Motors

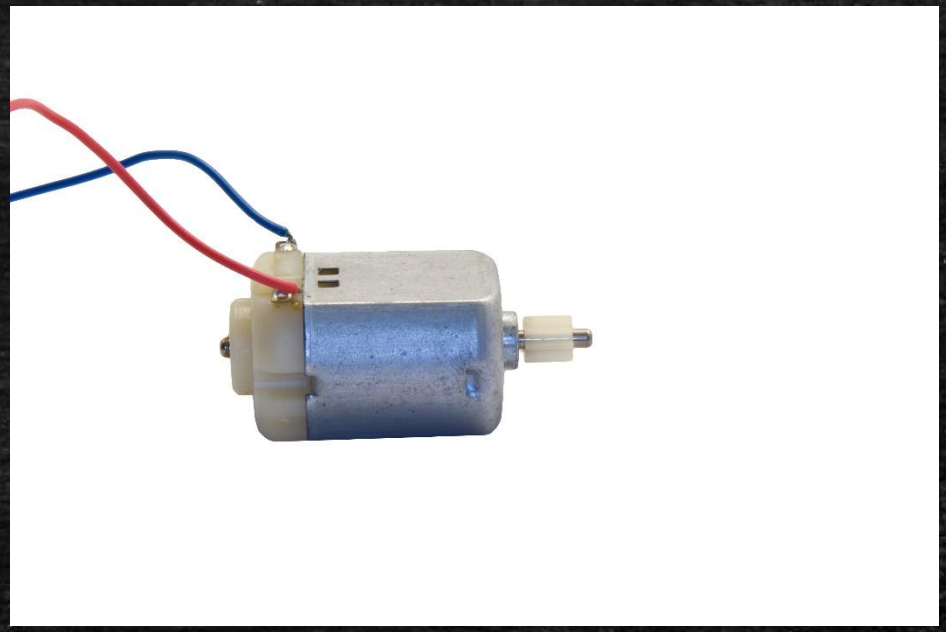
“Turn” up!

What we will be covering

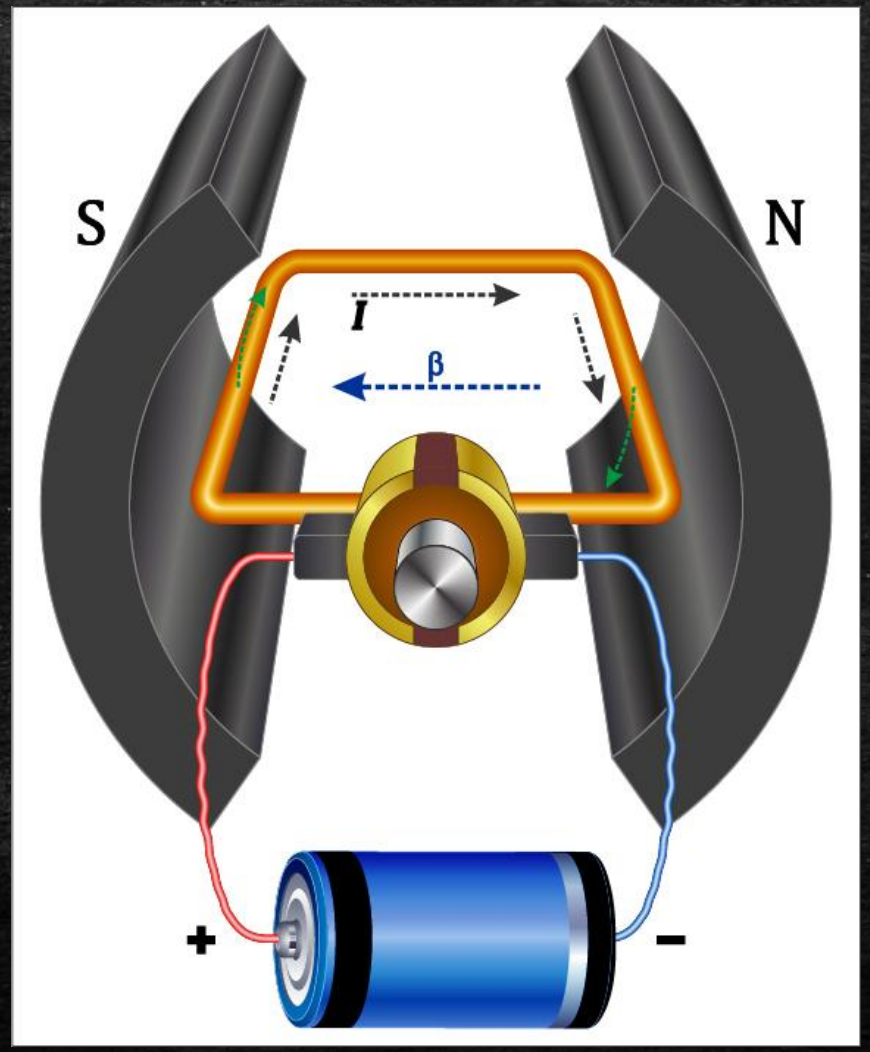
- What a motor is and basic operating principle
- Motor drivers
- Working with motor drivers and Arduinos
- Thinking about the design process
- Resources on the website and online

