

# Follow the Light



# Follow the Light Pre-Quiz

- 1. Provide a “stimulus-sensor-coordinator-effector-response” framework using human eyes as the color sensor.**
- 2. Provide the logic for a program for a LEGO robot that enables it to follow a flashlight.**

# Follow the Light Pre-Quiz Answers

1. Provide a “stimulus-sensor-coordinator-effector-response” framework using human eyes as the color sensor.

Humans have two eyes that collect light that falls on objects in front of them, and helps them “see” the objects.

Stimulus-to-response framework: sight of a scary object such as a wasp > two eyes > human brain > signal to leg muscles > run to safety

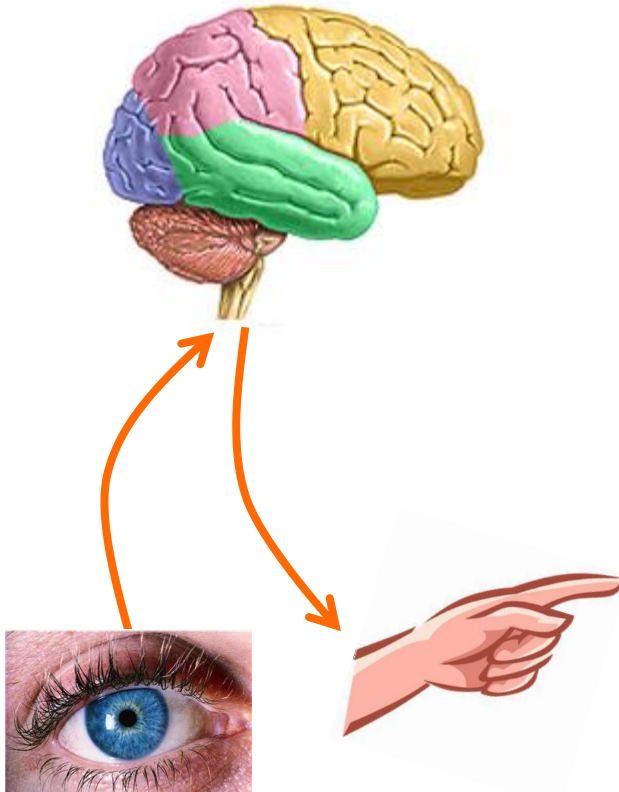
2. Provide the logic for a program for a LEGO robot that enables it to follow a flashlight.

Use two color sensors attached to the front of the taskbot.

Turn the taskbot towards the sensor (of the two) that reads the higher intensity of light.

# Human-Robot Similarities

Your brain commands your hand to perform a task, depending on what it has seen.



Similarly, the EV3 brick can command its motor to move the taskbot, as we will now do in an activity.



# Follow the Torch Light Activity

## **Objective** – Your Engineering Challenge

**Build a LEGO taskbot with a color sensor, and program it to make the robot follow a flashlight as the light beam is moved around by a person.**

# Engineering Design Process

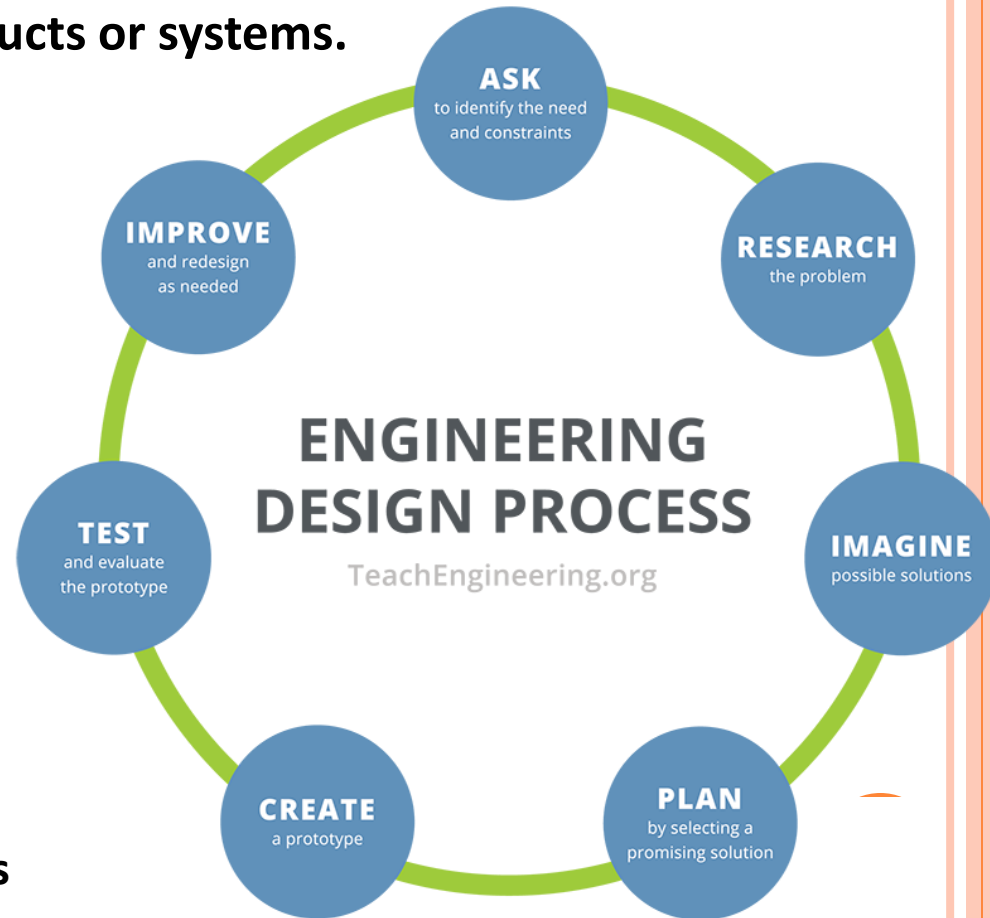
## What is the engineering design process?

