ILP 2021 – W2S2
If/Elif/Else statements,
While/Break statements

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TECHNOLOGY AND DESIGN

Outline (Week2, Session2 – W2S2)

- The if statement
- The elif statement
- The else statement
- Dead code and code structure
- Nested ifs
- While statements
- Infinite looks and how to kill them
- The break statement
- (If time allows, recursion!)

Nested if structures

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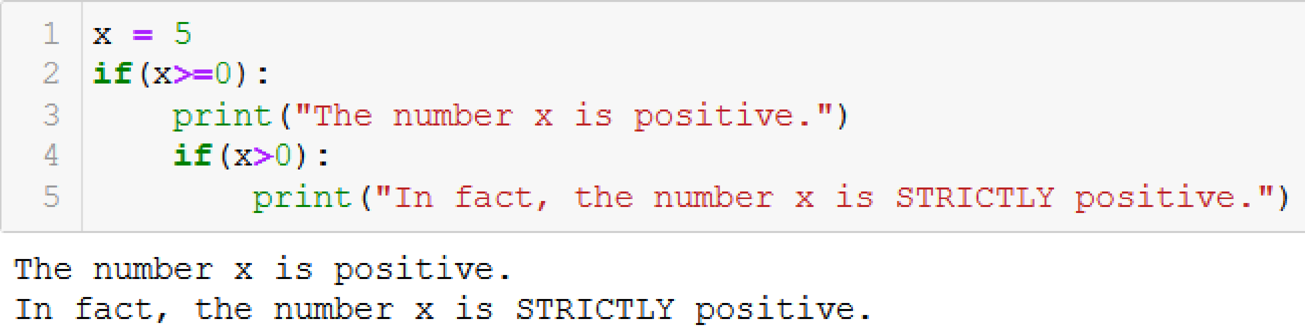

```python
x = 5
if(x>=0):
    print("The number x is positive.")
    if(x>0):
        print("In fact, the number x is STRICTLY positive.")
```

```
The number x is positive.
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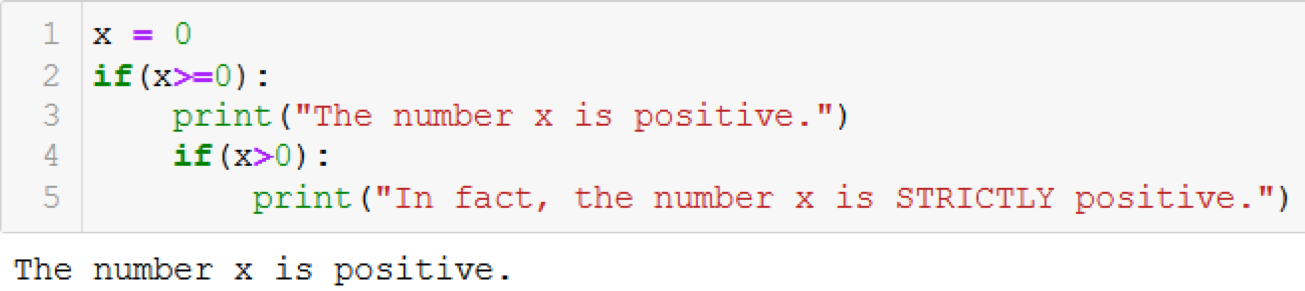

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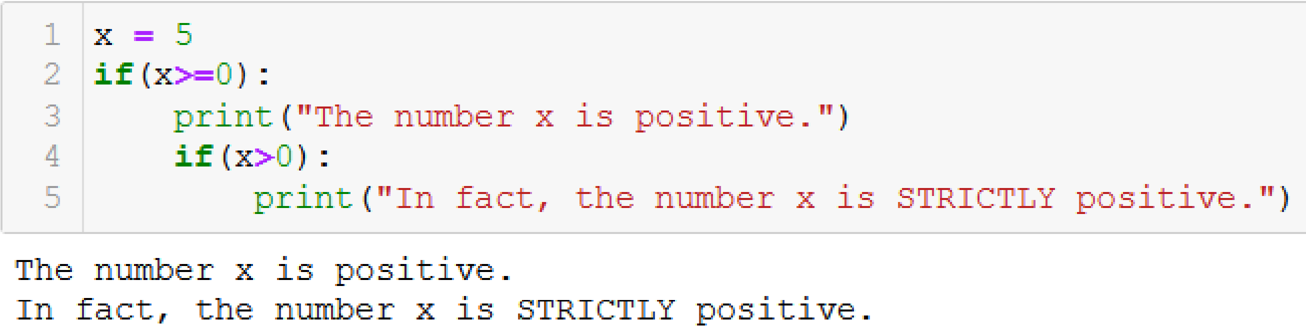
Each if might have its own elif/else statements, placed on the same indentation level.



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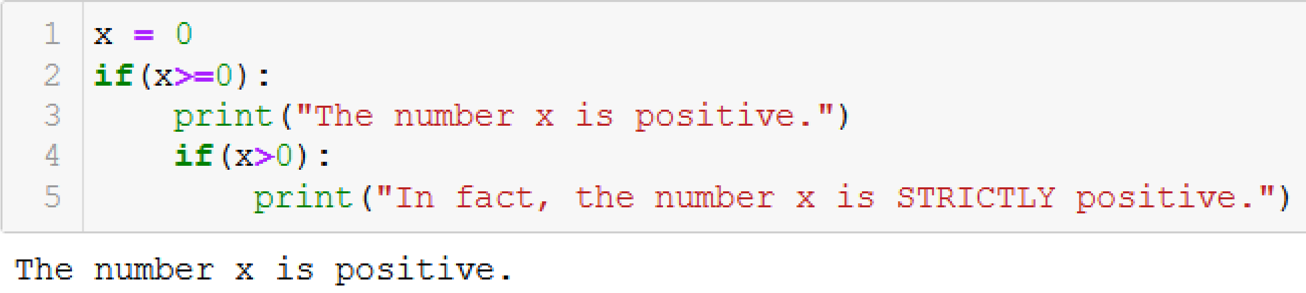

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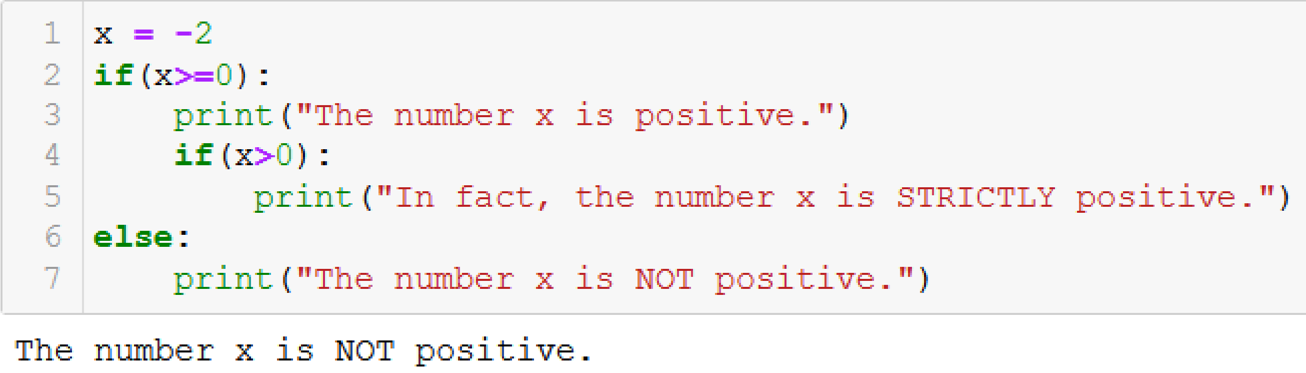
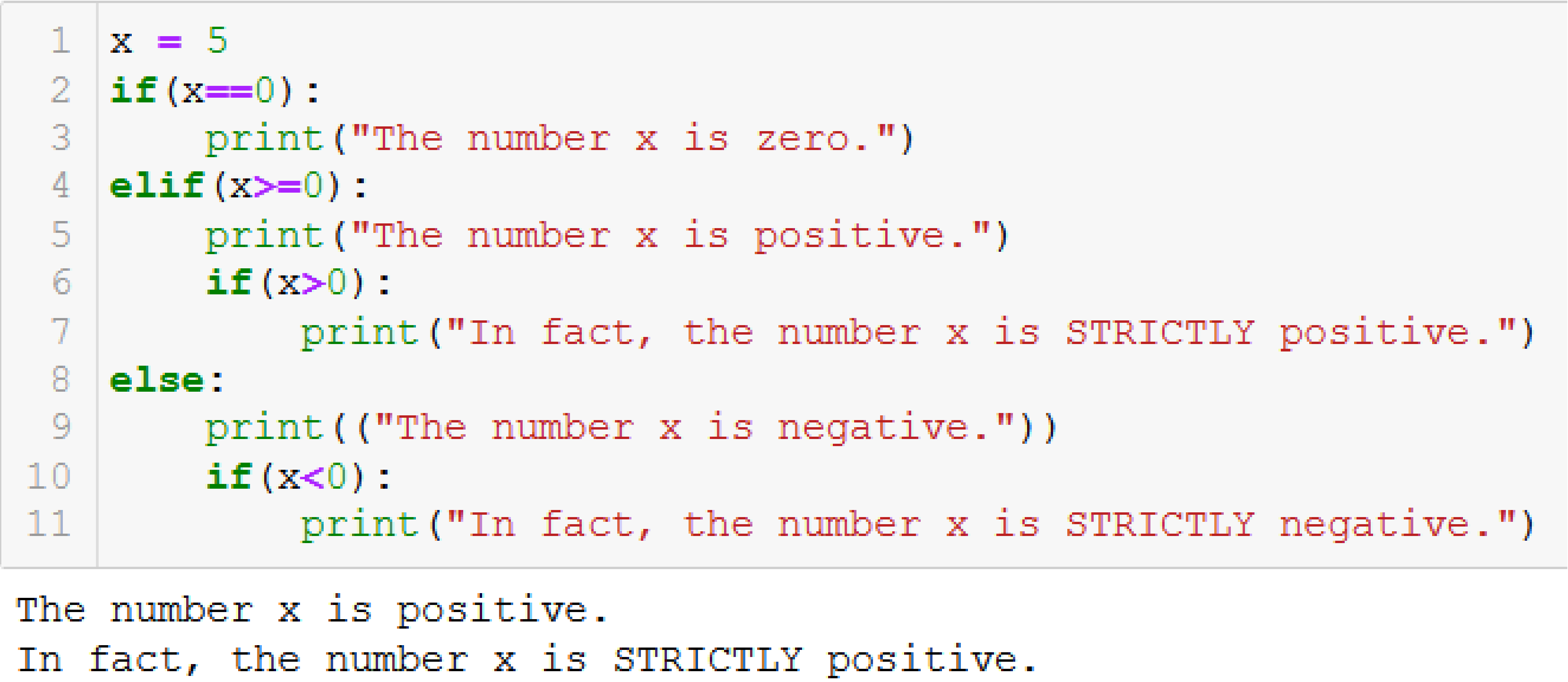