What is a motor?

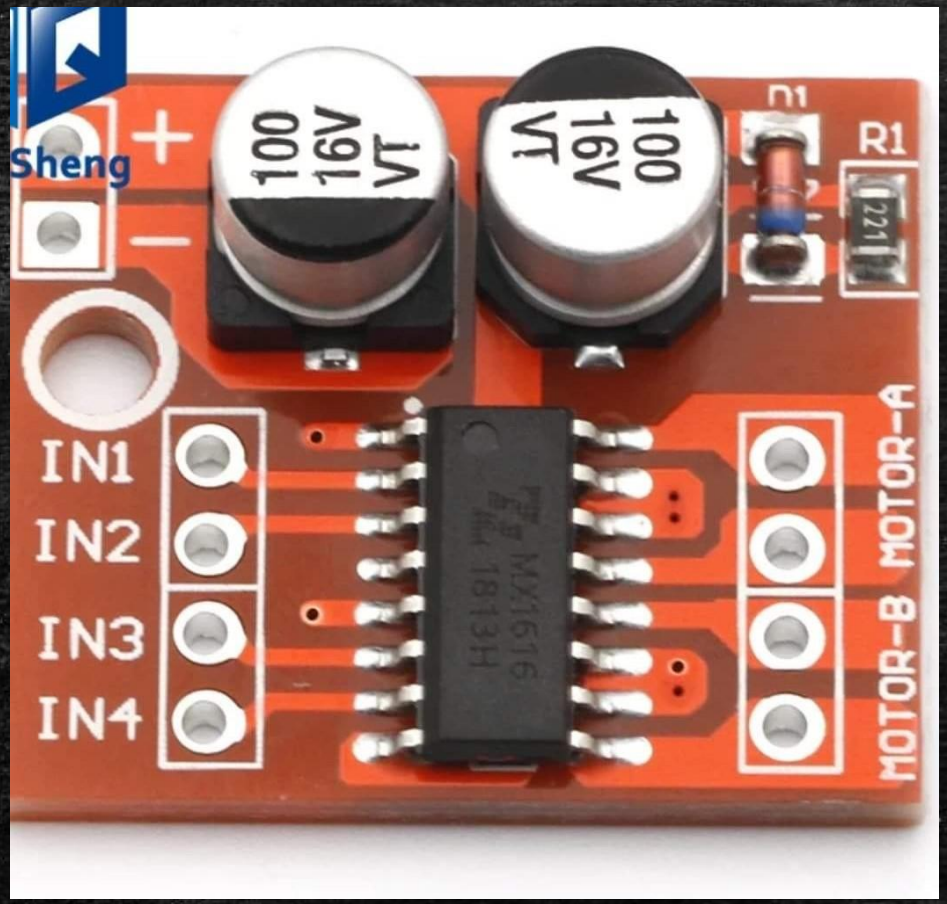
- An electrical machine that converts electrical energy into mechanical energy ~ google
- Really easy to use
- Really versatile and common
- Tons of different types



How does it work?