A series of steps used by engineering teams to guide them as they develop new solutions, products or systems.

## Steps

1. Identify **criteria** and **constraints**
2. Research the problem
3. Brainstorm possible solutions
4. Select a promising solution
5. Create a prototype
6. Test and evaluate the prototype
7. Improve and redesign

➔ The process is **cyclical** — it is usually necessary to test and modify many times to improve your design and get it right!



# Follow the Torch Light Activity

Let's get started:

- Divide the class into groups of three students each.
- Distribute the LEGO taskbots and the parts necessary to attach the color sensors to them.
- Have each group attach a color sensor to its taskbot following the instructions in the LEGO base set.

Discuss as a group the logic of the program.

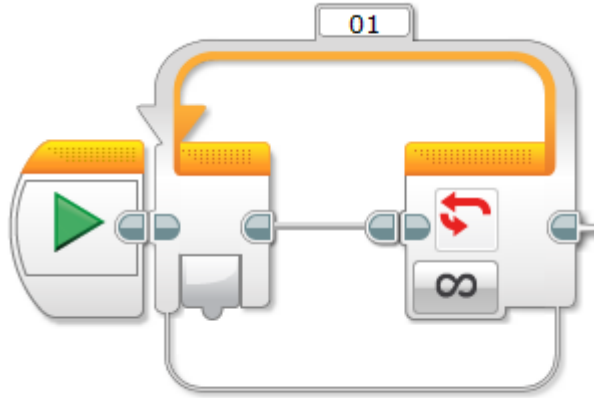
Write down your programming design.

Create, test and debug your program.

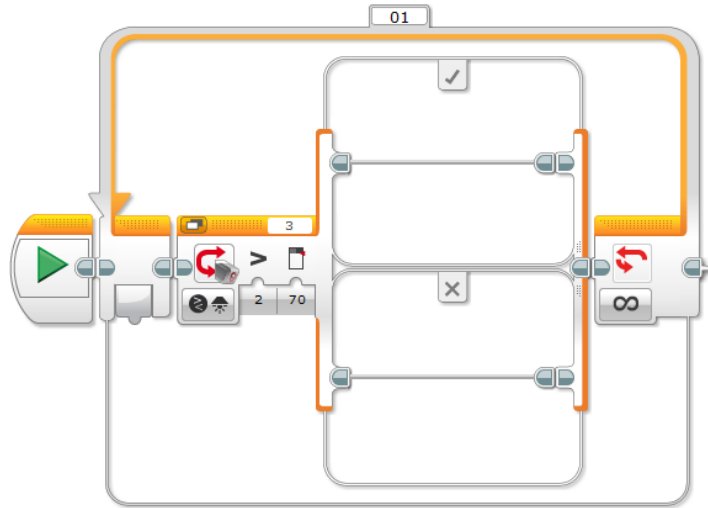


# Answers: Follow the Torch Light Activity

1. Click the “loop” icon and drag and drop the loop command onto the sequence beam. Verify the loop control is set to forever in the control panel.



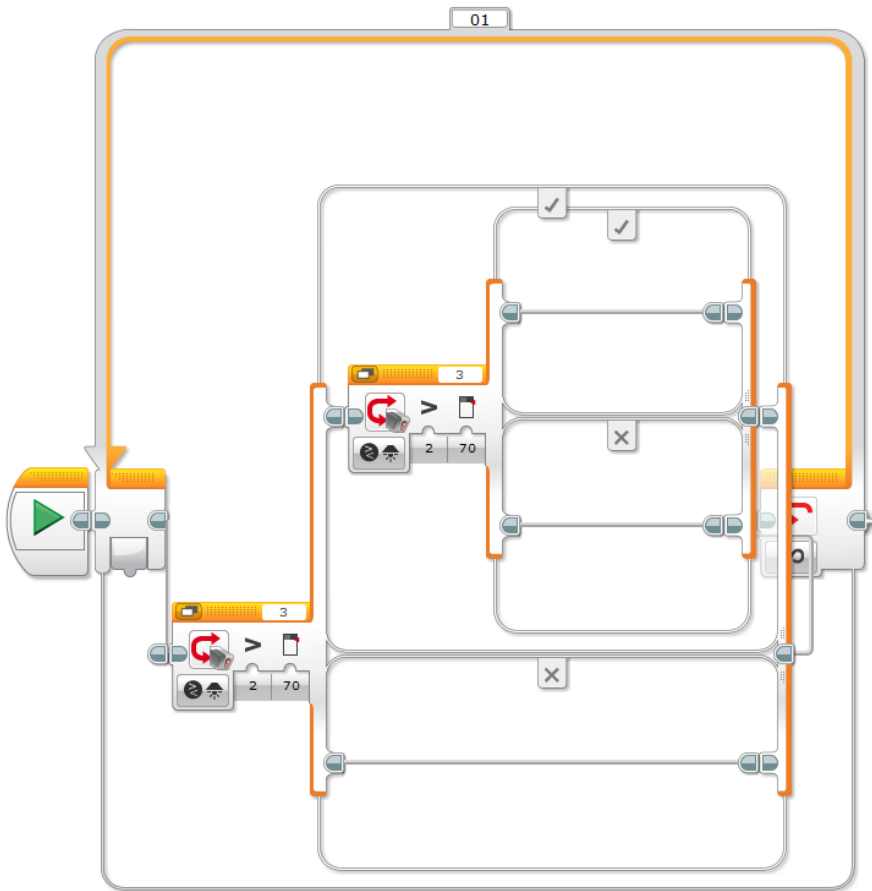
2. Click the “switch” icon and drag the switch inside of the loop command.





