

COMP 9721: Introduction to Machine Learning

Review:

1. Machine Learning
2. Machine Learning sub-categories
3. Review of the application examples

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Exercises:

What kind of ML algorithm you would use for this problem:

A financial institute wants to build a ML model that predict stock market price for the next day,

Or

Predict electricity price for next day

What are the features?

What is the proper ML algorithm to solve this problem?



3

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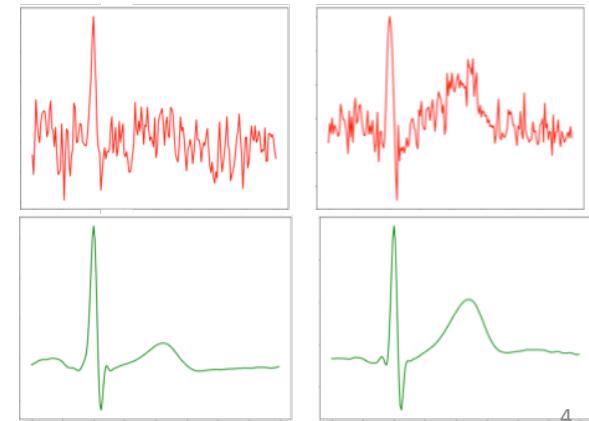
Exercises:

What kind of ML algorithm you would use for this problem:

A company that built medical device want to built an ML model that collect medical data like (heart rate, blood pressure...) and filter the noise,

What are the features?

What is the proper ML algorithm to solve this problem?



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Exercises:

What kind of ML algorithm you would use for this problem:

A company that built car engine, want to train a model to tell if anything is wrong with the engine or not, if yes, most likely what is the part that causes the problem?

What are the features?

What is the proper ML algorithm to solve this problem?

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Statistics



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Before getting into different type of ML algorithm, lets learn a little about features:

Feature (Or variable):

Is an individual measurable property or characteristic of a phenomenon being measured and observed.

Simply features are those properties of a problem based on which you would like to predict results. A variable is any characteristics, number, or quantity that can be measured or counted.

Like: Number of bedrooms in a house, age, amount of rain, grade in a course, date, color, province, score...

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Features and variable types (Data type):

- Numeric variables are those that have a measurable quantity as a number. Numeric variables are **quantitative variables**.

Examples?

Numeric variables are either continuous or discrete:

A continuous variable can take any value between a certain set of real numbers (between 0 and 1).

Examples?

A discrete variable can take a value based on a count from a set of distinct whole values.

Examples?

- Categorical variables have values that describe a 'quality' or 'characteristic' of a data unit. Therefore, categorical variables are **qualitative variables** and will be represented by a non-numeric value.

Categorical variables are ordinal or nominal:

An ordinal variable can take a value that can be logically ordered or ranked.

