

CONSTRUCTION CREW

MISSION 5

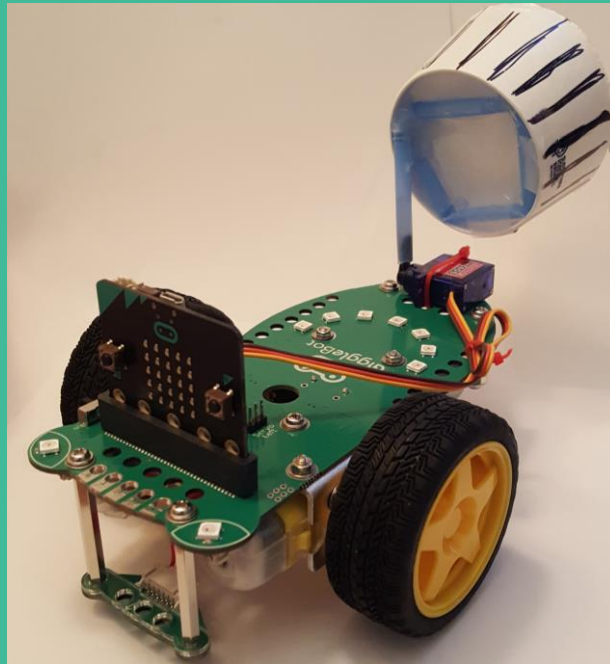


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> ROBOT CONSTRUCTION CREW

YOUR ROLE: SELF-DRIVING DUMP TRUCK OPERATOR

❶ A **self-driving car**, also known as a **robot car**, **autonomous car**, or **driverless car**, is a vehicle that is capable of moving in its environment with little or no human input.

YOUR TASK: DELIVER MATERIALS

Transform your GiggleBot into a self-driving dump truck that delivers materials. The GiggleBot dump truck will follow a path to the dump site.

CONSIDERATIONS

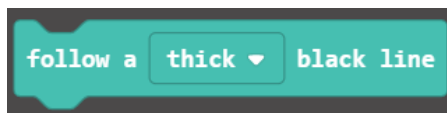
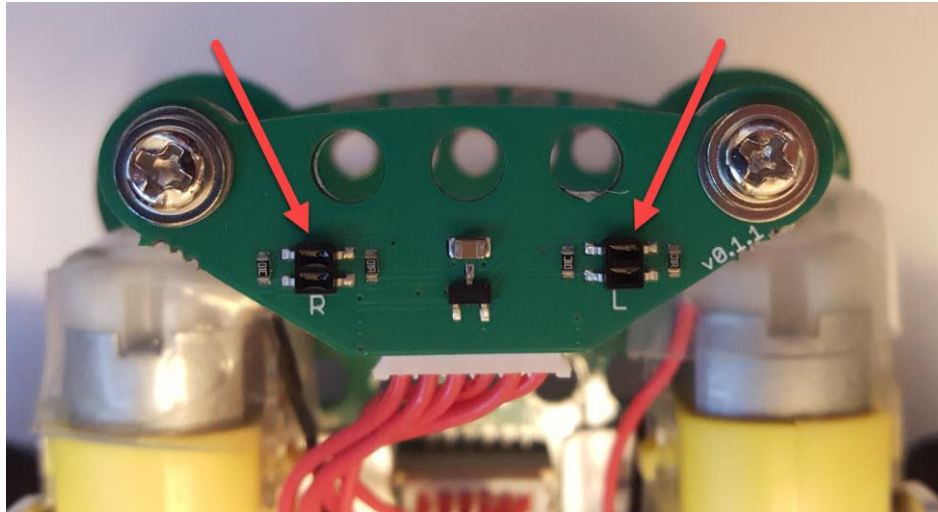
- > Where will you attach the dump bin?
- > How will you position the servo so that they it can be programmed to empty the bin?
- > What will you transport? How much weight can your container and servo handle?
- > What will the container look like? What construction materials will you use to create the container?
- > Where will GiggleBot transport materials from/to?

