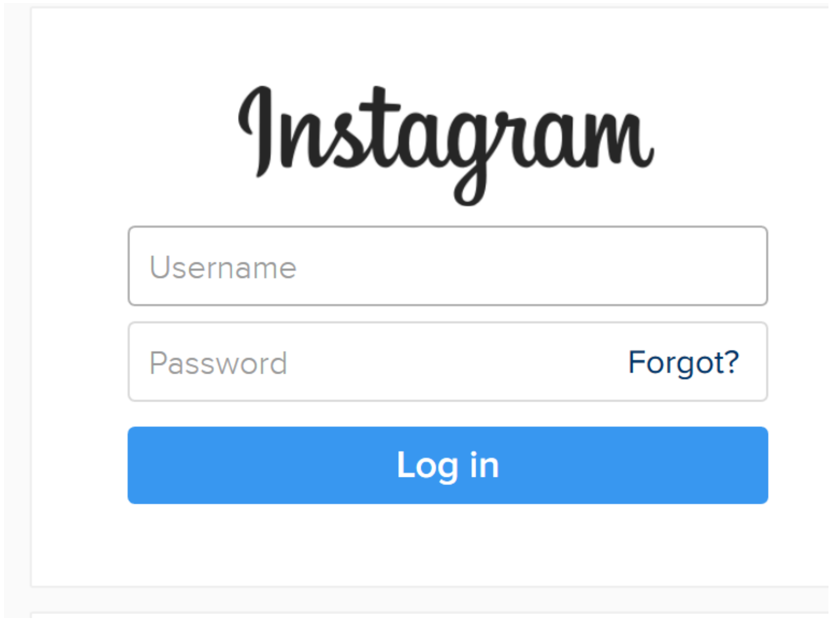
ITP 115 – Programming in Python

Branching

Consider Instagram Login



Correct Account Info

Email:	`ttrojan@usc.edu`
Password:	`traveler`

1. How do we check if the password is correct?
2. If the password is correct, what should we do? What if it is incorrect?

Program Flow

```
correctUserName = "ttrojan"
correctPassword = "traveler"


username = input("Please enter your name: ")
password = input("Please enter your password: ")


print("Welcome", username)
```

Program Flow

```
password = input("Please enter your password: ")

print("Welcome", username)
```

- But what if the password is incorrect?
  - We have no way to make *decisions* or change the *flow of control*

Flow of control

- The order a program performs actions
- Up to now our programs have been sequential
- **Branching statements** choose between 2 or more possible actions

Branching

- Fundamental part of computer programming
- Making a decision to take one path or another
- Use the `if` structure
- All `if` structures have a **condition**
  - Think of a **condition** like a "Yes or No" Question

The condition

```
if number > 1:
```

- Conditions evaluate to `True` or `False`
  - An expression that evaluates to `True` or `False` is a **boolean expression**
  - Operators that evaluate to `True` or `False` are called **boolean operators**

Syntax

- Place a colon `:` after the `condition:`
- Indent the lines underneath the `if` statement
- There is also an optional `else` *(more in a moment)*

```
if condition:
    statement1
```

```
if condition:
    statement1
else:
    statement2
```

