Educator Guide

Python 101 - Lesson 7

60 minutes

Emergency Response

WHILE LOOPS AND SEQUENCES

EDUCATION.MINECRAFT.NET

THEME OVERVIEW

In this lesson, students will code the Agent to help in emergency situations where it is not safe for humans. The Agent will be first programmed in simulated environments until the software is advanced enough for the real world.

LESSON OBJECTIVES

By the end of the lesson, students will:

- Utilize the coding concepts of while loops
- Understand the importance of sequences
- Apply while loops with different conditions

KEY VOCABULARY

While Loops – A command that when it is true it will repeat the code.
Sequences – The order in which the computer will execute a set of instructions

CODING CONCEPTS

- **While Loops**
  The while loop command is a conditional loop, that means that it only repeats a piece of code when a condition is met (true). If the condition is true, the while loop will continue to repeat the code, but if it is false, it will stop. The concept of while loops is something that we use in everyday life. Some examples would be:
    - While you're in the cold outside, don't forget to wear a jacket
    - While at school, be nice to your teachers
- **Sequences**
  A sequence is the order in which we want the computer to execute a set of instructions that we provide, as programmers. For example, Agent move forward, Agent turn, Agent place block, and then Agent turn again. The order of the commands in the sequence is important as if you used the same commands in a different order, the outcome would not be the same. When programming, making a sequence for a specific task (e.g., placing a block) and then repeating that sequence, is a great way to shorten a code and make it more understandable.

LESSON ACTIVITIES

Direct Instruction (Teacher-Led; "I Do")

Today, we will continue working in our new computer science unit, "Python 101". The lesson for today is called "Location, Location, Location" (**slide 1**)

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

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

“You will code the Agent so it can help in emergency situations by building multiple structures like water barriers, firebreaks, and rebuilding house foundations. The Agent will be used in situations when it is not safe for humans. The Agent will be coded in simulated environments until the software is advanced enough to try the Agent in the real world. In the game, the emergency workers have already marked out guidelines, using Redstone dust, for the Agent to follow and to know where the structures need to be built.” (**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, “Emergency Responses” 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: Water Barrier (Slides 9-16)
Objective: Write code to make the Agent build a water barrier

Explanation:
The emergency worker needs your help to write some code to make the Agent build a water barrier to stop the damage that occurs from water during floods. This activity will be completed in two parts:

- Part 1: Code the Agent to move forward as long as there is Redstone dust in front of it. You will not know how long the Redstone dust line is, and because of that, you cannot use a for loop. However, you can use a while loop with a condition that detects Redstone dust in front of the Agent. Once the students run the code the Agent will move forward until it reaches the gold block.

(**Hint**: Tell the students to replace the word 'True' in the while loop and place their condition instead)

- Part 2: Code the Agent to create a two-block high water barrier. Write a sequence that will make the Agent place two blocks to its right. Then tell the students to loop the sequence using a while loop, following the line of Redstone dust. When the code is run, the Agent will now build a two-block high barrier sealing off the water. When the Agent reaches the gold block, Activity 1 is complete.
  (**Hint**: The Agent has already been given the required blocks and students do not have to give the Agent any blocks)

Code snippets:

Before:

```
# Replace the lines below with your code #
# While loop with an Agent detect condition |Part 1
# Make the Agent place a block to its right         |Part 2
# Make the Agent move up                            |Part 2
# Make the Agent place a block to its right         |Part 2
# Make the Agent move back down                     |Part 2
# Make the Agent move forward               |Part 1
# End of while loop
```

After:

Part 1:

```
# Replace the lines below with your code #
while agent.detect(AgentDetection.REDSTONE, FORWARD):
# Make the Agent place a block to its right         |Part 2
# Make the Agent move up                            |Part 2
# Make the Agent place a block to its right         |Part 2
# Make the Agent move back down                     |Part 2:
    agent.move(FORWARD, 1)
# End of while loop
```

(Hint: When copying and pasting code snippets into the code builder, indentations do not always copy across)

Part 2:

```
while agent.detect(AgentDetection.REDSTONE, FORWARD):
    agent.place(RIGHT)
    agent.move(UP, 1)
    agent.place(RIGHT)
    agent.move(DOWN, 2)
    agent.move(FORWARD, 1)
```

Independent Work (Teacher Support; "You Do")

Activity 2: Fire Break (Slides 17-22)

Objective: Write a code that will develop the Agent to build a firebreak

Explanation:

The fireman needs your help to develop the Agent to make it build a firebreak to stop the spread of the fire in the simulated area. This firebreak needs to be concrete and one block high and it will be placed on uneven ground. To make this wall, you will have to use two while loops, one to make the Agent follow the Redstone dust and another to make the Agent check the elevation of the ground.