MATERIALS

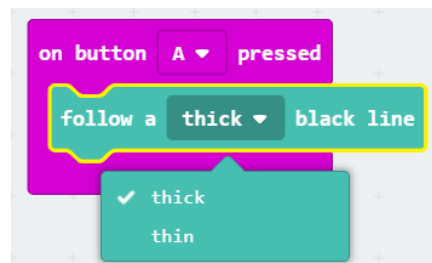
- > GiggleBot and good batteries
- > micro:bit and provided cable
- > Laptop / computer
- > Servo, servo horn, small screw and screwdriver
- > Line follower pages (need to be printed)
- > Pipe cleaners, zip ties or hot glue gun
- > Craft supplies to build a container on the GiggleBot (ex. cardboard, straws, tape, glue, construction paper, paper cups)

> LEARN: LINE FOLLOWER

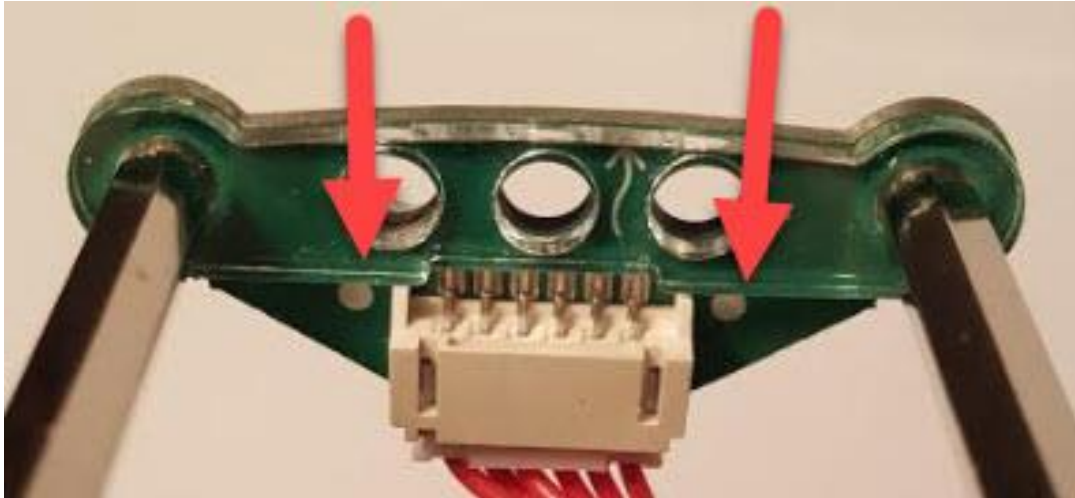
The line follower sensor is on the front of the GiggleBot. Flip over your GiggleBot and look at the bottom of the sensor. There are two black sensors on the bottom. These sensors read black and white. Using these sensors the GiggleBot can tell whether it is on the line or not.



The simplest way to program the GiggleBot to follow a line is to use the **follow a thick black line** block. Using the dropdown menu on the block you can change the thickness of the line the GiggleBot will detect.

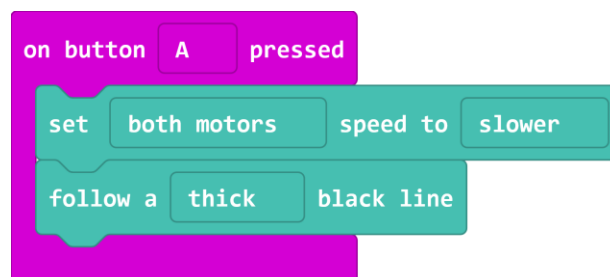


- > A **thick black line** is one that is wide enough that both sensors will be on top of it at all times. The GiggleBot will stop when both sensors read white. The pre-printed lines are considered thick lines.
- > A **thin black line** is one that fits between the two sensors on the bottom of the line follower sensor. This means that if both sensors read black, it will stop. When both sensors read white, it will continue to move.



Pro tip: the position of the sensors is also visible with the two white dots on top of the line follower.

Let's make a path and test out these blocks. Using the preprinted lines, create a path for the GiggleBot to follow. To make the GiggleBot more accurate, add a block to slow down the speed.

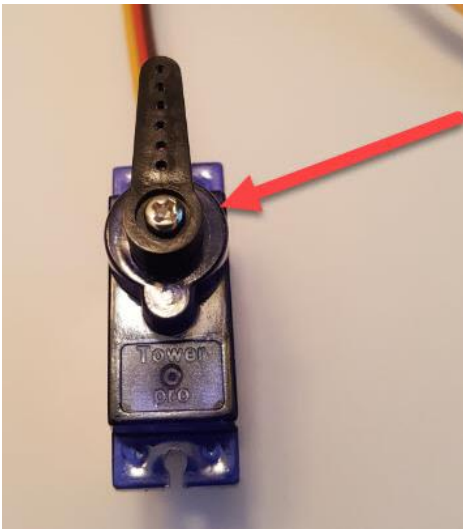



Change the speed higher or lower to see how it impacts the GiggleBot. Think about what speed you may want to use for your dump truck.

