LEGO Mindstorms EV3 Summer Robotics Camp

Day 1

Lesson 1

- Introductions and rules
- Install EV3 app on Chromebooks
- Issue kits, look at brick, motors, and sensors
- Build a basic drive base
- Program Sound, Graphics Display, and Brick Status Lights

Rules

- Maximize Effort
- Switch Roles
- Be Resourceful
- Have Fun

Build a robot drive base with instructions from the EV3 app for the Robot Educator Driving Base. It is identical to the one in the instruction booklet in the Core Set.

Lesson 2

- Navigate an obstacle course using curved moves

Show the students the dead-reckoning course. Use the **Move Steering** block to build the program. Also discuss the **Move Tank** and **Wait** blocks. As teams finish the challenge, they can add **Display**, **Sound**, and **Brick Status Light** blocks to their existing code.

Lesson 3

- Navigate the obstacle course
- Grab an object
- Return to base

The next challenge is to add a lifting arm to their robot using the medium servo motor. The robot will have to drive to the end of the course, pick-up the object, then return to base. First program the arm for 90 degrees of rotation using the **Medium Motor** block, then show the class what happens if the arm starts up and cannot finish the rotation. Change to 0.25 seconds up instead of rotation and repeat. The advantage of this method is that the robot will eventually return to base and you would not have to take a penalty to retrieve it. Another problem for the teams to look at is the speed with which they raise the arm; too fast and the object they try to pick up may fly off their claw.

Day 2

Lesson 4 - Stop at Object

- Learn the difference between Change and Compare Modes
- Use the Ultrasonic Sensor

The students should install the Ultrasonic Sensor using the instructions provided. If the lights are not on when the EV3 is running, the sensor may not be working. The students can also see the distance readings of the ultrasonic sensor while it is connected to the computer. The sensor does not seem to detect very well so the robot may need to move slowly while sensing ultrasonically.

As an additional challenge, the students to write code to look for an object, drive toward it, then hit it or indicate that it has gotten within 6 inches, using the **Display**, **Sound**, and **Brick Status Light** blocks.

Lesson 5 - Stop at Angle

- Turn a robot using the Gyro Sensor
- Use the Gyro Sensor
- Use Port View to check Gyro Sensor readings

The Gyro Sensor is probably the most difficult sensor to work with. The main problem is drift, i.e. even when stationary the angle can slowly change values. There is another problem that frequently occurs when the Gyro Sensor is first powered up; the sensor zeros while it was bumped or moved. This behaves similar to drift but values change much faster. You can reset the Gyro Sensor by unplugging it, shutting it off, then plugging it back in. Be sure the sensor is still when you plug it in.

The final issue is that that the faster you turn the robot, the more it will overshoot the target angle. The solution is to always turn the robot at the same rate and select an angle slightly less target. For example, turn at 25% power and set your target angle to 80 degrees. It is also very helpful to use Port View to check the Gyro Sensor readings.

Lesson 6 - Stop at Line

- Use the Color Sensor
- Use Port View to check Color Sensor readings
- Use a Loop control structure

(Optional) Today's robot visitor is an NXT robot that operates like a Segway.
Lay down a line of black tape down one side of a 4' x 8' whiteboard sheet. Robots cross the sheet in a path perpendicular to the line, stop, then return to where they started.

Day 3

- Write code to follow a line
- Examine PID control
- Race down the line against other robots.
- Sumo match video
- Add a bumper to the EV3 Robot.
- Introduce Sumo fields and game.
- Discuss Sumo robot strategy.

Lay down a course that has a curved, straight, then curved section with electrical tape, about 9 feet long. The students will need to use a **Switch** block inside a **Loop**. When the light is above a certain level the robot veers slightly one direction and when it is below that same level it veers the other. The amount of turn depends on the curviness of the tape.

For the first part of the day, the students will be adding a bumper to their EV3 Caster-Bot and write code to avoid an obstacle.

Introduce each class to the Sumo field and game rules. First robot pushed off loses the match. Each robot is programmed to stop after 60 seconds using a second thread in the program.

Discuss some strategy for Sumo Robotics, such as weight, lifting, bumpers, ultrasonic, wheel size, shape, and light sensing.

Each class determines two Sumo masters that go on to compete in the LEGO Sumo Stadium.

Day 4

- Introduce FLL Challenge
- Handout score sheets
- Start missions
- Assign two or three easy missions each team must complete before they start trying the more difficult missions
- Schedule first round of tournament at the end of day

Day 5

- Continue working on missions
- 9:30 test runs
- 11:00 parents start arriving to watch round 2 and 3
- 12:00 meet with parents while students take apart their robots and clean up their kits
- 12:30 dismiss