Discrete Structures: CMPSC 102

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Week 2

About Python

- `www.python.org`
- Download python3 if you are using your own hardware

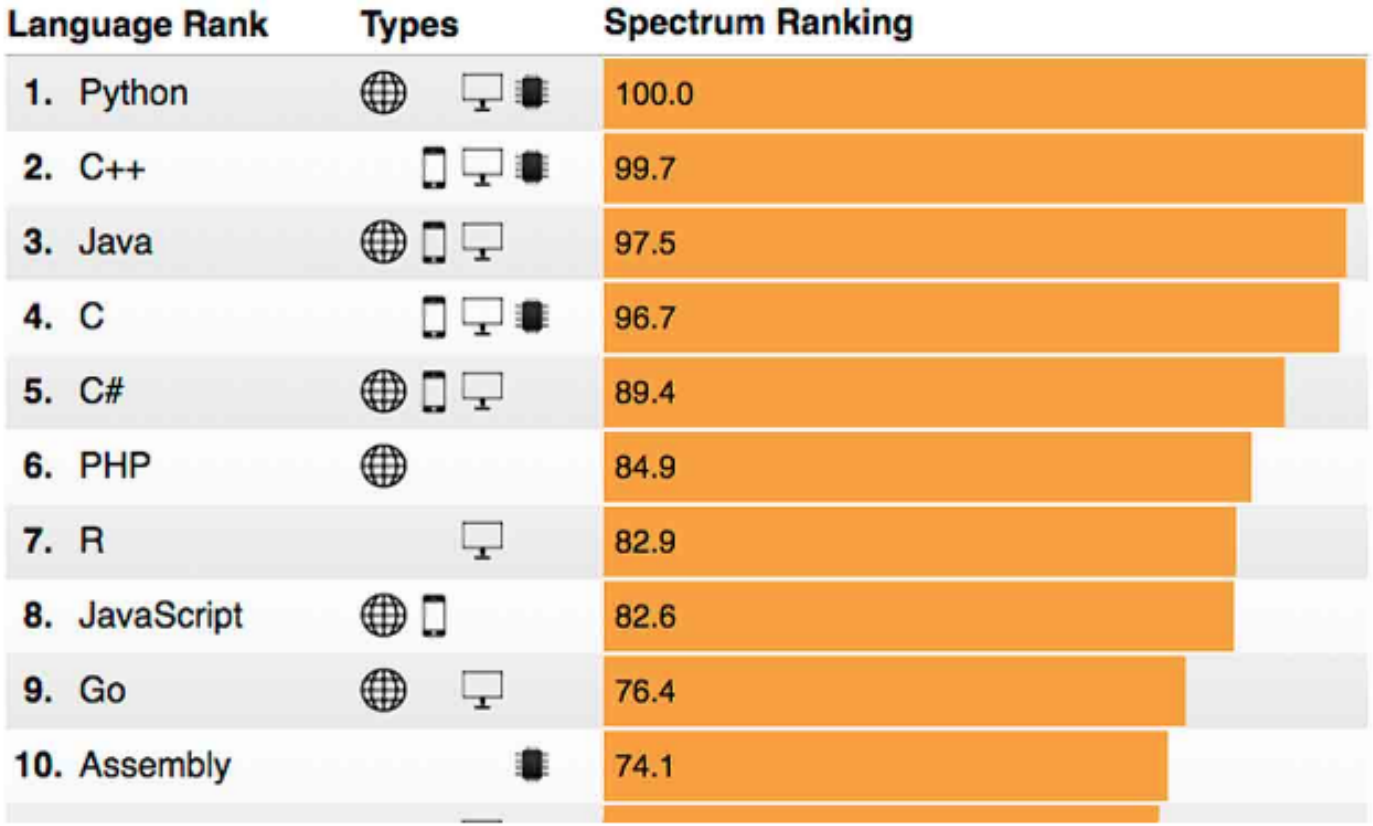
About Python...

- Is an interpreted, object-oriented, high-level programming language with dynamic semantics.
- Excellent for Rapid Application Development thanks to Its high-level built in data structures, combined with dynamic typing and dynamic binding
- A scripting language for tool-making or automation
- Used for *quick and dirty* solutions, quick automation, or to connect existing components together from other languages.

About Python...

- Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance.
- Python supports modules and packages, which encourages program modularity and code reuse.
- The Python interpreter and the extensive standard library are open source and freely available in all major platforms

The 2018 Top Programming Languages



Language Rank	Types	Spectrum Ranking
1. Python		100.0
2. C++		99.7
3. Java		97.5
4. C		96.7
5. C#		89.4
6. PHP		84.9
7. R		82.9
8. JavaScript		82.6
9. Go		76.4
10. Assembly		74.1