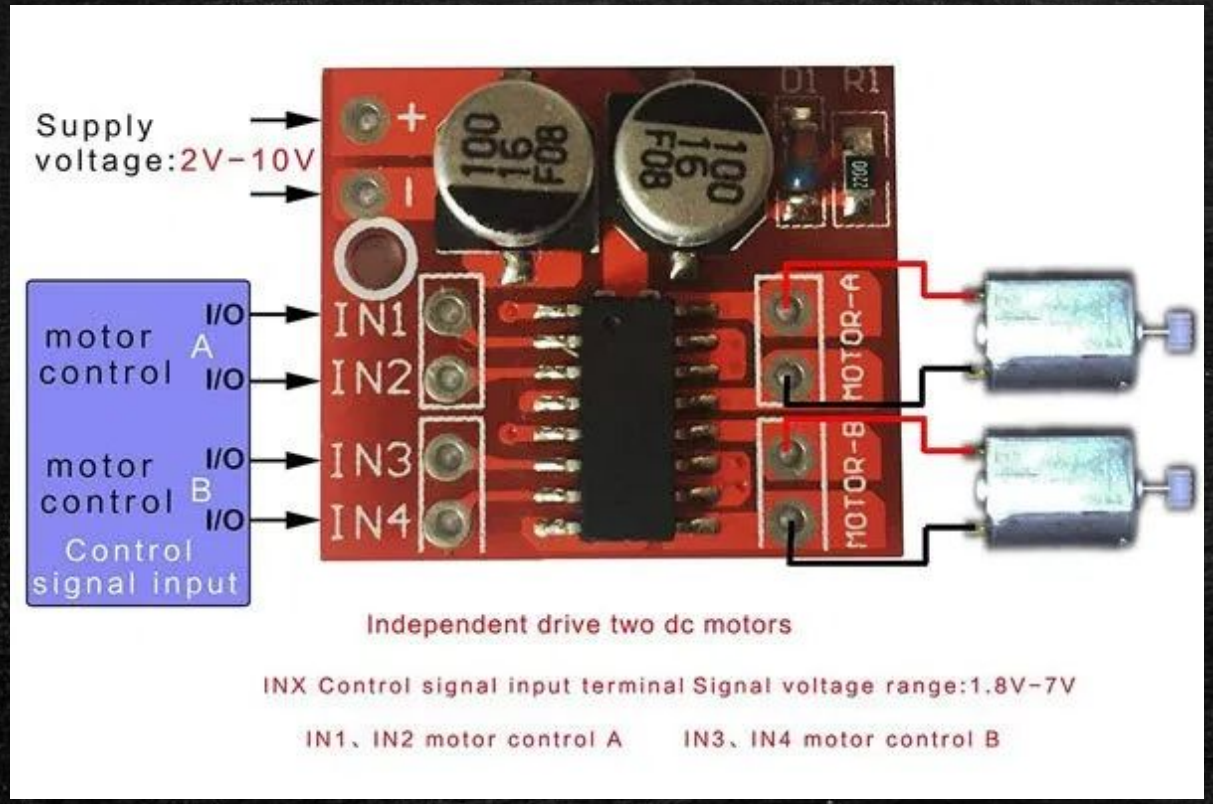


Motor driver #1



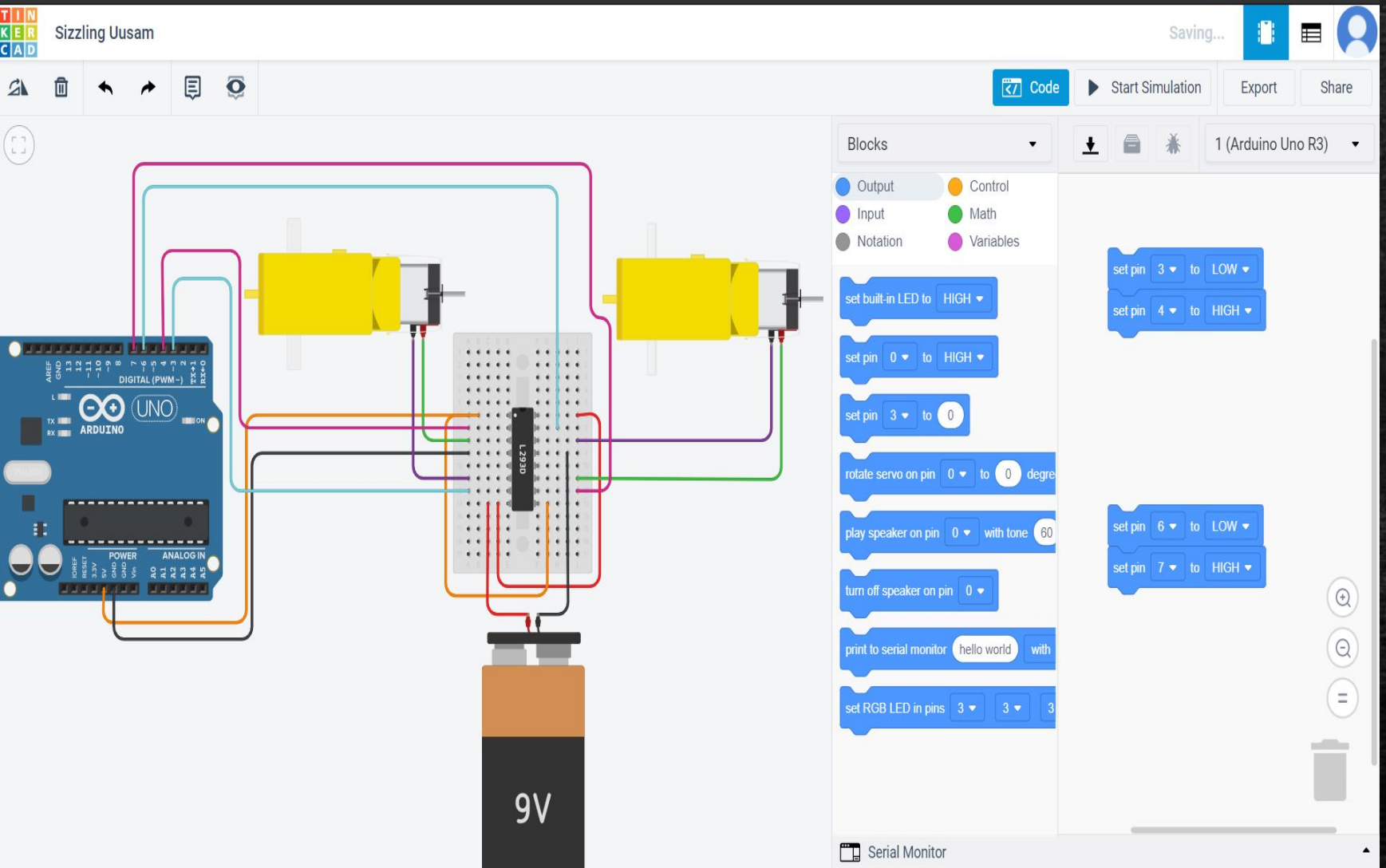
- Acts as a middle-person between the motors and their control circuits
- Motors usually require more power than control circuits so to be safe, motor drivers are used instead of sourcing large amounts of power from control circuits
- In our case, the control circuit or “Brain” is the Arduino

