Python 2 – Conditionals and loops

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CS111
Yesterday's Lecture

Input and Output
user_input_as_str = input('Prompt: ')
print('Hello. You entered: ' + user_input_as_str)

Comments
# everything to the right of the # is ignored
print('hi') # this is ignored

Data types (and conversion functions)
Strings, integers and floats
str(), int(), and float()

Assigning values to variables and
(Overloaded) Operators -- *, **, %, +, /, //
x = x * 2  # <-- this puts the number 4 in x
y = 'y' * 2  # <-- this puts the string 'yy' in y

# get input from user
feet = int(input("Enter feet: "))

# convert to metres
feet_to_metres = 0.3048
metres = feet * feet_to_metres

# print output
print(str(feet) + " ft. equals " + str(metres) + " m."
Printing multiple things out

**Concatenate**

```python
print(str(feet)+" feet is equal to "+str(metres)+" metres.")
```

**Or use commas**

```python
print(feet," feet is equal to ",metres," metres.")
```
Today’s lecture

conditional statements
conditional execution. "If something is the case, then run these statements, otherwise, run those statements."

loops
repeated execution. "Run this sequence of statements again and again until XXX."

Reminder: Please get a pencil / pen and paper (or a laptop) out, so you can work through some exercises.
Conditional Statements

If...
IF statement

Conditional activity (ie. ‘if this then do that’) is an important part of many programs.

The if statement lets you introduce conditional activity into your program.

Statements that are executed when if is true must be tabbed underneath the if statement.

In python, white space is important! Incorrect whitespace can cause syntax errors.

Syntax

```python
if [logical condition]:
    [lines of code here]
else:
    [lines of code here]
```
# Comparison operators

The following will evaluate to true or false:

<table>
<thead>
<tr>
<th>Meaning</th>
<th>Operator</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than</td>
<td>&lt;</td>
<td>a &lt; b</td>
</tr>
<tr>
<td>Less than or equal to</td>
<td>&lt;=</td>
<td>a &lt;= b</td>
</tr>
<tr>
<td>Greater than</td>
<td>&gt;</td>
<td>a &gt; b</td>
</tr>
<tr>
<td>Greater than or equal to</td>
<td>&gt;=</td>
<td>a &gt;= b</td>
</tr>
<tr>
<td>Equal to</td>
<td>==</td>
<td>a == b</td>
</tr>
<tr>
<td>Not equal to</td>
<td>!=</td>
<td>a != b</td>
</tr>
</tbody>
</table>
Logical operators

You can combine comparisons using the following operators:

**and**

If the test in `a and b` evaluate to true, then the logical condition will be true, eg:

```
if x > 1 and y < 2:
```

**or**

If `either a or b` evaluate to true, then the overall logical condition will be true, eg:

```
if x > 1 or y < 2:
```
Logical operators

**not**
Inverts True into False and False into True. eg:

```python
if not(x):
```
Exercise: Logical and Boolean Operators

[Program A]
print( 5 > 4 )

[Program B]
print( 5 == 4 )

[Program C]
print( 5 > 4 and False )

[Program D]
x = 0
print( x <= 5 and x >= 0 )

[Program E]
x = 5
print( x != 3 )

[Program F]
x = 4
print( x==0 or x==1 )
print( True or False )

[Program G]
print( not(x) or x )
print( not(x) and x )
IF statement example

Write a program that asks the user to enter a number between 1 and 10 (inclusive). The program will print out "Correct" if the number is in the range and "Incorrect" if the number is outside the range.

Example (user input is displayed in **bold**)

Enter a number (1-10): 34
Incorrect

Enter a number (1-10): 6
Correct
# get input from user, and put it in the variable called "number"
users_number = int( input("Enter a number (1-10): ") )

# print output depending on input
if users_number >= 1 and number <= 10:
    print("Correct")
else:
    print("Incorrect")
Exercise

Write a program that asks the user to enter a number. The program should determine if the number is odd or even, and print out an appropriate message.

Example (user input is displayed in **bold**)

Enter a number: **56**
You entered 56 which is even

Enter a number: **33**
You entered 33 which is odd
Hint

How do you check if a number is even?

What is an even number?
Hint

How do you check if a number is even?

What is an even number?

