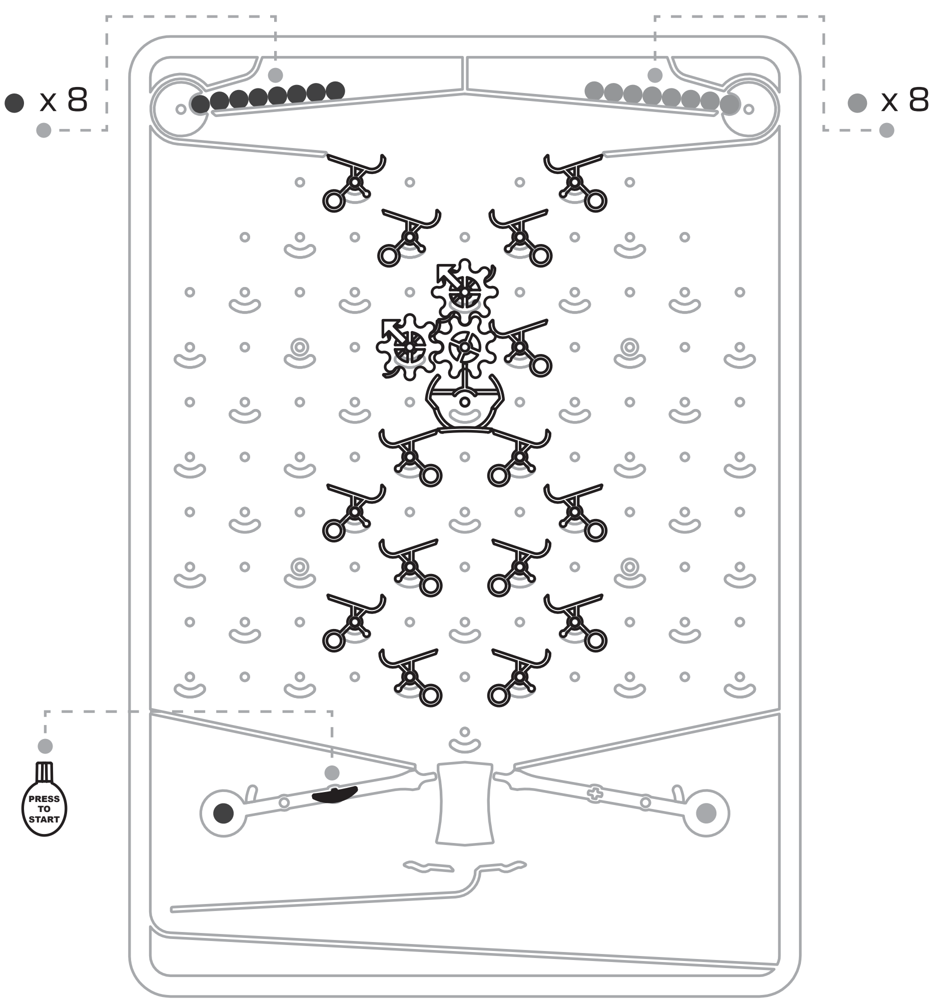
Explanation: Two gear bits connected together make a **permanent** latch. After being flipped once, they can't be flipped back again.

The first blue ball flips the latch. The second blue ball and all the rest of the red balls are sent to the red lever by the flipped latch.



Actually, there is a way to flip the latch back to the original position. Can you figure out how?

Send a ball onto the lower bit only.