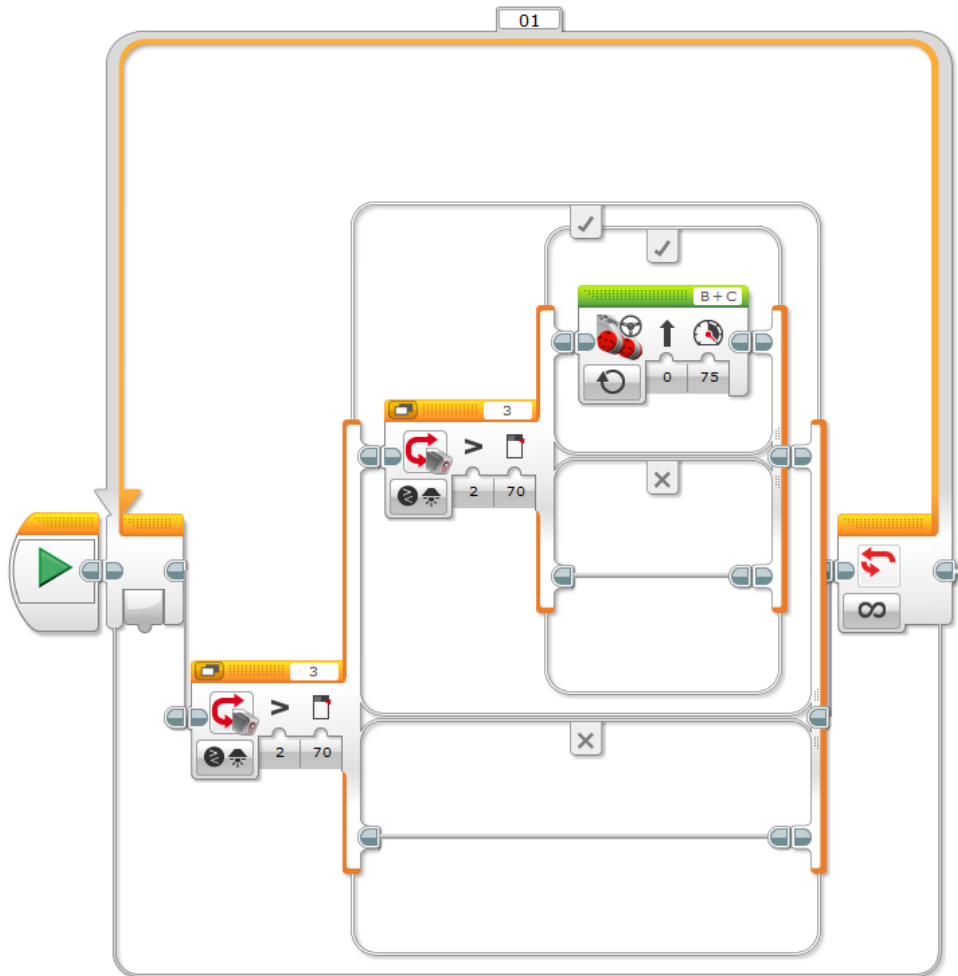
## Answers: Follow the Torch Light Activity

3. Click the “switch” icon and drag the switch inside of the top of the previous switch.  
Verify the following setting in the control panel.
  - a. Control: sensor
  - b. Sensor: Color sensor
  - c. Display: Flat view Checked
  - d. Port: 2
  - e. Compare: Light > 70
  - f. Function: Generate light checked