> LEARN: SERVOS

A servo is a motor that allows for control of rotational movement. Normal motors will rotate until they are told to stop. Servos rotate only as far as we tell them to. You see normal motors on things like electric cars, washing machines, or fans: the motor just rotates in a direction. You see servos in things like robotic arms where the object needs to move a very small and specific amount. We can attach one or two servos to the GiggleBot to add extra movement. You could make the GiggleBot into an animal and create moving arms, legs, wings, fins, or antennae using servos. You could transform the GiggleBot into a traffic control vehicle and raise/lower signs using servos. These are only a few ideas, but the options with the servos are endless.

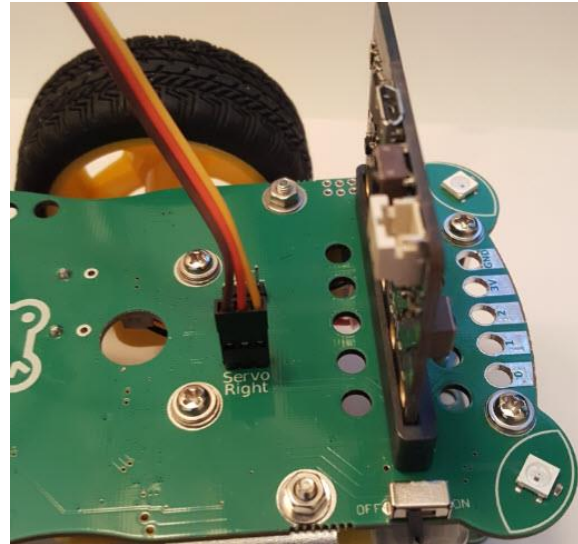
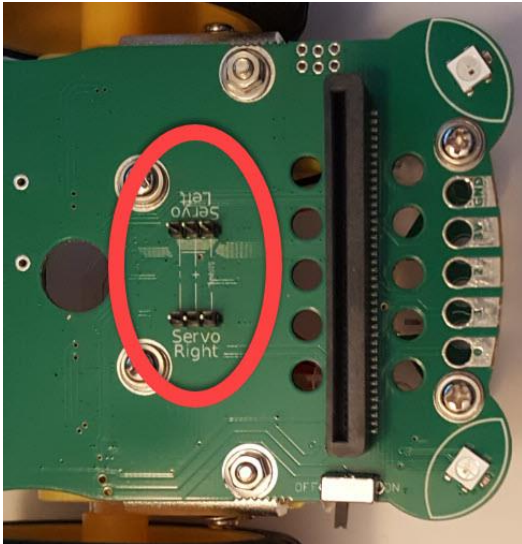
Your servo comes with several different horns and screws to attach the horn to the motor. We will use the single arm to learn about servos and create the dump bed mechanism. Use the screwdriver to attach the horn to the servo. After you create your dump truck, experiment with the other horns to see what you can create.



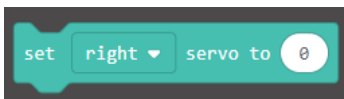
 Use a screwdriver to connect the horn to the servo with a small screw.

CONNECT THE SERVO

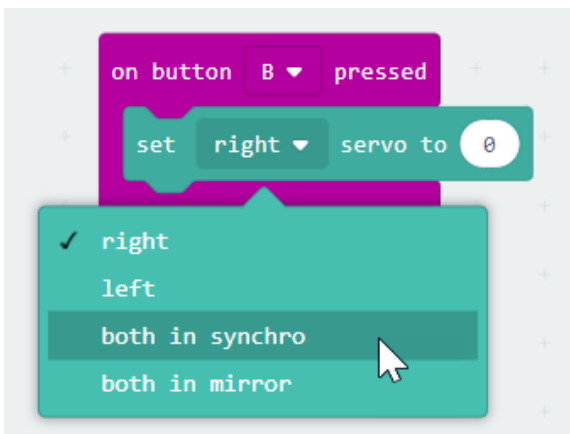
Connect one of your servos to the GiggleBot. If it is not connected correctly, the servo will not work. The brown wire (it can also be black) goes towards the back of the GiggleBot.