```python
x = -2
if(x>=0):
    print("The number x is positive.")
    if(x>0):
        print("In fact, the number x is STRICTLY positive.")
else:
    print("The number x is NOT positive.")
```

```
The number x is NOT positive.
```

Nested if structures



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    print(("The number x is negative."))
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        print("In fact, the number x is STRICTLY negative.")
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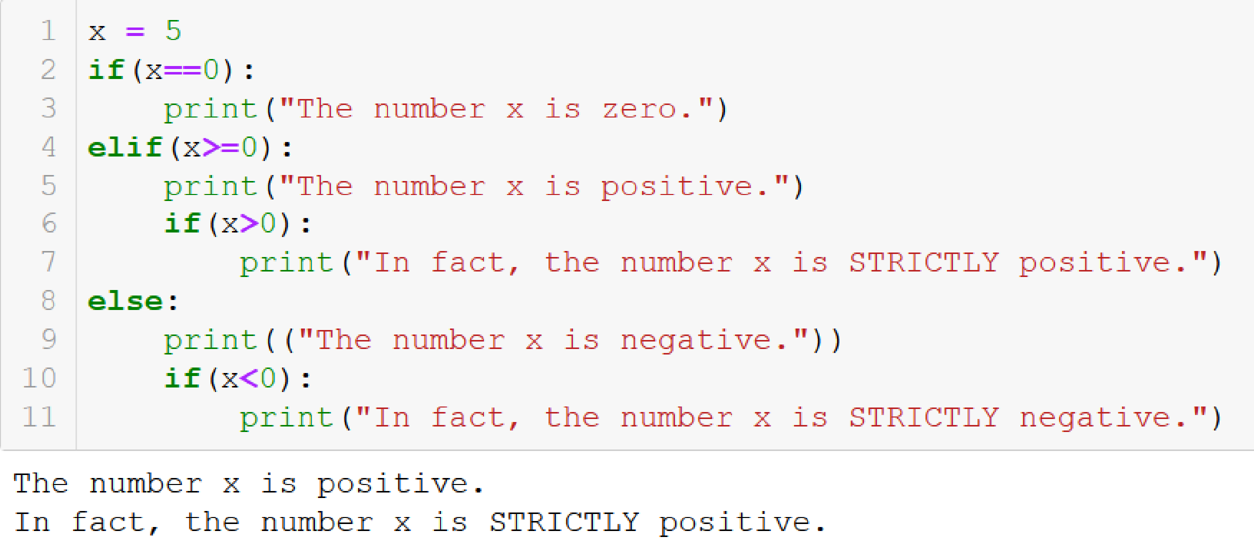
Nested if structures vs. combined conditionals

Nested **if** structures can, most of the time, be rewritten with combined conditionals (using **and**/**or** Boolean operators).



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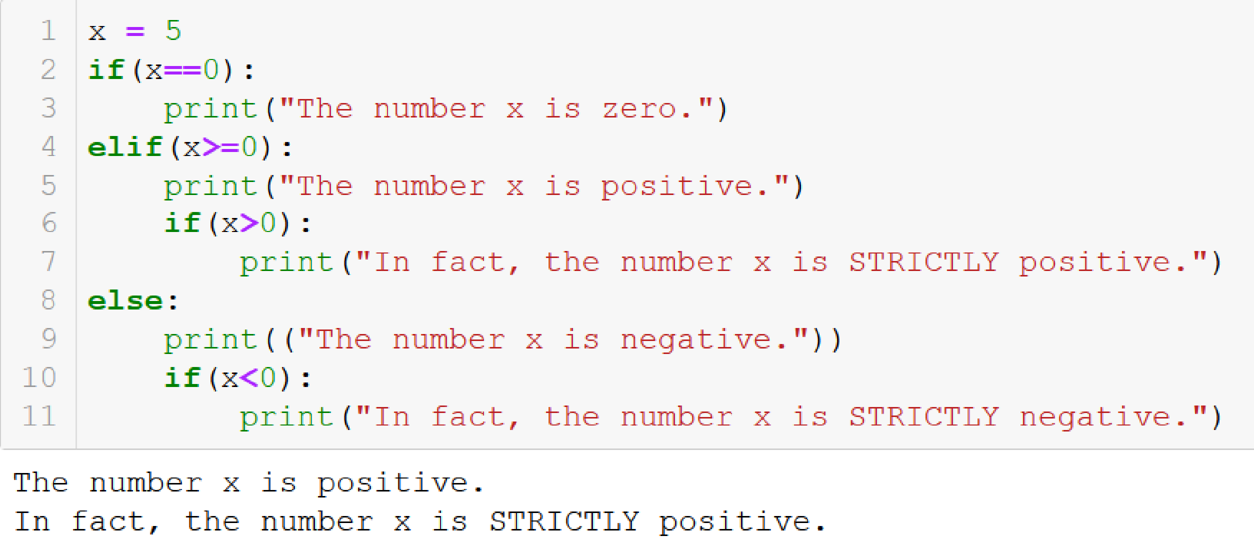

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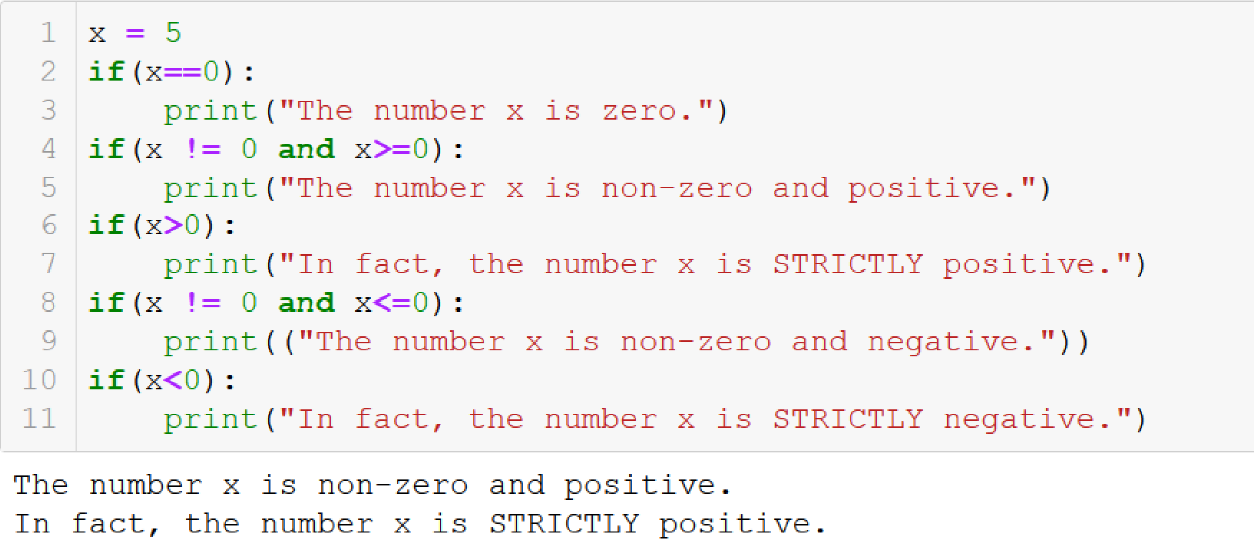