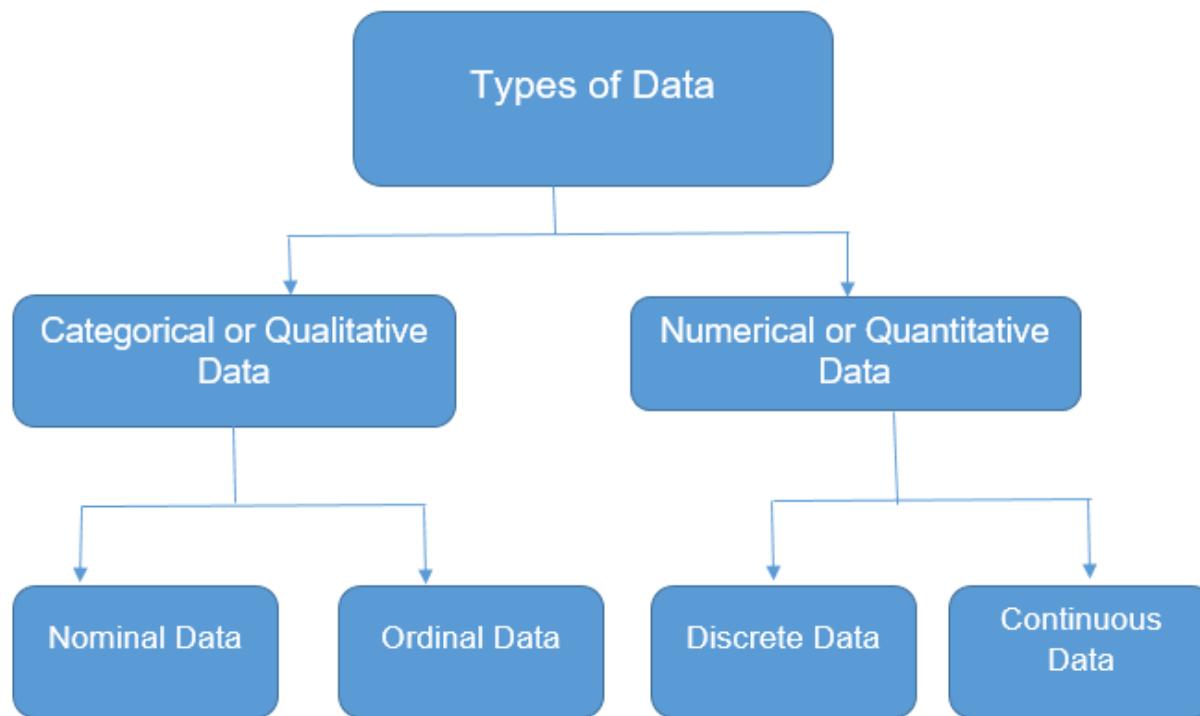
Examples: quality of a restaurant: poor, good, excellent, others?

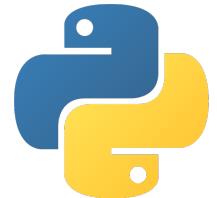
A nominal variable can take a value that is not able to be organised in a logical sequence.

Examples hair color, others?

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Data:





Programming Languages:

Main programming language in this program is Python (Not the snake!).

Created by Guido van Rossum in 1991.

www.python.org

It received a huge attention recently.

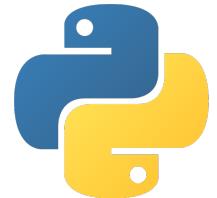
Python is slow:

1. It is a high level programming language, code is more understandable and it is similar to how humans thinks (You do less, computer do more).
2. It is dynamic, size and type of variables wont be declare at the beginning.

Pros:

1. It is productive and easy to understand. It requires less time, effort, and lines of code to perform the same task in other languages.
2. There are several packages and libraries that we can use. We will explore them in this course.





Installing Python:

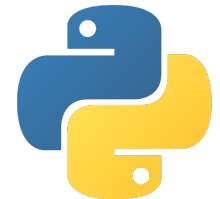
It is highly recommend to install Anaconda (Again not the snake!).

Anaconda is a open source platform for python and R languages. It can be downloaded from

<https://www.anaconda.com/distribution/>

With anaconda already comes with so many packages,

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Installation:

Make sure you are working on anaconda python, find out by executing:

→ which python

Create a new environment

→ conda create -n "env_name" python=3.7 anaconda

Activate the environment

→ source activate PY3_7

(deactivate by → source deactivate)

Numpy (v 1.17.3): conda install -c conda-forge numpy

Matplotlib (v 3.1.2): conda install -c conda-forge matplotlib

Scipy (v1.4.1): conda install -c conda-forge scipy

scikit-image (0.16.2): conda install -c conda-forge scikit-image

scikit-learn (0.22.1): conda install -c conda-forge scikit-learn

pandas (0.25.3): conda install -c conda-forge pandas

pillow 7.0.0): conda install -c conda-forge pillow

imutils 0.5.3): conda install -c conda-forge imutils

keras 2.3.1): conda install -c conda-forge keras

tensorflow 2.0.0): conda install -c anaconda tensorflow

OR: tensorflow 1.13.2): conda install -c conda-forge tensorflow

opencv 4.2.0): conda install -c conda-forge opencv

Note: for slow ipython Kernel, just downgrade the ipython kernel:

conda install ipykernel=4.10.0

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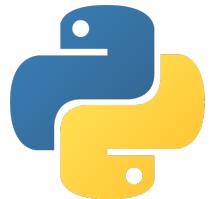