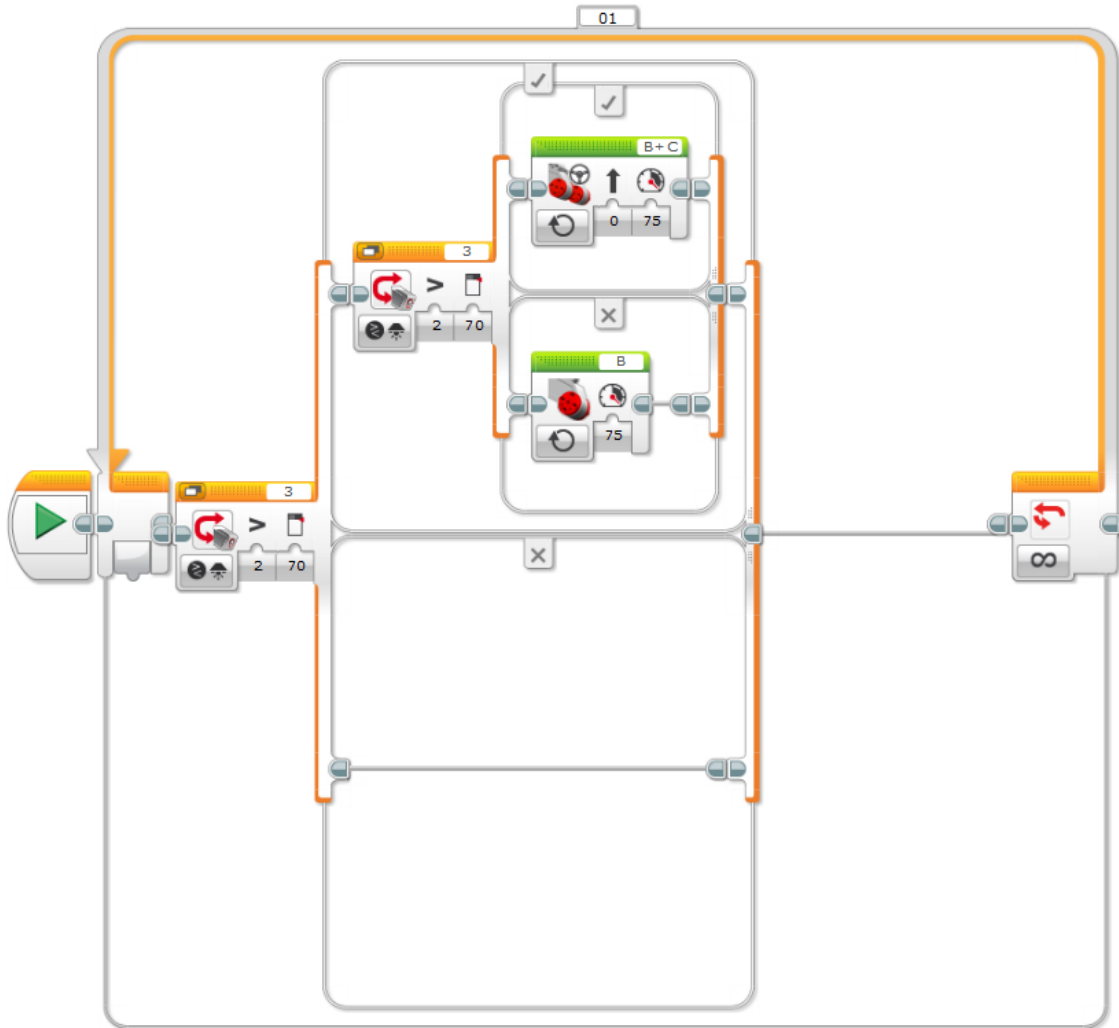
## Answers: Follow the Torch Light Activity

4. Click the “move” icon and drag and drop the move block in the top of the new switch.  
Verify the following settings in the control panel.
  - a. Port: B and C
  - b. Direction: Forward
  - c. Steering: In the middle
  - d. Power: 75
  - e. Duration: Unlimited