```
x = 5
if(x==0):
    print("The number x is zero.")
if(x != 0 and x>=0):
    print("The number x is non-zero and positive.")
if(x>0):
    print("In fact, the number x is STRICTLY positive.")
if(x != 0 and x<=0):
    print(("The number x is non-zero and negative."))
if(x<0):
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```
The number x is non-zero and positive.
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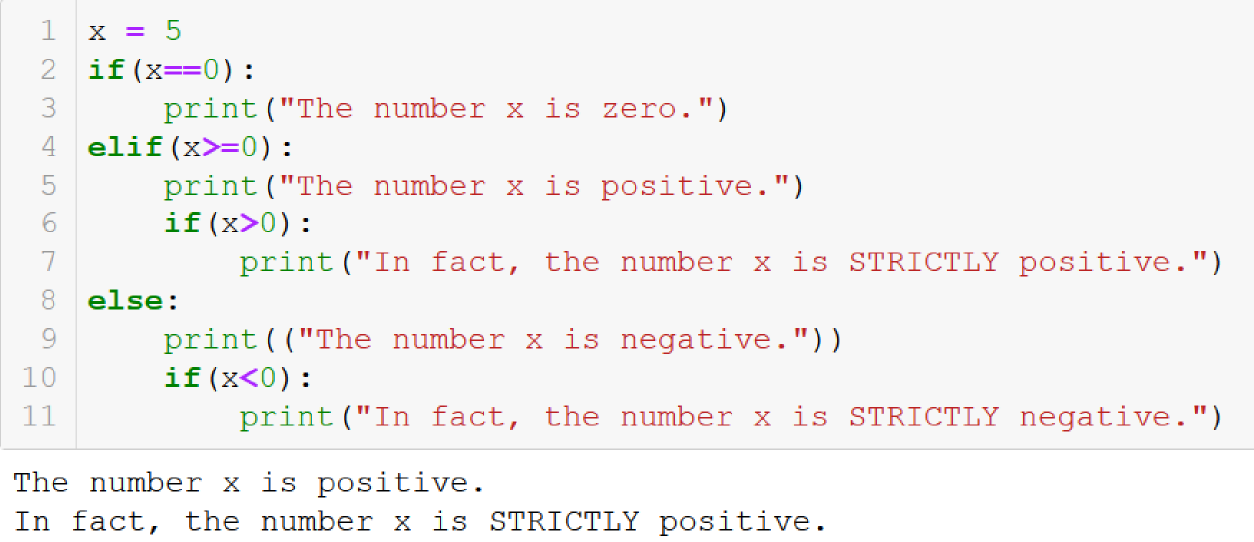
Nested if structures vs. combined conditionals

Nested **if** structures can, most of the time, be rewritten with combined conditionals (using **and**/**or** Boolean operators).

For instance, both structures on the right are equivalent.

Personal preference: Whenever possible, try to avoid the nested **if** structures. They are often overly complicated and prone to errors in designing the code.



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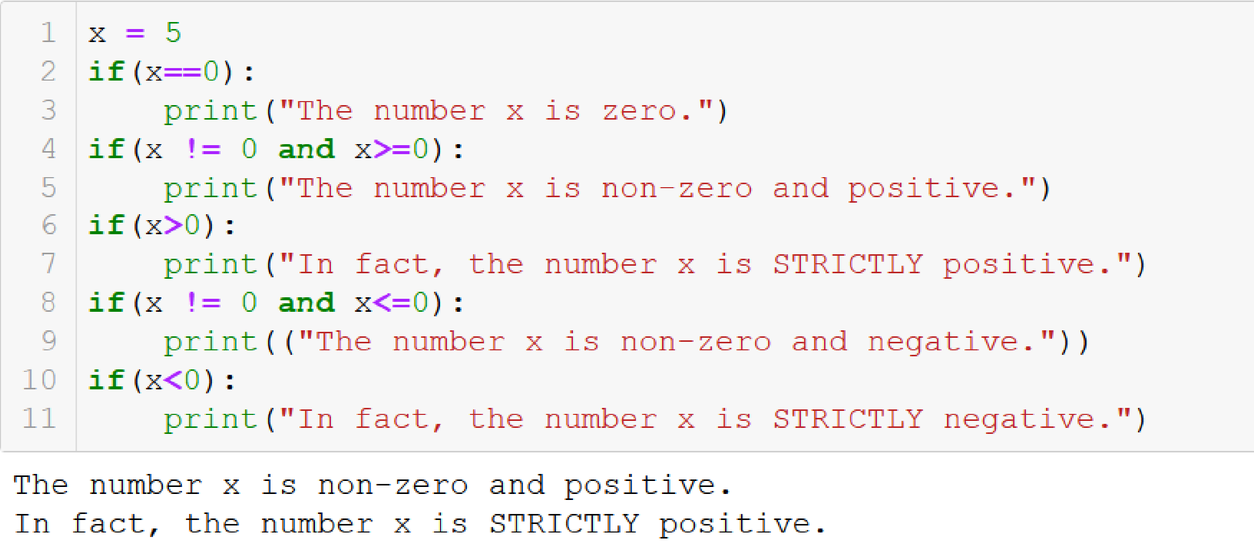

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Activity 3 - Race and class check

Write a function **character_creation()**, according to the following requirements.

- The function will **receive two parameters**: **user_race** and **user_class**.
- For simplicity, only **three races** are available: **Human, Elf,** and **Dwarf**.
- For simplicity, **only four classes** are available: **Warrior, Hunter, Mage** and **Priest**.
- **Humans** can play **all classes**.
- **Elves** cannot be **warriors**.
- **Dwarves** cannot be **mages or priests**.
- The function should **not return anything.**
- It should **print** "You cannot play a character that is ...{race} and ...{class}.", with **blanks filled** accordingly, **if the combination of user_race and user_class is not acceptable**.
- Not acceptable here means that its race and/or class is not among the ones listed above, or the combination is not permitted, as listed above.
- **If the combination is valid**, it should **print** "Your character's race is ...{race} and your character's class is ...{class}.", with blanks filled accordingly.

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The **if** statement is the simplest **conditional structure**.

- **How it works:**
  - If the Boolean condition specified for the **if** statement is **True**, then execute the block of code inside the **if** statement.
  - If the Boolean condition is **False**, ignore the block of code in the **if** statement.
  - Once we are done executing the code in **if** (or ignoring it), move on to the next (non-indented) line.

The while statement

The **while** statement is another type of **conditional structure.**

- **How it works:**
  - If the Boolean condition specified for the **while** statement is **True**, then execute the block of code inside the **while** statement.
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The **if** statement is the simplest **conditional structure**.