CONTROLLING THE SERVO



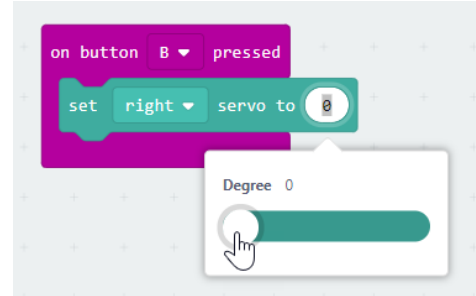
To control the servos you will use the **set right servo to 0** block. You can control the left servo, right servo, both servos synchronously (in synchro), or both servos in mirror.



① **in synchro** means that the two servos will move in the same way at the same time (like synchronized swimming)

① **in mirror** means that the two servos will move opposite of one another (think of butterfly wings opening and closing)

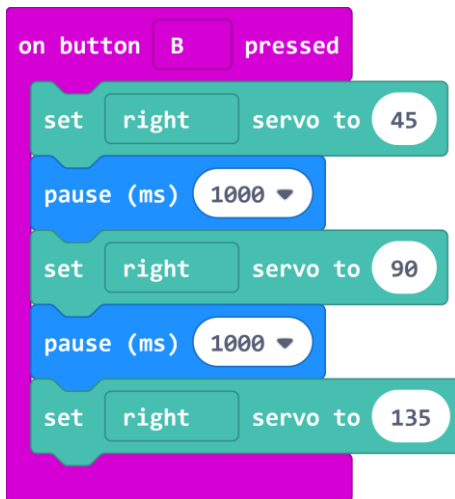
For this mission you will only use one servo, but **in synchro** and **in mirror** come in handy when you are using more than one servo. You can control how far the servo rotates by changing the number of degrees in the block.



PLAY AROUND

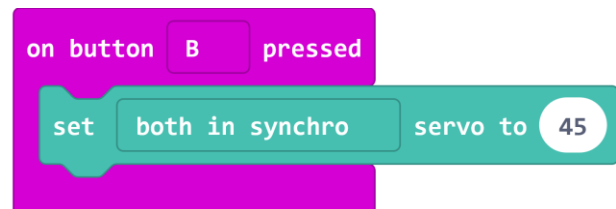
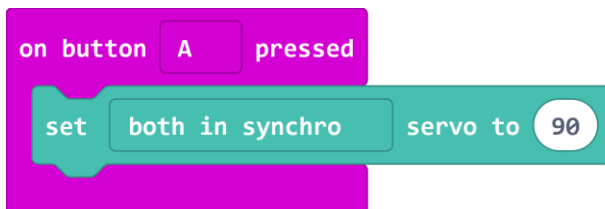
Experiment with programming one or both of the servos.

A few sample programs are shown below. Transfer each to your GiggleBot and try it out.

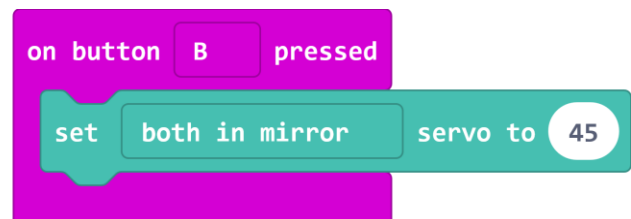
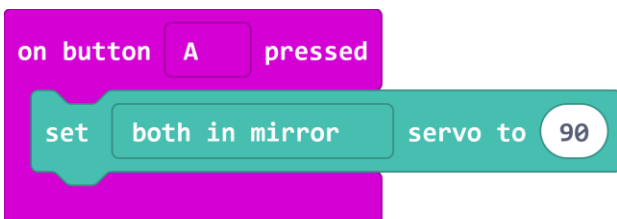


What happens if you remove the **pause** blocks?

Compare **in synchro**:



with **both in mirror**:



Try them out to see the difference!

> PLAN IT OUT

Think about what you want to transport in your GiggleBot dump truck and where it will go. For this mission, you will only use one of the servos. Your servo cannot move too much weight, so we cannot haul large rocks or your sibling, but you can transport things like building blocks, beads, or a small stuffed animal.

Decide where you want the dump truck to travel to and what kind of line you will use.

