HOUR OF CODE

OZOBOT BASIC TRAINING LESSON 1

WHAT IS OZOBOT?

What students will learn

- What kind of a robot is Ozobot?
- How does Ozobot sense its environment and move in it?
- How can you give commands to Ozobot?

Topics

- Robotics: line-following and color sensing
- Physics: optics
- Computer science: visual coding

Maze challenge

Use visual codes to navigate paths to deterministically arrive at the finish point.

Real-life connection

Examples of other line-following robots and their industrial and commercial applications

Common Core Standards

CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.
CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.
CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.

Age

Grades K-12

Ozobot skill level

Beginner

STEM topics

- inter-disciplinary: robotics, physics and math come together to create a line-following robot
- computer science: use visual codes to program the robot

Materials

- Ozobots (1 per group of about 3 students), charged
- Blank white paper, a few sheets per group
- Markers in colors black, red, light blue and light green (we recommend you use Ozobot markers. Alternatively, choose Sharpie's wide chisel tip or Crayola classic markers), one set per group
- Printouts #1-4, one each per group, but have a couple of extra copies of #2 and 4 in case students make a mistake
- Printout of OzoCodes reference chart (www.ozobot.com/gamezone/color-language), one per group
- Optional: printout of lesson PDF, one per group, if students are learning self-guided

Estimated duration

60 min, can be extended to two class sessions

LESSON

What is Ozobot?

Ozobot is a miniature robot, the smallest of its kind, and there are a lot of things Ozobot can do:

1. Ozobot drives on lines

You can draw a line, place Ozobot on it and it will follow the line.

Draw a black line (1/4", 6mm in width) on a white piece of paper. Turn Ozobot on by pressing the button on the side. Place Ozobot on the line.

How does this work?

Turn Ozobot over and see what's underneath. On the bottom, you can see 5 openings with lights shining out of them. An optical sensor lives in each of these openings. These sensors are Ozobot's eyes. Each of the sensors sees how bright the paper underneath is. This way, Ozobot can see where the white and where the black parts are and therefore knows where the line is.

2. How to take care of Ozobot

It may happen that Ozobot starts behaving strangely. For example, Ozobot may stop to be able to follow lines. To prevent this from happening, do the following maintenance every time you start playing with Ozobot or whenever you change your location or type of paper:

1) Calibrate

What does this mean? Ozobot's "eyes" (the sensors) are very sensitive to the surrounding light. So much so that, if the paper changes or if you go closer to the window, it affects how Ozobot sees what's underneath. To let Ozobot know what its surroundings are, you need to calibrate:

Use printout #1 and follow the instructions to calibrate your Ozobot.

After calibrating, Ozobot knows how dark the black lines are, how white the paper in the background is and how much light is in the room.

Sometimes, calibration alone is not enough and you may want to:

2) Clean the wheels

Ozobot is very small, so just a bit of dust or grease can get into the drivetrain. It's like driving through a dirty, muddy field with a car. You would certainly want to give the car a good cleaning afterwards. But don't try to clean Ozobot with soap and water, this would most certainly break Ozobot. Instead, take a clean white sheet of paper and move Ozobot's wheels gently back and forth on the paper. Done, Ozobot's wheels are clean!

Lastly, you will have to charge Ozobot periodically:

3) Charge the battery

Ozobot's motor is fueled by a tiny battery, much like cell phones, but smaller. If Ozobot blinks red, then the battery needs charging very soon. Plug the special USB cable to a computer and plug Ozobot to the cable. When the battery is almost charged fully, Ozobot starts blinking green. Ozobot shows a solid green light when the battery is completely charged.

3. Ozobot can see colors

Continue drawing lines with different color segments: blue, green, red. Let Ozobot drive on these lines and see how Ozobot reads those colors and the LED in Ozobot's dome shines in that color.

How does it work?

The middle sensor is actually a color sensor. It can detect red, green and blue colors. And, since every color can be mixed using these three colors, Ozobot can see all of them.