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The while statement

The **while** statement is another type of **conditional structure.**

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The **while** statement is another type of **conditional structure.**

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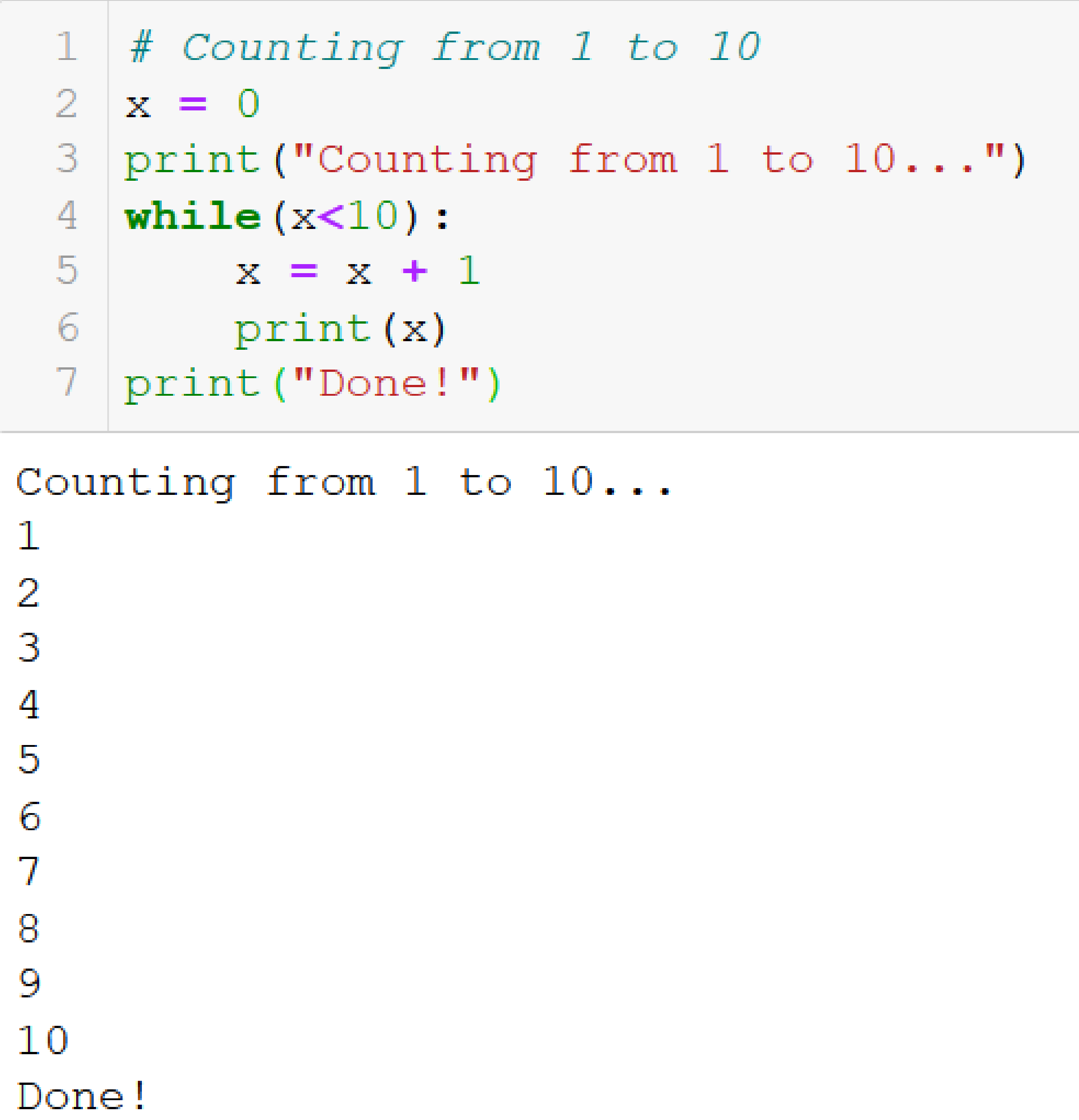
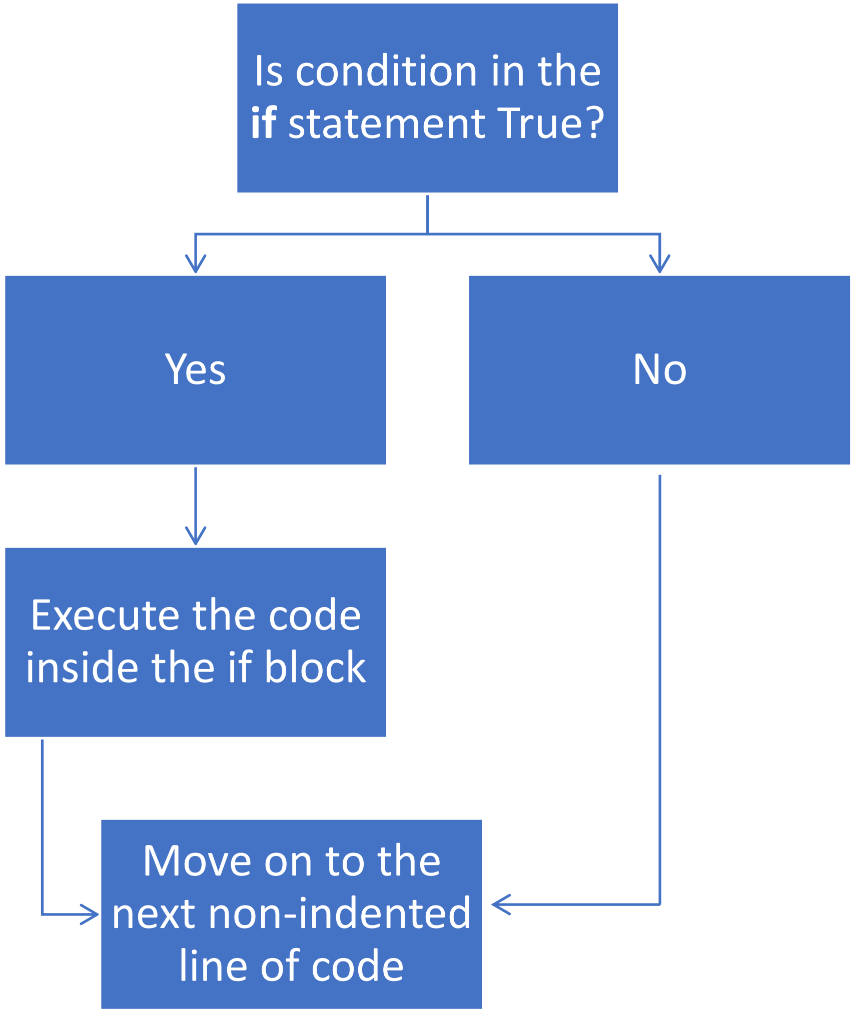


```python
# Counting from 1 to 10
x = 0
print("Counting from 1 to 10...")
while(x<10):
    x = x + 1
    print(x)
print("Done!")
```

```
Counting from 1 to 10...
1
2
3
4
5
6
7
8
9
10
Done!
```

Architectures: if vs. while



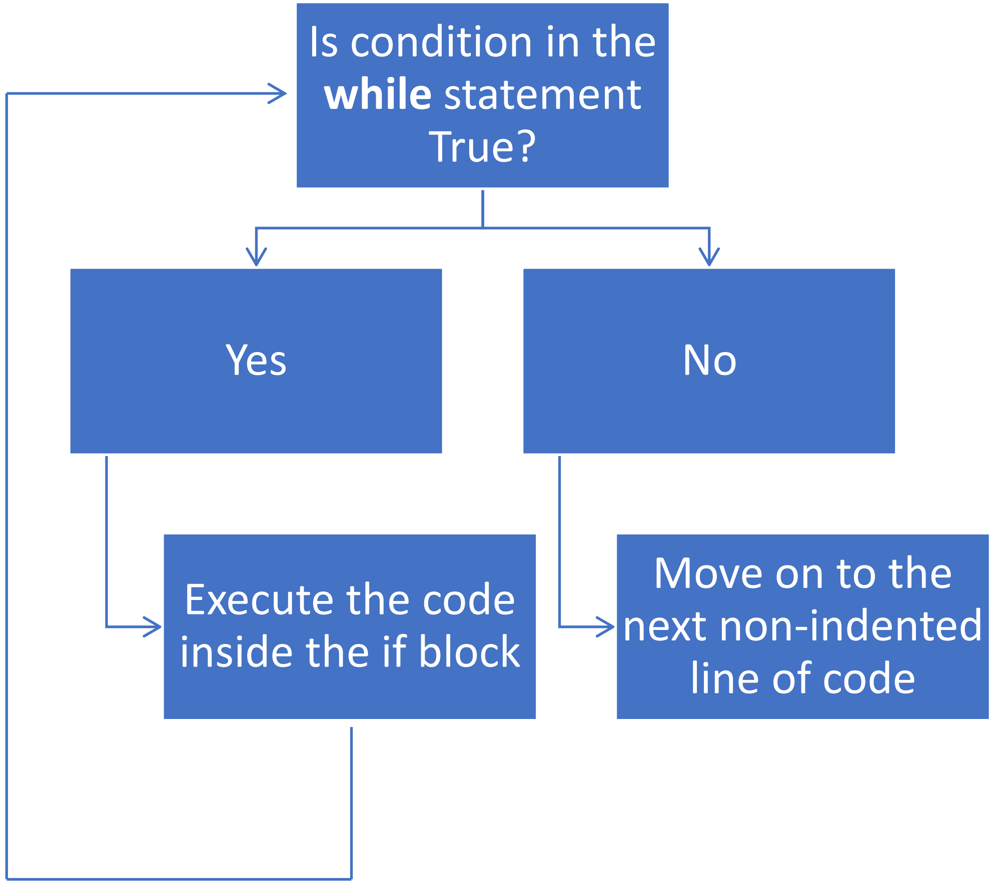
Is condition in the **if** statement True?