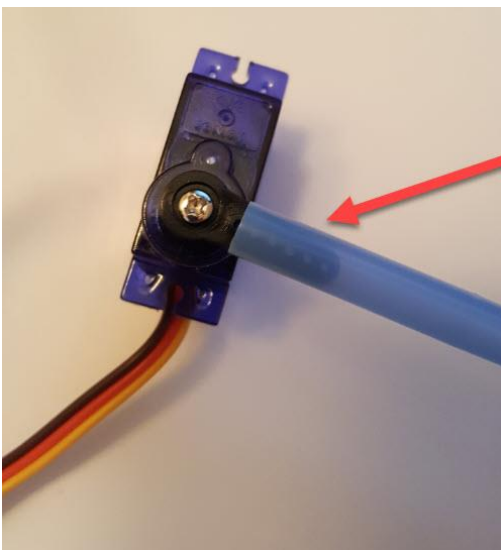
- > Is it going to drop off materials in another room?
- > Will it move things from one side of the room to another?

It is up to you!

BUILD YOUR DUMP BED

Build a container to carry supplies to the dump site. It will be attached to a servo so that you can program the GiggleBot to dump it out just like a real dump truck.

- > Ensure that the servo is securely attached to the GiggleBot using a pipe cleaner and that the arm can move freely. You can use pipe cleaners as suggested here, however hot glue (with parent supervision) or zip ties are more secure. You only want the arm on the servo to move, not the servo itself.



Pro Tip: A good way to attach a dump bed to the arm of the servo is using a straw. Slide the straw over the arm and attach securely with glue, tape, or a small rubber band.

BUILD YOUR PATH

Using the preprinted lines or black tape, create a path for your GiggleBot to follow. Leave a white space at the end of the path so that the robot knows when to stop.

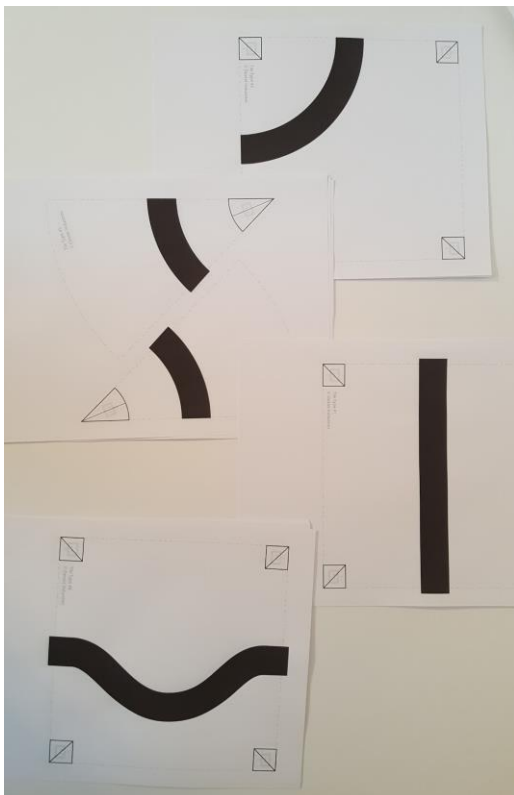
BUILD YOUR PROGRAM

Use the skills from the Learn section to create a program for the GiggleBot. Remember, you will need to tell the robot to follow the line, turn around, dump out the contents of the container, and then follow the line back to the start.

ARE YOU STUCK??

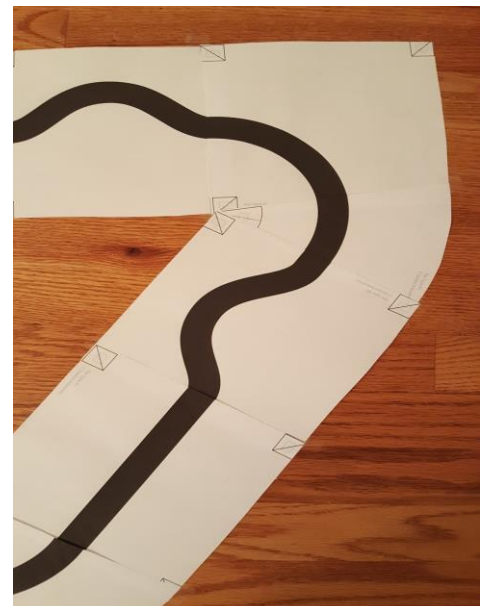
Let's build together!