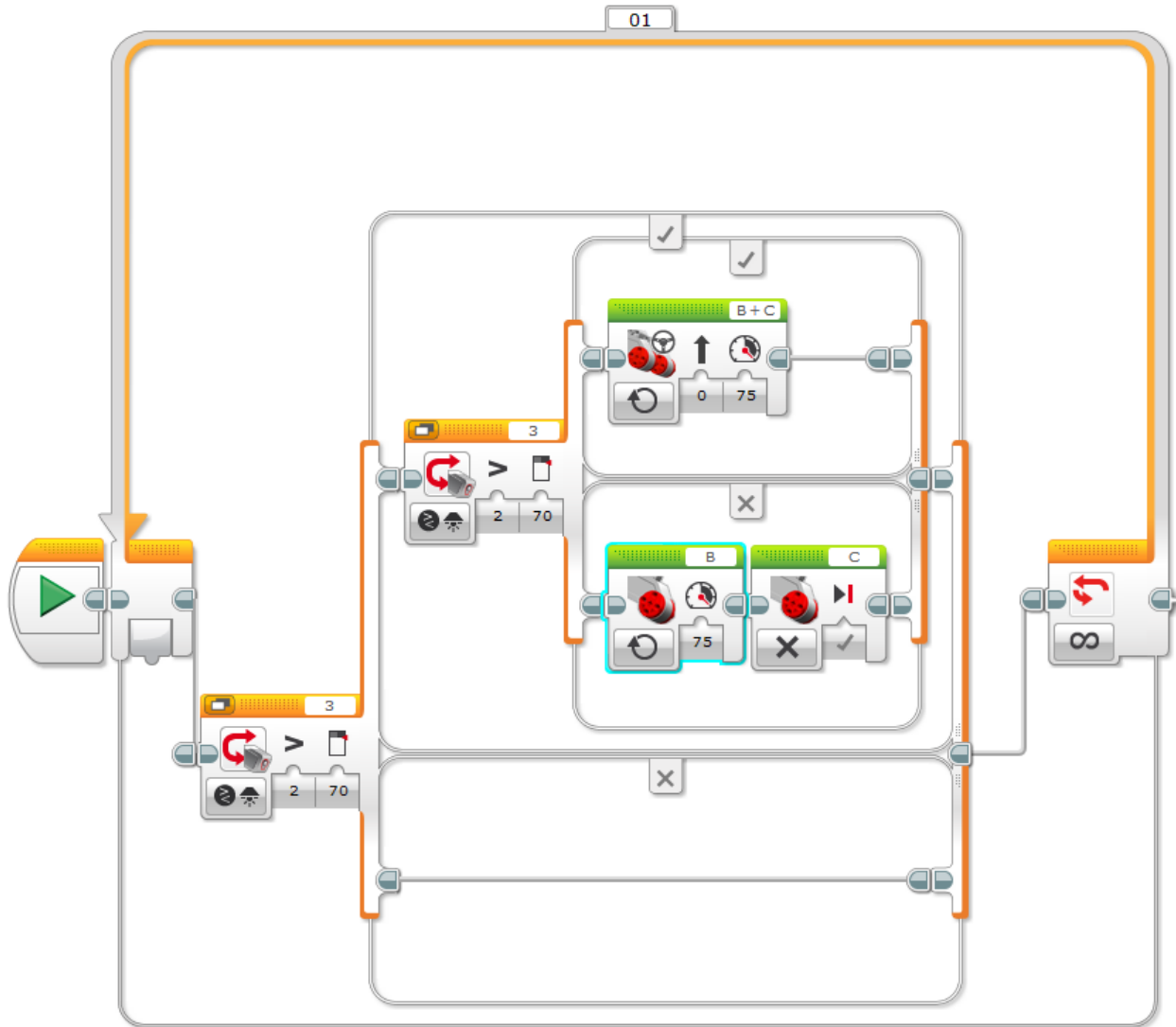
## Answers: Follow the Torch Light Activity

5. Click the “move” icon and drag and drop the move block in the bottom of the new switch. Verify the following settings in the control panel.
  - a. Port: B
  - b. Direction: Forward
  - c. Power: 75
  - d. Duration: Unlimited



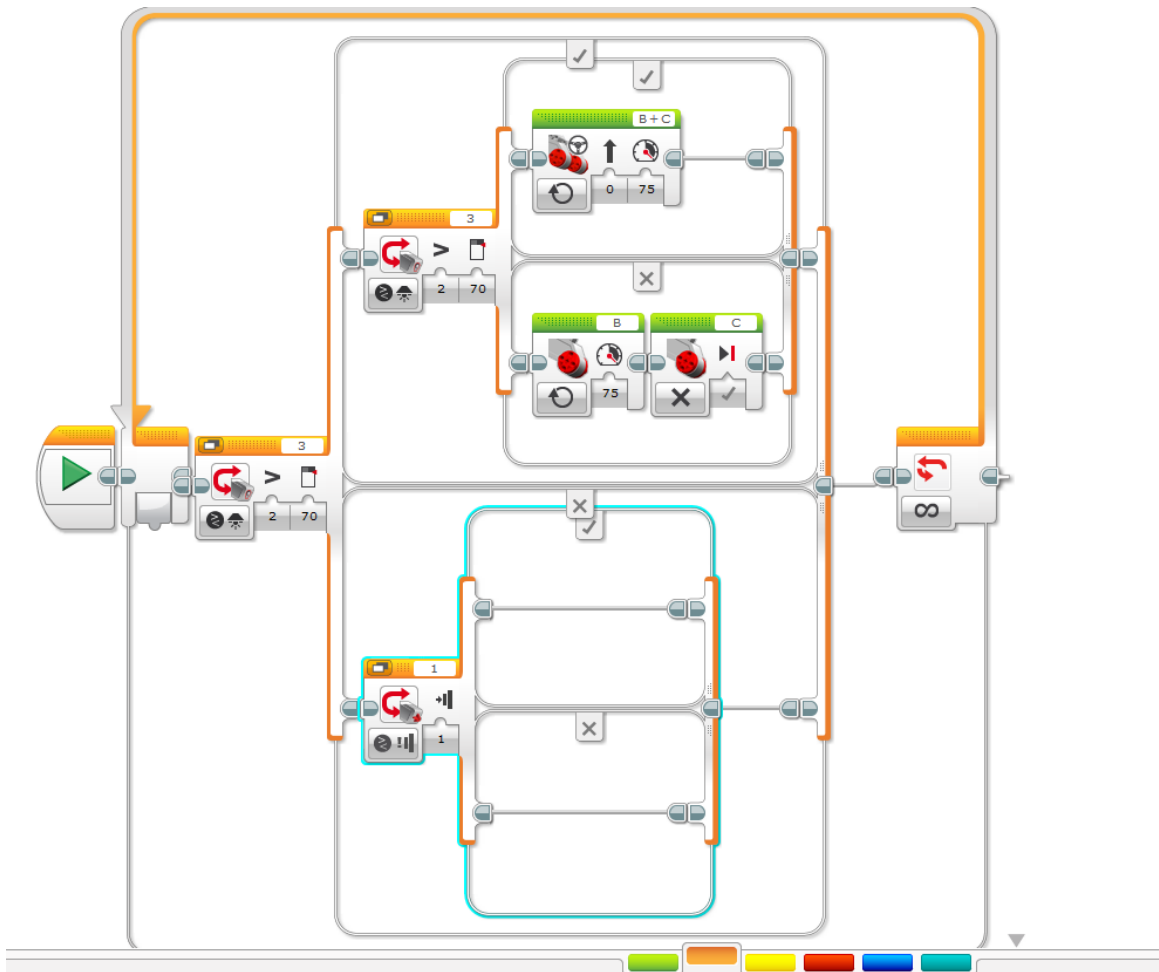
# Answers: Follow the Torch Light Activity

