



Week 4 Agenda

Week 4 If Statements and Indentation requirements

Chapter 5 in Python Crash Course: A Hands-on, Project-Based Introduction to Programming

Conditional Statements

Programming often involves examining a set of conditions and deciding which action to take based on those conditions. Python's `if` statement allows you to examine the current state of a program and respond appropriately to that state.

If Statements are Everywhere!

The Traffic Light: An Everyday IF Statement



IF light is **red**, THEN stop!

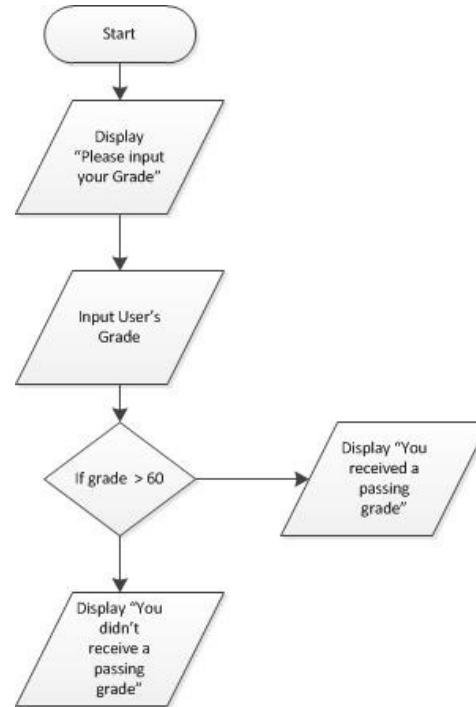
IF light is **yellow**, THEN what???

IF light is **green**, THEN go!

Example

Flowcharts are an effective way to visually show the program flow when if statements are used. In the flowchart example on the left we have an `if` statement represented by the diamond shape.

In this example we evaluate whether or not the grade input by the user is over 60. If the result of the comparison is true we display “You received a passing grade”, if it is false, we display “You didn’t receive a passing grade”.





If Statement Syntax

```
if <Boolean expression>: # notice the colon at the end of the line
    <indented block of code> # any number of indented lines
```

Example:

```
if grade > 60:
    print("You received a passing grade")
```



Else Statement

It is likely that we will want the program to do something even when an if statement evaluates to false. In our grade example, we will want output whether the grade is passing or failing.

To do this, we will add an else statement to the grade condition above that is constructed like this:

```
grade = input("Please input your Grade: ")

if grade > 60:
    print("You received a passing grade")
else:
    print("You didn't receive a passing grade")
```



Else If Statement

In many cases, we will want a program that evaluates more than two possible outcomes. For this, we will use an `else if` statement, which is written in Python as `elif`. The `elif` or `else if` statement looks like the `if` statement and will evaluate another condition.

```
balance = input("Please enter your balance")

if balance < 0:
    print("Balance is below 0, add funds now or you will be charged a penalty.")
elif balance == 0:
    print("Balance is equal to 0, add funds soon.")
else:
    print("Your balance is 0 or above.")
```

Comparison Operators

There are multiple comparison operators which can be used in Python if statements:

Operator	Meaning	Example
<code>==</code>	equals	<code>if a == b:</code>
<code>!=</code>	not equals	<code>if a != b:</code>
<code><</code>	less than	<code>if a < b:</code>
<code>></code>	greater than	<code>if a > b:</code>
<code><=</code>	less than or equal to	<code>if a <= b:</code>
<code>>=</code>	great than or equal to	<code>if a >= b:</code>

Nested If Statement

When a Boolean expression in an if statement evaluates to True, then the indented block of code runs. But the indented block of code can contain another if statement. And if the Boolean expression in an indented if statement also evaluates to True, then the indented code block associated with that if statement will run; for example:

```
# Purchases at a gas station
totalGasPurchase = priceOfGas * nGallons
amountLeftOver = startingAmountOfMoney - totalGasPurchase

# See if we have enough money to buy a Powerball lottery ticket
if amountLeftOver > 2:
    feeling = evaluateEmotions()
    if feeling == 'lucky':
        buyPowerballTicket()
        amountLeftOver = amountLeftOver - 2
```

Example Program Using Nested If Statements

```
priceOfGas = input('Please enter the price of gas: ')
nGallons = input('Please enter the number of gallons purchased: ')
startingAmountOfMoney = input('How much money do you have in your pocket: ')
# Purchases at a gas station
totalGasPurchase = float(priceOfGas) * float(nGallons)
amountLeftOver = float(startingAmountOfMoney) - totalGasPurchase
# See if we have enough money to buy a Powerball lottery ticket
print ('The total gas purchase is ', round(totalGasPurchase, 2))
print ('Your change is ', round(amountLeftOver, 2))
if (amountLeftOver >= 25):
    print ('We have a bunch of money left over!!!')
    dinner = input('Should we go out to dinner? Enter Y for Yes and N for No: ')
    print(dinner)
    if (dinner == 'Y' or dinner =='y'):
        restaurantChoice = input('Where do you want to eat? ')
        print ('Heading to: ', restaurantChoice)
    else:
        print ('Heading home.')
else:
    print ('Looks like we should save some money and go home!')
```



Indentation

In many programming languages indentation doesn't matter because a block of code is typically encapsulated within brackets {}. In Python however, it is important that blocks of code be indented the same number of spaces. If a particular line of code within a block doesn't have the appropriate spacing the following error will be given. In this case you'll need to check the indentation of the lines of code surrounding the error:

```
C:\CIS245>python nestedif.py
  File "nestedif.py", line 14
    if (dinner == 'Y' or dinner =='y'):
                           ^
TabError: inconsistent use of tabs and spaces in indentation
```

To resolve issues such as above you must check that the indentation within the If statement block of code is consistent. Many modern IDEs have tools to help with locating and resolving these issues.



