Python Activity 8: Looping Structures – WHILE Loops

Learning Objectives
Students will be able to:

Content:
- Explain the three parts of a loop
- Explain the syntax of a while loop
- Explain sentinel-controlled and counter controlled loops
- Explain short-cut operators

Process:
- Write code that includes sentinel-controlled and counter controlled loops
- Write code that uses short-cut operators

Prior Knowledge
- Python concepts from Activities 1-7

Critical Thinking Questions
1. Closely examine the Python program below.

FYI: A looping structure allows a block of code to be repeated one or more times. A while loop is one of the two looping structures available in Python.

```
    # This program prints a person's name 20 times
    name = input("Enter your name: ")
    x = 0
    while (x < 20):
        print(name)
        x += 1
```

a. In the Python code, circle all the code associated with the WHILE loop.

b. Enter and test the code. What does the line of code: $x+=1$ do?

d. How does the Python interpreter know what lines of code belong to the loop body?

e. Every loop structure requires three actions. Identify the line of code in the Python program that corresponds to each of the three actions.
   - Initialize a variable used in the test condition:
   - Include a test condition that causes the loop to end when the condition is false:
   - Within the loop body, update the variable used in the test condition:
2. Enter and execute the following code. Beside each line of code explain what the code does.

```python
# This program prints numbers from 1 to the
# value entered by the user
number = int(input("Enter a number: "))

x = 1
while(x <= number):
    if(x % 10 == 0):
        print(x)
    else:
        print(x, end=" ")
    x = x + 1
```

3. The following code should print the numbers from 1 to 10, but it does not print anything. Correct the problem.

```python
number = 12
while number <= 10:
    print(number)
    number = number + 1
```

4. Examine the following code:

```python
number = 0
while number <= 10:
    print(number)
    number = number - 1
```

   a. What will the output be? ___________________________________________

   b. Does the program end? Why or why not? ________________________________
      ____________________________________________________________________

5. Examine the following code:

```python
number = 1
while number <= 10:
    if number % 2 == 0:
        print(number, end=" ")
    number = number + 1
```

   a. State the output. ____________________________________________________

   b. What caused the output to display on one line? _________________________
      ____________________________________________________________________

   c. What control structures are used in this code? ________________________
      ___________________________ and _________________________________
6. The following directions will create a program that prompts the user to enter a number between 1 and 10. As long as the number is out of range the program re-prompts the user for a valid number. Complete the following steps to write this code.

a. Write a line of code that prompts the user for a number between 1 and 10.

b. Write a Boolean expression that tests the number the user entered by the code in step “a.” to determine if it is not in range.

c. Use the Boolean expression created in step “b.” to write a while loop that executes when the user input is out of range. The body of the loop should tell the user that they entered an invalid number and prompt them for a valid number again.

d. Write the code that prints a message telling the user that they entered a valid number.

e. Put the segments of code from steps “a-d” together. Enter and execute the code. Does it work properly? If not, correct it and test it again.

f. How many times does the loop execute?

FYI: A looping structure for which you know the number of times it will execute is known as a count-controlled loop.

7. Sometimes a programmer does not know how many times data is to be entered. For example, suppose you want to create a program that adds an unknown amount of positive numbers that will be entered by the user. The program stops adding numbers when the user enters a zero or a negative number. Then the program prints the total. Before creating this program, review the three actions required for all loops:

a. Initialize a variable that will be used in the test condition: What will be tested to determine if the loop is executed? Write a line of code that initializes a variable to be used in the test condition of the loop for this program. The variable should contain a value entered by the user.

b. Include a test condition that causes the loop to end when the condition is false: What is the test condition for the while loop used in this program?

c. Within the loop body, update the variable used in the test condition: Write the code for the loop body. Include the code to update the variable in the test condition.
d. Is this a *count-controlled* loop? Why or why not?

________________________________________________________________________

e. Complete the program. Enter and execute the code. Does it work properly? __________

**FYI:** Short-cut operators provide a concise way of creating assignment statements when the variable on the left-hand side of the assignment statement is also on the right-hand side. The addition short-cut operator (+=) is usually used for incrementing a variable.

8. Enter and execute the following code:
   ```python
   number = 1
   number += 3
   print(number)
   ```
   a. What does the “+=” shortcut operator do? ______________________________________

   b. The code: `x += 5` is equivalent to which of the following lines of code?
   - `x = 5`
   - `x = y + 5`
   - `x = x + 5`
   - `y = x + 5`

   c. Replace the operator ‘+=’ with the following *shortcut operators* and execute the code. Explain what each operator does.
   - `-=` _________________________________________________________
   - `*=` _________________________________________________________

9. Enter and execute the following code:
   ```python
   bonus = 25
   salary += bonus
   print(“Total salary:”, salary)
   ```
   a. What is the output of the preceding code? Is it what you expected? __________

   b. Rewrite the code so that it produces valid output.

   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

   c. Is the following line of code valid: `23 += total`? Why or why not? __________
10. The following code should print the numbers beginning with 100 and ending with 0. However it is missing a line of code. Add the missing code, using the shortcut operator. Draw an arrow to indicate where the code belongs.

```python
countdown = 100
while countdown > 0:
    print(countdown)
print(“Done!”)
```

11. Enter and execute the following code:

```python
doAgain = “y”
while doAgain == “y”:
    word = input(“Enter a word:”)
    print(“First letter of “ + word + “ is “ + word[0])
    doAgain = input(“Type ‘y’ to enter another word and anything else to quit.”)
print(“Done!”)
```

a. What does the program do? ______________________________________________

b. What is the variable name used to store the user’s input? _______________________

c. In the print statement, what does `word[0]` represent? _______________________

d. Change 0 to 1 in `word[0]` in the print statement above. What is printed? ________

e. When does the program end? ___________________________________________

f. Why is the loop in this program an example of a sentinel control loop?

FYI: A sentinel-controlled while loop is a loop that repeats the loop body until the user enters a pre-specified value.

g. Examine the print statement in this program:
```
print("First letter of " + word + " is " + word[0])
```
What happens if you replace the “+” with a “,”?

12. Examine the code below.
```
name = “Simone”
cost = 3.56
numApples = 89
```

What type of data is stored in each variable: (integer, floating point, or string)

- name - ________________________________
- cost - ________________________________
- numApples - ___________________________
FYI: A variable that can store only the values True and False is called a Boolean variable.

13. Given the assignment statement: foundCost = False
   • What value is stored in the variable foundCost? ________________________________
   • What type of data is stored in foundCost? ________________________________

Application Questions: Use the Python Interpreter to check your work

1. Write a code segment that prompts the user for an even number. As long as the number is not even, the user should be given a message and prompted again for an even number.
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

2. Write code segment that prompts the user for a letter from ‘a-z’. As long as the character is not between ‘a-z’, the user should be given a message and prompted again for a letter between ‘a-z’.
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________