

ILP 2021 – W2S2

If/Elif/Else statements, While/Break statements

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Outline (Week2, Session2 – W2S2)

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

Nested **if** structures

Definition (nested **if structure):**

A **nested **if** structure** is a structure which includes one or multiple **if** statement(s), inside another **if** statement.

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

The number x is positive.
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Each **if** might have its own **elif/else** statements, placed on the same indentation level.

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```

The number x is positive.

```
1 x = -2
2 if(x>=0):
3     print("The number x is positive.")
4     if(x>0):
5         print("In fact, the number x is STRICTLY positive.")
6 else:
7     print("The number x is NOT positive.")
```

The number x is NOT positive.

Nested **if** structures

```
1 x = 5
2 if(x==0):
3     print("The number x is zero.")
4 elif(x>=0):
5     print("The number x is positive.")
6     if(x>0):
7         print("In fact, the number x is STRICTLY positive.")
8 else:
9     print(("The number x is negative. "))
10    if(x<0):
11        print("In fact, the number x is STRICTLY negative.")
```

The number x is positive.

In fact, the number x is STRICTLY positive.

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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1 x = 5
2 if(x==0):
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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.

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10    if(x<0):
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```

The number x is positive.

In fact, the number x is STRICTLY positive.

```
1 x = 5
2 if(x==0):
3     print("The number x is zero.")
4 if(x != 0 and x>=0):
5     print("The number x is non-zero and positive.")
6 if(x>0):
7     print("In fact, the number x is STRICTLY positive.")
8 if(x != 0 and x<=0):
9     print(("The number x is non-zero and negative. "))
10 if(x<0):
11     print("In fact, the number x is STRICTLY negative.")
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The number x is non-zero and positive.

In fact, the number x is STRICTLY positive.

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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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 **magicians 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.

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- Once we are done executing the code in **while**, move back to the while statement, and repeat until the condition is no longer True.