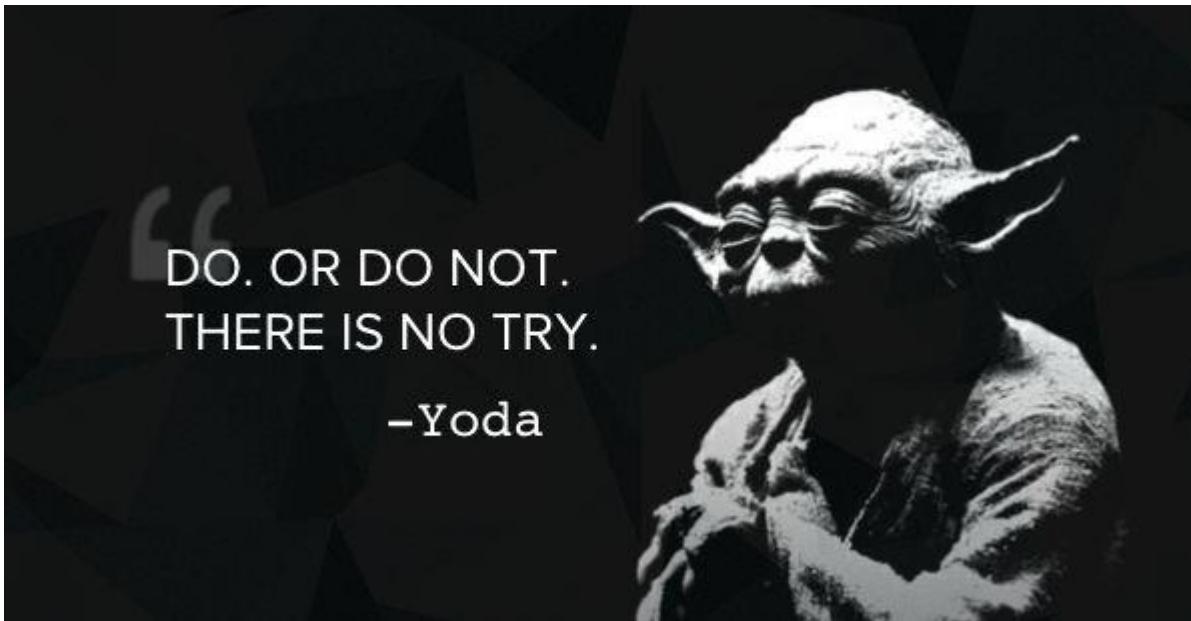
Python Exception Handling

In programming we typically encounter two types of issues with our code; syntax errors and exceptions. Syntax errors prevent the execution of the program until they're corrected and occur when the rules of the Python language are not followed. An example of a syntax error would be excluding the ":" after the first line of an **If Statement** such as:

```
if (amountLeftOver >= 25) #notice we're missing the :
```

Exceptions are created during the execution of a program and although don't necessarily stop the program from running can cause unexpected behavior. The good thing about most programming languages including Python is that we have the ability to handle exceptions without our programs.

Except in Programming...





Try Except

- In Python we have the ability to use a Try Except block to catch exceptions in our programs.
- The try statement works as follows:
 - *First, the try clause (the statement(s) between the try and except keywords) is executed.*
 - *If no exception occurs, the except clause is skipped and execution of the try statement is finished.*
 - *If an exception occurs during execution of the try clause, the rest of the clause is skipped. Then if its type matches the exception named after the except keyword, the except clause is executed, and then execution continues after the [try](#) statement.*
 - *If an exception occurs which does not match the exception named in the except clause, it is passed on to outer [try](#) statements; if no handler is found, it is an unhandled exception and execution stops with a message as shown above.*
 - *A try statement may have more than one except clause, to specify handlers for different exceptions. At most one handler will be executed. Handlers only handle exceptions that occur in the corresponding try clause, not in other handlers of the same try statement.*



Try Except Syntax

```
try:  
    <statement(s) that may cause an error>  
except:  
    <statement(s) to execute IF an error occurs>  
else:    #optional, often not needed  
    <statement(s) to execute if NO error occurs>
```



Try/Except Example

```
# Check for potential error
# if the userInput isn't an Integer, catch the exception and print a message

userInput = input('Please enter an integer: ')
try:
    userInput = int(userInput)
except:
    print 'The number you entered was not an integer'
    # Code here to alter execution because we do not want to keep going
```

Cyclomatic Complexity

Cyclomatic complexity is a software metric used to measure the complexity of a program. This metric measures independent paths through program source code.

Independent path is defined as a path that has at least one edge which has not been traversed before in any other paths.

Cyclomatic complexity can be calculated with respect to functions, modules, methods or classes within a program.

This metric was developed by Thomas J. McCabe in 1976 and it is based on a control flow representation of the program. Control flow depicts a program as a graph which consists of Nodes and Edges.

In programming things such as multiple embedded if statements can lead to Cyclomatic complexity. An increased Cyclomatic complexity leads to degraded efficiency of the application as well as making the program more difficult to read. When designing a program especially if statements we need to ensure that our program isn't becoming too complex.



References

The Basics of Compiled Languages, Interpreted Languages, and Just-in-Time Compilers,

<https://www.upwork.com/hiring/development/the-basics-of-compiled-languages-interpreted-languages-and-just-in-time-compilers/>



The End

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