BUILD THE PATH:



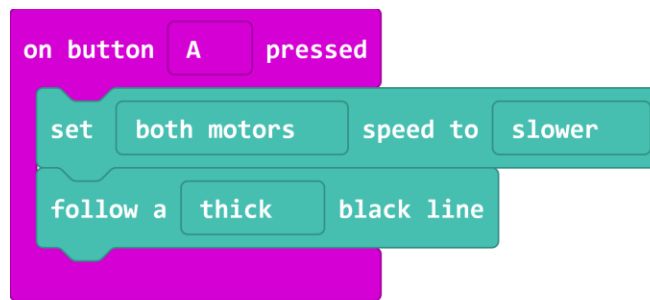
Piece together the preprinted lines to create a course. The course can be as long or as short as you like.

Make sure that the pieces are taped together so that there is one continuous line for the GiggleBot to follow. Ensure that there is also white space at either end of the path the GiggleBot is going to follow. We will use the white color to tell the robot to stop moving when we write the program.

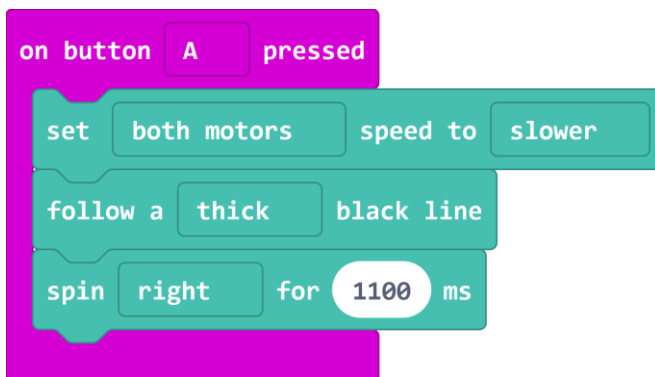


BUILD THE PROGRAM:

First, we need to tell the GiggleBot to follow the line to the dump site. Determine what you want to start the program, the speed of the GiggleBot, and what size line you are using. For the program below, the GiggleBot moves at a slow speed on a thick line when the A button is pressed.

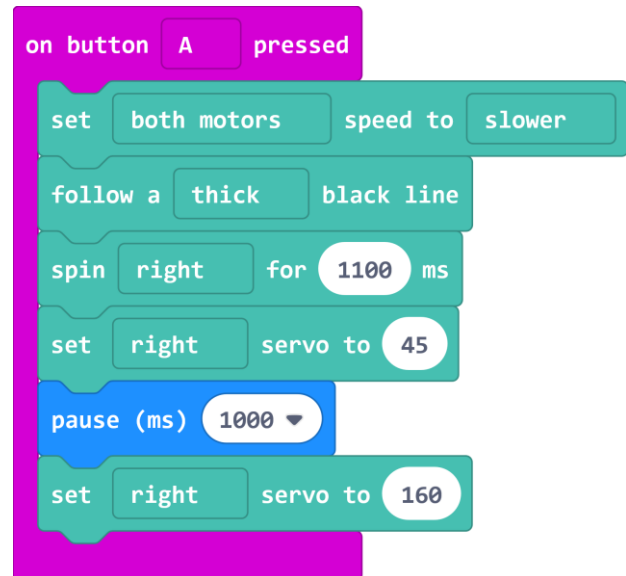


The GiggleBot will follow the line until the line follower reads all white. At that point, the GiggleBot will stop.



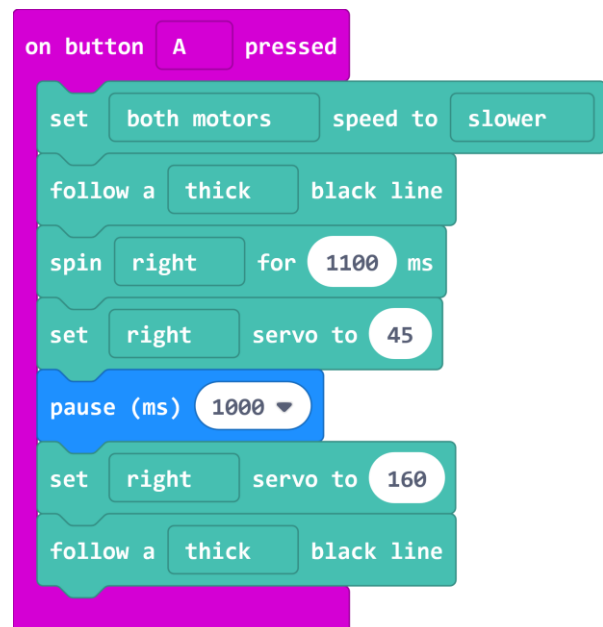
At this point the GiggleBot can turn around and dump out the contents of its dump bed. The time needed to spin around may vary depending on the path and location of the dump site and the end of the path.