Yes

No

Execute the code inside the if block

Move on to the next non-indented line of code



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Infinite loops

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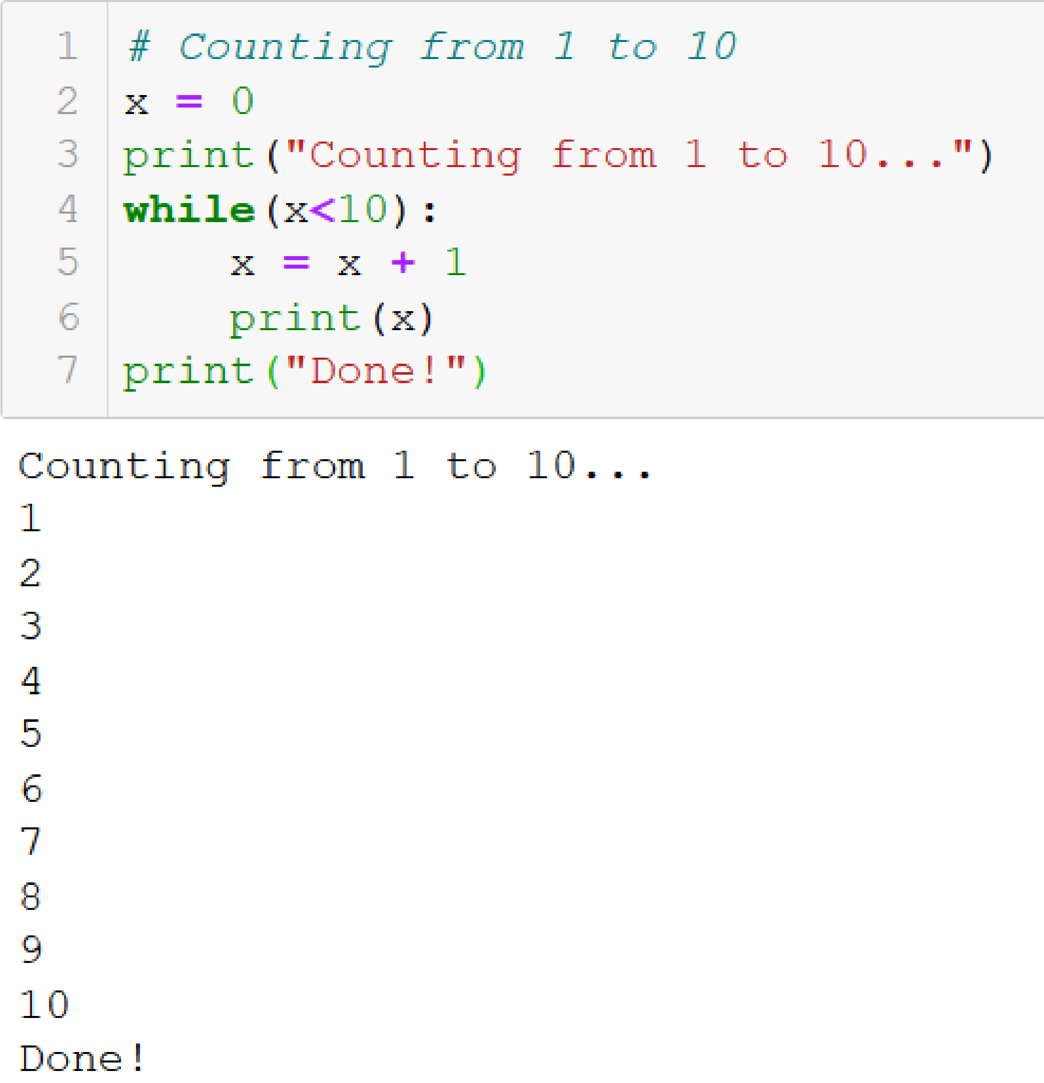

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print("Done!")
```

```
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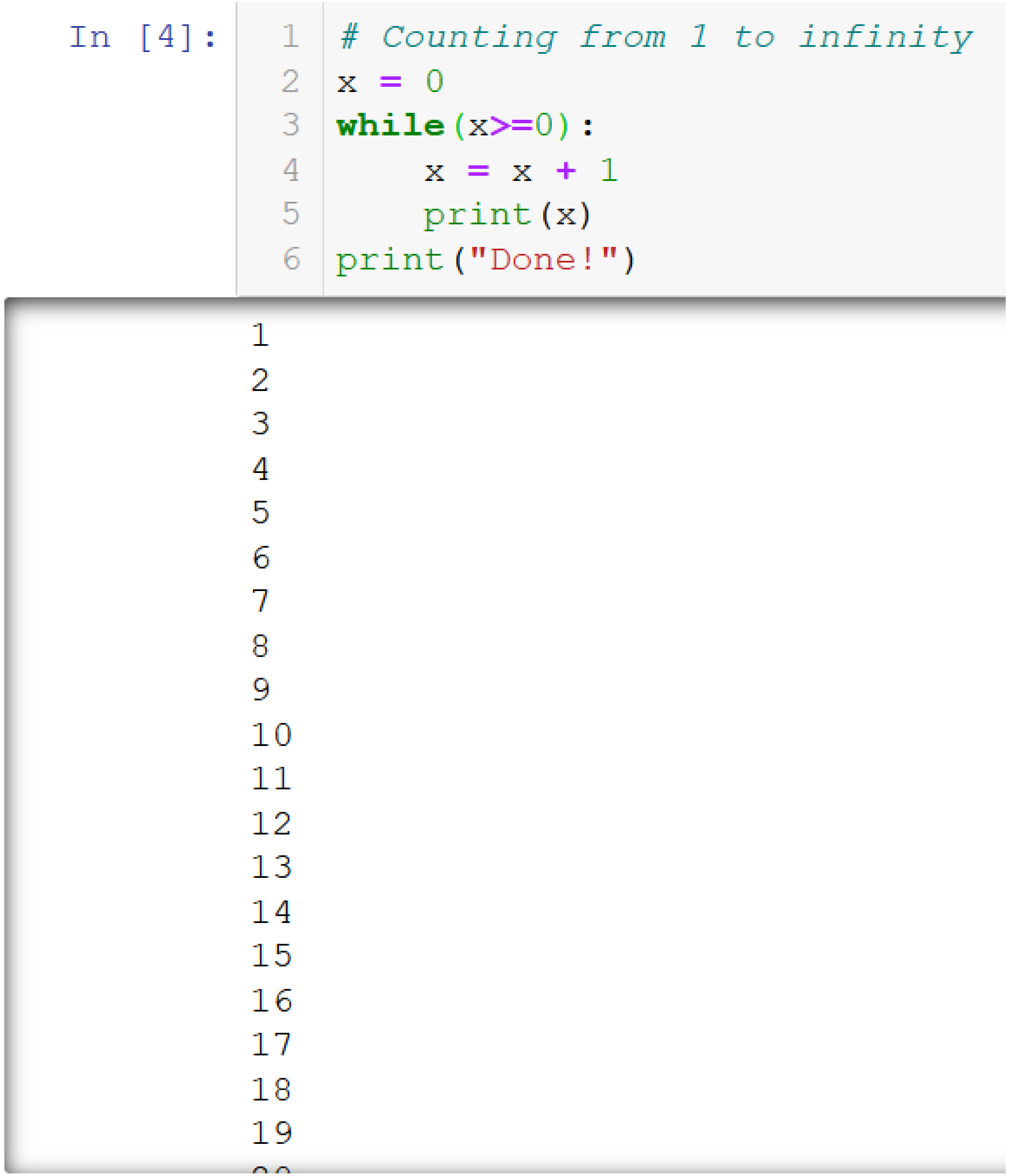
```

Infinite loops

The **while** statement repeats a condition until it is no longer **True**.

This means that there should be a clear process that **makes your condition no longer True**, at some point.

Otherwise, the **while** block will keep on repeating indefinitely… This is called an **infinite loop**.