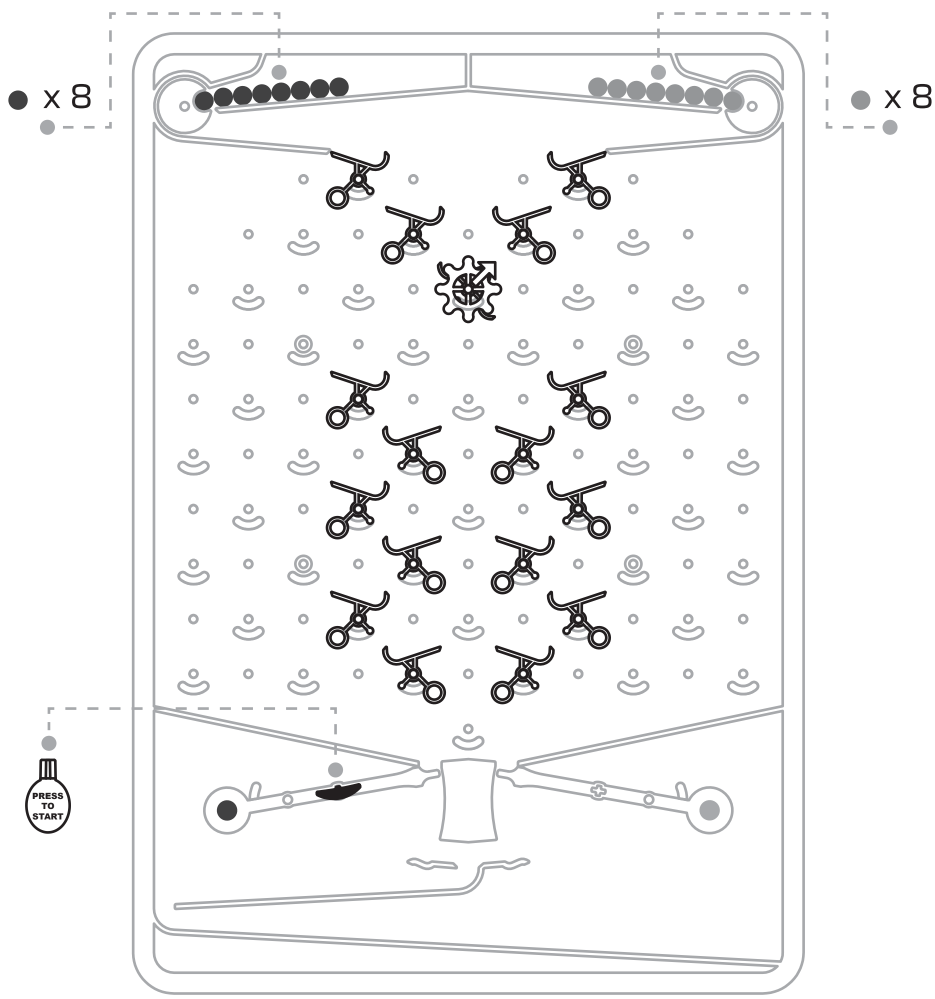


Challenge 28: Latch

Objective: Release only the blue balls.

Required output:

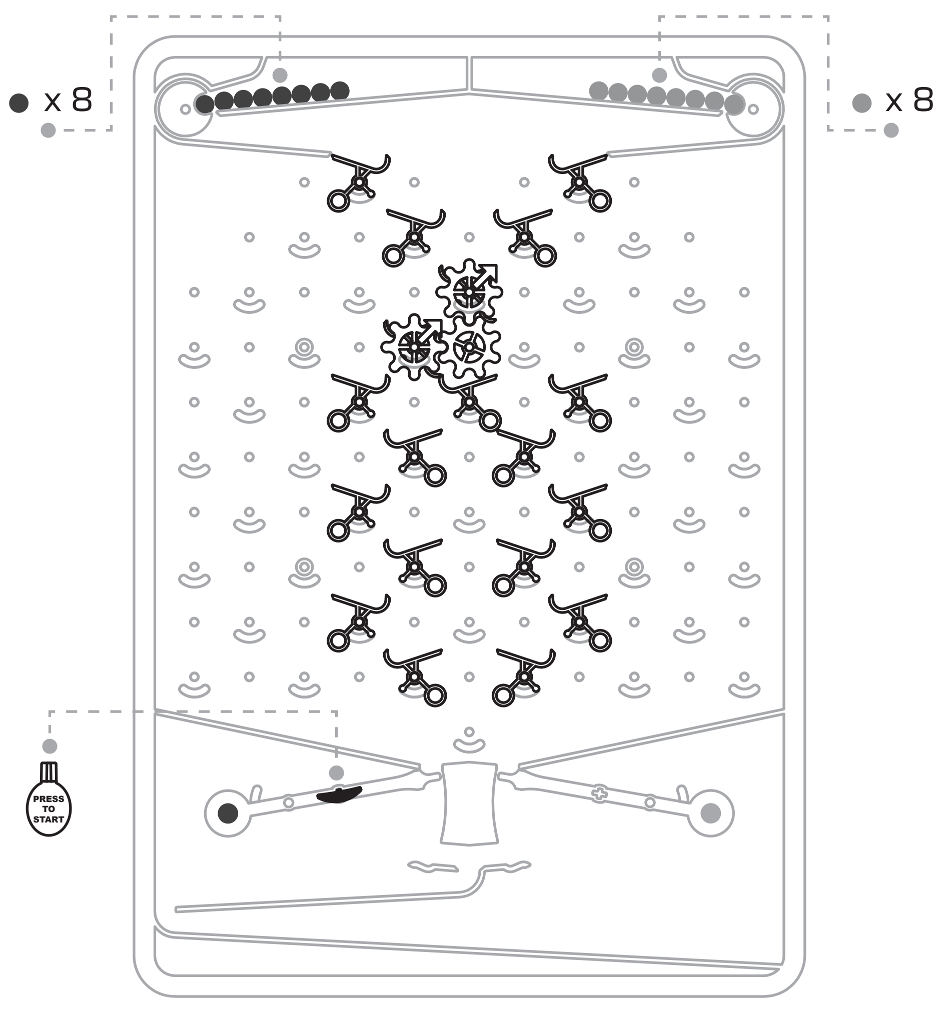
Starting setup



Available parts

Challenge 28 Solution

Explanation: Use a latch to send all balls to the ramps on the left side.

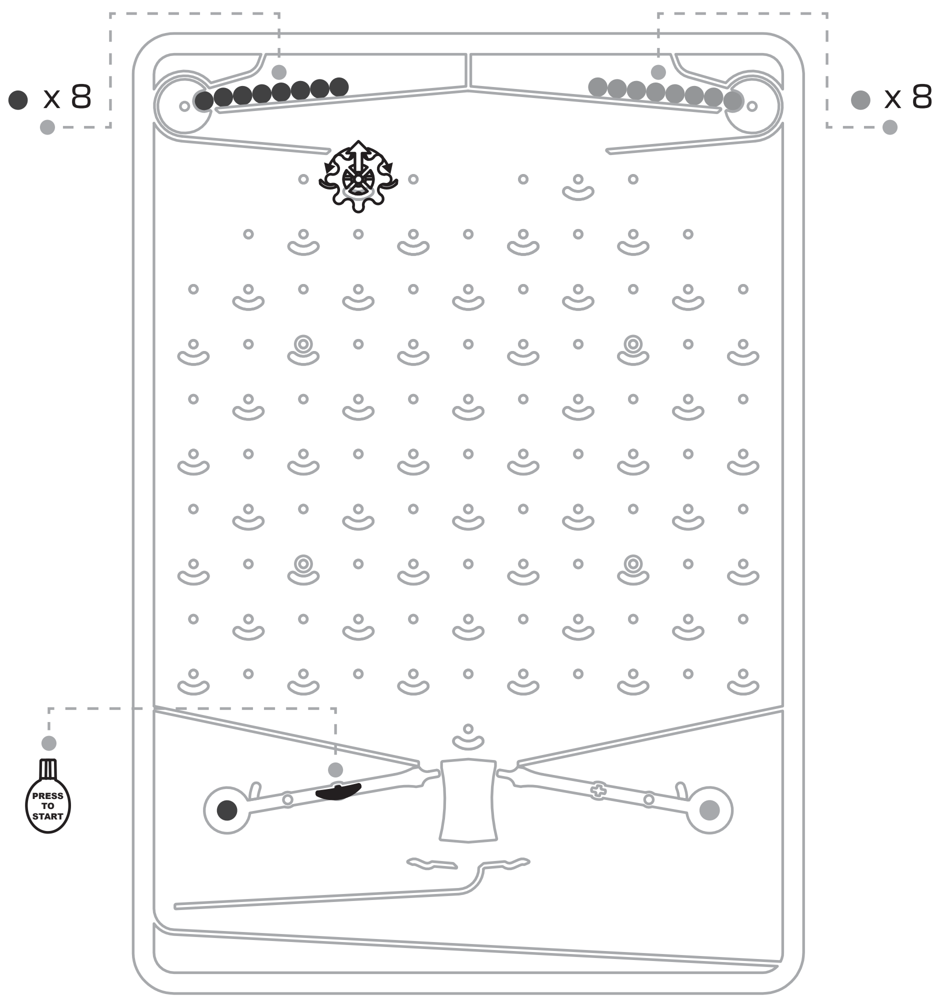


Challenge 29: One-Shot Switch

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

Required output:

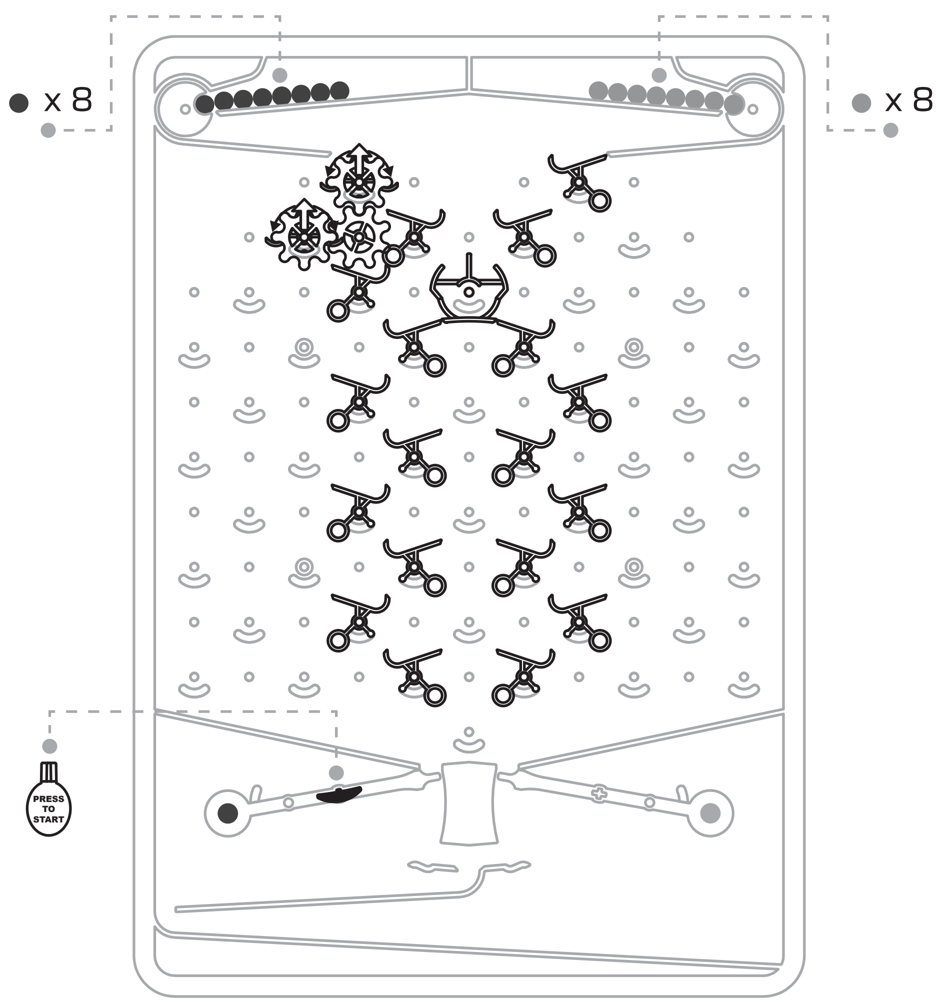
Starting setup



Available parts

Challenge 29 Solution

Explanation: Use the first blue ball to flip the latch and trigger a red ball. The red ball triggers another blue ball that, from then on, is forced to trigger more blue balls by the (now flipped) latch.