- > Add a block onto the program to tell the GiggleBot to turn around.
- > Once the GiggleBot has turned around, it needs to dump out the contents of the dump bed using a servo. This program only uses one servo, but it can be modified for more than one servo if you want to use two.
- > You will also need to change the values for the servo based on the orientation of your servo and servo arm. Think back to your experimentation with servos earlier in the mission.



i This may take a couple iterations to get it to dump out the contents of the dump bed.

Lastly, we will tell the GiggleBot to drive back to the starting point. Since the GiggleBot in the example turned around about 180 degrees to dump out the contents of the dump bed, it is already facing the correct way and is back on the line. If your GiggleBot is not back on the line, add a block to adjust the position of the GiggleBot before it follows the line back.



- > Download and transfer your program to the GiggleBot.

> TRY IT OUT

Be sure that the path for your GiggleBot to follow is complete. There should not be any gaps in the black line path (unless you want the robot to stop at multiple locations). Also, make sure that the servo is attached securely to the GiggleBot and does not move around when it is turned on. Run your program and see if the GiggleBot is able to transport the materials all the way to the dump site and then return to the start.

ITERATE

Did your GiggleBot's dump truck follow the line all the way to the dump site? Did it dump out the contents of the container? Did it turn and drive away? What are some areas for improvement? In engineering, we try a solution, think about what needs to change, and we iterate.

As you modify and revise your program, save each new program with a version number – you never know when you might want to take another look at an older version (for example: Dump_V1 where "V" stands for version).

EXTENSION

- > Create a GiggleBot dump truck that uses two servos. One servo is in charge of rotating the dump bin and the other dumps out the contents.
- > What else could you use the servo for? How could you create a defense mechanism for a game of battlebots?

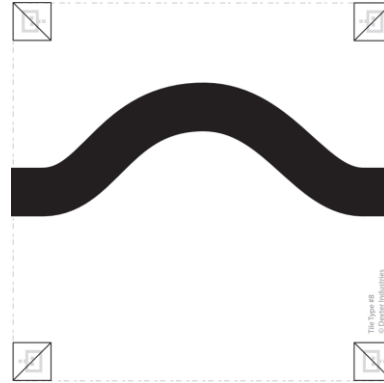
> ANNEX 1: LINES

You can print the following pages as often as you need in order to create the path of your dream.

The following tiles are the most useful in this mission:



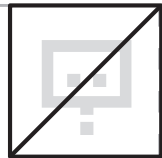
Tile 1: driving straight



Tile 2: a bump, just for fun

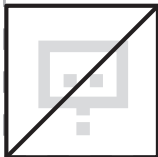
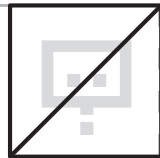