Python Practice:

Good Programming Habits (apply to any programming languages):

1. Well comment your code, put as much details and descriptions as possible,
2. Choose variables names that make sense! Meaningful names! (don't use names that are very similar for different variables, like "my_string" and "my_striing")
3. Program simply,
4. Use Version Control and properly structure your repository,
5. Follow the DRY Principle ("Don't Repeat Yourself"),
6. Limit line length, I usually use 80,
7. Have nice file and folder structure,
8. Follow proper indents, make it much easier to follow your code,
9. Avoid deep nesting
10. Use general/universal variables at the beginning of your code, then use that variable throughout instead of using numbers,
11. In your names use "_" but not other punctuations (will get error for most of them anyways!)
12. Take care of warnings if possible, although it won't stop you from running.
13. More to discuss later...

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Python:

Anaconda website

Anaconda navigator and Spyder environments

Import libraries

Variable explorer

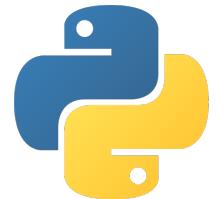
Set up working directory

Line and column number

Permission

Different Python Environment and Access python interpreter

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Pp: Python practice

"Hello World" example

Indentation

Comments

Warnings

Short keys for comments and indents

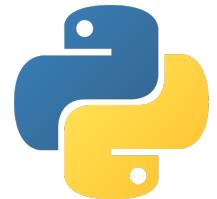
Python is case sensitive

Operations and their orders

Orange and yellow little bars on the right hand side

Save/open code

Save/Load data



Python:

Data type:

Primitive data structures:

Strings

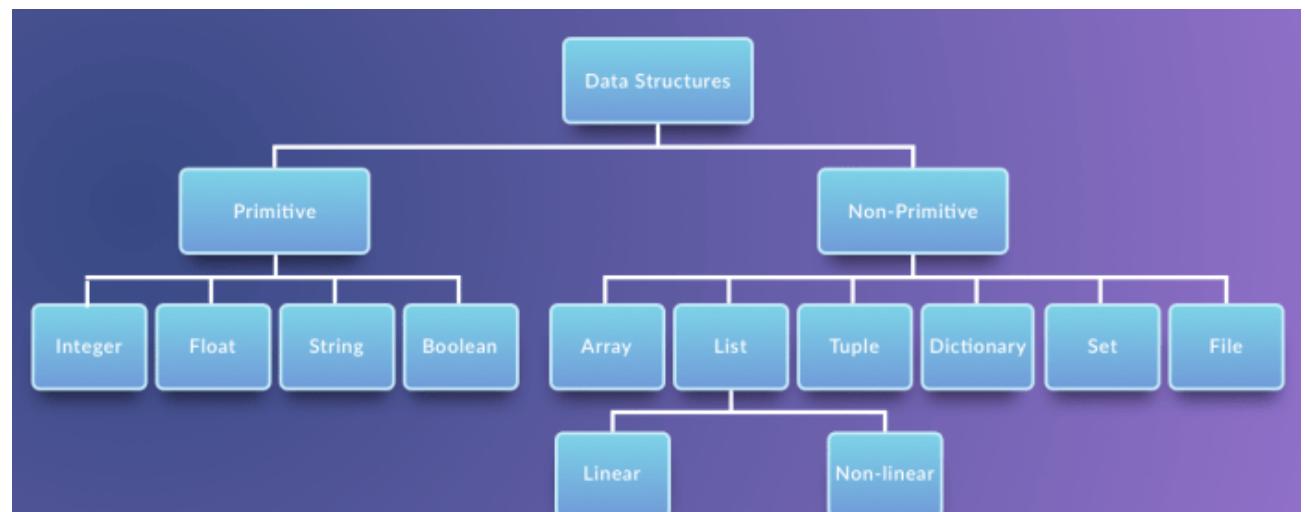
Numbers:

Float

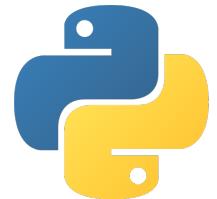
Integers

(Converts float to integers
and vise versa)

Boolean: True/False



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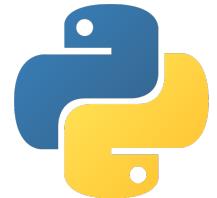
Pp: Python practice

Paste strings

Convert strings to numbers and vice versa

Exercises:

- 1: Create a float and an integer and add them together,
- 2: Create 2 strings, one as “my name is” and another with your name, then paste them and print them,
- 3: Create string and numbers and add/paste them together (once as strings, once as numbers)



Pp: Python practice

1. What is the version of my python?
2. What is date and time now?
3. Write a code that calculate the area and perimeter of a circle, a rectangle and a right angle triangle
4. Write a code that first name and last name and print something like: “amy last name is Robertson”
5. Create a number like p, then create an string like “nn” and “nnnn” then convert all back to numbers and add them together

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Will AI destroy more jobs than it can create or not?

AI is changing the way we live and work.

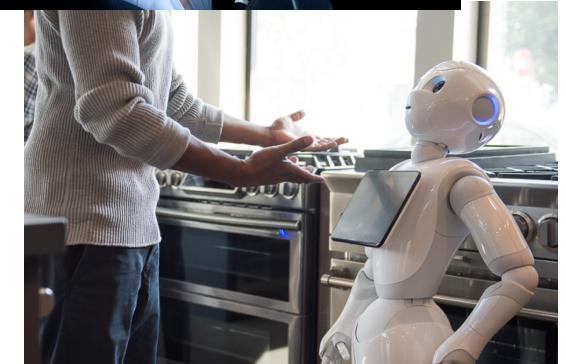
Sales robots, Autonomous cars, chatbots and many more...

Businesses are adopting AI to increase efficiency, sale and cut costs.

Survey results (Gartner Inc.) shows 90% business will be adopting AI in next 3 years.

Concerns, some survey results:

- 90% of responders thought 90% of jobs (mostly labour) will be lost due to automation, (
- 2013 Oxford university study: 47% of US employment is at risk from automation, and generally technology. (some functions of 47% of jobs will be automated)
 - So many misinterpret the study or some even question it,
- Recently OECD, claimed only 8% jobs are at risk.
- AI will create new occupations we can't imagine today. Those jobs are most likely to need new skills, that workers are not ready for them.



19

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Will AI destroy more jobs than it can create or not?

AI is considered the forth industrial revolution.

Like other new technologies and industrial revolutions, AI WILL destroy jobs in the short run.

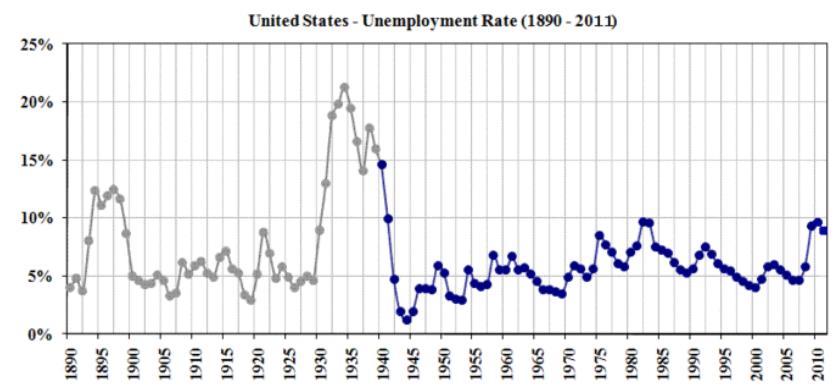
eg.: Email and internet replacing newsletters and jobs in mail delivery, we write less letters

Facts:

AI or other new technologies and automation did not cause net job loss and it will not in the future.