```python
# Counting from 1 to infinity
x = 0
while(x>=0):
    x = x + 1
    print(x)
print("Done!")
```

```
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
```

Infinite loops and how to kill them

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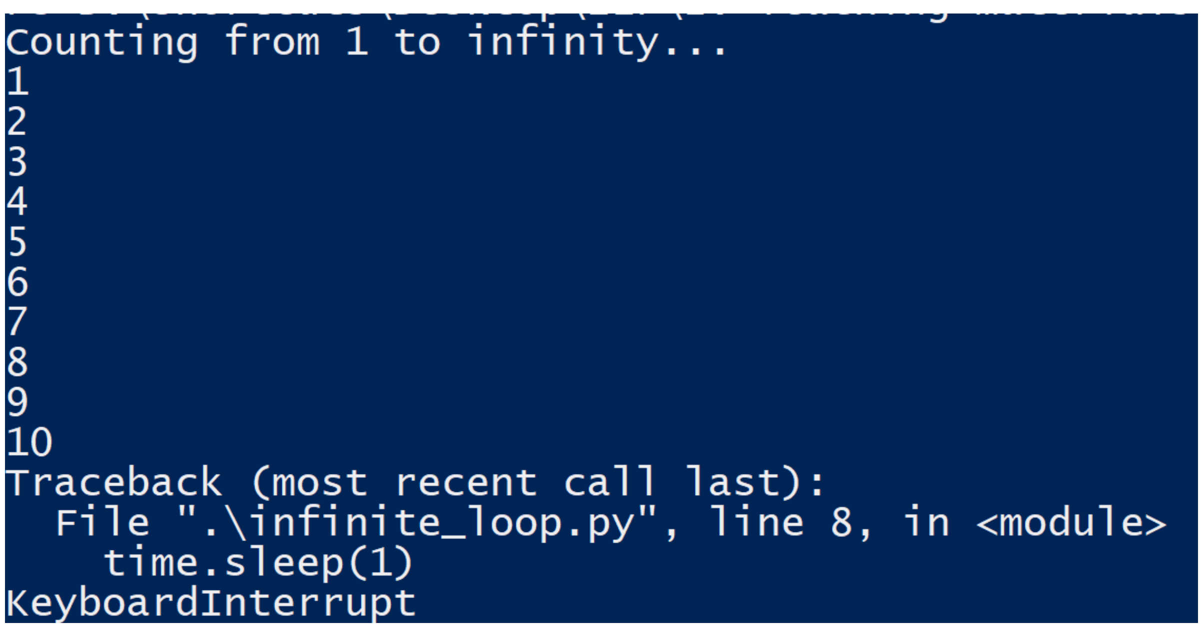

```
Counting from 1 to infinity...
1
2
3
4
5
6
7
8
9
10
Traceback (most recent call last):
  File ".\infinite_loop.py", line 8, in <module>
    time.sleep(1)
KeyboardInterrupt
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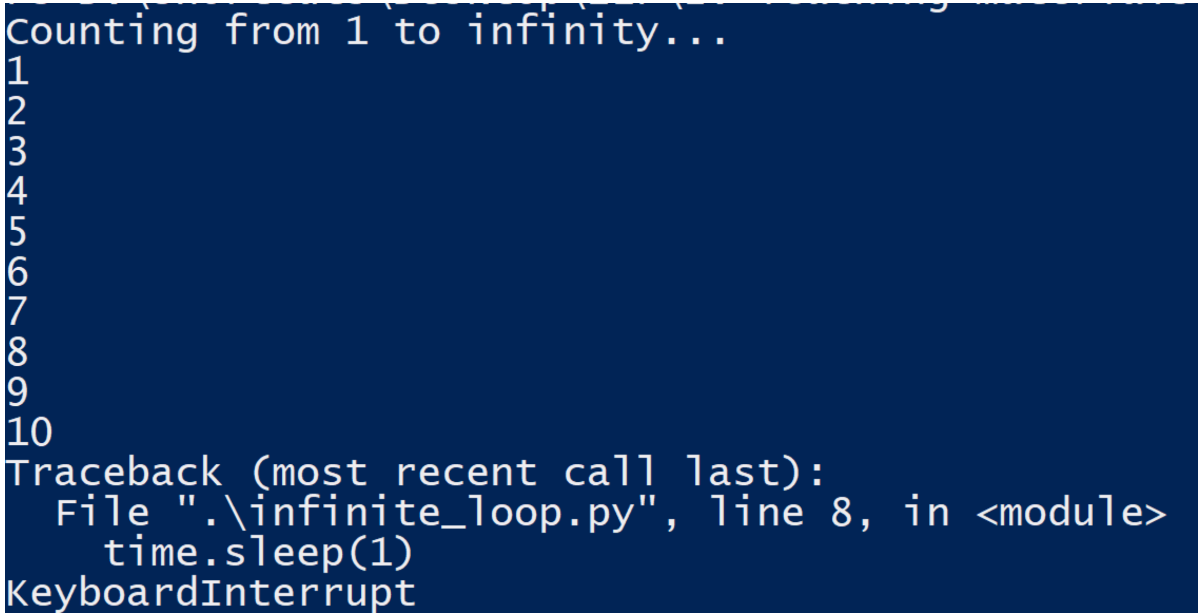

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1
2
3
4
5
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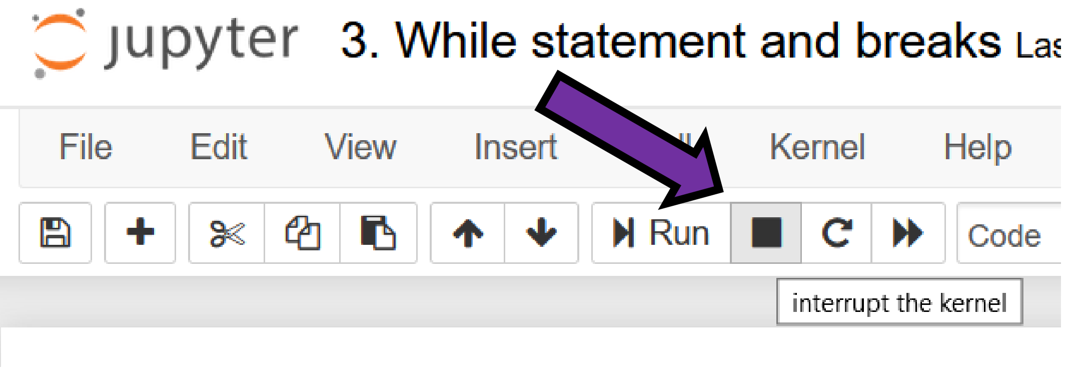

3. While statement and breaks Las

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Matt’s Great advice #7

Matt’s Great Advice #7: Avoid the infinite loops and dead code, by drawing structural diagrams.

Infinite loops and **dead code**, unless created on purpose, usually follow from a **poor design** in your code.

Drawing a **structural diagram**, **<u>before coding</u>**, greatly helps figuring out the right structure for your code.

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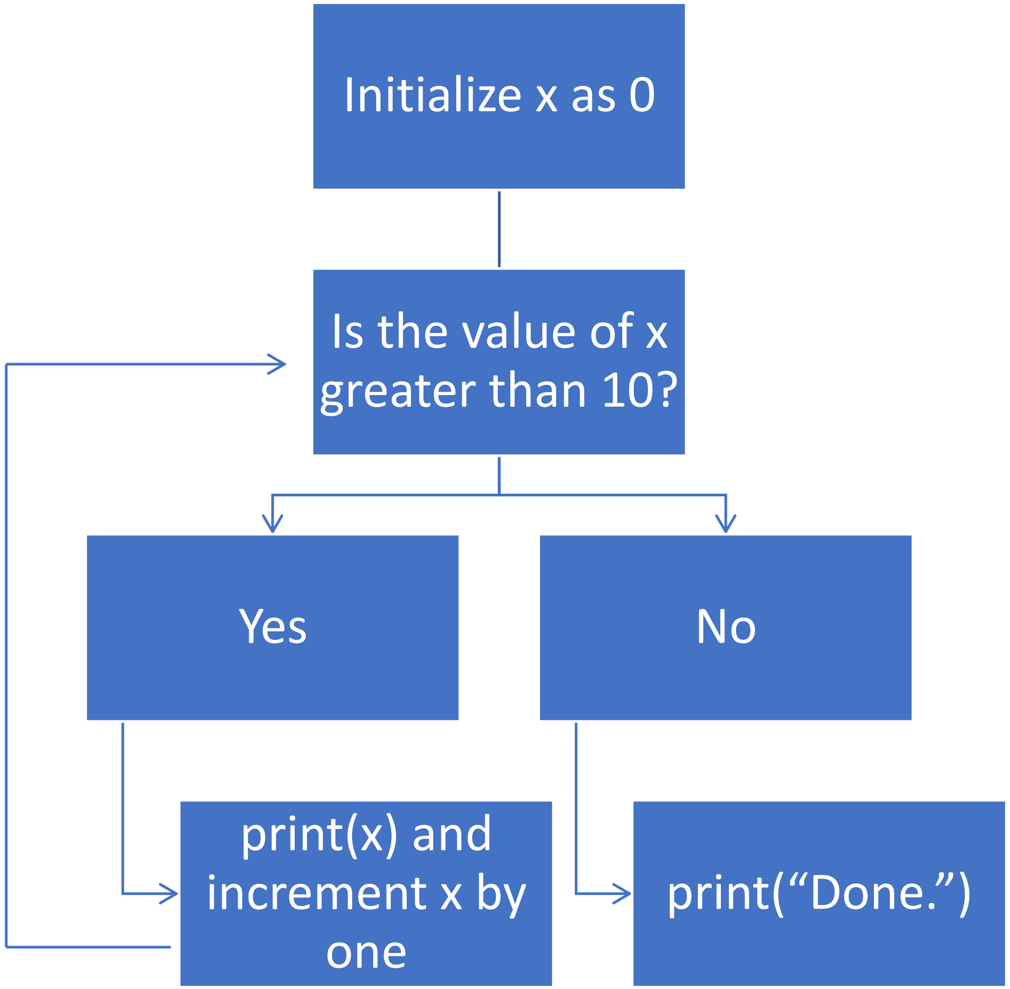
Initialize x as 0
Is the value of x greater than 10?
Yes
No
print(x) and increment x by one
print(“Done.”)