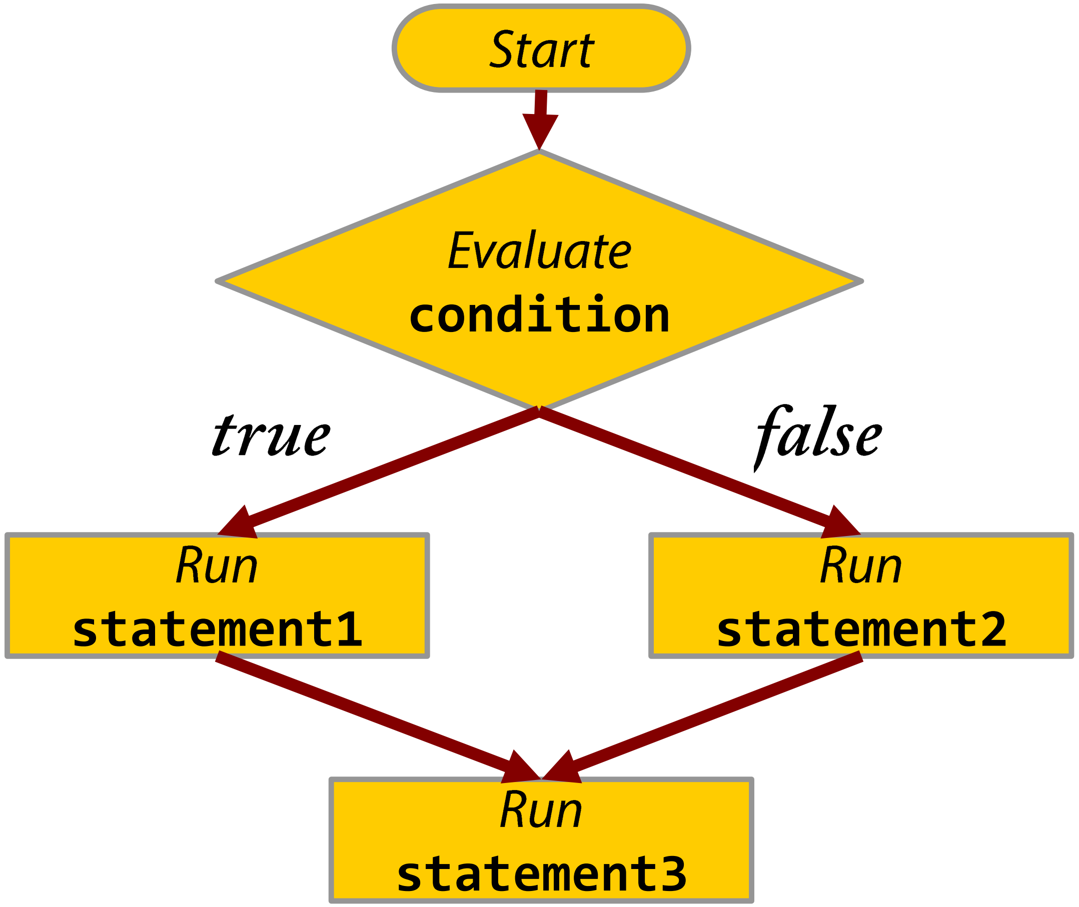
Examples

```
password = input("Enter your password: ")
if password == "secret":
   print("Access Granted")
else:
   print("Access Denied")
```

```
age = int(input("Enter your age: "))
if age >= 18:
   print("You can vote!")
else:
   print("Not yet")
```

Semantics of `if - else`

```
if condition:
   statement1

else:
   statement2

statement3
```



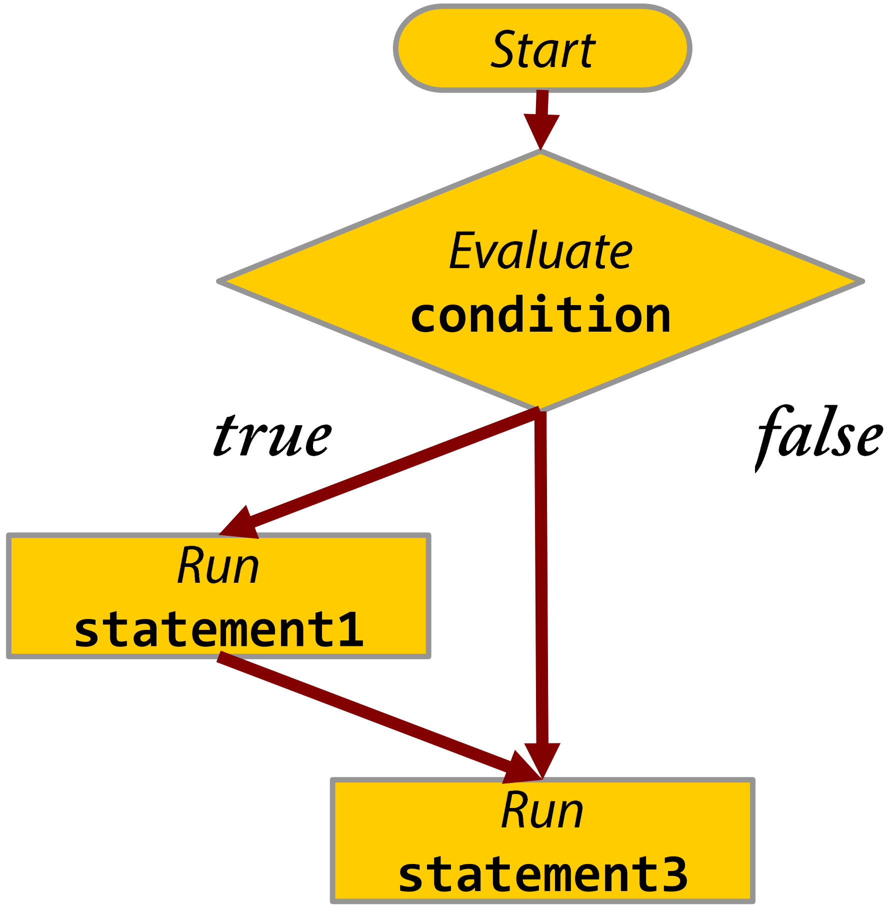
Semantics of `if - else`

```
if condition:
   statement1

else:
   statement2


statement3
```

