



Educator Guide

Python 101 - Lesson 6

60 minutes



Driving Around

CONDITIONALS AND BOOLEAN LOGIC

[EDUCATION.MINECRAFT.NET](https://education.minecraft.net)

THEME OVERVIEW

In this lesson, students will help CodingMine code the Agent to drive a car. This will require decision-making and analyzing the road by using conditionals and Boolean logic.

LESSON OBJECTIVES

By the end of the lesson, students will:

- Understand the coding concepts of conditionals
- Understand the concept of Boolean logic
- Understand how to use if, if else and elif conditionals
- Understand how to use Boolean logic with conditionals

KEY VOCABULARY

Indentation – utilized to declare a piece of code belongs to the code above

Compare – utilized when comparing two statements

CODING CONCEPTS

- **Boolean Logic**
Combines multiple logic statements that are either True or False into an expression that is either True (1) or False (0).
- **AND operator**
This operator looks at two Boolean statements and if they both are true (1) the operator will give us back a 1. However, if either one of those statements are false, then the operator will give us back a 0.
- **NOT operator**
This operator looks at a Boolean statement and flips it. This means, if the statement is 0 using the NOT operator will flip it to a 1.
- **Conditionals**
 - The **if command** is a conditional and will only run the code inside it if a desired condition is met (true). Tell the students that the outcome of a condition can only be true or false (1 or 0).
 - The **if else command** almost works in the same way. However, if the condition in the if conditional is not met (0) the else conditional will then run another piece of code.
 - The **elif** is a command that is placed after an if command and has its own defined condition. If the condition is true (1), the piece of code inside it will run.

Any conditional is basically an action to be taken if something is true or false. Tell the students that they are already using this concept in their everyday life. Some examples would be:

1. IF you have finished your homework, you can go out and play.
2. IF you like to play football, you can come with us to the pitch.
3. IF you like basketball I have a hoop in my backyard, ELSE we could play a board game.

SYNTAX / OPERATORS

Compare ==

Double equals or compare is used when we want to compare two statements (Boolean, numerical or string). The double equal signs are used with conditionals, to compare the defined condition against the Minecraft world or coding outcome.

Indentation

Indentations in Python are used when we want to declare that a piece of code belongs to the command above. To indent a piece of code, use the tab key on the keyboard.

LESSON ACTIVITIES

Direct Instruction (Teacher-Led; “I Do”)

Today, we will continue working in our computer science unit, “Python 101”. The lesson for today is called “Driving Around”. (**slide 1**)

Review the lesson objectives with students. (**slide 2**)

Define the important vocabulary with students. (**slide 3**)

“You need to help CodingMine further develop the Agent. CodingMine wants to code the Agent so that it can drive a car by itself. However, this means that the Agent needs to be able to make decisions and analyze the road for any obstacles and signs. To do this in a safe manner, before testing the Agent on the actual road, the students will be coding the Agent in a number of simulated traffic situations. You will help code the Agent using conditionals and Boolean logic.” (**slide 4**)

Explain the coding concept focus for students. (**slide 5**)

Explain the new syntax focus for the lesson. (**slide 6**)

Guided Instruction (Teacher Modeling; “We Do”)

Demonstrate how to locate and find the Python 101 lesson, “Location, Location, Location” from the in-game library. Showcase the spawn point for students and then explain that they will start their lesson by talking to the NPC, the CEO of CodingMine. (**slides 7-9**)

All students should log into Minecraft: Education Edition at this point and replicate these exact steps so you can complete the first activity together.

Activity 1: Stop and Go (Slides 10-15)

Objective: Write code to assist the Agent in understanding traffic lights

Explanation:

The developer needs your help to write some code to make the Agent understand traffic lights. In part 1, the Agent should keep moving when green blocks are to its left. In part 2, the Agent should stop when there is a red block to its left. In part 3, the Agent should wait for 2 seconds when there is a yellow block to its left and then continue to the gold.

- Part 1: Make the Agent move when there is a block to its left. When the students run the code, the Agent will move forward when there is block on its left side.
(**Hint:** Tell the students to replace the word ‘True’ in the conditional and place their condition instead)
- Part 2: Make the Agent stop when the light is red. When the students run the code, the Agent will move forward when there is not a block on its left side.
- Part 3: Make the Agent wait for 2 seconds once it is at the yellow light.
(**Hint:** Explain to the students that 1000 milliseconds is the same as 1 second)

Now when the students run the code, the Agent will move forward until there is a block on its left side. Then it will wait for around two seconds (this may depend on the computer speed) and continue. When the Agent reaches the last gold block, the activity is complete.

Code snippets:

Before:

```
# Replace the lines below with your code #
# for loop set to 7 |Part 1
# Add the operator NOT to the condition below |Part 2
# if conditional with an Agent detect condition |Part 1
# Make the Agent move forward |Part 1
# if conditional with an Agent detect condition |Part 3
# Pause for 2000 ms |Part 3
# Make the Agent move forward |Part 3
# End of loop
```

Part 2:

```
for index in range(7):
    if not agent.detect(AgentDetection.BLOCK, LEFT):
        agent.move(FORWARD, 1)
# if conditional with an Agent detect condition |Part 3
# Pause for 2 seconds |Part 3
# Make the Agent move forward |Part 3
```

Part 3:

```
for index in range(7):
    if not agent.detect(AgentDetection.BLOCK, LEFT):
        agent.move(FORWARD, 1)
    if agent.detect(AgentDetection.BLOCK, LEFT):
        loops.pause(2000)
        agent.move(FORWARD, 1)
```

Independent Work (Teacher Support; “You Do”)

Activity 2: Is It Left, or Right (Slides 16-22)

Objective: Code the Agent to read road signs and navigate busy streets

Explanation:

The programmer needs your help to write some code to make the Agent able to navigate busy streets by reading road signs. The Agent will have to stop and turn in different directions depending on the signs on a simulated road. This activity will happen in two parts:

- Part 1: Make the Agent turn left once it reaches the sign and continue to the gold block. When you run the code, the Agent will move forward until it

reaches the turn sign, after which it will go in the direction of that sign, finally stopping on the gold block.