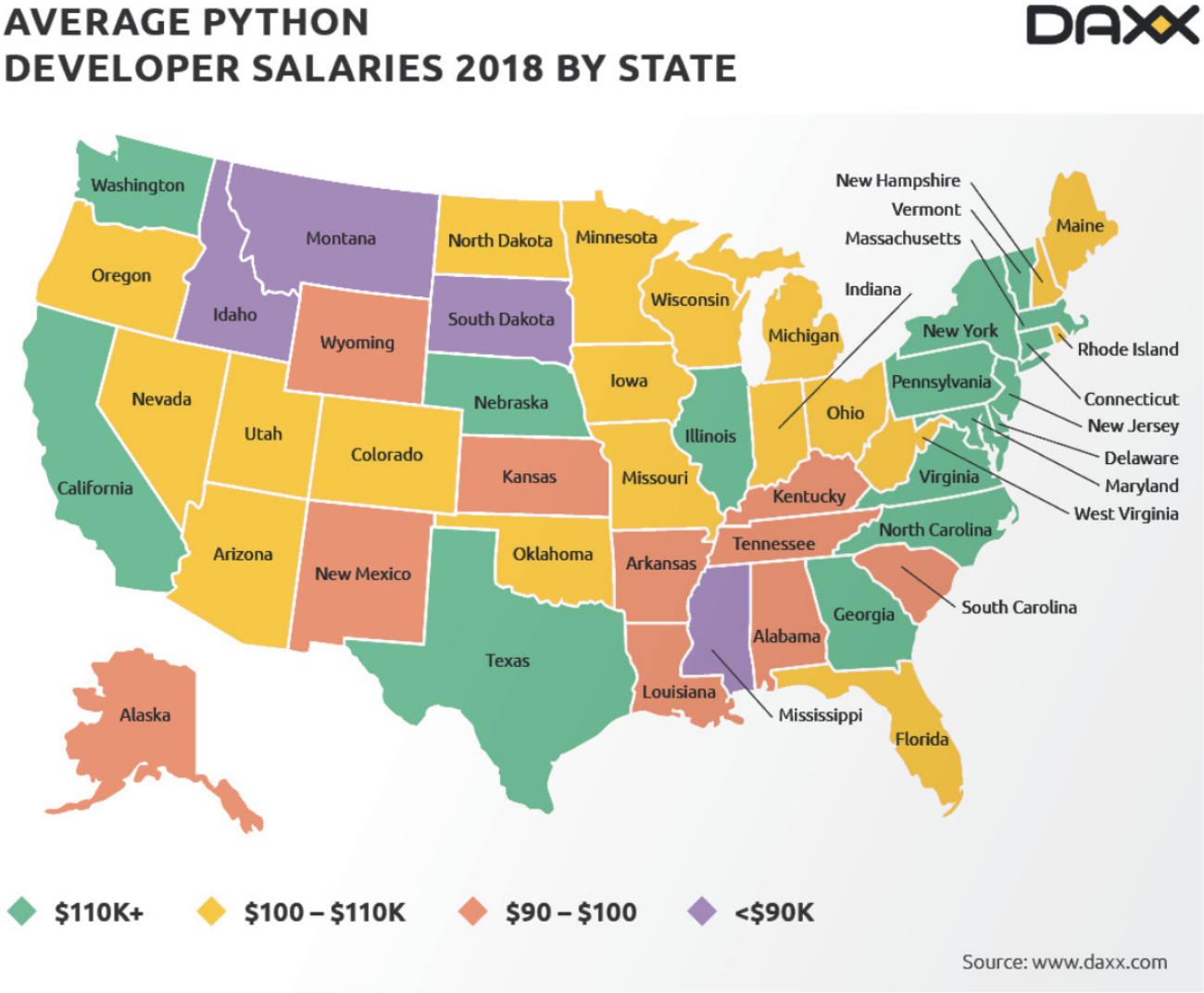
https://spectrum.ieee.org/at-work/innovation/the-2018-top-programming-languages

The 2018 Top Programming Languages

Most wanted programming languages 2018

https://www.daxx.com/article/python-developer-salary-usa

US High-Paying Python Development Jobs



https://www.daxx.com/article/python-developer-salary-usa

Average Salaries in Programming

Skill	Average salaries	Monthly jobs advertised
Python	US$116,379	6,550
Ruby	US$115,005	1,080
Java	US$112,592	10,443
Perl	US$111,928	1,398
C++	US$108,123	3,567
JavaScript	US$103,503	8,764
C#	US$101,715	4,101
PHP	US$94,690	1,664
ASP.NET	US$95,551	1,289
C	US$95,166	5,639

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Who Uses Python

Users of Python Programming

- Industrial Light and Magic (George Lucas to create the FX for Star Wars).
- Google
  - Googles very first web-crawling spider was first written in Java 1.0 and was so difficult that they rewrote it into Python.
- Facebook
  - Responsible for multiple services in infrastructure management
- Netflix
  - Used to power data analyses tasks from the server side
- Dropbox
  - Built its API in Python
- And others; Instagram, Spotify, Quora, Reddit

Where can i learn more about the language?

Free online resources

- Think Python First Edition, by Allen B. Downey
  - `http://greenteapress.com/wp/think-python/`
- A Collection of Tutorials
  - `https://wiki.python.org/moin/BeginnersGuide/Programmers`
- Interactive Python Tutorial
  - `https://www.learnpython.org/`
- Host, run, and code Python in the cloud!
  - `https://www.pythonanywhere.com/`

Running the Shell

From your terminal window

```
python3
```

```
Python 3.6.1 (v3.6.1:69c0db5050, Mar 21 2017, 01:21:04)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "help", "copyright", "credits" or "license" for
more information.
>>>
```

- Depending on where you run this, you may have a slightly different version number.