Look at the unemployment rate for US and Canada

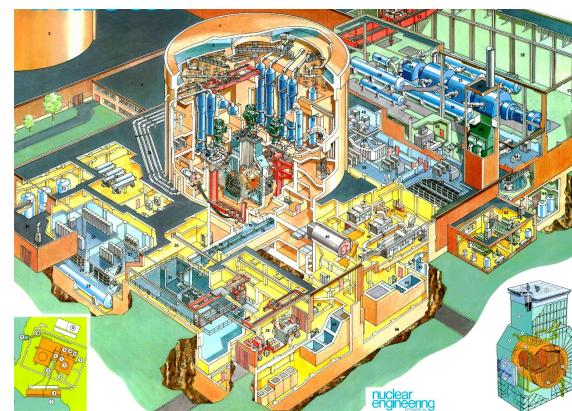
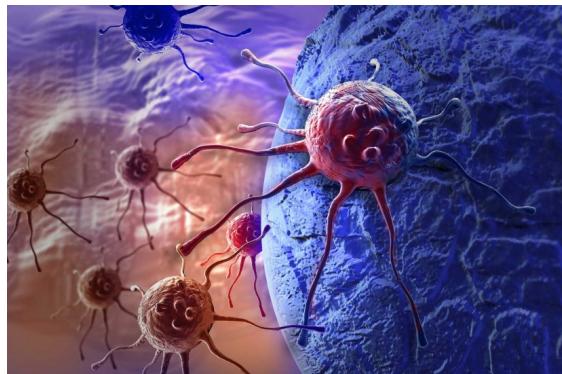
High unemployment rate in the 30s: Great depression, followed by WWII



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AI other benefits:

- AI will increase productivity -> raise wages (lower prices) -> more investments...
- As AI may destroy jobs it help us to increase the standards of our lives and will create new jobs in a economically healthier society.
- Widen our horizon and help us to advance in so many technology that we simply cant do now or it will take so long for us to do, examples: what about curing cancer or help us built better nuclear plants or achieve fusion...
- Do tasks that are dangerous or harmful to humans.
- ...



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What we can do to be prepared?

Act Now

I. Prepare ourselves and adopt

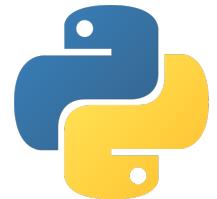
II. Appreciate that adopting AI for businesses will take time and won't happen overnight,

This is more obvious for some industries, for example look at nuclear industry:

- Develop AI,
- There are trainings, a lot of it. Train AI experts to know the industry or train experts in the industry to learn AI, (integration and interaction adaptation)
- Quality assurances, there are standards to follow and licence to be obtained,

III. It is hard to convince industries to adopt AI, sometimes hard to reason why would you want to change something that worked for 40 years?

