

Coding Fundamentals



Micro:bit Python Programming Compass and Comparisons

Overview

In this lesson, students learn to use the micro: bit magnetometer to program a compass using Python.

Objectives

- Understand and use the Micro:bit Compass
- Use degrees, directions, and conditional statements to make a working compass
- Create or follow a treasure map

Materials

- micro:bit and micro-USB cord
- Computer with access to the internet
- Blank paper for map making
- Some sort of “treasure” for students to hide

Approx. Time Required

1-2 hours

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Cyber Connections

- **Programming** – Students will program in Python.
- **Hardware and Software** – Students will utilize small electronics and learn how a computer is programmed while using micro-controllers.

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Compass and Comparisons

- Remind students of the line that should appear at the top of every program.

```
from microbit import*
```

- Review the `if:`, `elif:`, and `else:` commands. These are the main features of the programming for this lesson.
- Once students are comfortable with conditional statements, introduce them to the operators for comparison. The table below contains all of the operators needed for comparing variables, objects, or values.

<code>==</code>	Is equal to	If the values of two operands are equal, then the condition becomes true.
<code>!=</code>	Is not equal to	If values of two operands are not equal, then condition becomes true.
<code><=</code>	Is less than or equal to	If the value of left operand is less than or equal to the value of right operand, then condition becomes true.
<code>>=</code>	Is greater than or equal to	If the value of left operand is greater than or equal to the value of right operand, then condition becomes true.
<code><</code>	Is less than	If the value of left operand is less than the value of right operand, then condition becomes true.
<code>></code>	Is greater than	If the value of left operand is greater than the value of right operand, then condition becomes true.

- All comparisons should be made from left to right. Below are a few examples and their meaning and value. For these examples, assume $A = 2$ and $B = 4$.

$A == B$. This statement reads: A is equal to B. Since A and B are not equal, this statement becomes false.

$A < B$. This statement reads: A is less than B. Since A is 2 and B is 4, this statement is true.

$A != B$. This statement reads: A is not equal to B. This is true.

Give further examples involving comparison operators if students struggle to grasp the concept.

- Now is a good time to have students fill out the Cardinal directions associated with the degrees on the compass worksheet.
- Once students have the `if:`, `elif:`, and `else` statements involved, get the directions to display on the micro:bit.
- There are two important compass related commands that students will need to understand to make their compass work.

The first one is `compass.calibrate()`. This step is required at the beginning of each time using the compass. It calibrates the compass with the correct degrees for each direction.

The second one is `compass.heading()`. This command returns a degree value in which the compass is currently heading between 0 and 360, with both 0 and 360 being north. Students will likely want to store this in a variable name (i.e. degrees).

- Once students are familiar with these commands and how they work, it is time for them to write their own compass code. Below is sample code of a working compass.

```
from microbit import *

compass.calibrate ()

while 2 > 1:
    degrees = compass.heading()
    if degrees >= 0 and degrees <= 45:
        display.show("N", delay = 100)
    elif degrees > 45 and degrees < 135:
        display.show("E", delay = 100)
    elif degrees > 135 and degrees < 225:
        display.show("S", delay = 100)
    elif degrees > 225 and degrees < 315:
        display.show("W", delay = 100)
    elif degrees > 315 and degrees < 360:
        display.show("N", delay = 100)
```

- With working compasses in hand, split students into groups. Each group will hide a "treasure" and use their compass to make a set of instructions to follow (20 paces north, 8 paces west, etc.). When all groups are finished, have two groups swap instructions and use their compass to find the treasure. This is a good hands on activity to teach students to use the compasses they made and also provides opportunity for a grade.