Write two sequences in the code, one where the Agent will place a block to its left and move forward, and another where the Agent will place a block to its left, move up, then place one more block and then move forward. The second sequence is needed when there is a change in terrain elevation.

When the code is run the Agent will move forward placing a one block high wall to its left as it moves. When it encounter a block in front it will climb up that block. When the Agent reaches the gold block, Activity 2 is complete.

Code snippets:

Before:

```
# Replace the lines below with your code #
# While loop 1 with an Agent detect Redstone condition
# While loop 2 with an Agent detect block condition
# Make the Agent place a block to its left
# Make the Agent move up
# Make the Agent place a block to its left
# Make the Agent move forward
# End of while loop 2
# Make the Agent place a block to its left
# Make the Agent move forward
# End while loop 1
```

After:

```
while agent.detect(AgentDetection.REDSTONE, FORWARD):
    while agent.detect(AgentDetection.BLOCK, FORWARD):
        agent.place(LEFT)
        agent.move(UP, 1)
        agent.place(LEFT)
        agent.move(FORWARD, 1)
    agent.place(LEFT)
    agent.move(FORWARD, 1)
```

Activity 3: Home Reconstruction (Slides 23-27)
Objective: Write a code that will develop the Agent to build foundations

Explanation:
The emergency worker needs your help to develop the Agent to make it build foundations for homes that need to be rebuilt after a hurricane. You will be doing this by coding the Agent to follow a foundations plan laid out on the floor, made from Redstone dust.

- **Part 1**: Write some code to make the Agent build the foundation for a small wooden house. This house needs to be built within the outline of Redstone dust. This code requires two sequences, one for the straight pieces of wall, and another for the outside until it has completed the foundations.
- **Part 2**: Write some code to make the Agent build the foundations for a large brick house. This code requires an additional sequence to be added to the existing code, one for the inside corners. When building an inside corner, the Agent will have to detect Redstone dust to its right, place a block, move forward, place another block, move back, turn, place another block, and then continue on.

When the students run the code, the Agent will follow the Redstone dust outline and place bricks for the foundations. When the foundations are complete, Activity 3 and the lesson are complete.

Code Snippets:

Before:

```
# Replace the lines below with your code #
# While loop 1 with an Agent detect condition |Part 1
# Make the Agent place a block to its left    |Part 1
# Make the Agent move forward                 |Part 1
# While loop 2 with an Agent detect condition |Part 1
# Make the Agent turn left                    |Part 1
# Make the Agent move forward                 |Part 1
# End of while loop 2
# While loop 3 with an Agent detect condition         |Part 2
# Make the Agent place a block to its left            |Part 2
# Make the Agent move forward                         |Part 2
# Make the Agent place a block to its left            |Part 2
# Make the Agent move back                            |Part 2
# Make the Agent turn right                           |Part 2
# End of while loop 3
# End of while loop 1
```

After:

Part 1:

```
while agent.detect(AgentDetection.REDSTONE, FORWARD):
    agent.place(LEFT)
    agent.move(FORWARD, 1)
    while agent.detect(AgentDetection.REDSTONE, LEFT):
        agent.turn(LEFT_TURN)
        agent.move(FORWARD, 2)
# While loop 3 with an Agent detect condition          |Part 2
# Make the Agent place a block to its' left            |Part 2
# Make the Agent move forward                          |Part 2
# Make the Agent place a block to its' left            |Part 2
# Make the Agent move back                             |Part 2
# Make the Agent turn right                            |Part 2
# End of while loop 3
```

Part 2:

```
while agent.detect(AgentDetection.REDSTONE, FORWARD):
    agent.place(LEFT)
    agent.move(FORWARD, 1)
    while agent.detect(AgentDetection.REDSTONE, LEFT):
        agent.turn(LEFT_TURN)
        agent.move(FORWARD, 2)
    while agent.detect(AgentDetection.REDSTONE, RIGHT):
        agent.place(LEFT)
        agent.move(FORWARD, 1)
        agent.place(LEFT)
        agent.move(BACK, 1)
        agent.turn(RIGHT_TURN)
        agent.place(LEFT)
        agent.move(FORWARD, 1)
```

LESSON CONCLUSION

Ask students about the skills that they have learned during the lesson to reinforce the concepts learned. (**slides 28-29**)

1. When does a While loop repeat code?
   Answer: When its condition is met.
2. What is a sequence?
   Answer: A sequence is the order in which we want the computer to execute a group of commands.
3. What happens if the condition in a while loop is false?
   Answer: It will not run the code
4. When would you use a while loop instead of a for loop to make the Agent move forward?

Answer: You would use a while loop if you did not know the number of blocks that the Agent needed in order to move forward.

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-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 7 FORMATIVE ASSESSMENT

When does a While loop repeat code?	
What is a sequence?	
What happens if the condition in a while loop is false?	
When would you use a while loop instead of a for loop to make the Agent move forward?	