Running the Python3 Shell

- Type statements or expressions at prompt:
- print("Hello, world")
- x = 12**2
- print(x)
- print(x/2)
- # bla bla bla...
  - (this is a comment: everything after the # is ignored)

Data types

Note: Use identifiers to help you remember the types!

- Integers, counting numbers
  - num_int = 1
- Floats, decimals
  - num_float = 3.1415
- Strings
  - s_str = " Hello World"

Combining variables in print statements

```
x_int = 1
print(" The integer variable is :", x_int)

num_float = 3.14
print(" The float variable is :", num_float)

s_str =("Hello World'')
print(" The integer is equal to", s_str)
```

Mathematical Operators

Mathematical Operators

- $3 + 4$ # Addition
- $3 - 4$ # Subtraction
- $3 * 4$ # Multiplication
- $3/4$ # Division ($\frac{3}{4}$)
- $3\%4$ # Modulus; Returns the remainder from the division
- $3 * *4$ # Powers; raise three to the power of four

  $= 3 * 3 * 3 * 3$

  $= 3^4$

  $=$ pow(3,4)

Strings

Examples of working with strings

```
"hello"+"world"  # concatenation
"hello"*3  #repetition
"hello"[0] # indexing
"hello"[-1] # indexing from end
"hello"[1:4] # slicing out a subsequence
len("hello") # determine how many characters, size
"hello" < "jello" # comparison of ABC order
"e" in "hello" # True, "e" is found in the string

# General rule:
    single quotes and double quotes are the same
    'abc' == "abc"
```

Working with strings

Characters at the front

```
line = "python programming is fun"
line.startswith("python") # True
line.startswith(" python") # False. Why is this?
```

Conditionals: If statements

An `if` statement is a programming conditional statement that, if proved true, performs a specific function or task. If the condition is false, then another procedure is performed instead.

```
num_int = 5 #  Assignment of 5 to variable "num_int"
if num_int == 3: # condition to check
  print("  True")  # condition is true
else: # condition is not true
  print("  False") # num_int, is NOT equal to 3


#make a compressed conditional statement,
# no "else" statement necessary
num_int = 4
if num_int == 4: print("True")
```

If statements


```
name_str = "Bill"
if name_str == "Bill":
  print("Hello Bill!")
else:
  print("You are not Bill.")
  # Place the name in a string to print
  print("Your name is :",name_str)
```

For statements

A `for` loop is a statement in programming that performs predefined tasks while or until a predetermined condition is met.

```
# counter program
for i_int in range(10):
  print("  Count is:" ,i_int)
  # Note: you could add some conditional
  # if-statement here to check the value of i_int.

# Iterate through the string's chars
s_str = "hello world"
for i_int in s_str:
  print(i_int)
  # Note: you could add an if-statement here
```

For statements


```
# Remember each char of a string has own position

s_str = "ABC"
s_str[0] = 'A'
s_str[1] = 'B'
s_str[2] = 'C'
s_str[200] = ??


# Another way to iterate
# through a string using its length

for i_int in range(len(s_str)):
  print(s_str[i_int])
```

Conditional Statements

Watch for the white space in the code!


```
if condition :          |       if a > b:
   statements           |          print("I'll take a")
else:                   |       else:
   statements           |          print("I'll take b")
```

Conditional Statements

Watch for the white space in the code!


```
if testScore > medianScore:
  print("Above average.")
else:
  if testScore == medianScore:
    print("Average.")
  else:
    print("Below average.")
```

Find a Single Variable in a File

Watch out! Python uses white spaces (spaces and tabs) to define its blocks of code.

Make a source code: `vim nameReader.py`

```
file = open("names.txt")
for line in file:
    print("  Reading this line: ",line)
    if line.startswith("James"):
        print("** Found the name: ",line)
```

Make a textfile: `vim names.txt`

```
Jane smyth
Betty Davis
John smith
Buffalo Bill
James Bond
```

Find Two Variables in File

Make a source code: vim findEmail.py

```
file = open("emails.txt")
for line in file:
    name, email = line.split(",")
    if name == "James Bond":
        print("  ** Found email: ",email)
```

Make a textfile: vim emails.txt

```
Jane smyth,smythj$ac.edu
Betty Davis,davisb@ac.edu
John smith,smithj@mum.com
Buffalo Bill,buffalob@prairie.com
James Bond,bondj@magestySecrets.co.uk
```

Find the Summation of Numbers in a File

Make a source code: vim numberChecker.py

```
file = open("numbers.txt")
sum_int = 0 # defined outside of loop to be used inside and
for num in file:
    n_int = int(num) # convert string to integer
    print(" Reading this number: ",n_int)
    sum_int = sum_int + n_int
print("  ** The summation of the above number is :", sum_in
```

Make a textfile: vim numbers.txt

```
1
2
3
4
5
6
```