- It is a number that is divisible by 2.
- When you divide it by 2, there is nothing extra left over. There is no "remainder".
### Operators

<table>
<thead>
<tr>
<th>Operation</th>
<th>Symbol</th>
<th>Applied to integers</th>
<th>Applied to floating point numbers</th>
<th>Applied to strings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exponent</td>
<td>**</td>
<td>2 ** 3 = 8</td>
<td>2.0 ** 3.0 = 8.0</td>
<td>N/A (ERROR)</td>
</tr>
<tr>
<td>Multiply</td>
<td>*</td>
<td>2 * 2 = 4</td>
<td>2.0 * 2.0 = 4.0</td>
<td>“a” * 3 = “aaa”</td>
</tr>
<tr>
<td>Divide</td>
<td>/</td>
<td>10/3 = 3.333</td>
<td>10.0/3.0 = 3.333</td>
<td>N/A (ERROR)</td>
</tr>
<tr>
<td>Divide (integer)</td>
<td>//</td>
<td>10 // 3 = 3</td>
<td>10.0//3.0 = 3.0</td>
<td>N/A (ERROR)</td>
</tr>
<tr>
<td>Remainder</td>
<td>%</td>
<td>10 % 3 = 1</td>
<td>10.0 % 3.0 = 1.0</td>
<td>N/A (ERROR)</td>
</tr>
<tr>
<td>Add</td>
<td>+</td>
<td>8 + 9 = 17</td>
<td>8.0 + 9.0 = 17.0</td>
<td>“a” + “b” = “ab”</td>
</tr>
<tr>
<td>Subtract</td>
<td>-</td>
<td>9 - 7 = 2</td>
<td>9.0 - 7.0 = 2.0</td>
<td>N/A (ERROR)</td>
</tr>
</tbody>
</table>
# get input from user, and put it in the variable called "number"
users_number = int(input("Enter a number: "))

# print output, reporting on whether or not number is even
if (users_number % 2) == 0:
    print("You entered ", users_number, " which is even")
else:
    print("You entered ", users_number, " which is odd")
Loops

While...
Loops

Used to perform a sequence of statements repeatedly.

Statements that are executed when the "while’s condition" is True must be tabbed underneath the while statement

Syntax:
while [logical condition]:
    [statements that will repeatedly run while the condition is true...]
    [statements that run once the condition is no longer true]
Loops

Execute the sequence of statements in the block.

Is the condition true?

Yes

No

statements before the loop

statements after the loop
Example

Goal
Write a program to print the numbers from 1 to 5

WORK THROUGH LIVE
Example

Goal
Write a program to print the numbers from 1 to 5

Program
```python
current = 1
while current <= 5:
    print(current)
    current = current + 1
print("Finished!")
```

Output
```
1
2
3
4
5
Finished!
```
Exercise

What does these programs produce as output?

# Program A
x = 0
while x == 2 :
    print(x)
    x = x + 1

# Program B
x = 0
while x >= 0 :
    print(x)
    x = x + 1
Exercise

Write a program that repeatedly asks the user to enter a number between 1 and 10 (inclusive). When they do so, the program should print “Well done” on screen and end (i.e. stop asking the user to enter a number).

Example (user input is displayed in **bold**)

Enter a number between 1 and 10: **99**
Enter a number between 1 and 10: **-1**
Enter a number between 1 and 10: **10**
Well done
# get input from user, and put it in the variable called "number"
number = int(input("Enter a number between 1 and 10: "))

# keep asking for a number until it is in range
while number < 1 or number > 10:
    number = int(input("Enter a number between 1 and 10: "))
print("Well done")
Exercise

Write a program that repeatedly asks the user to enter a number. If the number is even, then “x is even” (where x is the number) should be printed on screen. If the number is odd, then “x is odd” should be printed on screen. The program must print “Thanks” and end when the user types ‘0’

Example (user input is displayed in **bold**)

Please enter a number: **45**
45 is odd
Please enter a number: **12**
12 is even
Please enter a number: **0**
Thanks
```python
user_input = int(input("Please enter a number: "))

# until the user input is 0....
while user_input != 0:
    # report on evenness of input
    if user_input % 2 == 0:
        print(user_input, "is even")
    else:
        print(user_input, "is odd")
    user_input = int(input("Please enter a number: "))

# the user's input was 0
print("Thanks")
```
Summary

**if statements**

allow you to introduce conditional activities into your program

```python
x = 10
if x == 5:
    print("x is equal to five.")
if x % 2 == 0:
    print("x is even")
```

**while loops**

allow you to repeat certain statements for as long as the logical condition evaluates to true

```python
x = 0
while x < 10:
    print(x)
    x = x + 1
```