Tile 8: rotate this one to turn the other way



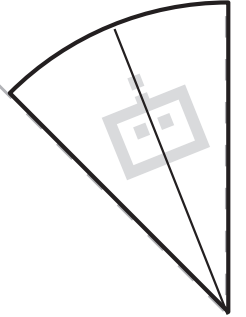
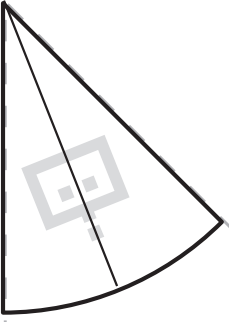
Tile Type #1
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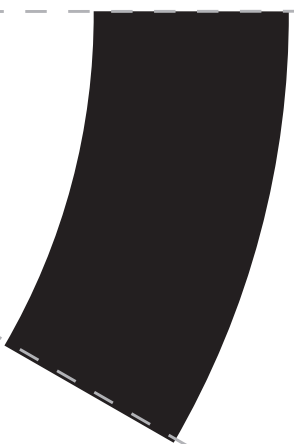
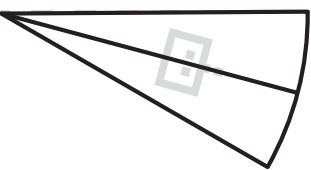
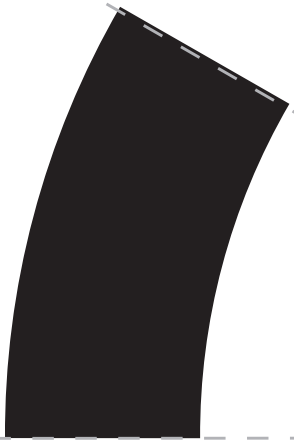
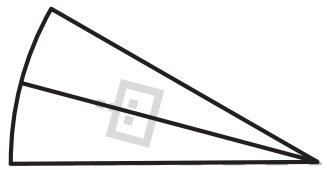
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Tile Type #5
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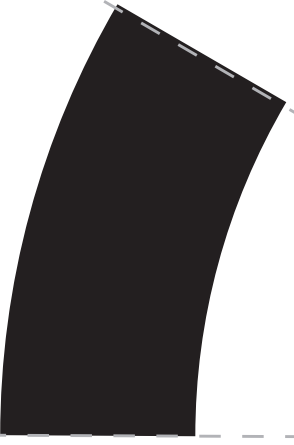
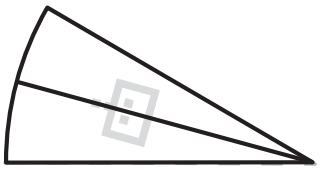


Tile Type #5
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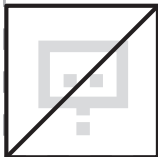
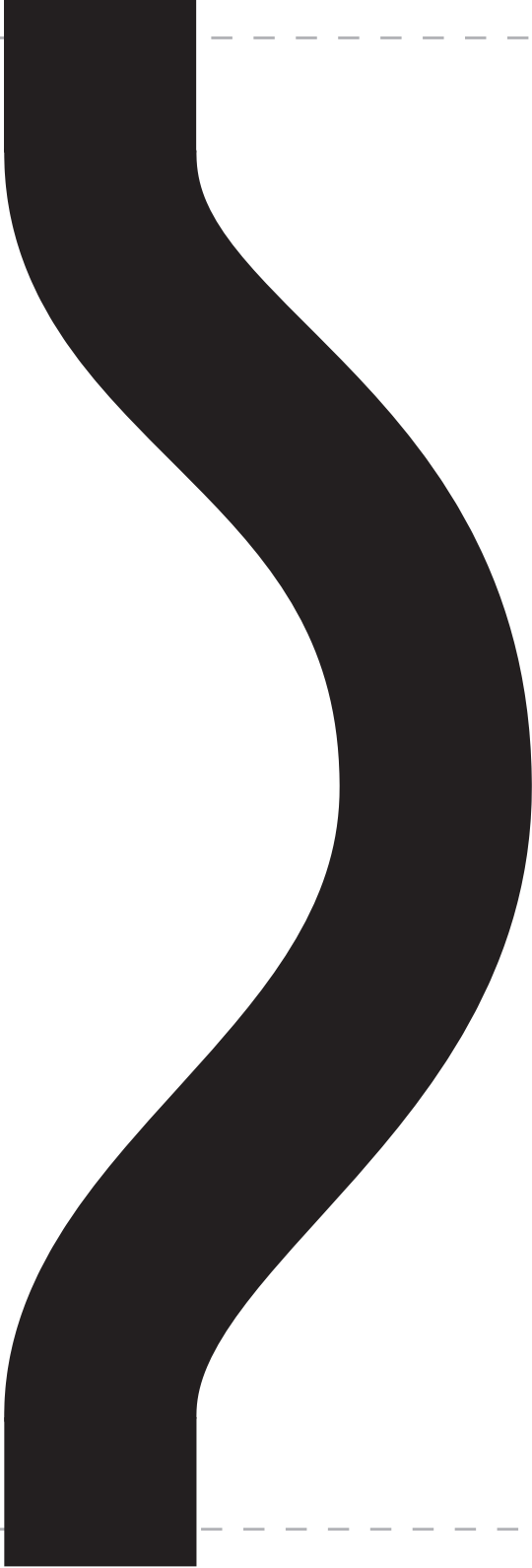
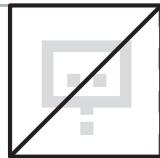
Tile Type #6
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Tile Type #8
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