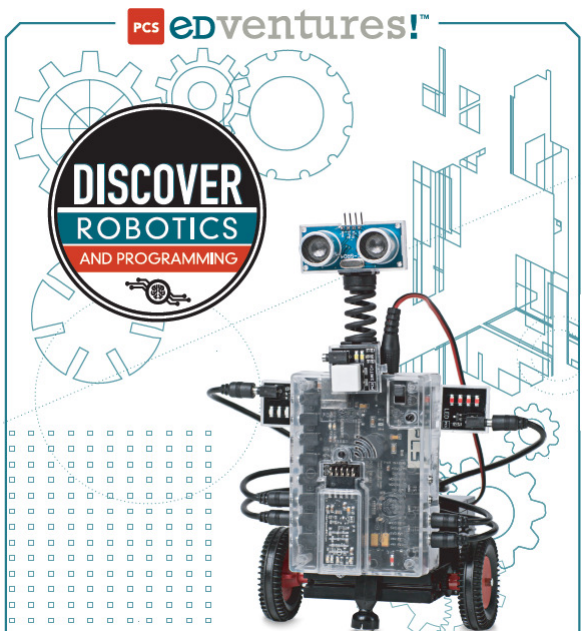
# Intro to Robotics

Week 2




## Key learning points from last week

- STEM careers can lead to high paying jobs
- Lots of students are enjoying building robots and competing
- Journaling and Peer Assisted Reflection is a normal STEM expectation and is required for this class
- The Robot's "Brain" is a computer that has inputs to collect sensor information (like how close it is to an obstacle) and outputs to drive things like motors
- Programing can be very simple using graphical images linked together in a sequence to make an robot behave in a certain way
- Programs are developed and compiled on a laptop or tablet and uploaded to the "brain" via Bluetooth
- DC motors can go forward or reverse based on polarity and they can speed up or down based on voltage
- Servo motors are used for things like arm movements.

# Today's Activities

- Build a motor control station
- Use Cortex software to write, compile, and upload motor control programs
- Programs to be written and executed by each group include:
  - Running motor A for 3 second
  - Running motor A for 3 seconds and then reverse motor A for 3 seconds
  - Run motors A & B for 3 seconds
  - Run motor A for 3 seconds and then motor B for 3 seconds

*You will write and execute other programs (Challenges 1 & 2) as time permits. For the challenges, you will build on the programs above, but you will not have an example to copy…you will have to figure out the changes required!*

# Don't forget to Journal!

YOUR NAME: UNIT NAME:

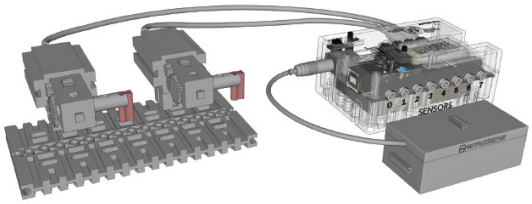
| QUESTIONS / HYPOTHESES: | |
|---|---|
| TESTS / EXPERIMENTS PERFORMED: | RESULTS: |

- An example of a possible journal entry:
  - Your question might be "what number do I input to get 3 seconds of run time?"
  - State your assumption / hypothesis, e.g. 3 ,30, ?
  - Your experiment might be to enter your assumption into the program you write
  - What was your results?

*It is an expectation of this class that you will keep a journal with daily updates*

## Motor Control Station Construction

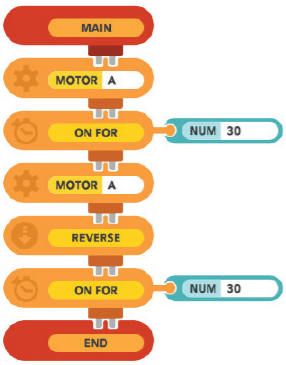
- Build station using instructions found on pages 32- 39 of the Brain and Cortex handout.
- When it is complete, it should look like:



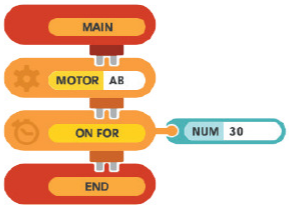
## Programming

- Each group will create a folder for programs with their user name.
- Each person will create and upload to the motor control station a program below and run their program
- Programs are on page 42 of your handout and include:

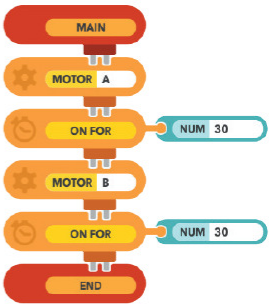
Program 1




Program 2




Program 3



# Challenge 1

- Using the motor testing station, create programs to do the following:
- Modify your program 3 to make motor A run for 10 seconds and motor B run for 5 seconds. Save as program 4.
- Modify program 1 to make motor B run for 5 seconds and then reverse for 8 seconds. Save as program 5
- Modify program 5 to make motors A and B run simultaneously for 5 seconds and then reverse simultaneously for 5 seconds.
- Using program 2, adjust the value of NUM such that the flag attached to motor A spins around exactly 3 times and stops from where it started. Write your number in your journal.
- Try the same challenge for motor B. Write your number in your journal. *Is the value that was used for motor A lesser (<), greater (>) or equal (=) to the value used in motor B for the same result? Write your answer in your journal.*

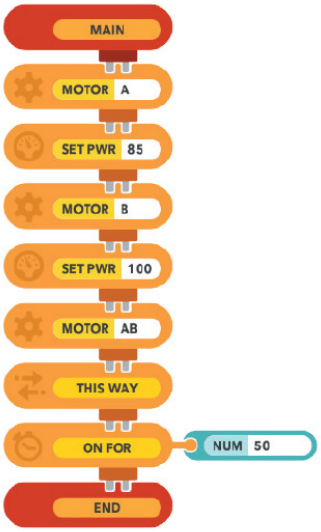
# Project 2 – Using "this way", "that way" and "set power" commands

- Motors default to:
  - the direction known as "this way"
  - 100% power. (As you found out in the last challenge, that amount of rotation might vary between motors.)
- SET PWR, THIS WAY, & THAT WAY are all global commands.

  *This means that once you use them, they are true for the rest of the program unless otherwise stated.*
- All other commands are known as local commands because once they are used in a program, they are no longer true.

  *For example, if BEEP or WAIT are part of a program, once they perform their function (or that moment of the program has passed) they no longer play a role in that program.*

# Program using “this way” and “set pwr”




This is how The Brain reads this program:

Motor A **SET PWR 85%**

Motor B **SET PWR 100%**

Motors A and B go **THAT WAY**

Turn **ON FOR** for 5 seconds

As you can see, specifics must be given to each motor individually, then call both motors again to turn on at the same time.

All programs are being interpreted by The Brain from the top of the program after the **MAIN** command through the **END** command at the bottom. Motors need to be identified in a command before they can follow directions.

# Program using “this way” and “that way”


In this program,

Motor A runs **THIS WAY**

Motor B set to go **THAT WAY**

Motors A and B turn **ON FOR** 5 seconds

See that in order to turn both motors on after stating their direction, both motors had to be named once again at the same time.

# Challenge 2

- Using the motor testing station, create programs to do the following:
  - Program 6 - Make motors A and B simultaneously run THIS WAY for 5 seconds and then run THAT WAY for 5 seconds.
  - Program 7 - Make motors A and B simultaneously run in opposite directions for 5 seconds and then both switch for another 5 seconds.
  - Program 8 – create a program to run both motor in the same direction and experiment with the SET PWR command on motors A and B. Adjust the percentage of power until both motors to run at the same speed.

*Be sure to Journal what you found out!*

# Key learning points from today

- You now know how to…
  - Write and save programs using Cortex software
  - Compile and up-load programs to the “brain”; then run them
  - Know a number of motor control commands and how to use them
  - Know how to adjust for differences in motor speed using software so that both motor run the same actual speed