- `statement1` happens if `condition` is **`true`**
- `statement2` happens if `condition` is **`false`**
- `statement3` is always executed afterwards
- `statement1` and `statement2` will never never execute

Skipping `else`

```
if condition:
   statement1


statement3
```



Question

- What if we want more than one statement to execute if a condition is true?

Create Blocks

- A **block** is one or more consecutive lines indented by the same amount

- Indenting sets lines off not only visually, but logically too
  - Together they form a single unit

- Indenting to create blocks is **<u>not optional</u>**
  - It's the only way to define a block

Block Example

```
favFood = input("Enter favorite food: ")
if favFood == "pizza":
   print("Your favorite food is pizza")
   favTopping = input("Enter favorite topping")
   if favTopping == "sausage":
      print("Your favorite topping is sausage")
      print("Me too")
  else:
      print("Your favorite topping is”, favTopping)
print("Have a great day!")
```

Block Example

```
favFood = input("Enter favorite food: ")
if favFood == "pizza":
   print("Your favorite food is pizza")
   favTopping = input("Enter favorite topping")
   if favTopping == "sausage":
      print("Your favorite topping is sausage")
      print("Me too")
  else:
     print("Your favorite topping is”, favTopping)
print("Have a great day!")
```

Every indented line in a block is grouped

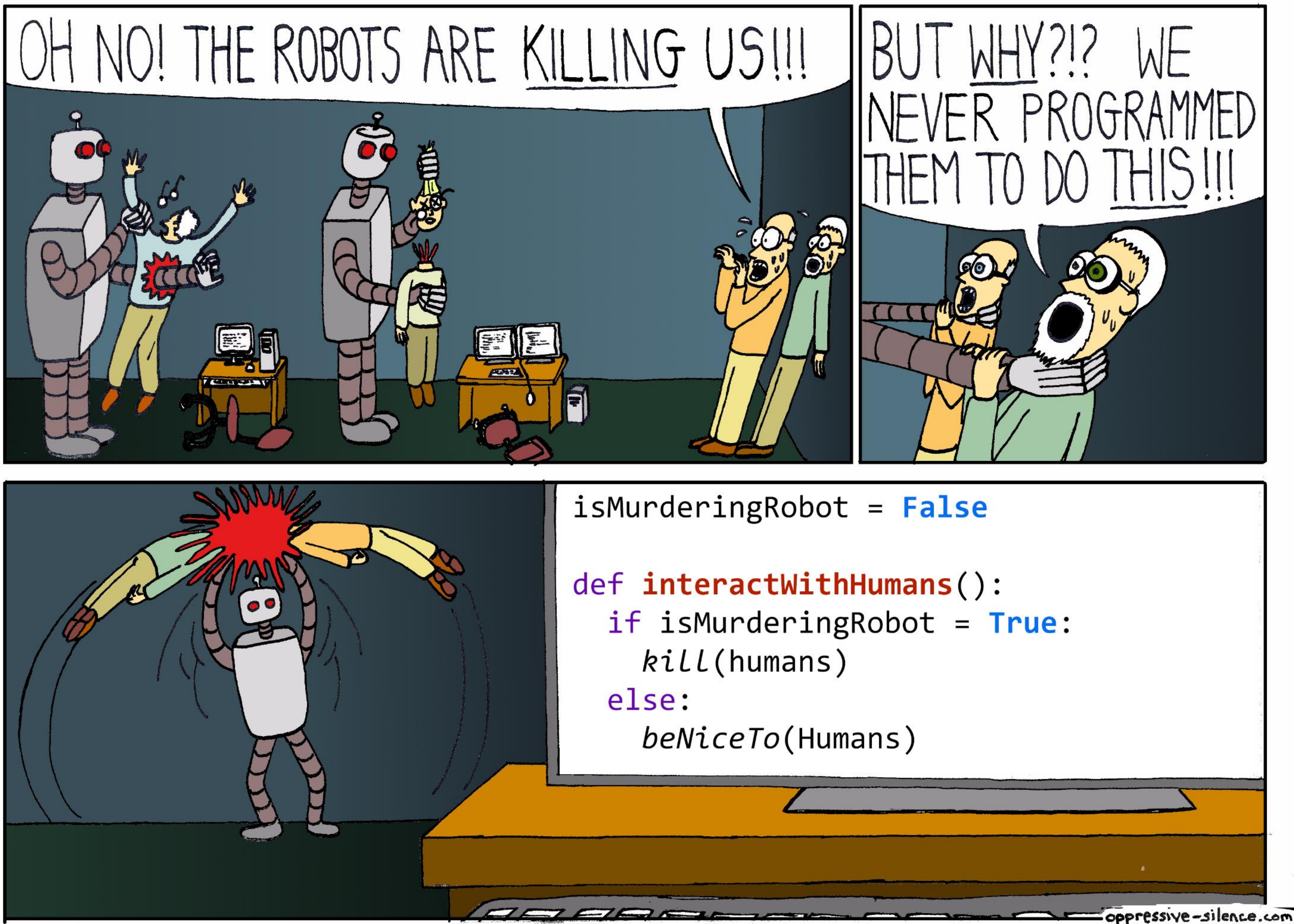
Comparison Operators

Operator	Meaning	Sample Condition	Evaluates To
`==`	equal to	`5 == 5`	`True`
`!=`	not equal to	`8 != 5`	`True`
`>`	greater than	`3 > 10`	`False`
`<`	less than	`5 < 8`	`True`
`>=`	greater than or equal to	`5 >= 10`	`False`
`<=`	less than or equal to	`5 <= 5`	`True`

If you compare strings, you get results based on alphabetical order

