Navigating a Maze
Navigating a Maze Pre-Quiz

1. What is the difference between a program and an algorithm?

2. About how many inches does an EV3 move in one motor rotation?

3. How many rotations do you need for a 90° turn?
1. What is the difference between a program and an algorithm?

A program is a sequence of instructions written to direct a computer to perform a task. It is specific to the computer. On the other hand, an algorithm is a clear and specific procedure for solving a problem in a finite number of steps, and it is general to any task. For example, the “addition algorithm” is a procedure for how to add together any two numbers.

2. About how many inches does an EV3 move in one motor rotation?

An EV3 taskbot moves about 7 inches in one rotation.

2. How many rotations do you need for a 90° turn?

A 90° turn is about 0.5 rotations with the steering pointer pulled all the way in one direction.
Activity: Navigating a Maze

Do This:

Program the robot to complete the maze (on the right ➔) using only the rotation sensor.
How Do You Develop a Computer Program?

- (As we saw in the previous lesson) a **program** is a sequence of logical instructions written to direct a computer to perform a task.
- Developing such instructions involves **careful thinking**!
- So, we are creating something that does not exist. In engineering, such a process is called “**design**.” In this case, we are “designing” a program to do a particular task.
- The **engineering design process** involves certain well-defined steps. **What do you think is the first step?**
- The **first step** is to come up with what you want the computer program to do! Define the problem. Understand the need.
- Once you know what you want the program to do, we need a method to do it. Let’s look more closely at the engineering design cycle, which tells us how.
Engineering Design Cycle: How Engineers Design

For engineers, the design process is a series of steps that helps teams frame and solve complex problems. *Anyone can do it!*

To figure out how to build something, engineering teams **gather information** and conduct research to understand the needs and challenges to be addressed.

^{-} So, in a design cycle, the steps are done in this sequence but often repeated because it may not work, or you want to improve the design!

More details on the next slide.
Engineering Design Cycle: How Engineers Design

**Ask/Concept**
- What do I want to do?
- What is the problem?
- What have others done?

**Imagining/Preliminary Designs**
- What could be some solutions?
- Brainstorm ideas.
- Pick one to start with that you think will work the best.

**Plan/Definitive Design**
- Draw a diagram of your idea.
- Make lists of materials you will need to make it.
- Decide how it works. How will you test it?

**Create**
- Build a prototype.
- Test it.
- Talk about what works, what doesn't, and what could work better.

**Improve/Iterate**
- Talk about how you could improve your product.
- Draw new designs.
- Make your product the best it can be!

http://www.mos.org/doc/1559
Activity: Navigating a Maze

Your Design Challenge:

Program the robot to complete the maze on the right using only the rotation sensor.

Things to keep in mind:

- If 1 rotation ≈ 7 inches, how many rotations are needed to make the robot go 3 ft? 1.5 ft? 2 ft?
- If 0.5 rotations is the duration for a 90° turn, what duration is needed for a 135° turn?
Programming Activity Answer

*Note*: Keep in mind that the values for durations shown in the solution are approximate and may need to be adjusted for each robot.
Navigating a Maze Post-Quiz

1. What is the difference between a program and an algorithm?

2. About how many inches does an EV3 move in one motor rotation?

3. How many rotations do you need for a 90° turn?
Navigating a Maze Post-Quiz Answers

1. **What is the difference between a program and an algorithm?**

   A program is a sequence of instructions written to direct a computer to perform a task. It is specific to the computer. On the other hand, an algorithm is a clear and specific procedure for solving a problem in a finite number of steps, and it is general to any task. For example, the “addition algorithm” is a procedure for how to add together any two numbers.

2. **About how many inches does an EV3 move in one motor rotation?**

   An EV3 taskbot moves about 7 inches in one rotation.

2. **How many rotations do you need for a 90° turn?**

   A 90° turn is about 0.5 rotations with the steering pointer pulled all the way in one direction.
**Vocabulary**

**algorithm**: A clear and specific procedure for solving a problem in a finite number of steps.

**brainstorming**: Thinking of ideas as a group.

**engineering**: Creating new solutions and new things.

**engineering design process**: A series of steps used by engineering teams to guide them as they develop new solutions and new things.

**iteration**: Doing something again, especially with the intent to make improvements.

**program**: A sequence of instructions written to direct a computer to perform a task.
Images Sources

- Slide 1: Maze lost sign; source: Lake County, FL: [http://www.lakecountyfl.gov/hometown_highlights/cornfield_maze.aspx](http://www.lakecountyfl.gov/hometown_highlights/cornfield_maze.aspx)
- Diagrams and screen captures by author