Example: diagram for our while loop, counting from 1 to 10.

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The code then resumes its execution with the next line outside of the **while** block.

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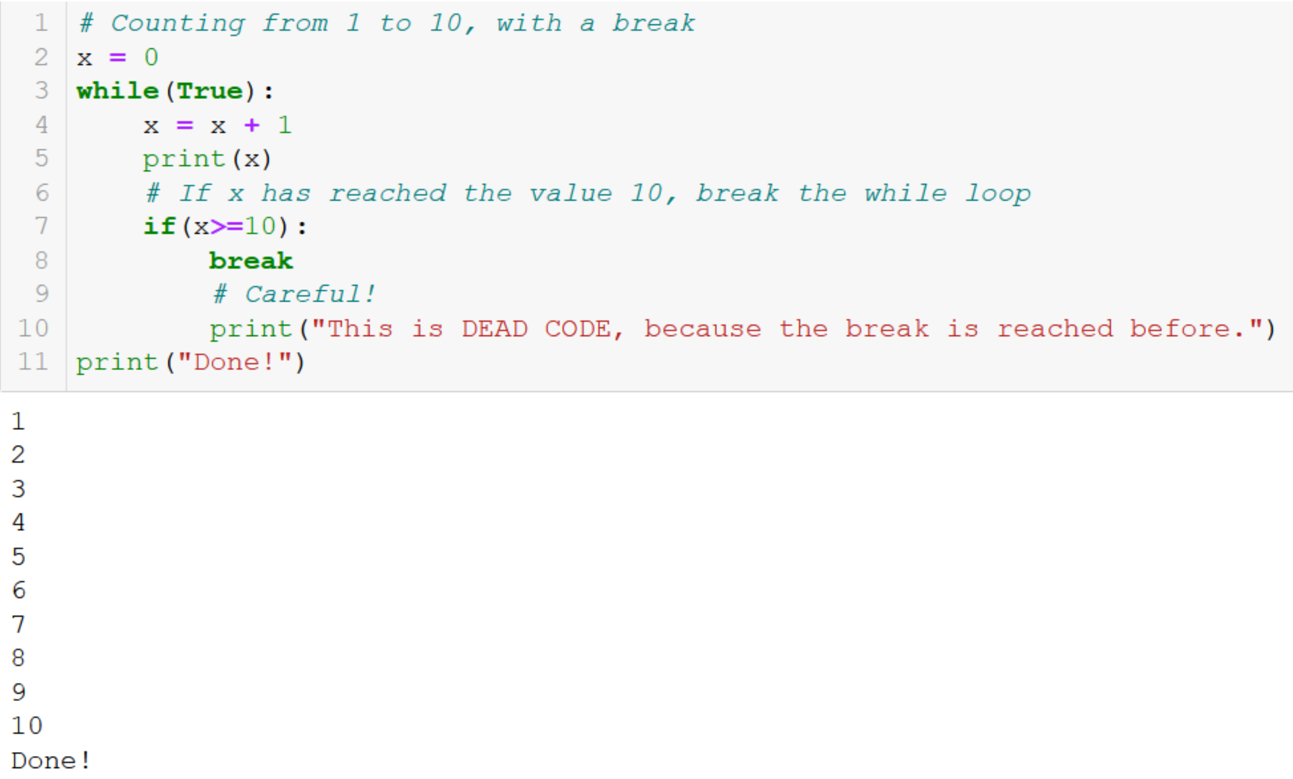
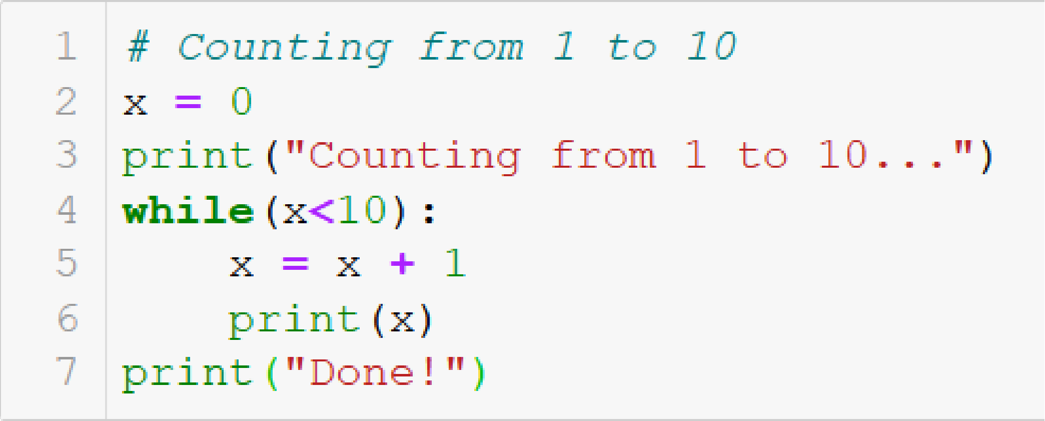


```python
# Counting from 1 to 10, with a break
x = 0
while(True):
    x = x + 1
    print(x)
    # If x has reached the value 10, break the while loop
    if(x>=10):
        break
        # Careful!
        print("This is DEAD CODE, because the break is reached before.")
print("Done!")
```

```
1
2
3
4
5
6
7
8
9
10
Done!
```

Standard **while** vs. infinite **while** + **break**

1. Standard **while** loop with condition in the while statement.



```
# Counting from 1 to 10
x = 0
print("Counting from 1 to 10...")
while(x<10):
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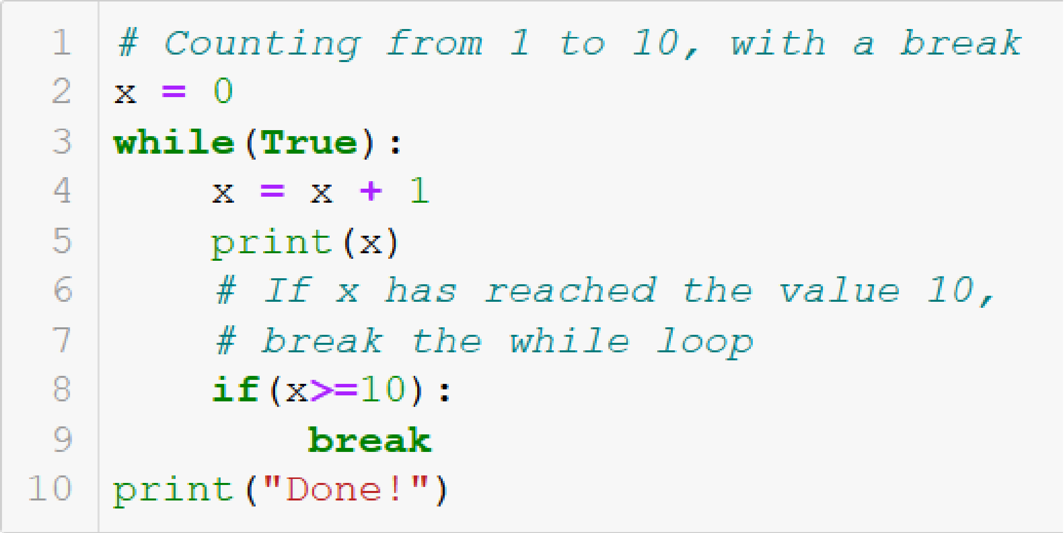
2. Infinite **while** loop with condition in an **if** statement, and **break** in the **if** block.



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while(True):
    x = x + 1
    print(x)
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    # break the while loop
    if(x>=10):
        break
print("Done!")
```

→ Both loops work and do the job, which one is better though?