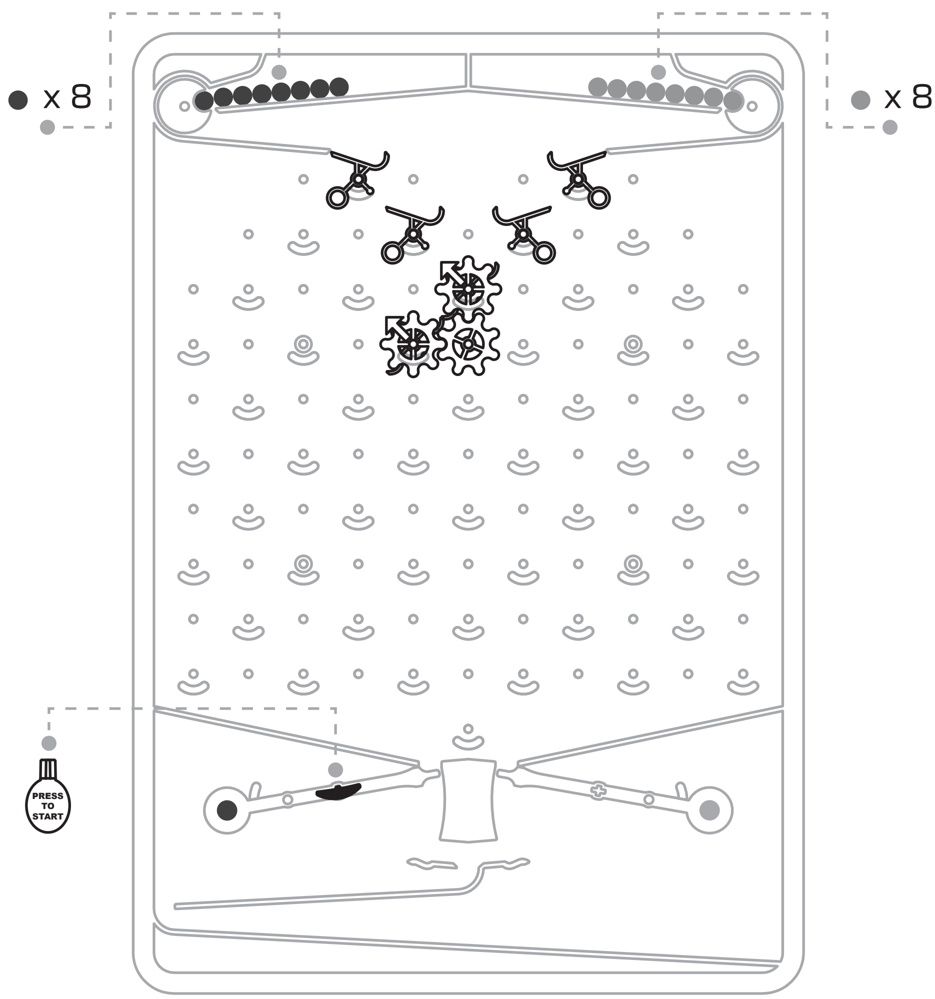


Bonus Puzzle A for Challenge 29

Objective: Release three blue balls and then the rest of the red balls.

Required output:

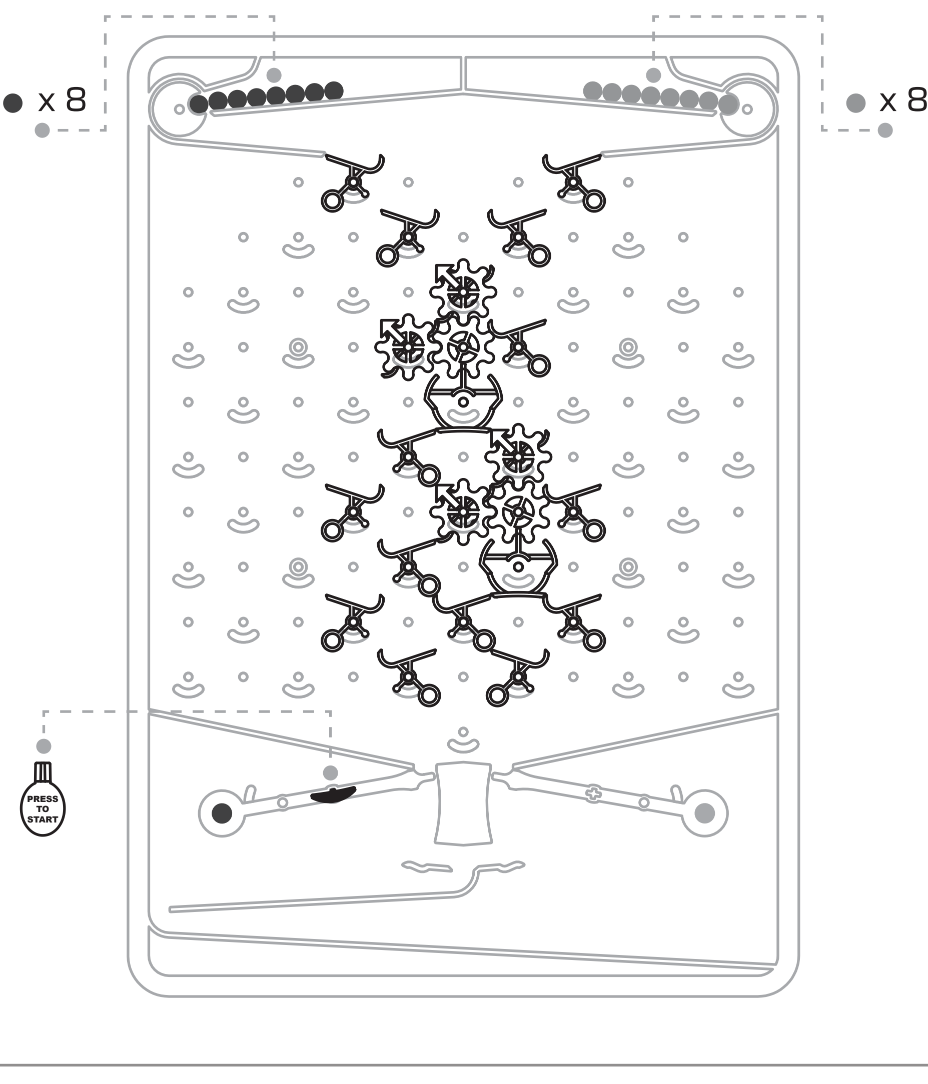
Starting setup



Available parts

Bonus Challenge 29-A Solution

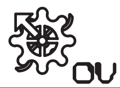
Explanation: This one's tricky! The first blue ball triggers the first latch and releases another blue ball. The second blue ball triggers the second latch and releases another blue ball. The third ball, and all balls from then on, trigger red balls to be released.

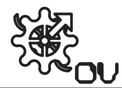


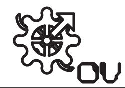
Challenge 30: Overflow

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

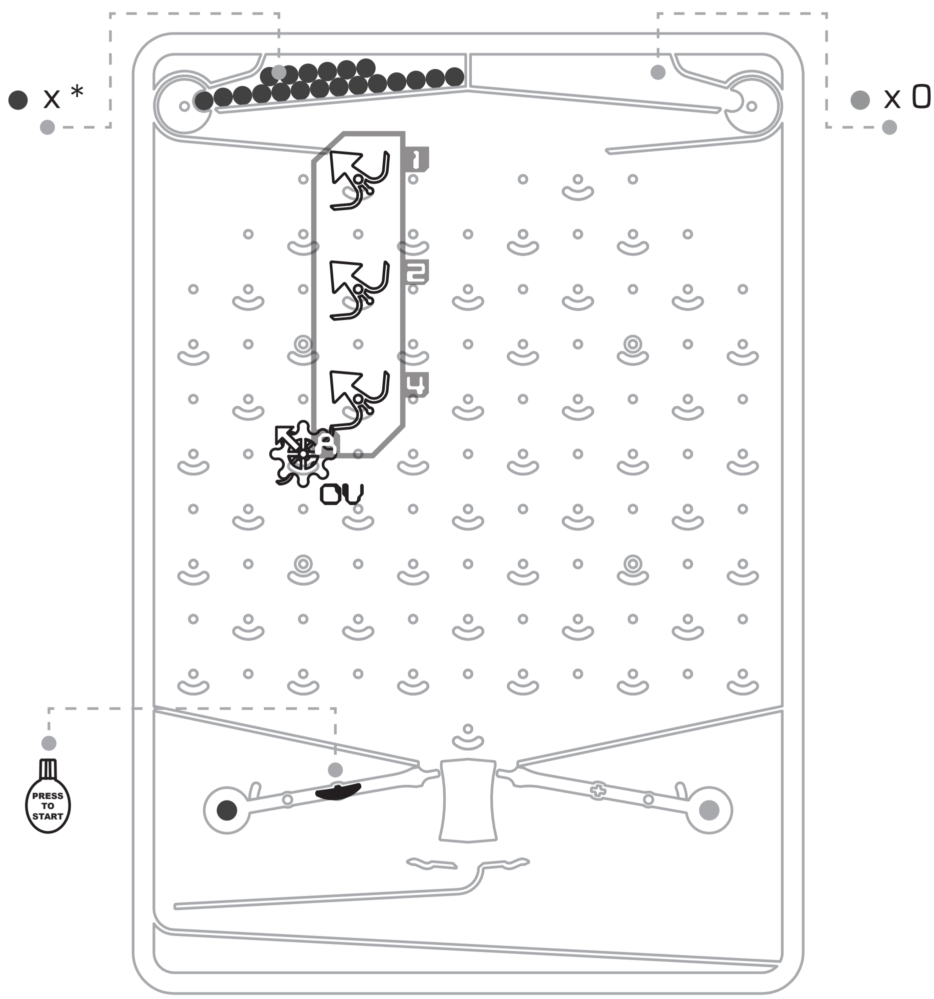
Examples:

● x 7 ⇒ 

● x 8 ⇒ 

● x 15 ⇒ 

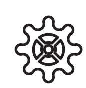
Starting setup



Available parts

 x 14

 x 1

 x 1

Challenge 30 Solution

Explanation: The latch flips when the count up register increments past 7. Once flipped, it remains flipped no matter how many balls run through the register.