6. Click the “move” icon and drag and drop the move block in the bottom of the new switch. Verify the following settings in the control panel.
  - a. Port: C
  - b. Direction: Stop



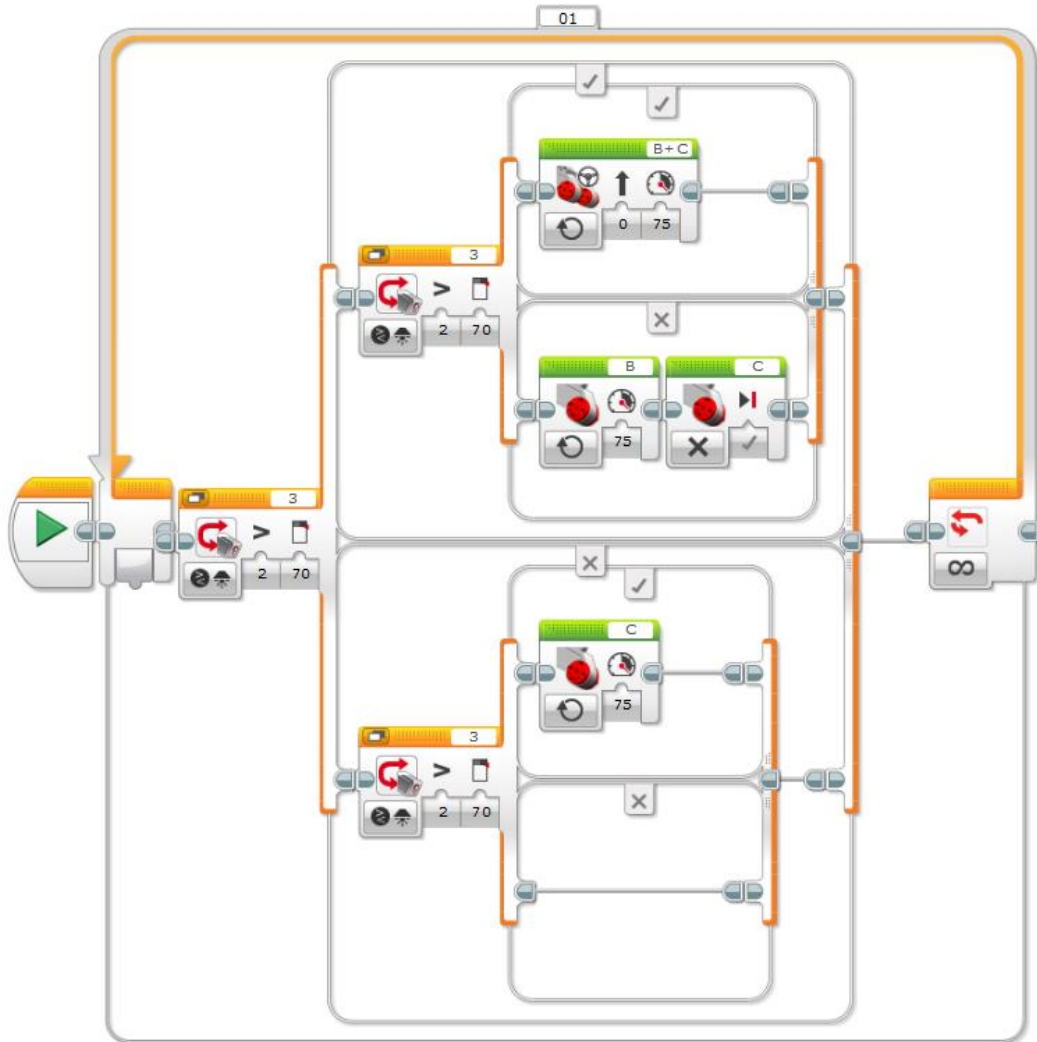
## Answers: Follow the Torch Light Activity

7. Click the “switch” icon and drag and drop the switch inside the bottom of the original switch. Verify the following settings in the control panel.
  - a. Control: sensor
  - b. Sensor: Color sensor
  - c. Display: Flat view Checked
  - d. Port: 2
  - e. Compare: Light > 70
  - f. Function: Generate light checked