#2



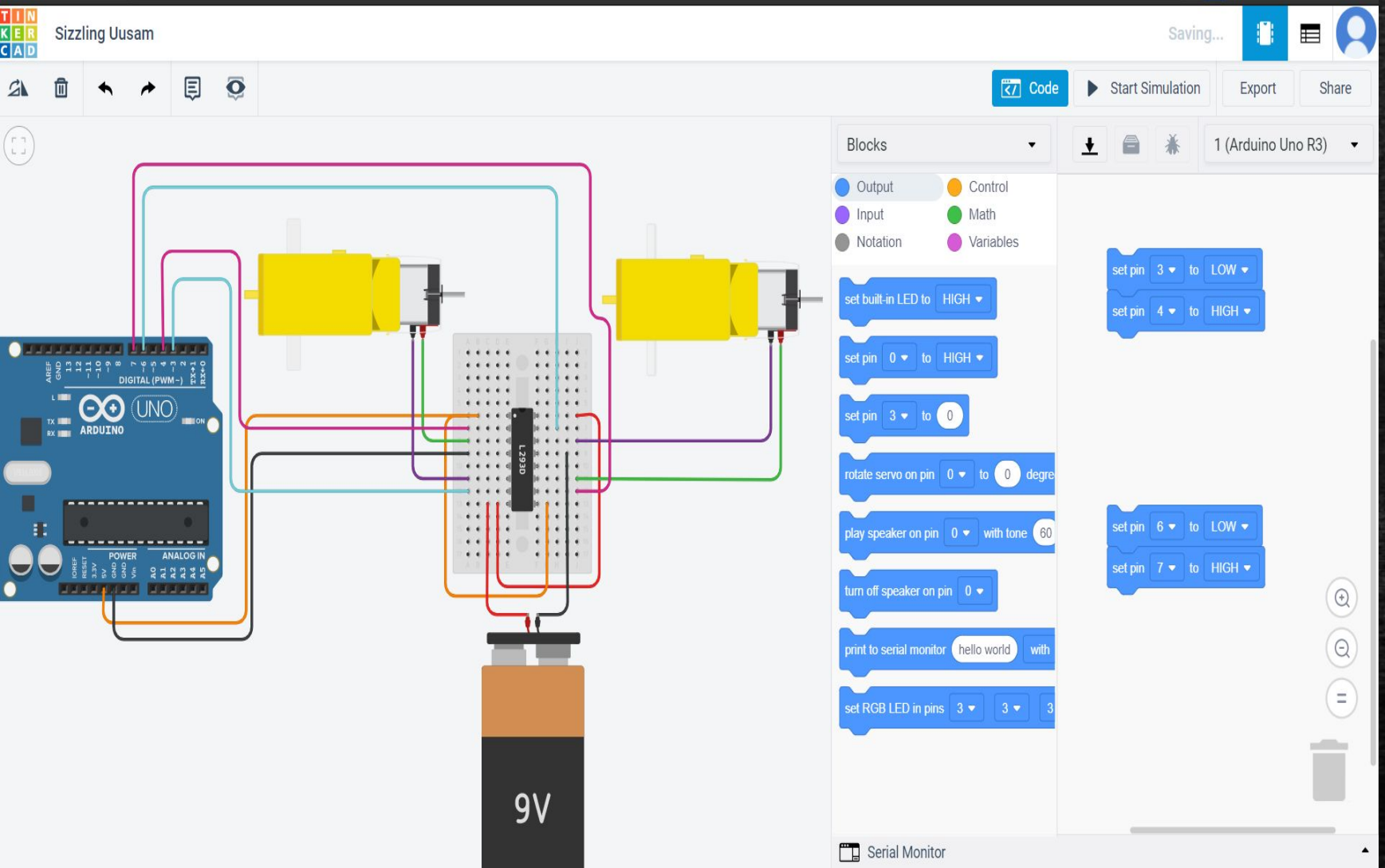
- IN1 & IN2: these are input pins used to control the first motor
- IN3 & IN4: these are input pins used to control the second motor
- MOTOR A: this is where the first motor is connected
- MOTOR B: this is where the second motor is connected
- "+" & "-": these are the power supply terminals for the board