```
1  # Counting from 1 to 10
2  x = 0
3  print("Counting from 1 to 10...")
4  while(x<10):
5      x = x + 1
6      print(x)
7  print("Done!")
```

Counting from 1 to 10...

1

2

3

4

5

6

7

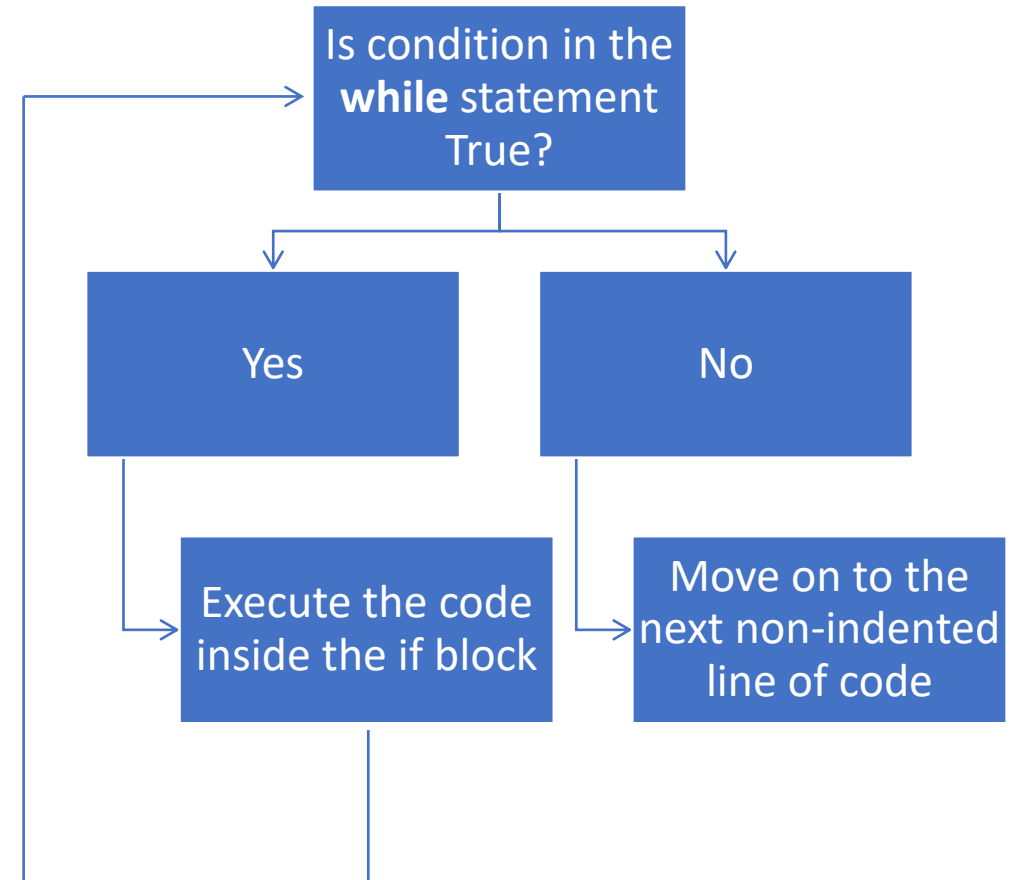
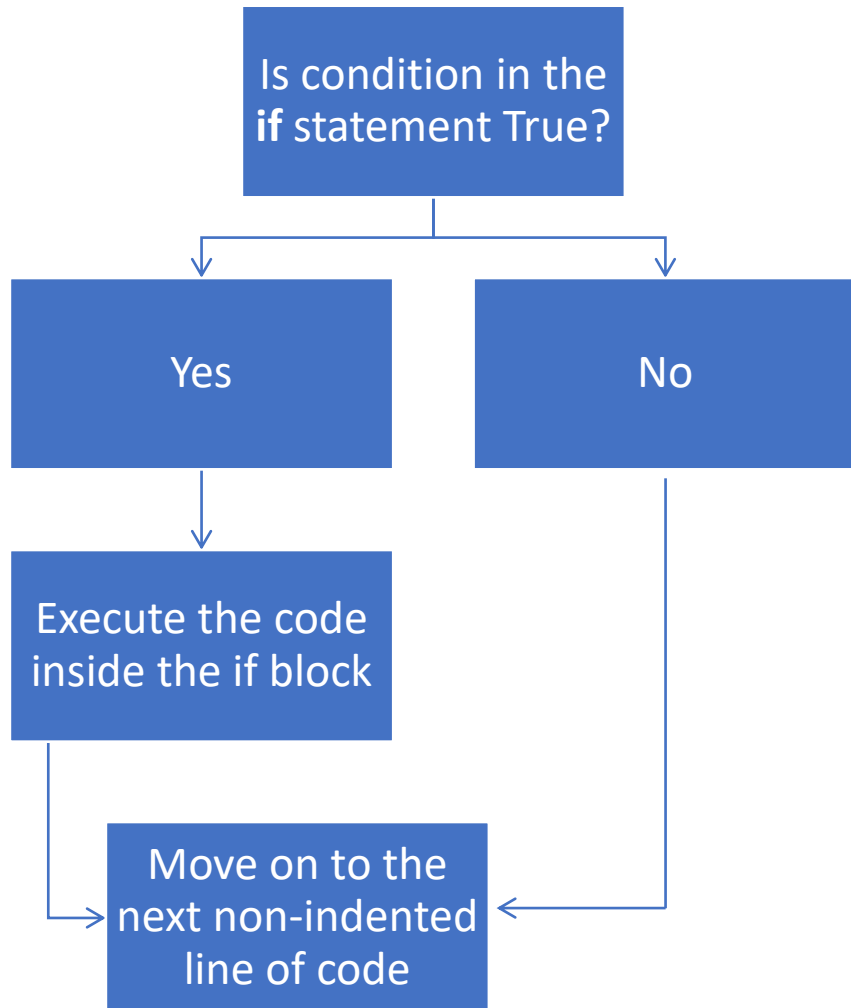
8

9

10

Done !

Architectures: **if** vs. **while**



Infinite loops

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3  print("Counting from 1 to 10...")
4  while(x<10):
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```

Counting from 1 to 10...

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2
3
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5
6
7
8
9
10
Done !

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**.

```
In [4]: 1 # Counting from 1 to infinity
        2 x = 0
        3 while(x>=0):
        4     x = x + 1
        5     print(x)
        6 print("Done!")
```

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Infinite loops and how to kill them

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This is called a **keyboard interrupt**. It is done with **CTRL+C** (or **CMD+C** on mac), in console mode and most IDEs.

```
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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Or, by using the **stop button** on Jupyter.

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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**, **before coding**, greatly helps figuring out the right structure for your code.