- Part 2: Make the Agent move forward, turning left and right, until it reaches the gold block. When you run the code, the Agent will move forward until it reaches a turn sign, after which it will go in the direction of that sign.

When the Agent reaches the gold block, Activity 2 is complete.

Code snippets:

Before:

```
left = BLUE_GLAZED_TERRACOTTA
right = PINK_GLAZED_TERRACOTTA
# Replace the lines below with your code #
# Change value of loop below from 9 to 21 |Part 2
# for loop set to 9 |Part 1
# if else conditional with an Agent inspect condition |Part 1
# Make the agent turn left |Part 1
# elif conditional with an Agent inspect condition |Part 2
# Make the agent turn right |Part 2
# else part of the if else conditional |Part 1
# Make the agent move forward |Part 1
# End of loop |Part 1
```

After:

Part 1:

```
left = BLUE_GLAZED_TERRACOTTA
right = PINK_GLAZED_TERRACOTTA
#Change value of loop below from 9 to 21 |Part 2
for index in range(9):
    if agent.inspect(AgentInspection.BLOCK, FORWARD) == left:
        agent.turn(LEFT_TURN)
#Replace with elif conditional with agent inspect condition |Part 2
#Make the agent turn right |Part 2
    else:
        agent.move(FORWARD, 1)
```

Part 2:

```
left = BLUE_GLAZED_TERRACOTTA
right = PINK_GLAZED_TERRACOTTA
for index in range(21):
    if agent.inspect(AgentInspection.BLOCK, FORWARD) == left:
        agent.turn(LEFT_TURN)
    elif agent.inspect(AgentInspection.BLOCK, FORWARD) == right:
        agent.turn(RIGHT_TURN)
    else:
        agent.move(FORWARD, 1)
```

Activity 3: Getting Through (Slides 23-26)

Objective: Write code to detect obstacles to navigate through a course

Explanation:

The AI developer needs your help to write an obstacle detection code to make the Agent navigate through a course with randomly placed blocks. The Agent should be able to get to the end, no matter where the blocks are placed. Once the Agent detects a block, it will be highlighted.

When the students have written the conditionals and the correct conditions inside, the Agent will be able to navigate through the course by detecting the block in front of it. When the Agent reaches the gold block, Activity 3 and the lesson are complete.

Code Snippets:

Before:

```
# Replace the lines below with your code #
# for loop set to 23
# if else conditional with two Agent detect commands, separated by an and not operator
agent.move(LEFT, 1)
# elif conditional with two Agent detect commands, separated by an and operator
agent.move(RIGHT, 2)
# else part of the else if conditional
agent.move(FORWARD, 1)
# End of loop
```

After:

```
for index in range(23):
    if agent.detect(AgentDetection.BLOCK, FORWARD) and not
agent.detect(AgentDetection.BLOCK, LEFT):
        agent.move(LEFT, 1)
    elif agent.detect(AgentDetection.BLOCK, FORWARD) and
agent.detect(AgentDetection.BLOCK, LEFT):
        agent.move(RIGHT, 2)
    else:
        agent.move(FORWARD, 1)
```

LESSON CONCLUSION

Ask students about the skills that they have learned during the lesson to reinforce the concepts learned.

1. When talking about Boolean logic what do 1 and 0 represent?
Answer: True (1) and false (0)
2. What are conditionals?
Answer: Conditionals are commands that run code if something is true or false.
3. What does the AND operator do?
Answer: The operator checks to see that two conditions are true.
4. What does the syntax == do?
Answer: /double equals compares a defined condition against the Minecraft world or coding outcome.

These questions are also available as a printable handout at the end of this document. They can be used as a formative assessment for this lesson's learning objectives.

EDUCATIONAL STANDARDS

UNITED STATES: CSTA

- **3A-AP-14** Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.
- **3A-AP-15** Justify the selection of specific control structures when trade-offs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made.
- **3A-AP-18** Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.

UNITED STATES: ISTE

- **1.5.a** Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.
- **1.5.c** Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.

AUSTRALIAN F-10 CURRICULUM: DIGITAL TECHNOLOGIES (YEAR 9 AND 10)

- Designing algorithms to solve real-world problems and describing algorithms using flow charts and structured English (ACTDIP040)
- Recognising that different algorithms can solve a problem with different trade-offs (ACTDIP040)
- Considering different algorithms and selecting the most appropriate based on the type of problem (ACTDIP041)

UK NATIONAL CURRICULUM: COMPUTING (KEY STAGE 4)

- Develop and apply their analytic, problem-solving, design, and computational thinking skills

NAME: _____ DATE: _____

PYTHON 101: LESSON 6 FORMATIVE ASSESSMENT

When talking about Boolean logic what do 1 and 0 represent?	
What are conditionals?	
What does the AND operator do?	
What does the syntax == do?	