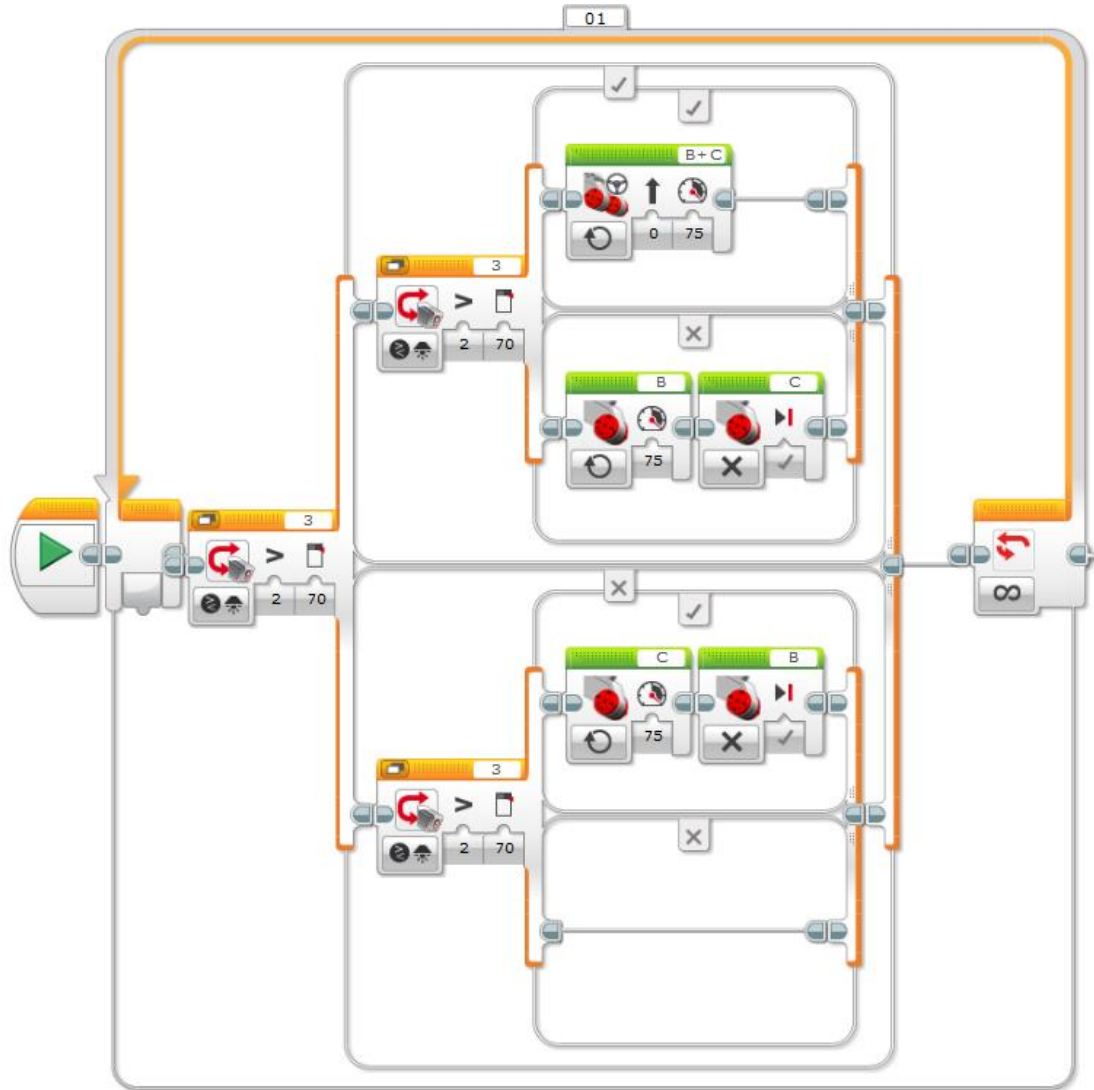
# Answers: Follow the Torch Light Activity

8. Click the “move” icon and drag and drop the move block in the top of the new switch. Verify the following settings in the control panel.
  - a. Port: C
  - b. Direction: Forward
  - c. Power: 75
  - d. Duration: Unlimited