IV. Don't wait for others to try it first!



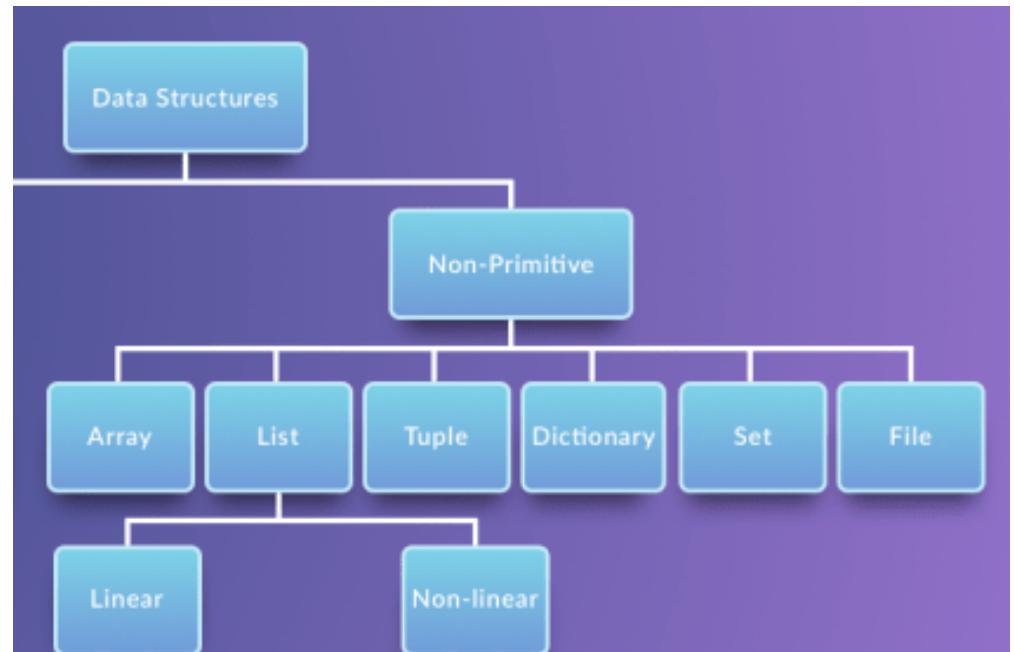
Python exercise:

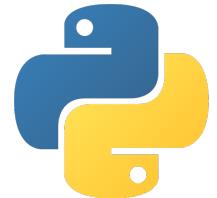
Data Types:

None-Primitive data types:

Non-primitive types are more sophisticated data structures in python.

- Array
- Lists
- Tuples
- Dictionary
- ...





Python:

1. Lists:

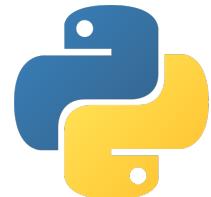
A list is a collection which is ordered and changeable. In Python lists are written with square brackets. In Python programming, a list is created by placing all the items (elements) inside a square bracket [], separated by commas.

Properties:

Lists need not be homogeneous always which makes it a most powerful tool in Python. A single list may contain DataTypes like Integers, Strings, as well as Objects. Lists are mutable, and hence, they can be altered even after their creation.

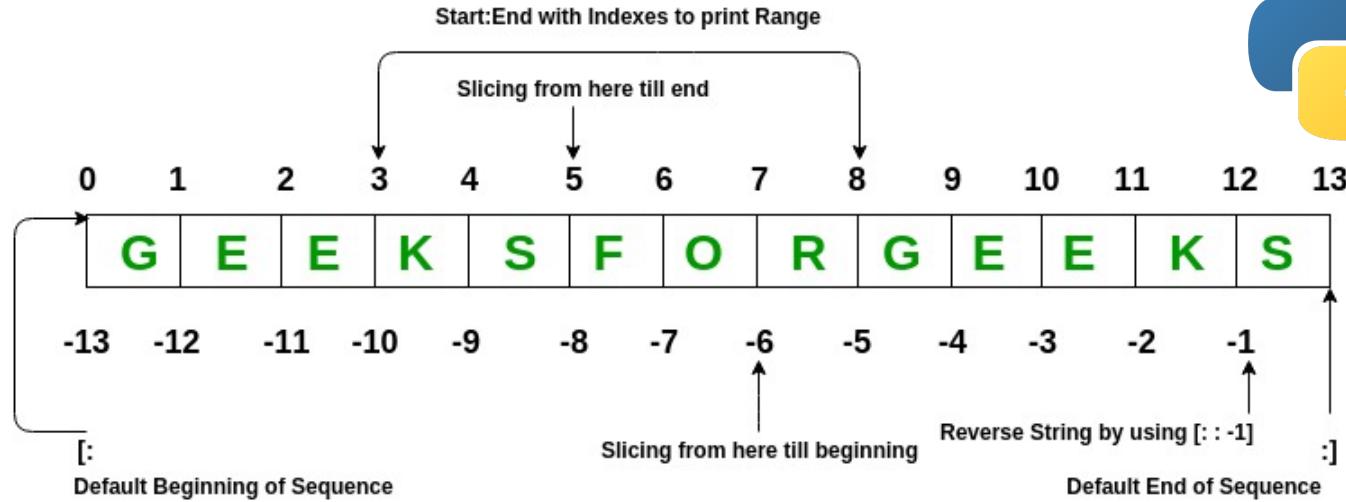
List in Python are ordered and have a definite count. The elements in a list are indexed according to a definite sequence and the indexing of a list is done with 0 being the first index