4. You can give commands to Ozobot.

You can give Ozobot commands by using colors.

Use printout #2: In any of the slots, mark (blue, black, blue) and (red, black, red) and (blue, green, blue). Place Ozobot on the line and see how Ozobot understands the colors.

What you drew on the paper are codes that Ozobot can understand. As Ozobot drives along the line, Ozobot sees the color sequence red black red. Ozobot has been programmed at the factory to know that this means: "drive slowly". As you have probably seen by now, the other codes mean "fast" and "turbo speed".

There are many different other codes that Ozobot knows. Take a look at the OzoCode reference chart to see some of them.
Optional: on a piece of blank papers, try out some of the codes. Make sure to draw a black line before and after each code. For more tips, please see the "Ozobot Tips" sheet downloadable from the Ozobot STREAM website (ozobot.com/learnzone/)

5. Order does matter

Use printout #3: Place Ozobot onto the track at any point and observe which movements Ozobot reads.

These 4 codes are the different "cool moves" from the OzoCode reference chart. Notice that the code for "Tornado" is the reverse of "Spin" and "Zigzag" the reverse of "Backwalk". And you can see on the track how it works: if Ozobot reads the code (red, green, red, green), then Ozobot does the tornado move. Now, if Ozobot sees the code with the colors reversed (green, red, green, red), then Ozobot spins.

Some codes are symmetric, for example "Slow" or "Fast", so it doesn't matter if Ozobot reads them from left to right or right to left. But many codes are not symmetric, like the ones you have just tried out. Make sure that you rotate them according to how Ozobot reads them. All codes on the reference chart are oriented to be read from left to right.

6. Are there other line-following robots?

Yes, a lot of line-following robots are used in factories, warehouses, hospitals and even restaurants! Some of the earliest Automated Guided Vehicles (AGVs) were line following mobile robots. They might follow a visual line painted or embedded in the floor or ceiling or an electrical wire in the floor.

The first AGV was invented in the 1950s and at the time it was simply a tow truck that followed a wire in the floor. Today, AGVs are used in nearly every industry: transporting materials for assembly lines, products in warehouses, but also food in restaurants or medicine in hospitals.

Maze Exercise

To review everything we learned today, take a look at the handout #4.

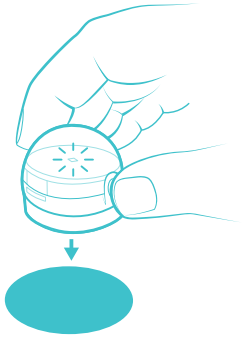
Can you help Ozobot find the way to the shop across the river? On the right is your house and Ozobot needs to take you from the house to the shop. But Ozobot might end up at the river with no place to go. So it is up to you to guide Ozobot with the help of codes. Make sure that when Ozobot starts at home, Ozobot always arrives at shop.

To accomplish this, fill in the codes on the bottom left of handout #4 into the empty spaces on the road. You have to use all codes, but you can use each of them only once. Once you have filled in all spaces, turn Ozobot on and place Ozobot on the line at the "Place here" marker. Does Ozobot arrive at the shop? Repeat this a couple of times. If you found you have made a mistake, take another copy and fill in the codes differently.