Motor driver and Arduino



- TinkerCAD doesn't have the actual motor driver board in our kits however, it has an IC (integrated circuit) or a chip that is commonly used as a motor driver
- It operates on the same principle, so we can use it
- The IC is called the L293D H-bridge Motor Driver

Operation



- If IN1 is high and IN2 is low, the motor rotates in a clockwise direction. The motor will rotate in the opposite direction if IN1 is low and IN2 is high
- if the two inputs are in the same state, the motor will be off.

Arduino motor lingo

magnificent_borwo1 | Arduino 1.8.13 (Windows Store 1.8.42.0)

File Edit Sketch Tools Help

magnificent_borwo1

```
void another(); // this is definition of the function that can be used later. It is always important to define your functions.

void setup()  //code in this function runs once
{
  Serial.begin(9600);
  //always remember to "define" or tell the Arduino how the pins being used are going to function...input or output
  pinMode(3, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(6, OUTPUT);
  pinMode(7, OUTPUT);
}

void loop()   //code in this function runs over and over again
{
  //MOTOR A ON
  digitalWrite(3, HIGH); // this sends a HIGH signal to IN1
  digitalWrite(4, LOW);  // this sends a LOW signal to IN2
  //MOTOR B ON
  digitalWrite(6, HIGH); // this sends a HIGH signal to IN3
  digitalWrite(7, LOW);  // this sends a LOW signal to IN4
}

void another()
{
  //this is another function...sometimes it is easier to split code into functions.
  // this helps make code tidy, and easier to read.
  // if you choose to do this method, always remember to define the function at the begining of this document.
  // if you do not want to define your functions, you would have to put the funcion before the "void loop()" function.
}
```

Done compiling.

```
Sketch uses 1788 bytes (5%) of program storage space. Maximum is 32256 bytes.
Global variables use 184 bytes (8%) of dynamic memory, leaving 1864 bytes for local variables. Maximum is 2048 bytes.
```

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Design

- When you receive your motor, try making a simple car… it drive forward, pause for a while, then continue driving forward. It could also, drive forward, pause for a while, then drive backwards
- Play around with the kit
- To make the chassis of your bot or car; foam board could be useful before going on to making a 3D model
- There are tons of different ways to make a chassis
- It could be useful to think of different ways to make your CAD model, the more practice the better you get!

Practice notes

- If you are practicing with the L293D IC, connect the "Enable" pins together and then connect them to the +5V terminal on the Arduino
- Connect the two "VCC" pins together and then, connect them to the positive terminal of the battery
- Connect any of the ground pins on the IC to any ground pin on the Arduino
- *these steps are to compensate for TinkerCAD's lack of the motor driver board that is provided in our kit.
- After following these steps, the remaining connections would be identical to the motor driver provided in the kit.