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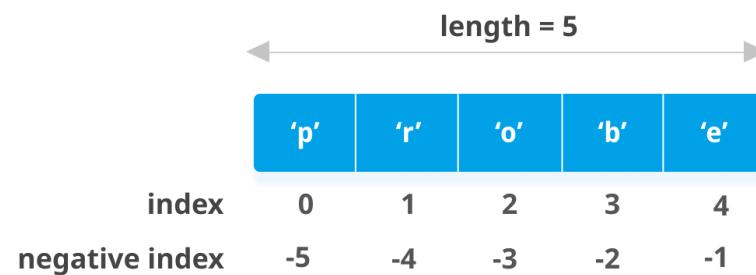


Python:

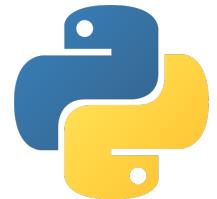
1. Lists:



Indexing start at 0 in python



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Python:

```
List = [ 0, 1, 2, 3, 4, 5]
```

1. Lists:

0	1	2	3	4	5
---	---	---	---	---	---

List[0] = 0 List[0:] = [0,1,2,3,4,5]

List[1] = 1 List[:] = [0,1,2,3,4,5]

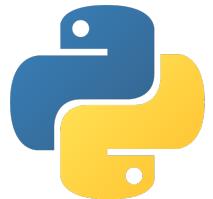
List[2] = 2 List[2:4] = [2, 3]

List[3] = 3 List[1:3] = [1, 2]

List[4] = 4 List[:4] = [0, 1, 2, 3]

List[5] = 5

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Pp: Python practice

1. Lists

Create a list

List indexing and slicing

Reassign values

Append, extend, add...

Remove elements

Copy

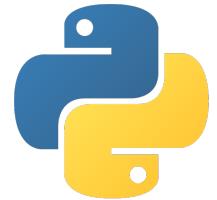
...

More references:

https://www.w3schools.com/python/python_lists.asp

<https://www.programiz.com/python-programming/list>

more advance: <https://docs.python.org/3/tutorial/datastructures.html>



Python:

1. Tuples:

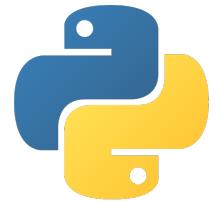
A Tuple is a sequence of immutable Python objects separated by commas. Tuple is similar to a list in terms of indexing, nested objects and repetition but a tuple is immutable (can not be changed) unlike lists.

One can use parentheses to create a Tuple.

`Tuple = (0, 1, 2, 3, 4, 5)`

<code>0</code>	<code>1</code>	<code>2</code>	<code>3</code>	<code>4</code>	<code>5</code>
<code>Tuple[0] = 0</code>		<code>Tuple[0:] = (0, 1, 2, 3, 4, 5)</code>			
<code>Tuple[1] = 1</code>		<code>Tuple[:] = (0, 1, 2, 3, 4, 5)</code>			
<code>Tuple[2] = 2</code>		<code>Tuple[2:4] = (2, 3)</code>			
<code>Tuple[3] = 3</code>		<code>Tuple[1:3] = (1, 2)</code>			
<code>Tuple[4] = 4</code>		<code>Tuple[:4] = (0, 1, 2, 3)</code>			
<code>Tuple[5] = 5</code>					

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Pp: Python practice

1. Tuples

Create a Tuple

Indexing and slicing

Reassign values, possible?

...

More on tuple:

https://www.w3schools.com/python/python_tuples.asp

<https://www.programiz.com/python-programming/tuple>