# Answers: Follow the Torch Light Activity

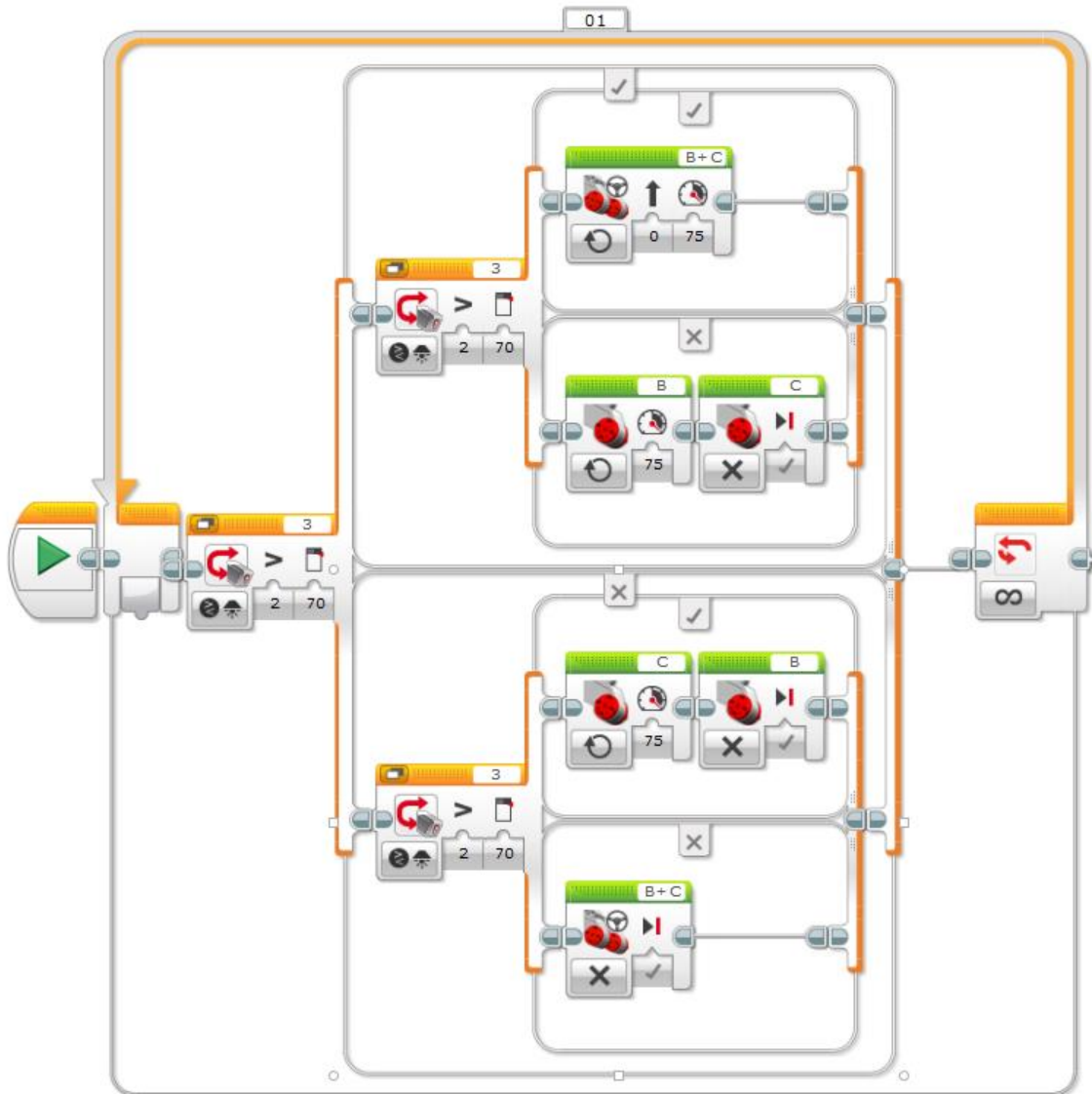
9. Click the “move” icon and drag and drop the move block in the top of the new switch. Verify the following settings in the control panel.
- Port: B
  - Direction: Stop



## Answers: Follow the Torch Light Activity

10. Click the “move” icon and drag and drop the move block in the bottom of the new switch. Verify the following settings in the control panel.

- a. Port: B and C
- b. Direction: Stop





# Follow the Light Post-Quiz

- 1. Compare the “stimulus-sensor-coordinator-effector-response” framework of the human eye to the framework using a color sensor for a LEGO robot.**
- 2. Provide the logic for a program for a LEGO robot that enables it to follow a flashlight.**

# Follow the Light Post-Quiz Answers

1. Compare the “stimulus-sensor-coordinator-effector-response” framework of the human eye to the framework using a color sensor for a LEGO robot.

**Stimulus-to-response frameworks:**

*For the human eye:* sight of a scary object such as a wasp > two eyes > human brain > signal to leg muscles > run away from wasps

*For the LEGO color sensor:* light > EV3 color sensor > (transmission to coordinator) value sent to EV3 brick via wire > brick sends a signal to the EV3 motors > robot moves

2. Provide the logic for a program for a LEGO robot that enables it to follow a flashlight.

**Use two color sensors attached to the front of the taskbot.**

**Turn the taskbot towards the sensor (of the two) that reads the higher intensity of light.**

# Vocabulary

- **peripheral**: Surrounding.
- **sensor**: A device that converts one type of signal to another; for instance, the speedometer in a car collects physical data and calculates and displays the speed the car is moving.
- **visual**: Related to seeing.

# Image Sources

Slide 1; ghost with flashlight, source: Microsoft® clipart at <http://office.microsoft.com/en-us/images/special-occasions-CM079001933.aspx?qu=flashlight&ex=1>

Slides 1, 4: LEGO parts; source: LEGO MINDSTORMS EV3 User's Guide

Slide 4: brain; source: ADAM, Medline Plus, U.S. National Library of Medicine, National Institutes of Health: <http://www.nlm.nih.gov/medlineplus/braindiseases.html>

Slide 4: eye; source: Microsoft® clipart: <http://office.microsoft.com/en-us/images/results.aspx?qu=eye&ex=1#ai:MP900406700|mt:2|>

Slide 4: pointing finger; source: Microsoft® clipart: <http://office.microsoft.com/en-us/images/results.aspx?qu=pointing+finger&ex=1#ai:MC900233154|>

Slide 6: two kids with flashlight; source: US Embassy: <http://iipdigital.usembassy.gov/st/english/article/2013/11/20131125287867.html#axzz2ll0npPnd>

Slides 7-15: Screen capture images by the author.