- *End lecture*

Review


OH NO! THE ROBOTS ARE KILLING US!!!
BUT WHY?!? WE NEVER PROGRAMMED THEM TO DO THIS!!!
oppressive-silence.com

```
isMurderingRobot = False

def interactWithHumans():
  if isMurderingRobot = True:
    kill(humans)
  else:
    beNiceTo(Humans)
```

Question

- What if we want to choose between more than 2 options?

Multibranch `if-elif` Statements

```
if condition1:
   statement1
elif condition2:
   statement2
elif condition3:
   statement3
…
else:
   defaultStatement
#some code after block
```

- Check `condition1`
  - If true, `statement1` happens **and** we leave this entire block
  - If false, check next condition
- Check `condition2`
  - If true, `statement2` happens **and** we leave this entire block
  - If false, check next condition

…

- If every condition was false, we go to **`else`** and `defaultStatement` happens

Example `if-elif` Statements

```
if score >= 90:
  grade = 'A'
elif score >= 80:
  grade = 'B'
elif score >= 70:
  grade = 'C'
elif score >= 60:
  grade = 'D'
else:
  grade = 'F'
```

What is the difference between these two?

```
if condition1:
  statement1
elif condition2:
  statement2
elif condition3:
  statement3
else:
  defaultStatement
```

```
if condition1:
  statement1
if condition2:
  statement2
if condition3:
  statement3
else:
  defaultStatement
```

Evaluating Any Value as `True` or `False`

- Any value in Python can be evaluated as either `True` or `False`
- So `2749`, `8.6`, `0`, `"banana"`, and `""` can each be evaluated as `True` or `False`
- It may seem bizarre, but this is valid in Python and can sometimes make for more elegant conditions

Rules for Evaluating Any Value as `True` or `False`

- Numbers
  - 0 and 0.0 are **`False`**
  - All other numbers positive and negative are **`True`**