ozobot

1

2



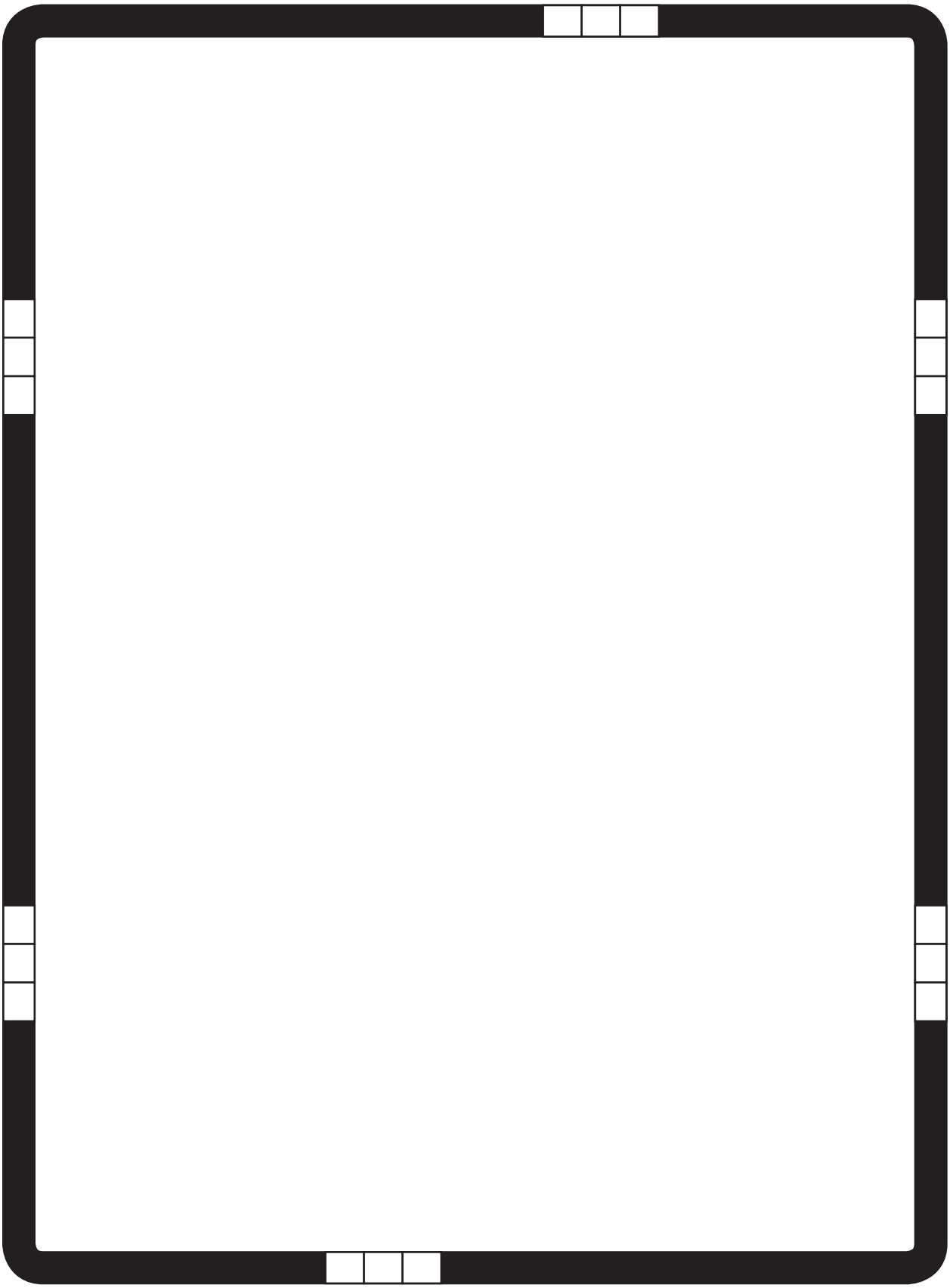
3