Matt’s Great advice #8

Matt’s Great Advice #8: Avoid the infinite loops, if possible.

Relying on an **infinite while** loop with a **break** is **risky**, and should be avoided when possible.

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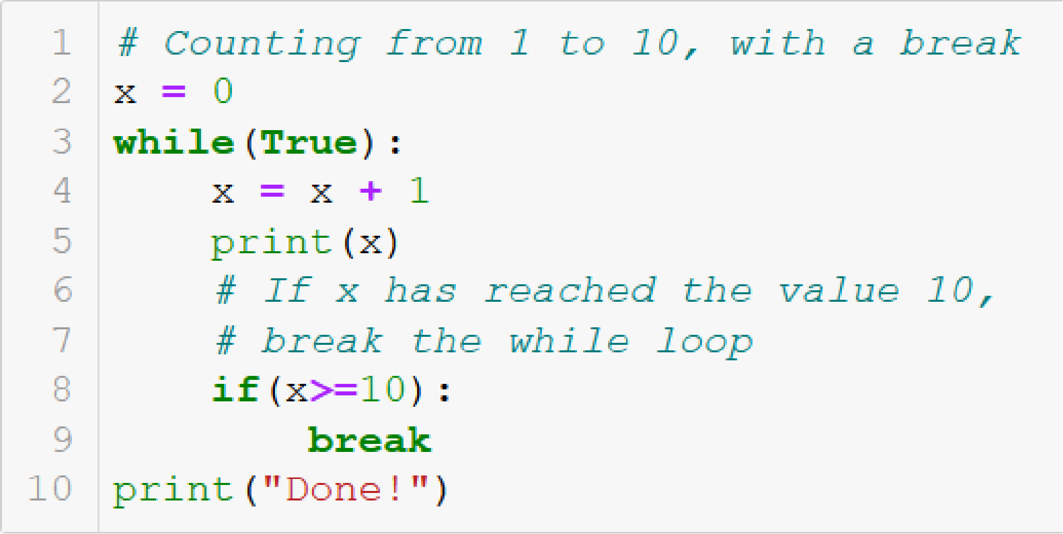
Relying on an **infinite** **while** loop with a **break** is **risky**, and should be avoided when possible.

It is often easily avoided, by using the Boolean expression of the **if** statement used for **break**, as the condition in the **while** statement.



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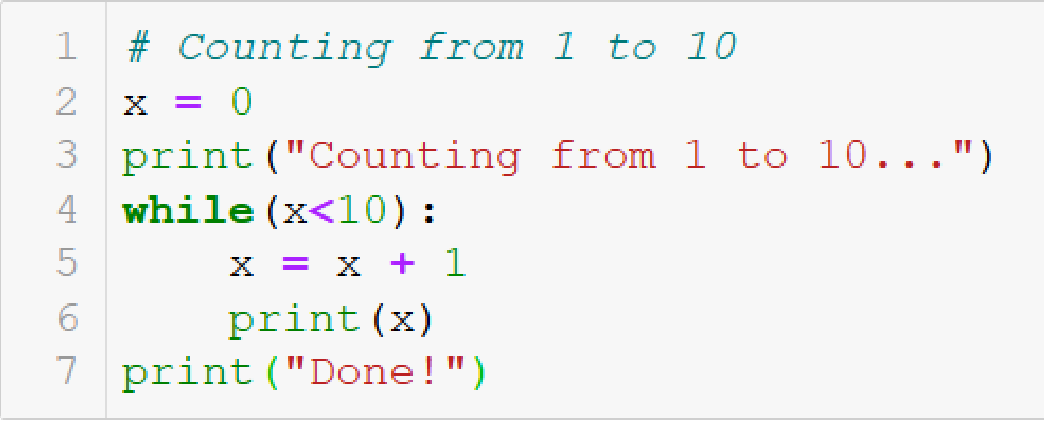

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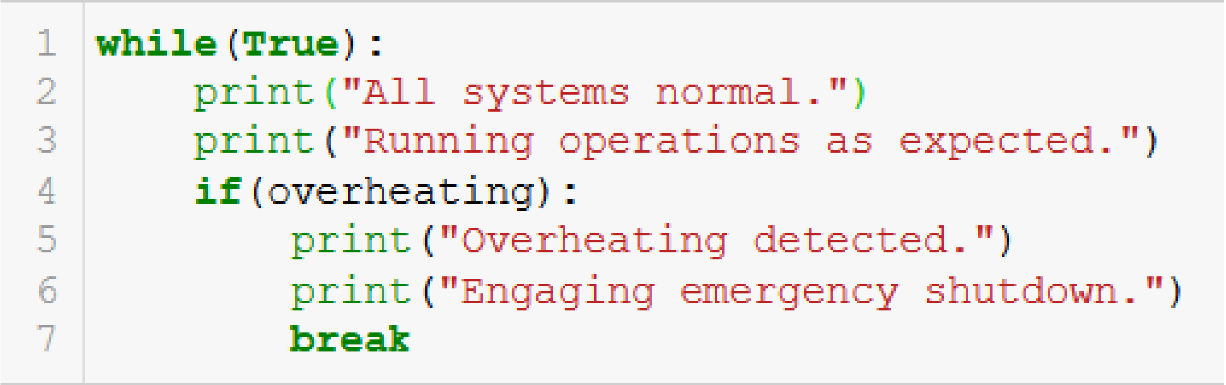
Note: a few cases, however, require the use of a **break** statement.
For instance, **emergency shutdowns**.



```
while(True):
    print("All systems normal.")
    print("Running operations as expected.")
    if(overheating):
        print("Overheating detected.")
        print("Engaging emergency shutdown.")
        break
```

Practice activities for while/break

Let us practice the **while**/**break** concepts a bit, with two activities.

Activity 1 – How many hits can you take.ipynb

Activity 1 - How many hits can you take

Your main character currently has a number of lifepoints, stored in **lifepoints_number**.

Your mentor gives you the following challenge: he will hit you, for a given number of times $\boldsymbol{n}$.

- The **first hit** will make you **lose one lifepoint**,
- the **second**, **two lifepoints**,
- the **third**, **three lifepoints**,
- and **so on**.
- **If** you take too many hits and **your lifepoints fall at or below zero, you fail the challenge.**
- Assuming you survive $\boldsymbol{n}$ hits, your mentor will give you $\boldsymbol{n^2}$ coins.

Write a function, named **maximal_coins_number()**, which

- **receives** your current number of **lifepoints**, as the variable **lifepoints_number**,
- and **returns** the **maximal number of coins** you can hope to obtain from the challenge,
- as well the **number of lifepoints** that will be **remaining after taking this maximal number of hits**.

Activity 2 – Guess the number game v2

Remember the guess the number game in W3S1, Activity 1? Back then, we had defined a function **guess_the_number()**,

- which received a **hidden number that the user had to guess** (passed as input **hidden_number**),
- **asked the user to input a number**, via the **input()** method and would store it in a variable **guessed_number**,
- and based on the two numbers would **display two messages**, reading:
    - "You have found the hidden number: True/False."
    - "Your number in guessed_number is lower than the hidden number: True/False.“

Your task is to write a **second version** (v2!) of this function, called **guess_the_number_v2().**

Activity 2 – Guess the number game v2

This v2 function will have the following features, replacing the previous ones:

- The game will **keep on asking the user to input()** values, **until the right number is found**.
- It will **display the message** "Your have found the right number!", **once the user has found the right number.**
- When that happens, it **also displays** "It only took you ... tries!" with the blank filled with the number of times the user had to type a number via input().
- Once the number has been found, the function no longer asks the user for inputs and stops.
- **While the user has not found the right number**, the game will **display either**
    - "Your number is lower than the hidden number." (if the last number entered by the user is lower than the hidden number)
    - or "Your number is higher than the hidden number." (if the last number entered by the user is higher than the hidden number).

Conclusion

- The if statement
- The elif statement
- The else statement
- Dead code and code structure
- Nested ifs
- While statements
- Infinite looks and how to kill them
- The break statement
- (If time allows, recursion!)

Up for a challenge?
(in the Extra challenges folder)

Challenge: Activity 1+ - How many hits can you take (extra challenge).ipynb

- Similarly, as in other challenges…
- Do not use any conditional statement (**if**/**while**)
- **Hint:** use a bit of maths on sequences!