- String
  - The empty string **`""`** is **`False`**
  - Everything else is **`True`**

- Other variables *(later in semester)*
  - Anything that is considered *empty* is **`False`**
  - Everything else is **`True`**

Testing for *empty* is very common

Treating Values as Conditions

```
mystery = "chicken"
if mystery:
    print("This is true")
```

```
This is true
```

Treating Values as Conditions

```
mystery = 0
if mystery:
    print("This is true")
else:
    print("This is false")
```

```
This is false
```

Understanding True and False

- What type of variable is **`x`**?
```
x = False
```
- What type of variable is **`y`**?
```
y = "False"
```
- Is the following considered **`True`** or **`False`**?
```
if x:
```
- Is the following considered **`True`** or **`False`**?
```
if y:
```

Question

- Simple conditions are comparisons where exactly 2 values are involved
- What if we want more complicated conditions?

Is this ball
red **AND** round?

Is this ball
red **AND** round?

Compound Conditions

- Logical operators

  `not` **`and`** **`or`**

- Combine simple conditions together with logical operators

- Logical operators combine 2 boolean expressions

- Using compound conditions, we can make decisions based on how multiple groups of values compare

Pick a number between 1 and 10...

and

- <u>Both</u> must be true
- Example:
  – Is your number greater than 5 **AND** less than 10?

or

- <u>Either</u> may be true
- Example:
  – Is your number 5 **OR** 10?

Syntax

and

`expression1 and expression2`

Both `expression1 and expression2` must be **`True`** for the whole to be **`True`**

or

`expression1 or expression2`

Either `expression1 or expression2` may be **`True`** for the whole to be **`True`**

Pick a number between 1 and 10...

and

- Is your number greater than 5 **AND** less than 10?

```
number > 5 and number < 10
```

or

- Is your number 5 **OR** 10?

```
number == 5 or number == 10
```

Syntax: `not`

- A boolean expression can be negated using the **`not`** operator

- Syntax

```
not condition
```

- Examples

```
not num >= 0
a or b and not a and b
```

Try Writing Expressions…

Pick a number between 1 and 10…

- Is your number between 3 and 7?
- Is your number smaller than 5?
- Is your number odd?

Try Writing Expressions…

Pick a number between 1 and 10…

- Is your number between 3 and 7?

```
    number > 3 and number < 7
```

- Is your number smaller than 5?

```
    number < 5
```

- Is your number odd?

```
    ((number % 2) == 1)
    ((number % 2) != 0)
    not ((number % 2) != 1)
```

Parentheses added for ease of reading

Truth Table

A	B	A and B	A or B	not A
True	True	True	True	False
True	False	False	True	False
False	True	False	True	True
False	False	False	False	True

Importing Modules

- Modules are files that contain code meant to be used in other programs
- Python comes in many built-in modules
- We can use a module in our program by using the **import** command
- Syntax: `import moduleName`

Example

```
# Miles Morales
# ITP 115
# Assignment 5

import someModuleName

name = input("Enter your name: ")
...
```

Place all **import** commands right beneath the comment header with your name

Accessing Functions inside Modules

- Most modules will have functions (commands)
- We use these functions just like `print` and `input` with one difference
- To access a function inside a module, you must use the module name
- Syntax

```
moduleName.functionName()
```

Random Module

- Has useful functions to generate random numbers and produce random results
- **`randrange(…)`** is a function which produces a random integer
- Given an integer input, **`randrange(…)`** will select a random number going from **0** up to that integer

Example: `randrange`

```
num = random.randrange(6)
```

– The variable num will store an integer randomly selected from a group of 6 numbers starting at 0

```
0, 1, 2, 3, 4, 5
```

```
num = random.randrange(21)
```

– The variable num will store an integer randomly selected from a group of 21 numbers starting at 0

```
0, 1, 2, 3, 4, 5, ... 18, 19, 20
```

Different Ranges

- What if you want numbers from 1-6, not 0-5?
- **<u>Shift the range!</u>**

```
random.randrange(6) + 1
```

- Why does this work?

Math Module

- The `math` module contains basic mathematical functions

- Examples

```
math.sqrt(...)
math.tanh(...)
math.sin(...)
```