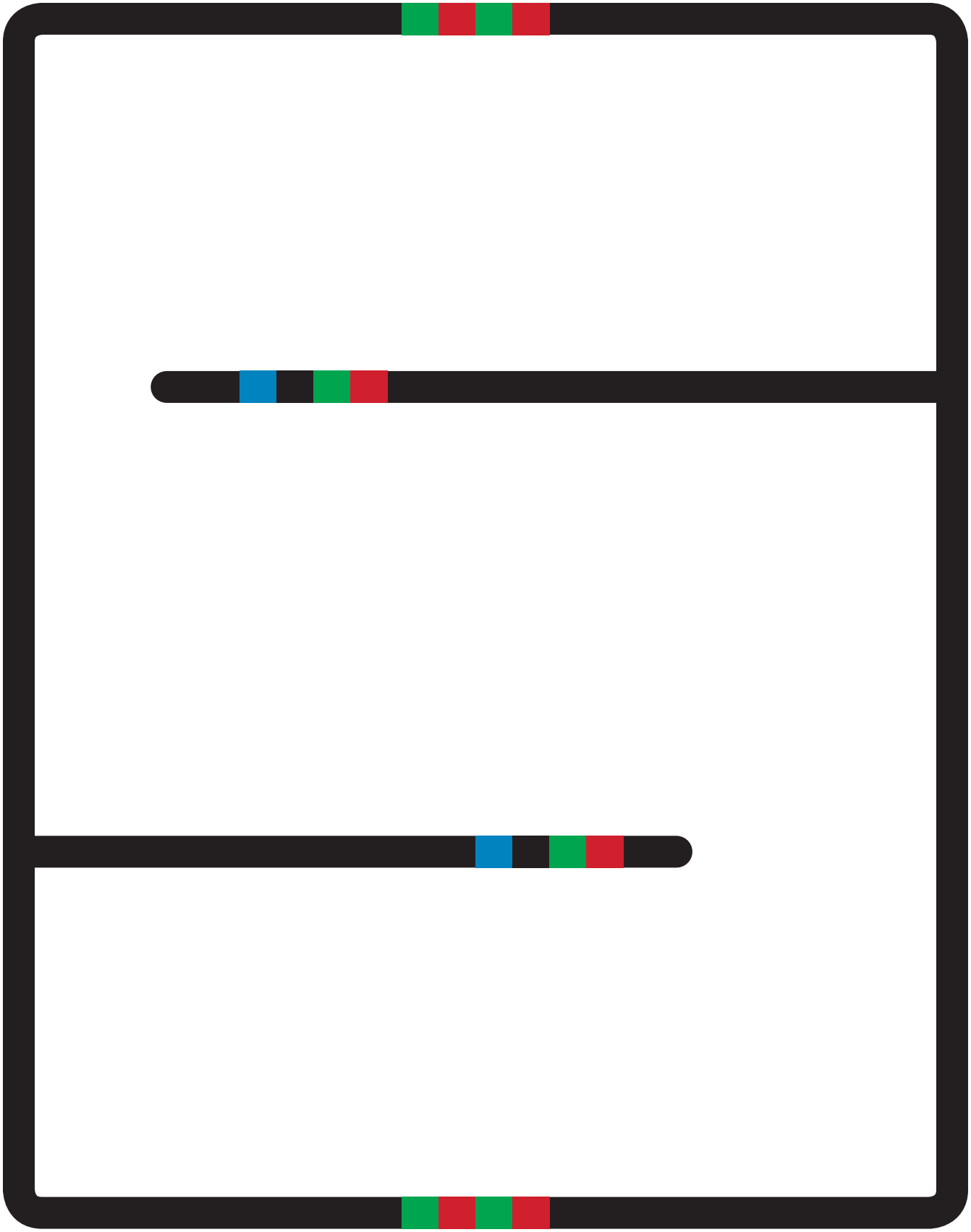
4

Prepare Ozobot for Play!