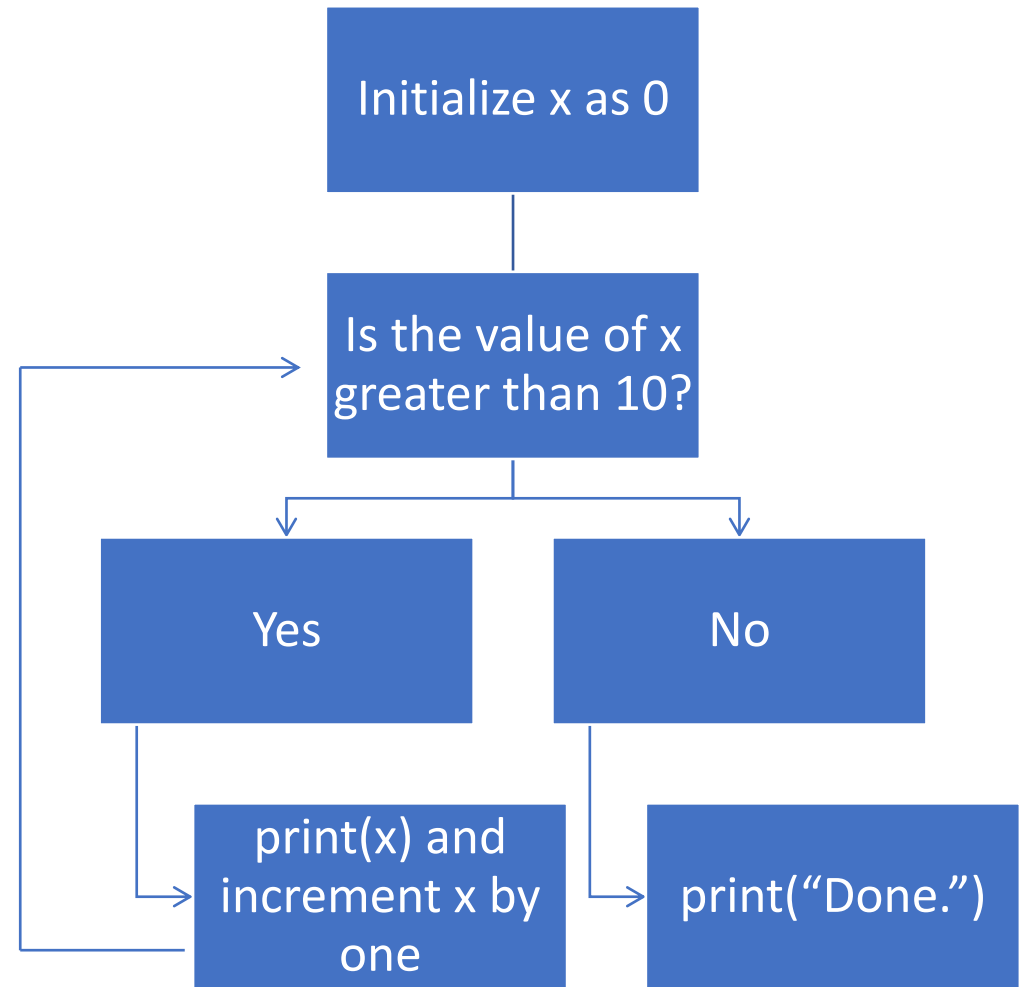


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Example: diagram for our while loop, counting from 1 to 10.

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Infinite loops will keep on executing forever, unless

1. You decide to crash the program on purpose and kill the loop manually.

Infinite loops: the **break** statement

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

Infinite loops: the **break** statement

Infinite loops will keep on executing forever, unless

2. You use a **break** statement.

When encountered, the **break** statement will immediately end the current **while** loop.

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

```
1 # Counting from 1 to 10, with a break
2 x = 0
3 while(True):
4     x = x + 1
5     print(x)
6     # If x has reached the value 10, break the while loop
7     if(x>=10):
8         break
9         # Careful!
10        print("This is DEAD CODE, because the break is reached before.")
11 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.

```
1  # Counting from 1 to 10
2  x = 0
3  print("Counting from 1 to 10...")
4  while(x<10):
5      x = x + 1
6      print(x)
7  print("Done!")
```

2. Infinite **while** loop with condition in an **if** statement, and **break** in the **if** block.

```
1  # Counting from 1 to 10, with a break
2  x = 0
3  while(True):
4      x = x + 1
5      print(x)
6      # If x has reached the value 10,
7      # break the while loop
8      if(x>=10):
9          break
10 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.



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.

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

```
1  # Counting from 1 to 10, with a break
2  x = 0
3  while(True):
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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.

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

```
1 while(True):  
2     print("All systems normal.")  
3     print("Running operations as expected.")  
4     if(overheating):  
5         print("Overheating detected.")  
6         print("Engaging emergency shutdown.")  
7         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 ***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 below zero, you fail the challenge.**

- Assuming you survive ***n*** hits, your mentor will give you ***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** "You 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 loops 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!