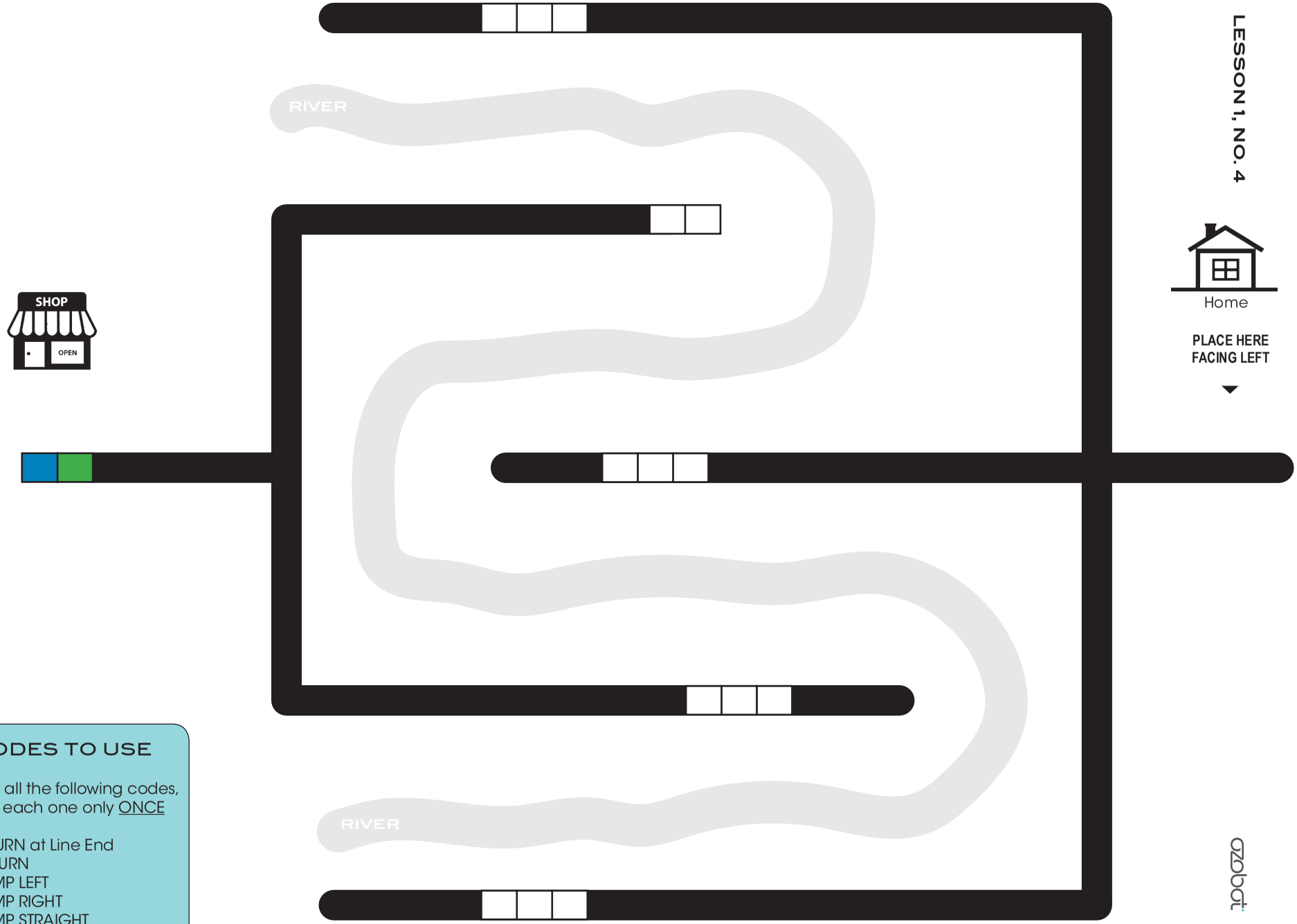
Before you begin, you need to calibrate your Ozobot! You should calibrate often, especially if Ozobot starts acting odd. When in doubt, calibrate!

1. Hold down the power button on Ozobot for 2 seconds until the LED light turns white.
2. Place Ozobot in the middle of the black dot above.
3. Ozobot will then blink blue, move forward, and then blink green.
4. When Ozobot blinks green, it means that it has successfully calibrated. Start over if Ozobot blinks red.





LESSON 1, NO. 4



CODES TO USE

Use all the following codes, but each one only ONCE

U-TURN at Line End
U_TURN
JUMP LEFT
JUMP RIGHT
JUMP STRAIGHT

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LESSON 1, NO. 4
SOLUTIONS

ozobot